



Tennessee Department of Environment and Conservation
 Division of Water Resources
 William R. Snodgrass Tennessee Tower,
 312 Rosa L. Parks Avenue, 11th Floor, Nashville, Tennessee 37243
 1-888-891-8332 (TDEC)

Phase II Small Municipal Separate Storm Sewer System (MS4) Annual Report

1. MS4 Information

Name of MS4: City of Hendersonville		MS4 Permit Number: TNS075353
Contact Person: Helen Morrison		Email Address: hmorrison@hvilletn.org
Telephone: (615-) 590-4649		MS4 Program Web Address: https://www.hvilletn.org/departments/public-works/stormwater
Mailing Address: 101 Maple Drive North		
City: Hendersonville	State: Tennessee	ZIP code: 37075

What is the current population of your MS4? 56,000

What is the reporting period for this annual report? July 1 2019 to June 30 2020

2. Discharges to Waterbodies with Unavailable Parameters or Exceptional Tennessee Waters (Section 3.1)

- A. Does your MS4 discharge into waters with unavailable parameters (previously referred to as impaired) for pathogens, nutrients, siltation or other parameters related to stormwater runoff from urbanized areas as listed on TN's most current 303(d) list and/or according to the on-line state GIS mapping tool (tdeconline.tn.gov/dwr/)? If yes, attach a list. Yes No
- B. Are there established and approved TMDLs (<http://www.tn.gov/environment/article/wrws-tennessees-total-maximum-daily-load-tmdl-program>) with waste load allocations for MS4 discharges in your jurisdiction? If yes, attach a list. Yes No
- C. Does your MS4 discharge to any Exceptional Tennessee Waters (ETWs - http://environment-online.tn.gov:8080/pls/enf_reports/f?p=9034:34304:4880790061142)? If yes, attach a list. Yes No
- D. Are you implementing specific Best Management Practices (BMPs) to control pollutant discharges to waterbodies with unavailable parameters or ETWs? If yes, describe the specific practices: Adhering to TDEC buffer and EPSC requirements for construction site runoff. City ordinance is being updated to comply with all water quality riparian buffer requirements. Yes No

3. Public Education/Outreach and Involvement/Participation (Sections 4.2.1 and 4.2.2)

- A. Have you developed a Public Information and Education plan (PIE)? Yes No
- B. Is your public education program targeting specific pollutants and sources, such as Hot Spots? If yes, describe the specific pollutants and/or sources targeted by your public education program: See attached PIE plan. Yes No
- C. Do you have a webpage dedicated to your stormwater program? If yes, provide a link/URL: <https://www.hvilletn.org/departments/public-works/stormwater> Yes No
- D. Summarize how you advertise and publicize your public education, outreach, involvement and participation opportunities: All public education participation and involvement activities are advertised on the City's public access Channel 3, the Stormwater webpage, the City's events webpage, and on the City's facebook page.

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- E. Summarize the public education, outreach, involvement and participation activities you completed during this reporting period: Goodlettsville Waterfest, Monthly Middle Tennessee Stormwater Group Meetings, Household Hazardous Waste Collection, City of Hendersonville Health Fair- Pollution Prevention Practices, Burris Elementary Stormwater Education Presentation, Jack Anderson Elementary Stormwater Education Presentation, Stormwater Staff also attended the TNSA Annual Stormwater Conference
- F. Summarize any specific successful outcome(s) (e.g., citizen involvement, pollutant reduction, water quality improvement, etc.) fully or partially attributable to your public education and participation program during this reporting period: The City Stormwater Division was able to provide stormwater education to approximately 500 people ranging from children to EPSC professionals by participating in several different meetings, events, and special training. The Stormwater Division sent Stormwater Educational flyers to every property owner in the City. Reaching approximately 21,000 property owners.

4. Illicit Discharge Detection and Elimination (Section 4.2.3)

- A. Have you developed and do you continue to update a storm sewer system map that shows the location of system outfalls where the municipal storm sewer system discharges into waters of the state or conveyances owned or operated by another MS4? Yes No
- B. If yes, does the map include inputs into the storm sewer collection system, such as the inlets, catch basins, drop structures or other defined contributing points to the sewershed of that outfall, and general direction of stormwater flow? Yes No
- C. How many outfalls have you identified in your storm sewer system? 715
- D. Do you have an ordinance, or other regulatory mechanism, that prohibits non-stormwater discharges into your storm sewer system? Yes No
- E. Have you implemented a plan to detect, identify and eliminate non-stormwater discharges, including illegal disposal, throughout the storm sewer system? If yes, provide a summary: The City Stormwater Division recently drafted an Illicit Discharge Detection and Elimination Standard Operating Procedure for stormwater staff to follow. Stormwater staff complete monthly inspections of representative MS4 outfalls and industrial areas. Citizens are also encouraged to call the illegal dumping hotline to report illegal dumping into the storm sewer system. Yes No
- F. How many illicit discharge related complaints were received this reporting period? 9
- G. How many illicit discharge investigations were performed this reporting period? 9
- H. Of those investigations performed, how many resulted in valid illicit discharges that were addressed and/or eliminated? 9

5. Construction Site Stormwater Runoff Pollutant Control (Section 4.2.4)

- A. Do you have an ordinance or other regulatory mechanism requiring:
- Construction site operators to implement appropriate erosion prevention and sediment control BMPs consistent with those described in the TDEC EPSC Handbook? Yes No
- Construction site operators to control wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste? Yes No
- Design storm and special conditions for unavailable parameters waters or Exceptional Tennessee Waters consistent with those of the current Tennessee Construction General Permit (TNR100000)? Yes No

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- B. Do you have specific procedures for construction site plan (including erosion prevention and sediment BMPs) review and approval? Yes No
- C. Do you have sanctions to enforce compliance? Yes No
- D. Do you hold pre-construction meetings with operators of priority construction activities and inspect priority construction sites at least monthly? Yes No
- E. How many construction sites disturbing at least one acre or greater were active in your jurisdiction this reporting period? 56
- F. How many active priority and non-priority construction sites were inspected this reporting period? 66
- G. How many construction related complaints were received this reporting period? 13
6. Permanent Stormwater Management at New Development and Redevelopment Projects (Section 4.2.5)
- A. Do you have a regulatory mechanism (e.g. ordinance) requiring permanent stormwater pollutant removal for development and redevelopment projects? If no, have you submitted an Implementation Plan to the Division? Yes No
 Yes No
- B. Do you have an ordinance or other regulatory mechanism requiring:
- Site plan review and approval of new and re-development projects? Yes No
- A process to ensure stormwater control measures (SCMs) are properly installed and maintained? Yes No
- Permanent water quality riparian buffers? If yes, specify requirements: The City has recently updated the Stormwater Ordinance to address specific requirements for permanent water quality riparian buffers. The ordinance revisions should be passed by 9/1/2020. Yes No
- C. What is the threshold for development and redevelopment project plans plan review (e.g., all projects, projects disturbing greater than one acre, etc.)? All projects are reviewed.
- D. How many development and redevelopment project plans were reviewed for this reporting period? 34
- E. How many development and redevelopment project plans were approved? 30
- F. How many permanent stormwater related complaints were received this reporting period? 121
- G. How many enforcement actions were taken to address improper installation or maintenance? 0- The City of Hendersonville is providing maintenance for public drainage systems. The majority of complaints are related to needed maintenance of the City's neglected stormwater infrastructure system.
- H. Do you have a system to inventory and track the status of all public and private SCMs installed on development and redevelopment projects? Yes No
- I. Does your program include an off-site stormwater mitigation or payment into public stormwater fund? If yes, specify. City Ordinance 18-204(2)(b) Provisions are made to manage stormwater by an off-site facility. The off-site facility must be in place and designed to provide the level of stormwater control that is equal to or greater than that which would be afforded by on-site practices. Further, the facility must be operated and maintained by an entity that is legally obligated to continue the operation and maintenance of the facility. Yes No

7. Stormwater Management for Municipal Operations (Section 4.2.6)

- A. As applicable, have stormwater related operation and maintenance plans that include information related to maintenance activities, schedules and the proper disposal of waste from structural and non-structural stormwater controls been developed and implemented at the following municipal operations:

Streets, roads, highways?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Municipal parking lots?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Maintenance and storage yards?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Fleet or maintenance shops with outdoor storage areas?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Salt and storage locations?	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Snow disposal areas?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No
Waste disposal, storage, and transfer stations?	<input type="checkbox"/> Yes	<input checked="" type="checkbox"/> No

- B. Do you have a training program for employees responsible for municipal operations at facilities within the jurisdiction that handle, generate and/or store materials which constitute a potential pollutant of concern for MS4s? Yes No

If yes, are new applicable employees trained within six months, and existing applicable employees trained and/or retrained within the permit term? Yes No

8. Reviewing and Updating Stormwater Management Programs (Section 4.4)

- A. Describe any revisions to your program implemented during this reporting period including but not limited to:

Modifications or replacement of an ineffective activity/control measure. The City's Stormwater Ordinance Title 18 has been updated to meet the minimum MS4 permit requirements. These updates should be effective by 9/1/2020.

Changes to the program as required by the division to satisfy permit requirements. The City is currently working with consultants to address deficient areas within our MS4 Program, recently completing a full program assessment (GAP analysis). The City will be focusing specifically to address storm sewer system mapping and illicit discharge detection and elimination education. The City has revised the existing stormwater ordinance to comply with the minimum requirements of the MS4 permit.

Information (e.g. additional acreage, outfalls, BMPs) on newly annexed areas and any resulting updates to your program. Newly annexed areas in the City will be documented with new storm sewer mapping. Newly developed and redeveloped areas with perm SCMs will be included in the permanent SCM inventory.

- B. In preparation for this annual report, have you performed an overall assessment of your stormwater management program effectiveness? If yes, summarize the assessment results, and any modifications and improvements scheduled to be implemented in the next reporting period. The City continues to evaluate and assess the stormwater management program overall effectiveness. Using the GAP analysis attached and scheduling regular progress meetings to ensure that improvements are made. See the attached GAP analysis and 2019-2020 annual assessment meeting minutes. Yes No

9. Enforcement Response Plan (Section 4.5)

- A. Have you implemented an enforcement response plan that includes progressive enforcement actions to address non-compliance, and allows the maximum penalties specified in TCA 68-221-1106? If no, explain. The City has implemented an ERP that includes progressive enforcement actions to address non-compliance and allows the maximum penalties specified in TCA 68-221-1106. Yes No
- B. As applicable, identify which of the following types of enforcement actions (or their equivalent) were used during this reporting period; indicate the number of actions, the minimum measure (e.g., construction, illicit discharge, permanent stormwater management), and note those for which you do not have authority:

<u>Action</u>	<u>Construction</u>	<u>Permanent Stormwater</u>	<u>Illicit Discharge</u>	<u>In Your ERP?</u>
Verbal warnings	#17	#0	#8-Forwarded to other agency	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Written notices	#189	#0	#1	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Citations with administrative penalties	#0	#0	#0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Stop work orders	#3	#0	#0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Withholding of plan approvals or other authorizations	#19-Hold building permits	#0	#0	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No
Additional Measures	#19	#0	#0	Describe: <u>Holding Codes Inspections</u>

- C. Do you track instances of non-compliance and related enforcement documentation? Yes No
- D. What were the most common types of non-compliance instances documented during this reporting period? Failure to properly design, install, maintain construction site BMPs

10. Monitoring, Recordkeeping and reporting (Section 5)

- A. Summarize any analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period. See attached E. coli report; Benthic report completed by CEC.
- B. Summarize any non-analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period. See the attached Visual Stream Assessment Report completed by CEC.
- C. If applicable, are monitoring records for activities performed during this reporting period submitted with this report. Yes No

11. Certification

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This report must be signed by a ranking elected official or by a duly authorized representative of that person. See signatory requirements in sub-part 6.7.2 of the permit.

"I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

David Lemarbre
 City Administrator
 Printed Name and Title

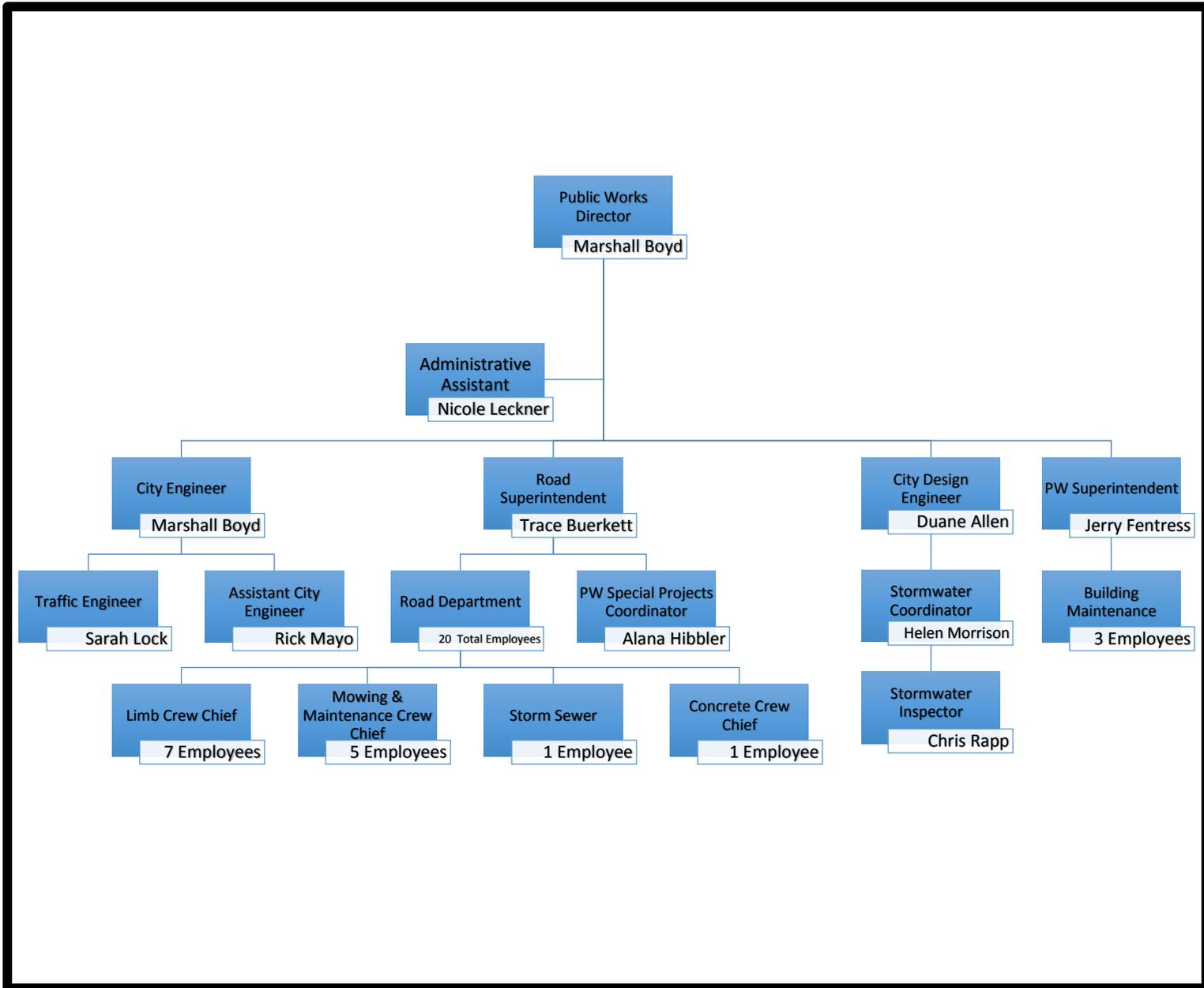

 Signature

8/4/2020
 Date

Annual reports must be submitted by September 30 of each calendar year (Section 5.4) to the appropriate Environmental Field Office (EFO), identified in the table below:

EFO	Street Address	City	Zip Code	Telephone
Chattanooga	1301 Riverfront Pkwy, Suite 206	Chattanooga	37402	(423) 634-5745
Columbia	1421 Hampshire Pike	Columbia	38401	(931) 380-3371
Cookeville	1221 South Willow Ave.	Cookeville	38506	(931) 520-6688
Jackson	1625 Hollywood Drive	Jackson	38305	(731) 512-1300
Johnson City	2305 Silverdale Road	Johnson City	37601	(423) 854-5400
Knoxville	3711 Middlebrook Pike	Knoxville	37921	(865) 594-6035
Memphis	8383 Wolf Lake Drive	Bartlett	38133	(901) 371-3000
Nashville	711 R S Gass Boulevard	Nashville	37216	(615) 687-7000

2019 Public Works Organizational Chart



Attachment 2A.

Table 1: Waters with Unavailable Parameters within the City of Hendersonville

Waterbody Name	Waterbody I.D. # (Milage)	Cause(s)	Source Name(s)	VSA	Benthic	<i>E. Coli</i>
Center Point Branch	TN05130202220_0500 (3.26 miles)	Nutrient Eutrophication Biological Indicators	Municipal (Urbanized High Density Area)	X	X	
Madison Creek	TN05130202220_0400 (0.34 miles)	Sedimentation/Siltation	Municipal (Urbanized High Density Area)	X	X	
		Alteration in stream-side or littoral vegetative covers	Municipal (Urbanized High Density Area)			
Manskers Creek	TN05130202220_1000 (1.12 miles)	Sedimentation/Siltation	Municipal (Urbanized High Density Area)	X	X	X
		<i>Escherichia coli</i>	Municipal (Urbanized High Density Area)			
Waterbody Name	Waterbody I.D. # (Milage)	Cause(s)	Source Name(s)	VSA	Benthic	<i>E. Coli</i>
Unnamed Trib to Cheatham Reservoir	TN05130202001T_0600 (1.13 miles)	Chlorine	Municipal Point Source Discharges	X	X	
		Alteration in stream-side or littoral vegetative covers	Municipal (Urbanized High Density Area)			
		Sludge	Municipal (Urbanized High Density Area) & Municipal Point Source Discharges			
Unnamed Trib to Drakes Creek	TN05130201047_0100 (2.19 miles)	Alteration in stream-side or littoral vegetative covers	Municipal (Urbanized High Density Area)	X	X	
Unnamed Trib to Drakes Creek	TN05130201047_0200 (2.28 miles)	Alteration in stream-side or littoral vegetative covers	Municipal (Urbanized High Density Area)	X	X	

Hendersonville MS4 Permit Public Information and Education Plan

Issue Date: 6/23/2020

Version: 2

Review Frequency: Annual

1. Introduction

The Public Information and Education (PIE) Plan is a requirement in the State of Tennessee's Small Municipal Separate Storm Sewer System (MS4) General National Pollution Discharge Elimination System Permit (hereafter referred to as the "NPDES permit"). Coverage under this permit was granted to the City of Hendersonville on April 3, 2017 under Permit Tracking Number TNS075353. The requirements of the PIE plan are listed in section 4.2.1 of the NPDES permit. Under this section, the City of Hendersonville must provide for the following:

- Detail specific goals and public information events/activities that will occur over the remainder of the permit cycle;
- Document all public education and outreach components;
- Incorporate an evaluation of components to assess overall effectiveness and the need for improvement;
- Include targeted educational campaigns addressing the following issues:
 - a. General public awareness on the impacts on water quality from general housekeeping maintenance/activities;
 - b. Home owner associations and other operators of permanent BMPs awareness of the importance of maintenance activities;
 - c. Local engineering and development community awareness of the stormwater ordinance, regulations, and guidance materials related to long-term water quality impacts;
 - d. General public and professional chemical applicators awareness on the proper storage, use, and disposal of pesticides, herbicides and fertilizers;
 - e. General public and related commercial and professional stakeholders awareness on the proper storage, use and disposal of oil and other automotive-related fluids;
 - f. General public and municipal employees on the awareness of identifying and reporting procedures for illicit connections/discharges, sanitary sewer seepage, spills, etc.;
 - g. Local engineering, development, and construction community awareness of stormwater ordinances, regulations and guidance materials related to construction phase water quality impacts; and
 - h. Municipal employee/contractor awareness of water quality impacts from daily operations.

This PIE plan presents an outline for the City of Hendersonville's public education and outreach program and documents the City's plan for compliance with the requirements.

2. Public Education and Participation & Goals

The City of Hendersonville participates in several special events throughout the year. Stormwater staff attend monthly stormwater group meetings, distribute trees for 250K Tree Day, and attend several community events to promote water quality in the community. Table 1 depicts the City of Hendersonville's active and planned efforts to provide targeted educational campaigns to address specific issues.

Table 1- City Efforts for Required Educational Campaigns		
Required Educational Campaigns	City Activities	Measurable Goals
a. General public awareness on the impacts on water quality from general housekeeping maintenance/activities;	<ul style="list-style-type: none"> Public education on good housekeeping maintenance/activities displayed on website Educational power points/videos shown on public access Channel 3 All special events advertised on Stormwater website 	<ul style="list-style-type: none"> Number of website visits between July 1 and June 30 each year. Number of recorded conversations with residents regarding stormwater (ex. BMPs, SCMs, drainage concerns, IDDE).
b. Homeowner associations and other operators of permanent BMPs/SCMs awareness of the importance of maintenance activities;	<ul style="list-style-type: none"> Provide educational information on permanent BMP maintenance on website Send out letters to owners/managers annually requesting inspection reports on permanent BMPs/SCMs. Require Operation and Maintenance (O&M) Agreement for permanent BMPs/SCMs to be submitted with the plans review/permit application process. 	<ul style="list-style-type: none"> Number of website visits between July 1 and June 30 each year. Number of recorded conversations with the community regarding BMP/SCM maintenance. Number of O&M Agreements submitted and recorded. Number of inspection reports submitted annually.
c. Local engineering and development community awareness of the stormwater ordinance, regulations, and guidance materials related to long-term water quality impacts;	<ul style="list-style-type: none"> All EPSC plans are reviewed by 3rd party contractor/consultant with education component to guide designers on how to properly design EPSC measures Provide educational information (TDEC Erosion and Sediment Control Handbook, Permanent BMP Manual, Stormwater Ordinance, EPSC plan review checklist) on website Provide educational information on importance of BMPs during construction and post-construction SCMs. Distribute brochure(s). 	<ul style="list-style-type: none"> Number of website visits between July 1 and June 30 each year. Number of plan sets reviewed by City staff and 3rd party contractor/consultant. Number of BMP/SCM brochures distributed. Number of plan sets that are prepared and submitted by personnel who have completed the TDEC Level 2 Design Course.
d. General public and professional chemical applicators awareness on the proper storage, use, and disposal of pesticides, herbicides and fertilizers;	<ul style="list-style-type: none"> Provide educational information for proper storage, use, and disposal of pesticides, herbicides, and fertilizers Distribute educational material to business owners/operators during hot spot inspections. Add education information to website 	<ul style="list-style-type: none"> Frequency of hot spot inspections. Number of brochures/information distributed during hot spot inspections. Number of businesses reached.
e. General public and related commercial and professional stakeholders awareness on the proper storage, use and disposal of oil and other automotive-related fluids;	<ul style="list-style-type: none"> Plan targeted mail outs to commercial and professional stakeholders regarding proper storage, use and disposal of oil and other automotive-related fluids. Distribute educational material to business owners/operators during hot spot inspections. Add education information to website. 	<ul style="list-style-type: none"> Frequency of hot spot inspections. Number of brochures/information distributed during hot spot inspections. Number of businesses reached.
f. General public and municipal employees on the awareness of identifying and reporting procedures for illicit connections/discharges, sanitary sewer seepage, spills, etc.;	<ul style="list-style-type: none"> Develop IDDE website subpage with educational information to identify illicit discharges/connections, sanitary sewer seepage, spills, etc. 	<ul style="list-style-type: none"> Number of website visits between July 1 and June 30 each year. Number of recorded conversations with residents/community regarding non-stormwater discharges (IDDE). Number of illicit discharges observed during hot spot inspections.
g. Local engineering, development, and construction community awareness of stormwater ordinances, regulations and guidance materials related to construction phase water quality impacts; and	<ul style="list-style-type: none"> Create webpage to provide ordinance education and design criteria for engineers, develops, and construction community Educational Day (1 per permit term) 	<ul style="list-style-type: none"> Number of website visits between July 1 and June 30 each year. Number of attendees at educational day.
h. Municipal employee/contractor awareness of water quality impacts from daily operations.	<ul style="list-style-type: none"> Provide annual training to municipal employees and contractors on stormwater pollution prevention and IDDE methods, etc. Provide training to applicable, new employees within 6 months of employment date. 	<ul style="list-style-type: none"> Record of training materials provided. Number of employees trained (initial and refresher trainings). Number of employees trained in association with O&M Plan and SPCC plan requirements.

3. Responsible Personnel

The Hendersonville Stormwater Division is wholly responsible for developing and implementing the PIE plan and meeting program specific goals. Table 2 depicts general PIE plan objectives and the responsible personnel.

Table 2- PIE Plan Responsible Personnel		
Personnel	PIE Plan Responsibility	Contact Information
Duane Allen	<ul style="list-style-type: none"> Oversees PIE Plan objectives. Reviews/Approves all distribution of public information/education materials and website content. 	615-822-1016 dallen@hvilletn.org
Helen Morrison	<ul style="list-style-type: none"> Reviews PIE Plan objective to be consistent with MS4 requirements. Coordinates all public education programs and events. Coordinates participation at community events with other MS4s. Oversees development of public educational materials. Documents public education events and activities for Annual Report. Oversees Stormwater web pages. Audits City facilities to ensure that appropriate stormwater-related employee training is being conducted and documented. 	615-590-4649 hmorrison@hvilletn.org
Christopher Rapp	<ul style="list-style-type: none"> Promotes education and outreach events through various means Provides educational programming at special events Performs hot spot inspections. Performs post construction BMPs/SCM inspections. Distributes educational material during inspections and/or owner/operator/contractor meetings. 	615-590-4659 crapp@hvilletn.org

4. PIE Plan Ultimate Goal

The ultimate goal of the City of Hendersonville PIE Plan is to minimize the discharge of pollutants to receiving streams by providing educational material and activities to raise awareness and promote behavior change within the local residential, commercial and development community, City employees, and their contractors. A summary of typical pollutants of concern and the source of pollutants can be seen in Table 3 below. Considerations for future PIE Plan initiatives should be able to tie back to prevention of these pollutants in stormwater.

Table 3- Typical Pollutant Runoff from Major Land Use Categories			
Major Land Use	Typical Pollutants	Typical Source	Resulting Water Quality Degradation to Target in Educational Messages
Residential	<ol style="list-style-type: none"> 1. Nutrients 2. Sediment 3. Pathogens 4. Organics 	<ol style="list-style-type: none"> 1. Over-fertilization, Pet Waste, Human Waste and Detergents from failing septic systems. 2. Grading areas without maintained controls. Removing stream bank vegetation. 3. Failing septic systems, illegal cross-connections of sanitary and stormwater, and pet waste. 4. Dumping of leaves/grass clippings in conveyances 	<ol style="list-style-type: none"> 1. Increased algal blooms, depleted dissolved oxygen levels from decaying algae. 2. Reduced water clarity for aquatic plants, smothers aquatic life, transports other pollutants. 3. Potentially harmful to human health. 4. Decomposition depletes dissolved oxygen levels within streams.
Light Commercial	<ol style="list-style-type: none"> 1. Hydrocarbons (Oil & Grease) 2. Trash 3. Nutrients 4. Sediment 	<ol style="list-style-type: none"> 1. High-traffic parking lot areas, leaking storage tanks, etc. 2. Poor grounds upkeep, especially in parking areas and around dumpsters. 3. Landscaping/golf courses. 4. Grading/developing without maintained controls. Removing stream bank vegetation. 	<ol style="list-style-type: none"> 1. Toxic to aquatic life and impact drinking water supplies. 2. Aesthetically displeasing, can block drainage pipes causing erosion, can be harmful to wildlife. 3. Increased algal blooms, depleted dissolved oxygen levels from decaying algae. 4. Reduced water clarity for aquatic plants, smothers aquatic life, transports other pollutants.
Industrial/Heavy Commercial	<ol style="list-style-type: none"> 1. Metals 2. Sediment 3. Hydrocarbons (Oil & Grease) 	<ol style="list-style-type: none"> 1. Exposed industrial processes/improper disposal. 2. Exposed industrial processes/improper disposal. Gravel parking lots with heavy truck traffic. 3. Equipment leakage, leaking storage containers, high-traffic pervious areas. 	<ol style="list-style-type: none"> 1. Acute or chronic toxic impacts to aquatic wildlife. 2. Reduced water clarity for aquatic plants, smothers aquatic life, transports other pollutants. 3. Toxic to aquatic life and impact drinking water supplies.

Source: Metro Nashville Municipal Separate Storm Sewer System Permit Public Information & Education Plan (2016)

5. Program Recordkeeping and Evaluation

City Stormwater Personnel will track PIE Plan initiatives (City Activities and progress toward meeting Measurable Goals in Table 2) throughout the year and will meet annually to review this information. The program's overall effectiveness will be evaluated based on the example criteria presented below and the need for improvement and/or modification will be determined based on the results of the program evaluation.

Suggested Criteria for Program Evaluation:

- Fewer violations noted during hot spot inspections.
- Fewer series of reviews for design plan submittals.
- Increased/Sustained maintenance of post construction BMPs/SCMs.
- Continuous/Increased website visits.
- Public participation.



The City of Hendersonville is known as the “City by the Lake,” but the City also has 32 miles of streams. This means that the quality of water in our waterways is essential. Listed below are common pollutants within the City’s waterways along with some suggestions for how we can work together as a community to reduce these pollutants. By doing so, we will improve water quality and be able to enjoy our waterways for generations to come!



ORGANICS

YARD WASTE

Placing organic matter (leaves, grass, limbs, etc.) in ditches and streams can cause blockages in the storm sewer system, resulting in infrastructure failures and flooding. Decomposing organic matter depletes oxygen in our streams and Old Hickory Lake resulting in algal blooms and fish kills. Below are a few tips for disposing of yard waste:

- Collect leaves, twigs & grass clippings (no trash) in biodegradable paper bags (not plastic). The City has **FREE** biodegradable bags available for City Limit Residents to pick up at City Hall and at each Fire Station (4 bags per resident per week). Bags can also be purchased at local home improvement and hardware stores.
- Place bagged yard waste and limbs within 12 feet of the edge of pavement for collection. For a list of additional yard waste guidelines visit: <https://www.hvilletn.org/departments/public-works/residential-collection-services/limb-collection>
- **Do not block ditches, roadways, sidewalks or waterways with yard waste.**



SEDIMENT

CONSTRUCTION SITE MAINTENANCE

Below are some common construction issues that need to be brought to the City’s attention to help reduce stormwater pollution:

- Sediment tracked into the street or carried into a waterway
- Illegal dumping of substances or spills (paints, concrete, oils)
- Excessive trash and debris

If any of these conditions or other construction site maintenance concerns are noted, please email the City at construction@hvilletn.org



PET WASTE

SCOOP THE POOP

Pet waste is a major cause of E. Coli in our streams and rivers. Bacteria found in dog feces can cause serious diseases in humans if contaminated water comes in contact with an open wound or is ingested. Clean up after your pet and encourage others to do so. What is left behind ends up in our streams and Old Hickory Lake.



PAINTS & OILS

PAINT AND OIL DISPOSAL

All motor oils, paints and solvents contain toxic chemicals that are hazardous to people, wildlife and plants.

- Latex paint can be dried and disposed of in the trash.
- Oil-based paint must be properly disposed of by scheduling an appointment with the Sumner County Resource Authority. Please call [615-452-1114](tel:615-452-1114) to schedule an appointment.
- Use drip pans to catch fluids during vehicle maintenance. Bring used motor oils to a local recycling facility.



FERTILIZERS & PESTICIDES

LIMIT USE OF FERTILIZERS & PESTICIDES

- Follow the instructions on fertilizer packaging to avoid excess fertilizer that can be washed into our storm sewer system. Mulched leaves and grass can be spread over your yard as a natural fertilizer. Composting is an affordable way to recycle yard waste and feed your plants. Visit <https://www.epa.gov/recycle/composting-home> for more information on composting at home.
- Natural pesticides/insecticides are better for the environment, your family, and pets.
- Excess nutrients (phosphorus, nitrogen) from fertilizers can cause algal blooms that reduce the amount of dissolved oxygen available to aquatic life in streams and Old Hickory Lake.



DID YOU KNOW?

DID YOU KNOW?

- Every time it rains, stormwater washes over the land and picks up pollutants that are transported to our streams and Old Hickory Lake.
- One quart of motor oil can contaminate up to 250,000 gallons of fresh water.
- The City of Hendersonville is home to the State Endangered Streamside Salamander.
- You and your family can make a difference by being proactive and taking small steps to eliminate stormwater pollution. For additional information on the City's Stormwater Management Program visit: <https://www.hvilletn.org/departments/public-works/stormwater>

Recycling Locations:

Batteries and Light Bulbs

Batteries + Bulbs
1002 Glenbrook Way
Hendersonville, TN 37075
615-590-8988

Used Motor Oil

Advance Auto Parts
Auto Zone
O'Reilly's Auto Parts
Walmart Auto Care Center

Limbs and Leaves

Community Brush Drop-Off Day*
Last Saturday of Every Month
7AM-3PM

*Only for City Limit Residents
(Bring ID)

Solid Waste and Recycling

Sumner County Resource Authority
625 Rappahannock Wire Road
Gallatin, TN 37066
615-452-1114

Drug Drop Off Box

Hendersonville Police Department
3 Executive Park Drive
Hendersonville, TN 37075
615-822-1111

501 Forest Retreat Road
Hendersonville, TN 37075
Call 615-822-1016 to request bagged yard
waste collection

Call the Hendersonville Stormwater Division at 615-822-1016 to report illegal dumping into the storm drain.



**FUN
AND FREE**

**July
19th**

Waterfest

**MOSS - WRIGHT
PARK**

10am - 12pm

Waterfest presented in collaboration with Goodlettsville Parks and Recreation is a free, family festival all about celebrating and connecting youth and their families to our local water. Join us to learn about the importance of water quality in our watershed through fun environmental activities for the entire family!

**DANCE
PARTY**

**TRIVIA
PRIZES**

**WATER
SLIDES**

**SO MUCH
MORE!!!**

PRESENTED BY



**CUMBERLAND
RIVER COMPACT**



Goodlettsville
PARKS AND RECREATION

Kids will need to have a parent or guardian sign a waiver before enjoying the waterslides. If you'd like to bring a day camp or group to this event, please contact us in advance: catherine.price@cumberlandrivercompact.org

Household Hazardous Waste Collection Event

Date: October 12, 2019

Location: Moss Wright Park, 705 Caldwell Drive, Goodlettsville, TN

Time: 8 a.m. - 1 p.m.

Tennessee residents are encouraged to attend this FREE event to properly dispose of household hazardous waste.

Accepted Items:

Automotive and Marine Products

- Fuel and oil additives
- Grease and rust solvents, naval jelly
- Carburetor or fuel injector cleaners
- Starter fluids
- Body putty
- Antifreeze/coolant
- Gasoline

Home Maintenance/Improvement Products

- Used strippers and thinners
- Adhesives
- Driveway sealant
- Roofing tar
- Wallpaper remover

Home Lawn and Garden Products

- Pesticides
- Fertilizers
- Wood preservatives

Miscellaneous

- Pool chemicals
- Photo processing chemicals
- Medicines/drugs
- Aerosols/compressed gas
- Mercury thermostats and thermometers
- Fluorescent tubes
- Compact fluorescent bulbs
- Needles and sharps (in a puncture-proof container)

Unacceptable Items:

Medical/Biological

- Infectious wastes
- Dead animals
- Any waste from a doctor's office, clinic, or veterinarian's office

Explosives/Ammunition

- Fireworks
- Military ordnance
- Gun powder
- Ammunition

Radioactive

- Smoke detectors
- Radium paint

Business/Institutional Waste

- No businesses, large or small
- No colleges or universities
- No schools
- No hospitals
- No home improvement or painting contractors
- No agribusiness

Miscellaneous

- Empty containers of any kind
- Automotive gas tanks
- Alkaline batteries-may be thrown away in the trash
- Electronics- contact your local Solid Waste Department for guidance
- Paint- contact your local Solid Waste Department for guidance

Contacts:

Bob Fletcher- 615-532-9265; Bob.Fletcher@tn.gov or Jeff McCormick- 615-851-2204

2019 TNSA Conference Schedule

Tuesday November 19

8:00 AM - 5:00 PM	Registration and Exhibit Hall Open		
8:00 - 8:45 AM	Registration and Networking		
8:45- 9:00 AM	Welcome Address - David Mason, TNSA President		
9:00 - 10:00 AM	45 Years of Stormwater Management. Andy Reese		
10:00 - 10:30 AM	Networking with Exhibitors		
10:30 - 11:00 AM	TDEC Updates, Jennifer Dodd		
11:00 AM - 11:45 PM	NPDES Small MS4 Compliance Evaluation. Robert Karesh & Brown Patton		
11:45 AM-1:00 PM	Lunch & Keynote Speaker		
1:30 - 3:45 PM	Manufactured Treatment Devices	IDDE Applications	Public Education & Project Partnerships
1:30 - 2:15 PM	Introducing a Centralized Guidance Resource for Stormwater Best Management Practices Performance Evaluations. Mark Miller	The City of Franklin Approach to Conducting Visual Stream Surveys and Outfall Screenings. Brittani Perez & Bristol Snider	Public Private Partnerships in Stream Restoration. Mary Beth Sutton and Joshua Rogers
2:15 - 3:00 PM	What does it all Mean? Evaluating Test Methods and Performance Expectations for BMPs. Jason Bates and Travis Dorman	Streamlined Data Visualization and Analytics for Smart Stormwater Management. Matthew Jones & Ryan O'Banion	7 Years Later: Nashville's Urban Runoff 5K and Water Quality Festival. Jennifer Watson and Allison Davis
3:00 - 3:30 PM	TNSA BMP Committee Panel Discussion - Regulatory and Plan Review Guidance for MTDs. Jason Bates, Crystal Bishop, Jacob Dorman and Chris Granju	Visualizing Surface Runoff and Stormwater Network Flow Direction Via Web Application. Garrett Boucher	Going Green at the Collins Hill Library is a Win for the Community. David Braswell
3:30 - 4:00 PM	Networking with Exhibitors		
	MS4 Policy Showcase	BMP Inspection Applications	Good Housekeeping
4:00 - 4:30 PM	Here We Go Again! Nashville's Stormwater Regulations Revisions. Rebecca Dohn.	Stormwater Inspections using Collector and Survey123. Kevin Bingham and Robbie Hanks	Implementing an Effective and Good Housekeeping Program. Paul Davis
4:30 - 5:00 PM	Water Quality Buffer Mitigation in the City of Chattanooga. Joshua Rogers	Using 360° Image Technology to Support BMP/SCM Maintenance. Ryan Obanion	
6:30 PM	Awards Dinner		

Wednesday November 20

7:00 - 8:00 AM	Breakfast in Restaurant		
8:00 AM - 5:00 PM	Registration and Exhibit Hall Open		
8:00 - 10:00 AM	Flood & Compensatory Mitigation	Stormwater Projects: Moderator Aaron Rogge	State and Federal Programs
8:00 - 9:00 AM	Flood Mitigation Success with HMGP. Byron Hinchey	Grassy Creek Stormwater Master Plan Addressing Neighborhood Flooding. Kathleen Smith and Dustin West	Clean Water Act/ WOTUS Update Casey Ehorn
9:00 - 9:30 AM	In Lieu Fee Mitigation and MS4s - Presentation and Panel. Jed Grubbs & MeKayle Houghton	Highland Park Demo Project Retrospective. Maria Price	TBD
9:30 - 10:00 AM		The Challenges of Restoring Habitat and Improving Water Quality in an Urban Lake. David Mason	Overview of the Endangered Species Act and Section 7 Compliance. Dustin Boles
10:00 - 10:30 AM	Networking with Exhibitors		
10:30 AM - 12:00 PM	Stormwater Funding	Design Considerations	Public Education & Involvement
10:30-11:00 AM	Stormwater Utility Fee Implementation, Year 1: Lessons Learned. Aaron Rogge and Jennifer Watson	Trees & Water Sensitive Urban Design. Matthew Werle	Together We are Better. Katherine Green
11:00 - 11:30 AM	Increasing Water Quality Through a Publicly Funded Grant Program. Joshua Rogers	Utilizing Buffers as a Development Amenity. Kelli Richardson	The Great Brush Creek Wild Tire and Trash Roundup. Ingrid Luffman and Jana Archer
11:30 AM - 12:00 PM	Stormwater Funding Strategies, Equitably Increasing your Bottom Line. David Elliott and Laurie Hawks	Karst Geology and Flooding - An Investigation of Blue Grass Lake in East Tennessee. Darrell Nicholas and Jessie Fears	Informing Watershed Based on Data Collected by Citizen Scientist. Ryan Jackwood
12:00 - 1:00	Lunch		
	MS4 Program Management	SCM Maintenance	Permeable Pavers
1:00 - 1:45 PM	If Your Permit Jumped Off a Bridge, Would You Follow? Even Good Permits Make Bad Ordinances. Mary Halley	Hybrid Stormwater Management BMPs for Enhanced Performance. Glen Payton and Yuya Ishizuka	Green Infrastructure Lessons Learned with Paver Projects. Laurie Hawks and David Elliott
1:45 - 2:30 PM	MS4 Program Management & Permit Compliance. Warren Garrett, Beverly Goodwin & Greg Edrington	How to do Post-Construction Maintenance Program without "Really Trying". Don Green	Permeable Paver Design - Paul Cureton
2:30 - 3:00 PM	Networking with Exhibitors - Visit all Exhibitors for an Extra Beer Ticket for the Social		
3:00 - 4:30 PM	TNSA Membership Meeting & Committee Updates - Door Prizes		
6:00 PM	Dinner		
7:30 PM	Social		

Thursday November 21

7:00 - 8:00 AM	Breakfast in Restaurant	
7:30 - 10:00 AM	Registration	
8:00 - 9:30 AM	Capital Improvement Studies & Projects	Technology Tools for Program Management
8:00 - 8:30 AM	Protecting Exposed/Threatened Utilities: Using Natural Channel Design to Wash Away Risk. Ward Marotti	Digital Transformation Saves You Time and Money while Increasing Stormwater Program Effectiveness. Nicole Beck and Jason Yoho
8:30 - 9:00 AM	Big Creek Drainage Study and Flood Mitigation Design Project, Shelby County, TN. Adrian Ward	Use of Public Domain Software for Managing Stormwater Data. Gerald Burnette
9:00 - 9:30 AM	Birdland Detention Study & Culvert Replacements. Jeff Shaver	Levering the State's Public LiDar Data. Paul Dudley
9:30 - 9:45 AM	Break	
9:45 - 11:15 AM	Construction EPSCs	Statewide Partner Updates
9:45 - 10:15 AM	Steep Slope Stabilization Demo Project. Kristen Stanfill	Keep Tennessee Beautiful Edmund McDavis
10:15-10:45 AM	Groundscape Concepts Erosion and Sediment Control - TC Kerrigan and Rick Roark	Tennessee Environmental Council's TN Tree Day Jeff Barrie & Cynthia Hernandez
10:45 - 11:15 AM	Redesigning the Construction Entrance to be Effective and Reusable. Jamie Utley & Nathan Barker	What can MTAS do for you? John Chlarson
11:15 AM - 12:00 PM	Closing Session - Going at it on Your Own - Starting a Stormwater Utility and Stormwater Program. Bryan Price & Carlton Cobb	
12:00 PM	Closing Address - Warren Garrett, TNSA President-Elect - Door Prizes	

Helen Morrison

From: Angela White <angela.white@sumnerschools.org>
Sent: Thursday, August 1, 2019 2:39 PM
To: Helen Morrison
Subject: Dr. William Burrus Elementary

Hi, Helen!

I am a teacher at a Tennessee Designated STEM school in Hendersonville, TN, Dr. William Burrus Elementary. I was given your contact information by the Cumberland River Compact, when I reached out for their support for this upcoming school year.

Our school-wide theme this year is centered around weather and water! I was wondering if you or one of your staff members at the Hendersonville Stormwater Department would be interested in presenting to our elementary students for real-world application? In addition, I would appreciate any resources you could provide, with special regard to water cisterns and rain barrels!

Please don't hesitate to let me know if you have any questions. Thank you so much for your time!

Angela White

Dr. William Burrus Elementary
Sumner County Schools



has received 1 PDH credits for attending:

**TENNESSEE STORMWATER
ASSOCIATION TECHNICAL MEETING**

June 25, 20020

Charlene DeSha

Charlene DeSha, TNSA Executive Director

Presented by:

Tennessee Stormwater Association

Level 1

[Introduction](#)
[Registration Information](#)
[Agenda](#)
[Training Class Schedule](#)
[Course Registration](#)
[Certification List](#)

Level 1 Certified - Click Column Heading to Sort

Quick Search x

Page of 1 Displaying 1 to 7 of 7 items

First Name	Last Name	Organization	City	Exp Date	Cert No
Larry	Allen	City of Hendersonville	Hendersonville	12/31/2020	117154
Marshall	Boyd	City of Hendersonville	Hendersonville	12/31/2021	119920
Ty	Buhler	City of Hendersonville	Mt Juliet	12/31/2021	140104
Thomas	Hoffman	City of Hendersonville	Hendersonville	12/31/2021	133879
Dustin	Jones	City of Hendersonville	Hendersonville	12/31/2020	137441
Earl	Mayo	City of Hendersonville	Hendersonville	12/31/2022	141587
Helen	Morrison	City of Hendersonville: Public	Hendersonville	12/31/2022	134493

Level 2 Certified

Records 1 to 5 of 5

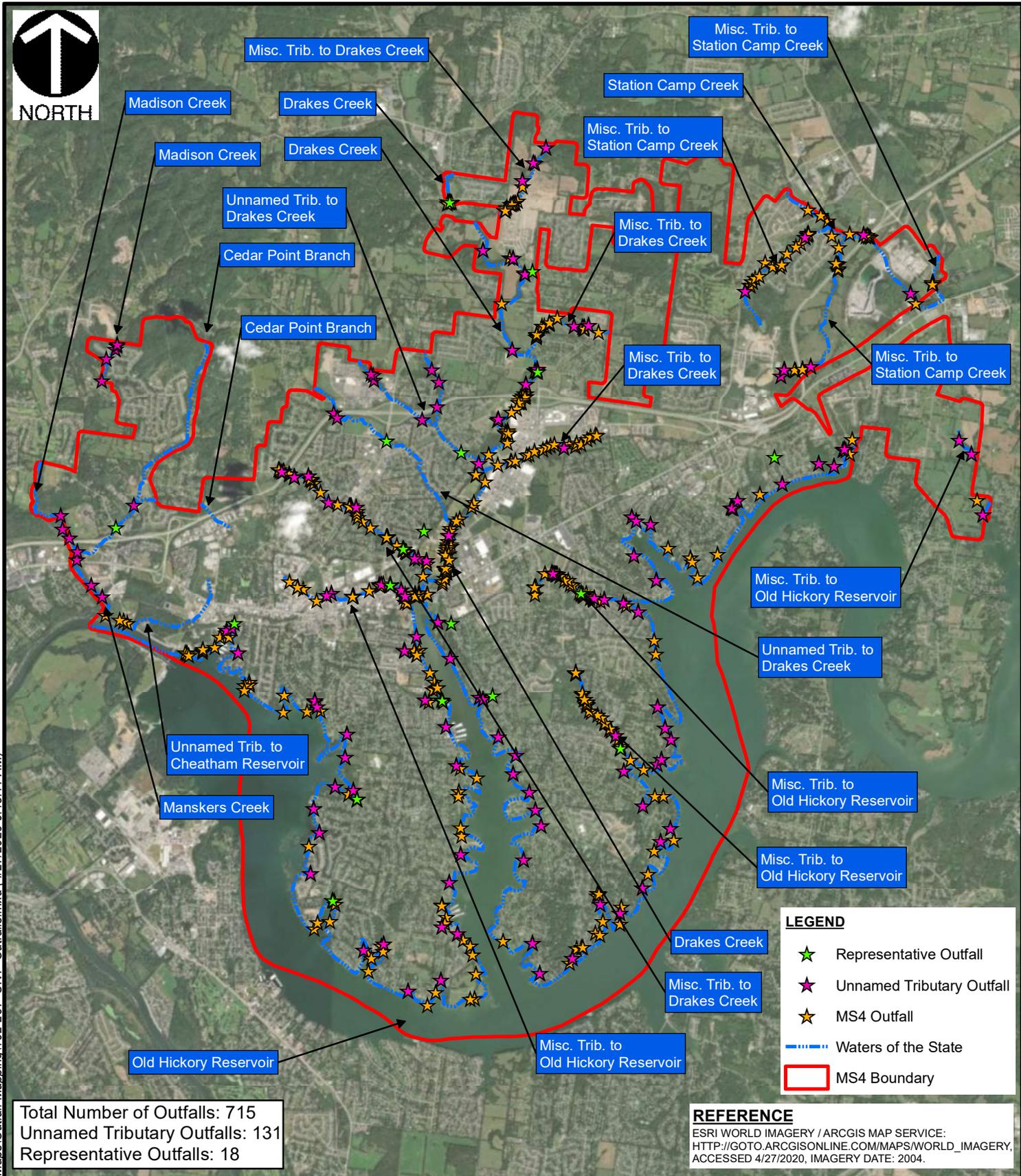
Enter First few Letters of Organization to search

Find

[Search by Name](#)

[Search by City](#)

First Name	Last Name	Organization <small>(sort)</small>	City <small>(sort)</small>	Cert. No.	Exp. Date
Larry	Allen	City of Hendersonville	Hendersonville	117154-D2	12/31/2022
Marshall	Boyd	City of Hendersonville	Hendersonville	119920-D2	12/31/2022
Jerry	Daniel	City of Hendersonville	Hendersonville		12/31/2018
Sarah	Lock	City of Hendersonville	Hendersonville		12/31/2019
Helen	Morrison	City of Hendersonville: Public Works	Hendersonville	134493-D2	12/31/2022



LEGEND

- ★ Representative Outfall
- ★ Unnamed Tributary Outfall
- ★ MS4 Outfall
- Waters of the State
- MS4 Boundary

REFERENCE
 ESRI WORLD IMAGERY / ARCGIS MAP SERVICE:
[HTTP://GTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY](http://gto.arcgis.com/maps/world_imagery),
 ACCESSED 4/27/2020, IMAGERY DATE: 2004.

Total Number of Outfalls: 715
 Unnamed Tributary Outfalls: 131
 Representative Outfalls: 18



Civil & Environmental Consultants, Inc.
 117 Seaboard Lane, Ste. E100 Franklin, Tennessee
 615-333-7797 • 800-763-2326
 www.cecinc.com

CITY OF HENDERSONVILLE
 MS4 PERMIT
 HENDERSONVILLE, SUMNER COUNTY, TN

CHARACTERIZED OVERALL OUTFALL LOCATIONS

DRAWN BY: JTM	CHECKED BY: LWK	APPROVED BY: JLW	FIGURE NO: 1A
DATE: 4/27/2020	SCALE: 1" = 1.25 miles	PROJECT NO: 192-267	

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- (a) Infiltration/percolation trench
- (b) Infiltration basin
- (c) Drainage (recharge) well
- (d) Porous pavement
- (4) Filtering systems
 - (a) Catch basin inserts/media filter
 - (b) Sand filter
 - (c) Filter/absorption bed
 - (d) Filter and buffer strips
- (5) Open channel
 - (a) Swale

(2). Requirements for existing problem locations. The City Engineer shall in writing notify the owners of existing locations and developments of specific drainage, erosion or sediment problem affecting such locations and developments, and the specific actions required to correct those problems. The notice shall also specify a minimum of twenty (20) days for compliance.

(3). Inspection of existing facilities. The City Engineer may, to the extent authorized by state and federal law, establish inspection programs to verify

Rev. 1/2004

that all stormwater management facilities, including those built before as well as after the adoption of this ordinance, are functioning within design limits. These inspection programs may be established on any reasonable basis, including but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of the municipality's NPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in drainage control facilities; and evaluating the condition of drainage control facilities and other BMPs.

(4). Corrections of problems subject to appeal. Corrective measures imposed by the City are subject to appeal under this ordinance.

18-208. Illicit discharges due to land disturbance. (1). Scope. This section shall apply to all water generated on developed or undeveloped land entering the municipality's separate storm sewer system.

(2). Prohibition of illicit discharges. No person shall introduce or cause

to be introduced into the municipal separate storm sewer system any discharge that is not composed entirely of stormwater. The commencement, conduct or continuance of any non-stormwater discharge to the municipal separate storm sewer system is prohibited except as described as follows:

- (a) Uncontaminated discharges from the following sources:
 - (1) Water line flushing or other potable water sources,
 - (2) Landscape irrigation or lawn watering with potable water,
 - (3) Diverted stream flows,
 - (4) Rising ground water,
 - (5) Groundwater infiltration to storm drains,
 - (6) Pumped groundwater,
 - (7) Foundation or footing drains,
 - (8) Crawl space pumps,
 - (9) Air conditioning condensation,
 - (10) Springs,
 - (11) Non-commercial washing, for example vehicles
 - (12) Natural riparian habitat or wet-land flows,
 - (13) Swimming pools (if dechlorinated –

Rev. 1/2004

typically less than one PPM chlorine),

- (14) Fire fighting activities, and
- (15) Any other uncontaminated water source.

(b) Discharges specified in writing by the City as being necessary to protect public health and safety.

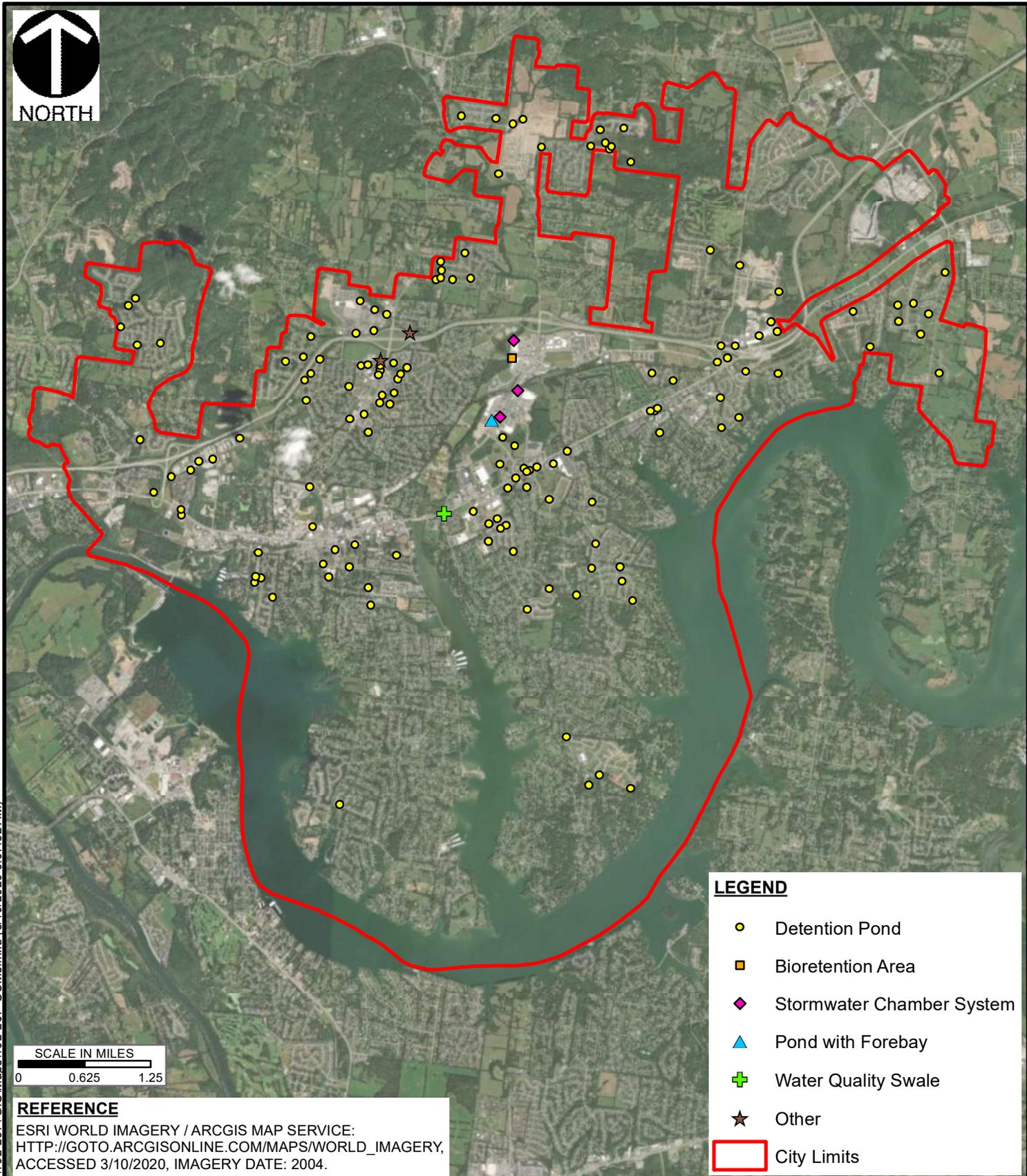
(c) Dye testing is an allowable discharge if the City Engineer pre-approves in writing.

(3). Prohibition of illicit connections.

(a) The construction, use, maintenance or continued existence of illicit connections to the separate municipal storm sewer system is prohibited.

(b) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(4). Reduction of stormwater pollutants by the use of best management practices. Any person responsible for a property or premises, which is, or may be, the source of an illicit discharge, may be required to implement, at the person's expense, the BMPs necessary to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions



REFERENCE

ESRI WORLD IMAGERY / ARCGIS MAP SERVICE:
[HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY](http://gto.arcgis.com/maps/world_imagery),
 ACCESSED 3/10/2020, IMAGERY DATE: 2004.

LEGEND

- Detention Pond
- Bioretention Area
- ◆ Stormwater Chamber System
- ▲ Pond with Forebay
- + Water Quality Swale
- ★ Other
- City Limits



Civil & Environmental Consultants, Inc.

117 Seaboard Lane, Ste. E100 Franklin, Tennessee

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www.cecinc.com

**CITY OF HENDERSONVILLE
 INVENTORY OF PERMANENT STORMWATER
 CONTROL MEASURE (SCM) ASSETS
 HENDERSONVILLE, TENNESSEE**

SCM ASSETS

DRAWN BY:	JTM	CHECKED BY:	###	APPROVED BY:	###	FIGURE NO:	1
DATE:	3/10/2020	SCALE:	1" = 1.25 miles	PROJECT NO:	192-267		

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June 20, 2019

Mr. Duane Allen
Design Engineer
City of Hendersonville
101 Maple North Drive
Hendersonville, Tennessee 37075

Dear Mr. Allen:

Subject: City of Hendersonville Gap Analysis Summary
Stormwater Management Program Support
CEC Project 190-706

1.0 INTRODUCTION & BACKGROUND

The Tennessee Department of Environment and Conservation (TDEC) requires coverage for stormwater discharges from certain small municipal separate storm sewer systems (MS4s) under the Phase II NPDES permit - TNS000000 (Permit). CEC understands that the City of Hendersonville (City) was originally covered under the 2003 permit. The City obtained coverage under the 2010 Permit on June 15, 2011 and coverage under the 2016 Permit was obtained on May 1, 2017. Civil & Environmental Consultants, Inc. (CEC) performed a gap analysis of the City of Hendersonville's (City) stormwater management program to assess compliance with the Permit requirements and evaluate overall program effectiveness. The gap analysis consisted of an in-person meeting on March 20, 2019, review of internal City documents, review of the TDEC permit web viewer for City permitting documents, and review of the City's website. Notes summarizing the March 20, 2019 meeting were sent to the City on April 2, 2019. However, the City requested a more detailed letter of our findings. There has also been subsequent correspondence between CEC and the City. This letter presents the findings of this gap analysis in greater detail.

2.0 GAP ANALYSIS FINDINGS

CEC used our MS4 Permit compliance experience including an audit checklist obtained from TDEC during recent audits for other MS4s to assess the City's stormwater management program. In some cases, the original requirement was located in the 2010 Permit (or the 2003 Permit); however, our recommendations refer to the 2016 Permit because it is the current permit in force and may have modified language compared to the 2010 permit. Permanent stormwater

requirements in the 2016 Permit were appealed, and TDEC has issued draft rule making language for public comment. Therefore, CEC did not include findings regarding the City's permanent stormwater management requirements. Following is a list of our findings from the gap analysis:

- 1) Inventory and tracking of Best Management Practices (now called Stormwater Control Measures or SCMs)
 - Due Date: **December 12, 2011** (within 180 days of coverage)
 - Permit location: Section 4.1.1 and 4.2.5.6 of the 2010 Permit (p.11 and p.19)
 - Actions taken: (None)
 - Recommendations: Begin mapping known SCM locations and develop a GIS database to comply with section 4.2.5.6 of the 2016 Permit

- 2) Develop a Public Information and Education (PIE) plan
 - Due Date: **June 15, 2012** (within 1 year of coverage)
 - Permit location: Section 4.2.1 of the 2010 Permit (p.11)
 - Actions taken: The City has produced a draft PIE plan and sent it to a consultant
 - Recommendations: Collaborate with the consultant on finalizing the PIE plan to comply with section 4.2.1 of the 2016 Permit

- 3) Develop and implement an Illicit Discharge Detection and Elimination (IDDE) Standard Operating Procedure (SOP) & mechanism for the public to report suspected illicit discharges
 - Due Date: **December 15, 2012** (within 18 months of coverage)
 - Permit location: Section 4.2.3 of the 2010 Permit (p. 13)
 - Actions taken: The City has produced a draft IDDE SOP and sent it to a consultant
 - Recommendations: Collaborate with the consultant on finalizing the IDDE SOP and develop webpage for public reporting of suspected illicit discharges to comply with section 4.2.3 of the 2016 Permit

- 4) Develop and implement an Enforcement Response Plan (ERP)
 - Due Date: **December 15, 2012** (within 18 months of coverage)
 - Permit location: Section 4.2.3 of the 2010 Permit (p. 13)
 - Actions taken: The City has produced a draft ERP and sent it to a consultant
 - Recommendations: Collaborate with the consultant on finalizing the ERP to comply with section 4.2.3 of the 2016 Permit

- 5) Define "Priority Construction Activity" in the Ordinance
 - Due Date: **June 15, 2013** (within 24 months of coverage)
 - Permit location: Section 4.2.4.j of the 2010 Permit (p. 15)
 - Actions taken: The City has approved a Task Order to perform the work
 - Recommendations: Collaborate with the consultant on Ordinance revisions to comply with section 4.2.4j of the 2016 Permit

- 6) Develop and implement a Construction Inspection Standard Operating Procedure (SOP)
 - Due Date: **June 15, 2013** (within 24 months of coverage)
 - Permit location: Section 4.2.4.h of the 2010 Permit (p. 15)
 - Actions taken: The City has produced a draft Construction Inspection SOP based on what is currently being done and sent it to a consultant
 - Recommendations: Collaborate with the consultant on finalizing the Construction Inspection SOP to comply with section 4.2.4h of the 2016 Permit

- 7) Include requirements for construction site operators to control waste materials in Ordinance
 - Due Date: **June 15, 2013** (within 24 months of coverage)
 - Permit location: Section 4.2.4.e of the 2010 Permit (p. 15)
 - Actions taken: The City has approved a Task Order to perform the work
 - Recommendations: Collaborate with the consultant on Ordinance revisions to comply with section 4.2.4e of the 2016 Permit

- 8) Add buffer requirements to Ordinance
 - Due Date: **August 31, 2015** (within 5 years of Permit issuance)
 - Permit location: Section 4.2.5.1 of 2010 Permit (p.15)
 - Actions taken: The City has approved a Task Order to perform the work
 - Recommendations: Collaborate with the consultant on Ordinance revisions to comply with section 4.2.5.2.4 of the 2016 Permit

- 9) Develop Operation and Maintenance (O&M) plans for municipal operations & train employees on O&M plans
 - Due Date: **August 31, 2015** (within 5 years of Permit issuance)
 - Permit location: Section 4.2.6 of 2010 Permit (p.20)
 - Actions taken: The City has drafted a couple of O&M plans and sent them to a consultant for review
 - Recommendations: Collaborate with the consultant on finalizing the O&M plans and continuing developing other required O&M plans to comply with section 4.2.6 of the 2016 Permit

- 10) Storm sewer system map
 - Due Date: **August 31, 2015** (within 5 years of Permit issuance)
 - Permit location: Section 4.2.3 of the 2010 Permit (p. 13)
 - Actions taken: The City has requested and received a Task Order to perform the work
 - Recommendations: Approve the Task Order and begin the work to comply with section 4.2.3 of the 2016 Permit

- 11) Develop and/or document existing guidelines for interagency coordination of spill response
 - Due Date: **August 31, 2015** (within 5 years of Permit issuance)
 - Permit location: Section 4.2.3 of the 2010 Permit (p. 13)
 - Actions taken: (None)
 - Recommendations: Develop draft guidelines and coordinate with other agencies to finalize the coordination of spill response to comply with section 4.2.3 of the 2016 Permit

- 12) Ordinance Update for construction site runoff pollutant control program consistent with requirements of reissued NPDES general permit for construction stormwater runoff
 - Due Date: **March 30, 2018** (within 18 months of reissuance of the CGP)
 - Permit location: Section 4.1.2 of the 2016 Permit (p. 11)
 - Actions taken: The City has approved a Task Order to perform the work
 - Recommendations: Collaborate with the consultant on Ordinance revisions to comply with section 4.1.2 of the 2016 Permit

- 13) Set up a Stormwater Appeals Committee
 - Due Date: (This is a permit recommendation, not a requirement)
 - Permit location: Section 4.2.5.1 of the 2016 Permit (p. 16)
 - Actions taken: The City has enlisted the help of a consultant to set up this committee
 - Recommendations: Work with the consultant to finalize the creation of the committee and develop a training schedule using the Municipal Technical Advisory Service (MTAS) as the trainer

- 14) Employee training on IDDE and O&M plans
 - Due Date: New employees must be trained within six months of their employment or movement into an applicable job category
 - Permit location: Section 4.2.6 of the 2016 Permit (p. 21)
 - Actions taken: The City is actively looking for training courses to attend
 - Recommendations: Attend relevant training courses and set up training date for relevant employees once O&M plans are finalized to comply with section 4.2.6 of the 2016 Permit

- 15) Create an “Annual Review Meeting Agenda” to evaluate program effectiveness
 - Due Date: Before turning in the annual report (which is due September 30 of every year)
 - Permit locations: Section 3.1.2 (p. 6), Section 4.2.1 (p. 11), Section 4.2.4.f (p. 15), Section 4.4.1 (p. 22), and Section 5.1.a (p. 27)
 - Actions taken: The City has a pending Task Order to perform the work
 - Recommendations: Approve the Task Order and collaborate with the consultant on creating an Annual Review Meeting Agenda to comply with section 4.4.1 of the 2016 Permit

Mr. Allen – City of Hendersonville
CEC Project 190-706
Page 5
June 20, 2019

CEC appreciates the opportunity to provide engineering services to the City and looks forward to continuing our working relationship to help meet the recommendations in this letter. Please contact us if you have any questions at 615-333-7797 or jbryan@cecinc.com or scasey@cecinc.com.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



Justin Bryan, P.E., CPESC
Project Manager



Steven E. Casey, P.E., CPESC
Senior Principal

TITLE 18**WATER AND STORM SEWERS¹****CHAPTER**

1. WATER.
2. LAND DISTURBANCE REGULATIONS
3. POST CONSTRUCTION RUNOFF AND ILLICIT DISCHARGE AND CONNECTION TO STORMWATER REGULATIONS
4. NATIONAL FLOOD INSURANCE PROGRAM REGULATIONS
5. STORMWATER UTILITY

CHAPTER 1**WATER²****SECTION**

- 18-101. Definitions.
- 18-102. Public nuisance declared.
- 18-103. Prohibition.
- 18-104. Abatement.
- 18-105. Appeals to board of mayor and aldermen.
- 18-106. Compliance required.
- 18-107. Obstruction of city building inspector.
- 18-108. Violation and penalty.

18-101. Definitions. For the purpose of this chapter, the following terms, phrases, words, and their derivation, shall have the meanings given herein:

(1) "Aldermen:" "Aldermen", when used herein, shall mean the Board of Mayor and Aldermen of the City of Hendersonville, Sumner County, Tennessee.

(2) "Certified mail: "Certified mail may be used instead of registered mail whenever this chapter requires a notice to be given by Registered Mail.

(3) "City:" "City", when used herein shall mean the City of Hendersonville, Sumner County, Tennessee.

(4) "City building inspector: " The "city building inspector" shall be and mean that person designated as such by the mayor, or the city building inspector's designated representative.

¹Municipal code references

Building, utility and housing codes: title 12.

Refuse disposal: title 17.

²Municipal code reference

Plumbing code: title 12, chapter 2.

(5) "Computation of time:" The time within which any act is to be done shall be computed by excluding the first and including the last day, unless the last day is a Saturday, a Sunday, or a legal holiday, and then it shall also be excluded.

(6) "Gender: "Words importing the masculine gender shall include the feminine and neuter.

(7) "Number: "Words used in the singular include the plural and the plural includes the singular number.

(8) "Obstruction to the natural flow of water:" The term "obstruction to the natural flow of water", as used in this chapter, is hereby defined to mean and include any bridges, culverts, drainage structures, pipes, dams, spans, trestles, viaducts, causeways, artificial or man-made drains, or any other such or similar structure, and the depositing or dumping of any material, waste, refuse, garbage, or any other such or similar acts, that impede, impair, or hinder the natural flow of water so that injury or imminent danger, annoyance, hurt, harm, inconvenience, or damage to the general public or its property is likely to ensue, or the rights of the public generally or a considerable number of persons or inhabitants of this city are infringed, impaired, endangered, or placed in jeopardy, or threatened to be placed in jeopardy of harm, damage, or injury.

(9) "Person:" Person means any individual, firm, partnership, corporation, company, association, or joint stock association, and includes any trustee, receiver, assignee, or other similar representative thereof.

(10) "Shall; may: "The word "shall" is mandatory. The word "may" is permissive. (Ord. #1975-19, July 1975, modified)

18-102. Public nuisance declared. Any obstruction to the natural flow of water is hereby declared and proclaimed to be a public nuisance. (Ord. #1975-19, July 1975)

18-103. Prohibition. It shall be unlawful for any person to cause or to permit the construction, maintenance, or the existence of any obstruction to the natural flow of water within the area of this city or within this city's jurisdiction. (Ord. #1975-19, July 1975)

18-104. Abatement. (1) Whenever the city building inspector inspects or causes to be inspected any drains, streams, ditches, creeks, or any other bodies of water, or any places where water accumulates, or any structures, man-made or artificial, that affect the flow of any water by any means, directly or indirectly, when such structures are in, upon, near, or contiguous to the drains, streams, ditches, creeks, or any other bodies of water or any other places where water accumulates, and whenever the city building inspector shall find and be of the opinion that any bridge, dam, culvert, pipe, span, trestle, viaduct, causeway, artificial or man-made drain, or any such or similar structure, or the depositing or dumping of any material, waste, refuse, garbage, or any other such or similar acts, are in a state of nuisance and that any such conation, structure, or activity, as aforesaid, obstructs the natural flow of water, as herein defined, he shall notify or cause to be notified the person causing or permitting the construction, maintenance, or existence of said nuisance; and such person shall have such nuisance or the cause of such nuisance removed and abated within a

reasonable time as prescribed in such written notice. Such notice shall be served by Registered Mail or Personal Service upon such person. Such notice may state that the obstruction has been declared to be a nuisance, and that such obstruction must be removed, or remedied by repairing, altering, or demolishing the same; and that in any event, the condition must be abated within the time prescribed herein. Such notice may set forth facts to show that the condition complained of constitutes a nuisance of a public character and that it is an "obstruction to the natural flow of water", as herein defined. Such notice may be in the following form or substantially, the following form:

"NOTICE AND DEMAND FOR REMOVAL TO: _____
(name of person, as
_____ herein defined, causing, or responsible for such obstruction)

You will please take notice that the City of Hendersonville, Sumner County, Tennessee, requires you to remedy or remove and to completely abate the nuisance and obstruction arising from _____
(describe

_____ the condition complained of, the nuisance, and insert the
_____ facts as to the decision to proclaim such condition a nuisance)

at _____
(describe the place and location of the obstruction)

You are further advised that upon default or upon your failure to remove, abate, or remedy such nuisance or obstruction by repairing, altering, or demolishing it within ___ days from the service of this notice, the city may proceed to abate and remove such nuisance and require you to pay all the expenses and costs incident thereto, or the city may pursue its other and various legal recourses, unless such time is extended by virtue of your taking an appeal to the aldermen from the findings and declarations of the city building inspector that such conditions, as aforesaid, constitute a nuisance, which appeal must be taken pursuant to Ordinance 1975-19, within seventy-two (72) hours from the service of this notice upon you. This notice is given without prejudice to any right of action for damages the city has already sustained or may sustain by reason of said nuisance and obstruction as aforesaid, and without prejudice to any other right or relief or action to which the city may be entitled; all such rights the city has in this matter are hereby reserved.

Dated at _____, this _____
day of _____, 1975

THE CITY OF HENDERSONVILLE

By:

Title

(2) If such person or his agents shall neglect or refuse to comply with the terms of such notice and this chapter, the city building inspector, upon the expiration of the terms as set out in the said notice, is hereby empowered to remove such nuisance or the cause of such nuisance, utilizing either the services of some agency of this city or some private agency, at the expense of such person who is causing or responsible for said nuisance; such person's liability, if more than one, shall be joint and several. If the nuisance is abated by the city or its agents, public or private, the person causing or permitting the construction, maintenance, or existence of such nuisance shall be required to pay all of the reasonable expenses and costs of such abatement; such expenses and costs may be determined by the board of mayor and aldermen.

In the event that such person should feel aggrieved by any decision of the city building inspector in this regard, such aggrieved party shall, within seventy-two (72) hours from the receipt of the written or personal notice and demand for the abatement of the nuisance, file at the offices of the city building inspector and the city recorder, a request for a hearing by the aldermen, which request shall be in written form and shall contain the contentions of the aggrieved party. The aldermen shall hold a hearing to review the action of the city building inspector, and the aldermen shall affix a time and place for such hearing and shall notify such aggrieved person who is requesting a hearing. The aldermen, at such hearing or after such hearing, may affirm, amend, or set aside such action of the said city building inspector. No implementation of the order of the city building inspector for the abatement of the nuisance shall be effected, pending such hearing by the aldermen.

None of the remedies for the abatement of nuisances as set out in this chapter shall be deemed to be exclusive, or as precluding the city from seeking injunctive relief in equity or from seeking any other relief.

Nothing contained in this chapter shall be construed to affect, suspend, or delay any cause or right of action or actions that any other citizen or third party may have against such person causing such nuisance, nor will any action taken by the city affect any duty of such persons causing the nuisance to other citizens or third parties. (Ord. #1975-19, July 1975)

18-105. Appeals to board of mayor and aldermen. The aldermen shall hear and act upon such complaints filed by persons affected by decisions of the city building inspector, and may amend or set aside such decisions if contrary to the provisions of this chapter and the purpose and intent of this chapter. The concurring vote of a simple majority of those members present at such hearing shall be necessary to amend or set aside any order, requirement, decision, or determination of the city building inspector, provided, however, that a quorum of the board of mayor and aldermen is present at such hearing. A quorum constitutes a majority of all the members of said board of mayor and aldermen. Such an appeal shall only be perfected by the filing of an informal written request for a hearing before the aldermen and setting forth in such written request the contentions of the aggrieved party and explaining why the actions of the city building inspector should be set aside, modified, or vacated. Upon the perfecting of an appeal, the aggrieved party shall be granted a public hearing before the aldermen, as prescribed above, and he may appear on his own behalf or be represented by counsel. The aggrieved person's side of the matter shall first be heard, and subsequently, the city building inspector and the city attorney shall present their side, and both sides shall be permitted to introduce any relevant and competent evidence bearing on the issue. The notice of such hearing to which the aggrieved person shall be entitled shall be mailed to the said aggrieved person at least seven (7) days prior to the hearing date, unless in specific instances a shorter period of time is specified and agreed upon by the aldermen and the aggrieved person. Such notice of hearing shall be sent by Registered Mail to the address that shall be given by the aggrieved person in his written request for a hearing. The following disposition of any such complaint shall be in the form of a resolution, which shall affirm, amend, or set aside the decision of the city building inspector. No request to grant a rehearing of such decision of the aldermen shall be entertained unless new evidence is submitted that could not reasonably have been presented at the previous hearing. If justifiable grounds for a rehearing are alleged, they shall be made know, by a written communication to the aldermen, of which a copy of the same shall be filed with the city recorder; and if a motion to grant a rehearing shall receive the number of affirmative votes that is required to amend or set aside any decisions of the said city building inspector, as hereinabove prescribed, then a date for a rehearing shall be set. Such rehearing shall be conducted by the aldermen in substantially the same manner as required for the former hearing. (Ord. #1975-19, July 1975)

18-106. Compliance required. In lieu of enforcement of this chapter by way of prosecution, recovery of civil remedies, revocation of permits, condemnation, and other compulsory means, the city building inspector and the aldermen, either one or both, may seek to obtain the voluntary compliance with this chapter by way of notice, warning, or other educational means. This section does not, however, require that such non- compulsory methods be used before proceeding by way of a compulsory enforcement. (Ord. #1975-19, July 1975)

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18-107. Obstruction of city building inspector. No person shall interfere with or

obstruct the city building inspector or any of his designated representatives in carrying out any inspection, survey, or examination or the performance of any other duty for the office of the city building inspector. (Ord. #1975-19, July 1975)

18-108. Violation and penalty. Any person violating any provision of this chapter or permitting or causing any obstruction to the natural flow of water, as herein defined, shall be fined not more than fifty dollars (\$50.00) for each offense for each offense; and a separate offense shall be considered committed upon each day during or on which a violation occurs or continues. (Ord. #1975-19, July 1975, modified)

CHAPTER 2

LAND DISTURBANCE REGULATIONS**SECTION**

1. General Provisions.
2. Definitions
3. Land Disturbance Permits.
4. Waivers.
- ~~5.~~ Stormwater System Design and Management Standards.
- ~~5-6.~~ **Water Quality Riparian Buffers**
- ~~6-7.~~ Post Construction and Inspection.
- ~~7-8.~~ Existing Locations and Developments.
- ~~8-9.~~ Illicit Discharges Due to Land Disturbance.
- ~~9-10.~~ Enforcement.
10. Penalties.

18-102. General provisions. (1). **Purpose.** It is the purpose of this ordinance to:

(a) Protect, maintain, and enhance the environment of the City of Hendersonville and the public health, safety and the general welfare of the citizens of the city, by controlling discharges of pollutants to the City's stormwater system and to maintain and improve the quality of the receiving waters into which the stormwater outfalls flow, including, without limitation, lakes, rivers, streams, ponds, wetlands, and groundwater of the city.

(b) Enable the City to comply with the National Pollution Discharge Elimination System (NPDES) permit and applicable regulations, 40 CFR 122.26 for stormwater discharges.

(c) Allow the City to exercise the powers granted in Tennessee Code Annotated 68-221-1105, which provides that, among other powers municipalities have with respect to stormwater facilities, is the power by ordinance or resolution to:

- (1) Exercise general regulation over the planning, location, construction, and operation and maintenance of stormwater facilities in the municipality, whether or not owned and operated by the municipality:
- (2) Adopt any rules and regulations deemed necessary to accomplish the purposes of this statute, including the adoption of a system of fees for services and permits;
- (3) Establish standards to regulate the quantity of stormwater discharged and to regulate stormwater contaminants as may be necessary to protect water quality:

(4) Review and approve plans and plats for stormwater management in proposed subdivisions or commercial developments;

(5) Issue permits for stormwater discharges, or for the construction, alteration, extension, or repair of stormwater facilities;

(6) Suspend or revoke permits when it is determined that the permittee has violated any applicable ordinance, resolution, or condition of the permit;

(7) Regulate and prohibit discharges into stormwater facilities of sanitary, industrial, or commercial sewage or waters that have otherwise been contaminated; and

(8) Expend funds to remediate or mitigate the detrimental effects of contaminated land or other source of stormwater contamination, whether public or private.

(9) In the case of conflicting Ordinances, this ordinance shall prevail.

(2). Administering entity. The Director of Public Works shall administer the provisions of this ordinance.

18-202. Definitions. For the purpose of this chapter, the following definitions shall apply: Words used in the singular shall include the plural, and the plural shall include the singular; words used in the present tense shall include the future tense. The word "shall" is mandatory and not discretionary. The word "may" is permissive. Words not defined in this section shall be construed to have the meaning given by common and ordinary use as defined in the latest edition of Webster's Dictionary.

(1) "As built plans" means drawings depicting conditions as they were actually constructed.

(2) "Best management practices" or "BMPs" are physical, structural, and/or managerial practices that, when used singly or in combination, prevent or reduce pollution of water, that have been approved by the City, and that have been incorporated by reference into this ordinance as if fully set out therein.

~~(3) "Channel" means a natural or artificial watercourse community water with a definite bed and banks that conveys flowing water continuously or periodically.~~

(4) "Community water" means any and all waters of the state, rivers, streams, creeks, branches, lakes, reservoirs, ponds, drainage systems, springs, wetlands, wells and other bodies of surface or subsurface water, natural or artificial, lying within or forming a part of the boundaries of the City.

(5) "Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

(6) "Days" or "Daily" shall mean calendar days.

(7) "Design storm event" means a hypothetical storm event, of a given frequency interval and duration, used in the analysis and design of a stormwater facility.

(8) “Discharge” means dispose, deposit, spill, pour, inject, seep, dump, leak or place by any means, or that which is disposed, deposited, spilled, poured, injected, seeped, dumped, leaked, or placed by any means including any direct or indirect entry of any solid or liquid matter into the municipal separate storm sewer system.

(9) “Easement” means an acquired privilege or right of use or enjoyment that a person, party, firm, corporation, municipality or other legal entity has in the land of another.

(10) “Erosion” means the removal of soil particles by the action of water, wind, ice or other geological agents, whether naturally occurring or acting in conjunction with or promoted by anthropogenic activities or effects.

(11) “Erosion and sediment control plan” means a written plan (including drawings or other graphic representations) that is designed to minimize the accelerated erosion and sediment runoff at a site during construction activities.

(12) “Hotspot” (~~“priority area”~~) means an area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

(13) “Illicit connection” means illegal and/or unauthorized connections to the municipal separate stormwater system whether or not such connections result in discharges into that system.

(14) “Illicit discharge” means any discharge to the municipal separate storm sewer system that is not composed entirely of stormwater and not specifically exempted under 3(3).

(15) “Land disturbing activity” means any activity on property that results in a change in the existing soil cover (both vegetative and non-vegetative) and/or the existing soil topography. Land-disturbing activities include, but are not limited to, development, re-development, demolition, construction, reconstruction, clearing, grading, filling, trench, and excavation.

(16) “Maintenance” means any activity that is necessary to keep a stormwater facility in good working order so as to function as designed. Maintenance shall include complete reconstruction of a stormwater facility if reconstruction is needed in order to restore the facility to its original operational design parameters. Maintenance shall also include the correction of any problem on the site property that may directly impair the functions of the stormwater facility.

(17) “Maintenance agreement” means a document recorded in the land records that acts as a property deed restriction, and which provides for long term maintenance of stormwater management practices.

(18) “Municipal separate storm sewer system (MS4)” (“Municipal separate stormwater system”) means the conveyances owned or operated by the municipality for the collection and transportation of stormwater, including the roads and streets and their drainage systems, catch basins, curbs, gutters, ditches, man-made channels, and storm drains.

(19) “National Pollutant Discharge Elimination System permit” or “NPDES permit” means a permit issued pursuant to 33 U.S.C. 1342.

(20) “New Development Projects means new and redevelopment projects that disturb equal to or greater than one acre, or less than one acre if part of a larger common plan of development or sale.

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(21) “Off-site facility” means a structural BMP located outside the subject property boundary described in the permit application for land development activity.

(22) “On-site facility” means a structural BMP located within the subject property boundary described in the permit application for land development activity.

(23) “Peak flow” means the maximum instantaneous rate of flow of water at a particular point resulting from a storm event.

(24) “Person” means any and all persons, natural or artificial, including any individual, firm or association and any municipal or private corporation organized or existing under the laws of this or any other state or country.

(25) “Priority construction activity area” means construction activities discharging directly into, or immediately upstream of, waters the state recognizes as unavailable parameters (for siltation or habitat alteration) or Exceptional Tennessee Waters . "hot spot" as defined in 2(11).

(26) “Runoff” means that portion of the precipitation on a drainage area that is discharged from the area into the municipal separate stormwater system.

(27) “Sediment” means solid material, both mineral and organic, that is in suspension, is being transported, or has been moved from its site of origin by air, air, water, gravity, or ice and has come to rest on the earth’s surface either above or below sea level

(28) “Sedimentation” means soil particles suspended in stormwater that can settle in stream beds and disrupt the natural flow of the stream.

(29) “Soils Report” means a study of soils on a subject property with the primary purpose of characterizing and describing the soils. The soils report shall be prepared by a qualified soils engineer, who shall be directly involved in the soil characterization either by performing the investigation or by directly supervising employees.

(30) “Stabilization” means providing adequate measures, vegetative and/or structural, that will prevent erosion from occurring.

(31) “Stormwater” means stormwater runoff, snow melt runoff, surface runoff, infiltration and drainage.

(32) “Stormwater Control Measures (SCMs) means permanent practices and measures designed to reduce the discharge of pollutants from New Development Projects.

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(33) “Stormwater management” means the programs to maintain quality and quantity of stormwater runoff to or below pre-development levels.

(34) “Stormwater management facilities” means the drainage structures, conduits, ditches, combined sewers, sewers, and all appurtenances by means of which stormwater is collected, transported, pumped, treated or disposed of.

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~~(335)~~ “Stormwater management plan” means the set of drawings and other documents that comprise all the information and specifications for the programs, drainage systems, structures, BMPs, concepts and techniques intended to maintain or restore quality and quantity of stormwater runoff to pre-development levels.

~~(346)~~ “Stormwater runoff” means flow on the surface of the ground, resulting from precipitation.

~~(357)~~ “Stormwater utility” means the Public Works Department that administers the stormwater management ordinance, and other stormwater rules and regulations adopted by the municipality.

~~(368)~~ “Structural BMPs” means devices that are constructed to provide control of stormwater runoff.

~~(379)~~ “Surface water” includes waters upon the surface of the earth in bounds created naturally or artificially including, but not limited to, streams, other water courses, lakes and reservoirs.

~~(3840)~~ ~~“Watercourse” means a permanent or intermittent stream or other body of water, either natural or man-made, which gathers or carries surface water.~~

~~(41)~~ “Water Quality Riparian Buffer” means a setback from the top of water body’s bank of undisturbed vegetation, including trees, shrubs and herbaceous vegetation; enhanced or restored vegetation; or the re-establishment of native vegetation bordering streams, ponds, wetlands, springs, reservoirs or lakes, which exists or is established to protect those waterbodies. Buffer zones are not primary sediment control measures and should not be relied on as such. The buffer is measured from the top of bank.

~~(39)~~ ~~(42)~~ “Watershed” means all the land area that contributes runoff to a particular point along a waterway.

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18-203. Land disturbance permits. (1). When required. Every person will be required to obtain a land disturbance permit from the City in the following cases:

- (a) Land disturbing activity disturbs one (1) or more acres of land
- (b) Land disturbing activity of less than one (1) acre of land if such activity is part of a larger common plan of development or sale that affects one (1) or more acre of land;
- (c) Land disturbing activity of less than one (1) acre of land, in the discretion of the City Engineer if such activity poses a

unique threat to water, or public health or safety;

(d) The creation and use of borrow pits.

(2). Building permit. No building permit shall be issued until the applicant has obtained a land disturbance permit where the same is required by this ordinance.

(3). Exemptions. The following activities are exempt from the permit requirement:

(a) Any emergency activity that is immediately necessary for the protection of life, property, or natural resources.

(b) Existing nursery and agricultural operations conducted as a permitted main or accessory use.

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(c) Any logging or agricultural activity that is consistent with an approved farm conservation plan or a timber management plan prepared or approved by the appropriate state or federal agency.

(4). Application for a land disturbance permit.

(a) Each application shall include the following:

(1) Name of applicant;

(2) Business or residence address of applicant;

(3) Name, address and telephone number of the owner of the property of record in the office of the assessor of property;

(4) Address and legal description of subject property including the tax reference number and parcel number of the subject property;

(5) Name, address and telephone number of the contractor and any subcontractor(s) who shall perform the land disturbing activity and certified person who shall implement the erosion and sediment control plan;

(6) A statement indicating the nature, extent and purpose of the land disturbing activity including the size of the area for which the permit shall be applicable and a schedule for the starting and completion dates showing phasing of the land disturbing activity.

(7) Where the property includes a sinkhole, the applicant shall obtain from the Tennessee Department of Environment and Conservation appropriate permits.

(8) The applicant shall obtain from any other state or federal agency any other appropriate environmental permits that pertain to the property. However, the inclusion of those permits in the application shall not foreclose the City from imposing additional development requirements and conditions, commensurate with this

ordinance, on the development of property covered by those permits.

(b) Each application shall be accompanied by:

(1) A sediment and erosion control plan as described in 5(5).

(2) A stormwater management plan as described in 5(4) providing for stormwater management during the land disturbing activity and after the activity has been completed.

(3) Each application for a land disturbance permit shall be accompanied by payment of land disturbance permit and other stormwater management fees, of \$50.00.

(5). Review and approval of application.

(a) The City will review each application for a land disturbance

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determine its conformance with the provisions of this ordinance. Within thirty (30) days after receiving an application, the City shall provide one of the following responses in writing:

(1) Approval of the permit application;

(2) Approval of the permit application, subject to such reasonable conditions as may be necessary to secure substantially the objectives of this ordinance, and issue the permit subject to these conditions; or

(3) Denial of the permit application, indicating the reason(s) for the denial.

(b) If the City has granted conditional approval of the permit, the applicant shall submit a revised plan that conforms to the conditions established by the City. However, the applicant shall be allowed to proceed with his land disturbing activity so long as it conforms to conditions established by the City.

(c) No development plans will be released until the land disturbance permit has been approved and erosion and sediment control measures are in place.

(6). Permit duration. Every land disturbance permit shall expire and become null and void if substantial work authorized by such permit has not commenced within ninety (90) calendar days of issuance, or is not complete within twelve (12) months from the date of the commencement of construction.

(7). Notice of construction. The applicant must notify the City ten (10) working days in advance of the commencement of construction. The City shall conduct regular inspections of the stormwater management system construction. All inspections shall be documented and written reports prepared that contain the following information:

(1) The date and location of the inspection;

(2) Whether construction is in compliance with the approved stormwater management plan;

(3) Variations from the approved construction specifications;

(4) Any violations that exist.

(8). Performance Surety.

(a) The City may, at its discretion, require the submittal of a performance surety prior in the form of a letter of credit or cashiers check to issuance of a permit in order to ensure that the stormwater practices are installed by the permit holder as required by the approved stormwater management plan. The amount of the installation performance surety shall be the total estimated construction cost determine by the City Engineer of the structural BMPs approved under the permit plus any reasonably foreseeable additional related costs, e.g., for damages or enforcement. The performance surety shall contain forfeiture

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provisions for failure to complete work specified in the stormwater management plan.

(b) The performance surety shall be released in full only upon: 1) submission of as-built plans, 2) written detailed certification by a registered professional engineer licensed to practice in Tennessee that the structural BMPs have been installed in accordance with the approved plan and other applicable provisions of this ordinance, and 3) the City Engineer will make a final inspection of the structural BMPs to ensure that it is in compliance with the approved plan and provisions of this ordinance. Provisions for a partial pro-rata release of the performance surety based on the completion of various development stages can be made at the discretion of the City Engineer.

(9) Construction General Permit (CGP) Coverage. The Stormwater Pollution Prevention Plan prepared for the Land Disturbance Permit application shall be consistent with the requirements of the current CGP including the runoff pollutant controls.

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18-204. Waivers. (1). General. Every applicant shall provide for stormwater management as required by this ordinance. Requests to waive the stormwater management plan requirements shall be submitted to the City Engineer for approval.

(2). Conditions for waiver. The minimum requirements for stormwater management may be waived in whole or in part upon written request of the applicant, provided that at least one of the following conditions applies:

(a) It can be demonstrated that the proposed development is not likely to impair attainment of the objectives of this ordinance.

(b) Provisions are made to manage stormwater by an off-site facility. The off-site facility must be in place and designed to provide the level of stormwater control that is equal to or greater than that which would be afforded by on-site practices. Further, the facility must be operated and maintained by an entity that is legally obligated to continue the operation and maintenance of the facility.

(3). Downstream damage, etc. prohibited. In order to receive a waiver, the applicant must demonstrate to the satisfaction of the City that the waiver will not lead to any of the following conditions downstream:

- (a) Deterioration of existing culverts, bridges, dams, and other structures;
- (b) Degradation of biological functions or habitat;
- (c) Accelerated stream bank or stream bed erosion or siltation;
- (d) Increased threat of flood damage to public health, life or property.

(4). Land disturbance permit not to be issued where waiver requested. No land disturbance permit shall be issued where a waiver has been requested until the waiver is granted. If no waiver is granted, the plans must be resubmitted with a stormwater management plan.

18-205. Stormwater system design and management standards. (1) Stormwater design or BMP manual.

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(a) Adoption. The municipality adopts as its stormwater design and best management practices (BMP) manual the following publications, which are incorporated by reference in this ordinance as is fully set out herein:

- (1) TDEC Sediment and Erosion Control Manual
- (2) TDEC Manual for Post Construction Runoff Control
- (3) Hendersonville Construction Manual
- (4) Metro Nashville Stormwater Management Manual

(b) This manual includes a list of acceptable BMPs including the specific design performance criteria and operation and maintenance requirements for each stormwater practice. The manual may be updated and expanded from time to time upon the by the City Engineer, based on improvements in engineering, science, monitoring and local maintenance experience. Stormwater facilities that are designed, constructed, operated and maintained in accordance with these BMP criteria will be presumed to meet the minimum water quality performance standards. Failures to property design, install, or maintain BMPs shall constitute a violation of this ordinance

(2). General performance criteria for stormwater management. Unless granted a waiver or judged by the City Engineer to be exempt, the following performance criteria shall be addressed for stormwater management at all sites:

(a) All site designs shall control the peak flow rates of stormwater discharge associated with design storms specified in this ordinance or in the BMP manual and reduce the generation of post construction stormwater runoff to pre-construction levels. These practices should seek to utilize pervious areas for stormwater treatment and to infiltrate stormwater runoff from driveways, sidewalks, rooftops, parking lots, and landscaped areas to the maximum extent practical to provide treatment for both water quality and quantity.

(b) To protect stream channels from degradation, specific channel protection criteria shall be provided as prescribed in the BMP manual.

(c) Stormwater discharges to critical areas with sensitive resources (i.e., cold water fisheries, shellfish beds, swimming beaches, recharge areas, water supply reservoirs) may be subject to additional performance criteria, or may need to utilize or restrict certain stormwater management practices.

(d) Stormwater discharges from "hot spots" may require the application of specific structural BMPs and pollution prevention practices.

(e) Prior to or during the site design process, applicants for land disturbance permits shall consult with the City Engineer to determine if they are

subject to additional stormwater design requirements.

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(f) The calculations for determining peak flows as found in the BMP manual shall be used for sizing all stormwater facilities.

(3). Minimum control requirements.

(a) Design of stormwater facilities shall meet the multi-stage storm frequency storage requirements as identified in the BMP manual unless the City has granted the applicant a full or partial waiver for a particular BMP under Section 4 (Waivers).

(b) If hydrologic or topographic conditions warrant greater control than that provided by the minimum control requirements, the City may impose any and all additional requirements deemed necessary to control the volume, timing, and rate of runoff.

(4). Stormwater management plan requirements. The stormwater management plan shall include sufficient information to allow the City Engineer to evaluate environmental characteristics of the project site, the potential impacts of all proposed development of the site, both present and future, on the water resources, and the effectiveness and acceptability of the measures proposed for managing stormwater generated at the project site. To accomplish this goal the stormwater management plan shall include the following:

(a) Topographic Base Map: A one (1) inch equals one hundred (100) topographic base map of the basin (5' contours) containing the site (2' contours) which extends a minimum of one hundred (100) feet beyond the limits of the basin of the proposed development and indicates:

(1) Existing surface water drainage including streams, ponds, culverts, ditches, sink holes, wetlands; and the type, size, elevation, etc., of the two (2) nearest upstream and downstream drainage structures;

(2) Current land use including all existing structures, locations of utilities, roads, and easements;

(3) All other existing significant natural and artificial features;

(4) Proposed land use with tabulation of the percentage of surface area to be adapted to various uses; drainage patterns; locations of utilities, roads and easements; the limits of clearing and grading;

(5) Proposed structural BMPs;

(6) A written description of the site plan and justification of proposed changes in natural conditions may also be required.

(b) Calculations: Hydrologic and hydraulic design calculations prepared by a Tennessee Licensed Engineer for the pre-development and post-development conditions for the design storms specified in the BMP manual. These calculations must show that the proposed stormwater management

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measures are capable of controlling the quantity and quality of runoff from the site

in compliance with this ordinance and guidelines of the BMP manual. Such calculations shall include:

- (1) A description of the design storm frequency, duration, and intensity where applicable;
- (2) Time of concentration;
- (3) Soil curve numbers or runoff coefficients including assumed pre-developed conditions being before any land alteration, i.e. grass or wooded, post-developed conditions and soil moisture conditions;
- (4) Peak runoff rates and total runoff volumes for each watershed area;
- (5) Infiltration rates, where applicable;
- (6) Culvert, storm sewer, ditch and/or other stormwater conveyance capacities;
- (7) Flow velocities;
- (8) Data on the increase in rate and volume of runoff for the design storms referenced in the BMP manual;
- (9) Documentation of sources for all computation methods and field test results.

(c) **Soils Information:** If a stormwater management control measure depends on the hydrologic properties of soils (e.g., infiltration basins), then a soils report shall be submitted. The soils report shall be based on on-site boring logs or soil pit profiles and soil survey reports. The number and location of required soil borings or soil pits shall be determined based on what is needed to determine the suitability and distribution of soil types present at the location of the control measure.

(d) **Maintenance and Repair Plan:** The design and planning of all stormwater management facilities shall include detailed operation, maintenance, and repair procedures to ensure their continued performance. These plans will identify the parts or components of a stormwater management facility that need to be maintained and the equipment and skills or training necessary. Provisions for the periodic review and evaluation of the effectiveness of the maintenance program and the need for revisions or additional maintenance procedures shall be included in the plan. No area shall be disturbed over twenty (20) days without temporary seeding. A permanent elevation benchmark shall be identified in the plans to assist in the periodic inspection of the facility. An onsite inspection log of daily checking and repair is to be maintained weekly or after any rainfall of 0.5" or greater in a twenty-four (24) hour period, or during periods of prolonged rainfall.

(e) **Landscaping Plan:** The applicant must present a detailed plan for management of vegetation at the site after construction is finished, including who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved. Where it is required by the BMP, a registered landscape architect licensed in Tennessee must prepare this plan.

(f) **Maintenance Easements:** The applicant must ensure access to the site for the purpose of inspection and repair by securing all the maintenance easements

needed. These easements must be binding on the current property owner and all subsequent owners of the property and must be properly recorded in the land record.

(g) Maintenance Agreement:

(1) The owner of property to be served by an on-site stormwater management facility must execute an inspection, operation and maintenance agreement that shall operate as a deed restriction binding on the current property owner and all subsequent property owners.

(2) The maintenance agreement shall:

(a) Assign responsibility for the maintenance and repair of the stormwater facility to the owner of the property upon which the facility is located and be recorded as such on the plat for the property by appropriate notation.

(b) Provide for a periodic inspection by the property owner for the purpose of documenting maintenance and repair needs and ensure compliance with the purpose and requirements of this ordinance. The property owner will arrange for this inspection to be conducted by a registered professional engineer licensed to practice in the State of Tennessee who will submit a sealed report of the inspection to the City Engineer. It shall also grant permission to the City to enter the property at reasonable times and inspect the stormwater facility to ensure that it is being properly maintained.

(c) Provide that the minimum maintenance and repair needs include, but are not limited to: removal of silt, litter and other debris, cutting of grass, grass cuttings and vegetation removal, and replacement of landscape vegetation, in detention and retention basins, and inlets and drainage pipes and any other stormwater facilities. It shall also provide that the property owner shall be responsible for additional maintenance and repair needs consistent with the needs and standards outlined in the BMP manual.

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(d) Provide that maintenance needs must be addressed in a timely manner, on a schedule to be determined by the City Engineer.

(e) Provide that if the property is not maintained or repaired within the prescribed schedule, the City shall perform the maintenance and repair at its expense, and bill the same to the property owner. The maintenance agreement shall also provide that the City's cost of performing the maintenance shall be a lien against the property.

(3) The City shall have the discretion to accept the completion of any existing or future stormwater management facility, provided such facility

meets the requirements of this ordinance, and includes adequate and perpetual access and sufficient areas, by easement or otherwise, for inspection and regular maintenance. Any stormwater facility must also meet the City's construction standards and any other standards and specifications that apply to the particular stormwater facility in question.

(4) **Sediment and Erosion Control Plans:** The applicant must prepare a sediment and erosion control plan for all construction activities that complies with Section 5 (5) below.

(5). Sediment and erosion control plan requirements. The sediment and erosion control plan shall accurately describe the potential for soil erosion and sedimentation problems resulting from land disturbing activity and shall explain and illustrate the measures that are to be taken to control these problems. The length and complexity of the plan is to be commensurate with the size of the project, severity of the site condition, and potential for off-site damage. A registered professional engineer licensed in the state of Tennessee shall seal the plan. The plan shall also conform to the requirements found in the BMP manual, and shall include at least the following:

(a) **Project Description -** Briefly describe the intended project and proposed land disturbing activity including number of units and structures to be constructed and infrastructure required.

(b) A topographic map of the basin with contour intervals of five (5) feet or less and site contours of two (2) feet showing present conditions and proposed contours resulting from land disturbing activity.

(c) All existing drainage conveyances, including intermittent and wet-weather. Include any designated floodways or flood plains.

(d) A general description of existing land cover.
Individual trees and shrubs do not need to be identified unless

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requested.

(e) Stands of existing trees, as they are to be preserved upon project completion, specifying their general location on the property. Differentiation shall be made between existing trees to be preserved, trees to be removed and proposed planted trees. Tree protection measures must be identified, and diameter of the area involved must also be identified on the plan and shown to scale. Information shall be supplied concerning the proposed destruction of exceptional and historic trees in setbacks and buffer strips, where they exist. Complete landscape plans may be submitted separately. The plan must include the sequence of implementation for tree protection measures.

(f) Approximate limits of proposed clearing, grading and filling.

(g) Approximate flows of existing stormwater leaving any portion of the site.

(h) A general description of existing soil types and characteristics and any anticipated soil erosion and sedimentation problems resulting from existing characteristics.

(i) Location, size and layout of proposed stormwater and sedimentation control improvements.

(j) Proposed drainage network.

(k) Proposed drain tile or waterway sizes.

(l) Approximate flows leaving site after construction and incorporating water run-off mitigation measures. The evaluation must include projected effects on property adjoining the site and on existing drainage facilities and systems. The plan must address the adequacy of outfalls from the development: when water is concentrated, what is the capacity of waterways, if any, accepting stormwater off-site; and what measures, including infiltration, sheeting into buffers, etc., are going to be used to prevent the scouring of waterways and drainage areas off-site, etc.

(m) The projected sequence of work represented by the grading, drainage and sedimentation and erosion control plans as related to other major items of construction, beginning with the initiation of excavation and including the construction of any sediment basins or retention facilities or any other structural BMPs.

(n) Specific remediation measures to prevent erosion and sedimentation run-off. Plans shall include detailed drawings of all control measures used; stabilization measures including vegetation and non-vegetation measures, both temporary and permanent, will be detailed. Detailed construction notes and a maintenance schedule

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shall be included for all control measures in the plan.

(o) Specific details for: the construction of rock pads, wash down pads, and settling basins for controlling erosion; road access points; eliminating or keeping soil, sediment, and debris on streets and public ways at a level acceptable to the City. Soil, sediment, and debris brought onto streets and public ways must be removed by the end of the workday by machine, broom or shovel to the satisfaction of the City Engineer. Failure to remove the sediment, soil or debris shall be deemed a violation of this ordinance.

(p) Proposed structures; location (to the extent possible) and identification of any proposed additional buildings, structures or development on the site.

(q) A description of on-site measures to be taken to recharge surface water into the ground water system through infiltration.

(l) Scope. A water quality riparian buffer shall be established, protected, and maintained along all community waters in areas of **New Development** for which a land disturbance permit and Construction General Permit coverage is required. The goal of the water quality riparian buffer is to preserve undisturbed vegetation that is native to the streamside habitat in the area of the project. Vegetated, preferably native, water quality riparian buffers protect water bodies by providing structural integrity and canopy cover, as well as stormwater infiltration, filtration and evapotranspiration. **The buffer requirement may be fulfilled with a combination of an inner and an outer zone. The predominant vegetation in the inner zone of the buffer (adjacent to the community water) should be trees. The outer zone (adjacent to the development) of 60-foot riparian buffers may be composed of herbaceous cover or infiltration-based SCMs. The outer zone allows for more flexibility in the type of vegetation and placement of SCMs.**

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Water Quality Riparian Buffer Requirements for Sites That Require CGP Coverage		
Community water characteristics	Permanent buffer	During construction (temporary) buffer
Community water drainage area < 1 square mile and not designated as impaired or an Exceptional Tennessee Water (ETW)	30-feet (No averaging)	30-feet (Can be established on an average basis as long as minimum is 15-feet. City-approved buffer enhancement plan required for CGP-allowable, temporary buffer encroachment.)
Community water drainage area < 1 square mile and designated as impaired or an Exceptional Tennessee Water (ETW)	30-feet (No averaging)	60-feet (can be established on an average basis as long as minimum is 30-feet)
Community water drainage area > 1 square mile and not designated as impaired or an Exceptional Tennessee Water (ETW)	60-feet (Can be established on an average basis as long as minimum is 30-feet.)	30-feet (Can be established on an average basis as long as minimum is 15-feet. City-approved buffer enhancement plan required for CGP-allowable, temporary buffer encroachment.)
Community water drainage area > 1 square mile and designated as impaired or an Exceptional Tennessee Water (ETW)	60-feet (Can be established on an average basis as long as minimum is 30-feet)	60-feet (Can be established on an average basis as long as minimum is 30-feet)
Notes: 1) "Impaired" refers to community water that have unavailable parameters for siltation and habitat alteration. 2) If a New Development project encompasses both sides of a community water, buffer averaging can be applied to both sides, but must be applied independently.		

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(a) The buffer width shall be measured perpendicular from the top of bank on each side of the community water channel; around the perimeter of a pond or lake identified as a community water measured as perpendicular to the contour at which normal pool is located around; and around the perimeter of a wetland identified as a community water.

(b) The water quality riparian buffer is to remain undisturbed except for the following disturbances which are allowed subject to approval by the Director of Public Works including the approval of an erosion prevention and sediment control plan:

(i) Limited disturbances to remove and/or plant trees or vegetation, as required to maintain the overall health of vegetation in the buffer area. This includes the removal of invasive exotic plants and the establishment of native vegetation, and/or other practices to restore the ecological integrity of the buffer. Removal of individual trees that are in danger of falling, causing damage to dwellings or other structures, are dead or diseased, or have been heavily damaged by storms. The root wad or stump should be left in place, where feasible, to maintain soil stability. The Public Works Director may require a Buffer Enhancement Plan prior to buffer disturbance.

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(ii) Disturbances necessary for the construction of utility access areas and approved stream crossings as long as the crossings are perpendicular or as near to perpendicular as possible to the channel.

(iii) Disturbances as required to establish and/or restore buffer areas in accordance with an approved Buffer Enhancement Plan that demonstrates the pollutant removal function of the buffer is retained or improved.

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(iv) Passive recreation, pervious footpaths, biking or hiking paths, greenways, and boardwalks to approach the water resource as approved by the Director of Public Works. View corridors shall be allowed along greenways as approved by the Director of Public Works. Paths and greenways shall be designed to prevent the channelization of stormwater runoff, and should be constructed of pervious materials. If trails are constructed from impervious materials, runoff must either be directed to infiltration-based SCMs or the buffer width must be increased by the width of the trail. Trails constructed within the buffer must prevent or minimize the generation of pollutants.

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(v) Stormwater channels as approved by the Director of Public Works and subject to State and Federal permitting requirements.

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(vi) Cut and fill for floodplain compensations as approved by the Director of Public Works and in compliance with Ordinance 2017-16 regarding flooding.

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(c) A determination that standards cannot be met may not be based solely on the difficulty or cost associated with implementation. Every attempt should be made

for development and redevelopment activities not to take place within the buffer zone. A determination that water quality riparian buffer widths cannot be met on site may not be based solely on the difficulty or cost of implementing measures, but must include multiple criteria, such as: type of project, existing land use and physical conditions that preclude use of these practices.

(d) Any approved disturbance of the water quality riparian buffer shall be revegetated in kind and/or enhanced. The vegetative target for the inner zone is mature, moderately dense forest (i.e., trees) with woody shrubs and understory vegetation. Where forest vegetation has the potential to impact traffic safety or limit access, areas immediately surrounding approved stream crossings and utility access areas may be vegetated with dense grasses.

(e) For any proposed development and/or construction activity within or adjacent to a water quality riparian buffer, the following shall be required.

(i) The parameters of the water quality riparian buffer shall be delineated by the applicant and boundaries shall be clearly indicated and labeled on all plats, plans, permits and official maps.

(ii) Include a note on plans to reference protective covenants governing all water quality riparian buffer areas, labeled as: "Any water quality riparian buffer is subject to protective covenants recorded in the Register of Deeds (Sumner County). Disturbance and use of these areas is restricted; severe penalties apply."

(iii) Water Quality riparian buffers shall be protected during construction activities by a combination of fencing and flagging to prevent entry of construction equipment, storage and stockpiling. Buffer boundaries shall be marked during construction activities.

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18-2067. Post Construction and Inspection. (1). As built plans - All applicants are required to submit actual as built plans for any structures located on-site after final construction is completed. The plan must show the final design specifications for all stormwater management facilities and must be sealed by a registered professional engineer licensed to practice in Tennessee. A final detailed inspection report by the engineer of record is required before any performance security will be released. The City Engineer shall have the discretion to adopt provisions for a partial pro-rata release of the performance security on the completion of various stages of development. In addition, occupation permits shall not be granted until corrections to all BMPs have been made and accepted by the City Engineer.

(2). Land Cover and stabilization requirements.

(a) Any area of land from which the natural vegetative cover has been either partially or wholly cleared by development activities shall be revegetated according to a schedule approved by the City Engineer. The following criteria shall apply to revegetation efforts:

(1) Reseeding must be done with an annual or perennial cover crop accompanied by placement of straw mulch or its equivalent of sufficient coverage to control erosion until such time as the cover crop is established over ninety percent (90%) of the seeded area.

(2) Replanting with native woody and herbaceous vegetation must be accompanied by placement of straw mulch or its equivalent of sufficient coverage to control erosion until the plantings are established and are capable of controlling erosion.

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(3) Any area of revegetation must exhibit survival of a minimum of ninety percent (90%) of the cover crop throughout the year immediately following revegetation. Revegetation must be repeated in successive years until the minimum ninety percent (90%) survival for one (1) year is achieved.

(b) In addition to the above requirements, a landscaping plan must be submitted with the final design describing the vegetative stabilization and management techniques to be used at a site after construction is completed. This plan will explain not only how the site will be stabilized after construction, but who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate vegetative cover is preserved.

(3). Inspection of stormwater management facilities. Periodic inspections of facilities shall be performed as provided for in Section 5 of this ordinance and the Hendersonville Construction Manual.

(4). Records of installation and maintenance activities. Parties responsible for the operation and maintenance of a stormwater management facility shall make weekly records during construction and monthly records after acceptance of the installation of the stormwater facility, and of all maintenance and repairs to the facility, and shall retain the records for at least three (3) years. These records shall be made available to the City during inspection of the facility and at other reasonable times upon request.

(5). Failure to meet or maintain design or maintenance standards. If a responsible party fails or refuses to meet the design or maintenance standards required for stormwater facilities under this ordinance, the City Engineer, after twenty days' (20) notice, may correct a violation of the design standards or maintenance needs by performing all necessary work to place the facility in proper working condition. In the event that the stormwater management facility becomes a danger to public safety or

public health, the City Engineer shall notify in writing the party responsible for maintenance of the stormwater management facility. Upon receipt of that notice, the responsible person shall have ten (10) days to effect maintenance and repair of the facility in an approved manner. In the event that corrective action is not undertaken within that time, the City Engineer may take necessary corrective action. The cost of any action by the City under this section shall be charged to the responsible party and /or impose a minimum fine of five hundred (500) dollars per day up to ten thousand (10,000) per day.

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18-2078. Existing locations and developments. (1). Requirements for all existing locations and developments. The requirements of this ordinance shall apply to all locations and development at which land disturbing activities have occurred previous to the enactment of this ordinance including:

- (a) Denuded areas must be vegetated or covered under the standards and guidelines specified in the BMP manual and on a schedule acceptable to the City Engineer.
- (b) Cuts and slopes must be properly covered with appropriate vegetation and/or retaining walls constructed.
- (c) Drainage ways shall be properly covered in vegetation or secured with rip-rap, channel lining, etc., to prevent erosion.
- (d) Trash, junk, rubbish, etc. shall be cleared from drainage ways.
- (e) Stormwater runoff shall be controlled to the extent reasonable to prevent pollution of local waters. Such control measures may include, but are not limited to, the following:
 - (1) Ponds
 - (a) Detention pond
 - (b) Extended detention pond
 - (c) Wet pond
 - (d) Alternative storage measures
 - (2) Constructed wetlands
 - (3) Infiltration systems
 - (a) Infiltration/percolation trench
 - (b) Infiltration basin
 - (c) Drainage (recharge) well
 - (d) Porous pavement
 - (4) Filtering systems
 - (a) Catch basin inserts/media filter

- (b) Sand filter
- (c) Filter/absorption bed
- (d) Filter and buffer strips
- (5) Open channel
 - (a) Swale

(2). Requirements for existing problem locations. The City Engineer shall in writing notify the owners of existing locations and developments of specific drainage, erosion or sediment problem affecting such locations and developments, and the specific actions required to correct those problems. The notice shall also specify a minimum of twenty (20) days for compliance.

(3). Inspection of existing facilities. The City Engineer may, to the extent authorized by state and federal law, establish inspection programs to verify

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that all stormwater management facilities, including those built before as well as after the adoption of this ordinance, are functioning within design limits. These inspection programs may be established on any reasonable basis, including but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of the municipality's NPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in drainage control facilities; and evaluating the condition of drainage control facilities and other BMPs.

(4). Corrections of problems subject to appeal. Corrective measures imposed by the City are subject to appeal under this ordinance.

18-2089. Illicit discharges due to land disturbance. (1). Scope. This section shall apply to all water generated on developed or undeveloped land entering the municipality's separate storm sewer system.

(2). Prohibition of illicit discharges. No person shall introduce or cause to be introduced into the municipal separate storm sewer system any discharge that is not composed entirely of stormwater. The commencement, conduct or continuance of any non-stormwater discharge to the municipal separate storm sewer system is prohibited except as described as follows:

- (a) Uncontaminated discharges from the following sources:
 - (1) Water line flushing or other potable water sources,
 - (2) Landscape irrigation or lawn watering with potable

water,

- (3) Diverted stream flows,
- (4) Rising ground water,
- (5) Groundwater infiltration to storm drains,
- (6) Pumped groundwater,
- (7) Foundation or footing drains,
- (8) Crawl space pumps,
- (9) Air conditioning condensation,
- (10) Springs,
- (11) Non-commercial washing, for example vehicles
- (12) Natural riparian habitat or wet-land flows,
- (13) Swimming pools (if dechlorinated –

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typically less than one PPM chlorine),

- (14) Fire fighting activities, and
- (15) Any other uncontaminated water source.

(b) Discharges specified in writing by the City as being necessary to protect public health and safety.

(c) Dye testing is an allowable discharge if the City Engineer pre-approves in writing.

(3). Prohibition of illicit connections.

(a) The construction, use, maintenance or continued existence of illicit connections to the separate municipal storm sewer system is prohibited.

(b) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(4). Reduction of stormwater pollutants by the use of best management practices. Any person responsible for a property or premises, which is, or may be, the source of an illicit discharge, may be required to implement, at the person's expense, the BMPs necessary to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section

(5). Notification of spills. Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting in, or may result in, illicit discharges or pollutants discharging into stormwater, the municipal separate storm sewer system, the person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of

hazardous materials the person shall immediately notify emergency response agencies of the occurrence via emergency dispatch services. In the event of a release of non-hazardous materials, the person shall notify the City Engineer in person or by telephone or facsimile no later than the next business day. Notifications in person or by telephone shall be confirmed by written notice addressed and mailed to the City Engineer within three (3) business days of the telephone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least five (5) years.

(6). Requirements for construction site operators. Construction site operators are required to control wastes such as discarded building materials, concrete truck washout, chemicals, litter, and sanitary waste at construction sites within the jurisdiction to avoid adverse impacts to water quality.

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18-20910. Enforcement (1). Enforcement authority. The City Engineer or his/her

designees shall have the authority to issue notices of violation and citations, and to impose the civil penalties provided in this section.

(2). Notification of violation.

(a) Written Notice. Whenever the City finds that any permittee or any other person discharging stormwater has violated or is violating this ordinance or a permit or order issued hereunder, the City may serve upon such person written notice of the violation. Within ten (10) days of this notice, an explanation of the violation and a plan for the satisfactory correction and prevention thereof, to include specific required actions, shall be submitted to the City Engineer. Submission of this plan in no way relieves the discharger of liability for any violations occurring before or after receipt of the notice of violation.

(b) Consent Orders. The City Engineer is empowered to enter into consent orders, assurances of voluntary compliance, or other similar documents establishing an agreement with the person responsible for the noncompliance. Such orders will include specific action to be taken by the person to correct the noncompliance within a time period also specified by the order. Consent orders shall have the same force and effect as administrative orders issued pursuant to paragraphs (d) and (e) below.

(c) Show Cause Hearing. The City Engineer may order any person who violates this ordinance or permit or order issued hereunder, to show cause why a proposed enforcement action should not be taken. Notice shall be served on the person specifying the time and place for the meeting, the proposed enforcement action and the reasons for such action,

and a request that the violator show cause why this proposed enforcement action should not be taken. The notice of the meeting shall be served personally or by registered or certified mail (return receipt requested) at least ten (10) days prior to the hearing.

(d) Compliance Order. When the City Engineer finds that any person has violated or continues to violate this ordinance or a permit or order issued there under, he may issue an order to the violator directing that, following a specific time period, adequate structures, devices, be installed or procedures implemented and properly operated. Orders may also contain such other requirements as might be reasonably necessary and appropriate to address the noncompliance, including the construction of appropriate structures, installation of devices, self-monitoring, and management practices.

(e) Cease and Desist Orders. When the City Engineer finds That any person has violated or continues to violate this ordinance or any Permit or order issued hereunder, the City Engineer may issue an order to

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cease and desist all such violations and direct those persons in noncompliance to:

- (1) Comply forthwith; or
- (2) Take such appropriate remedial or preventive action as may be needed to properly address a continuing or threatened violation, including halting operations and terminating the discharge.
- (3) Conflicting standards. Whenever there is a conflict between any standard contained in this ordinance and in the BMP manual adopted by the municipality under this ordinance, the strictest standard shall prevail.

18-2101. Penalties. (1). Violations. Any person who shall commit any act declared unlawful under this ordinance, who violates any provision of this ordinance, who violates the provisions of any permit issued pursuant to this ordinance, or who fails or refuses to comply with any lawful communication or notice to abate or take corrective action by the City, shall be guilty of a civil offense.

(2). Penalties. Under the authority provided in Tennessee Code Annotated Section 68-221-1106, the municipality declares that any person violating the provisions of this ordinance may be assessed a civil penalty by the City Engineer of not less than five hundred dollars (500) and not more than ten thousand dollars (10,000) per day or the maximum allow by law for each day of violation. Each day of violation shall constitute a separate violation.

(3). Measuring civil penalties. In assessing a civil penalty, the City Engineer may consider:

- (a) The harm done to the public health or the environment;

- (b) Whether the civil penalty imposed will be a substantial economic deterrent to the illegal activity;
 - (c) The economic benefit gained by the violator;
 - (d) The amount of effort put forth by the violator to remedy this violation;
 - (e) Any unusual or extraordinary enforcement costs incurred by the municipality;
 - (f) The amount of penalty established by ordinance or resolution for specific categories of violations; and
 - (g) Any equities of the situation that outweigh the benefit of imposing any penalty or damage assessment.
- (4). Recovery of damages and costs. In addition to the civil penalty in subsection (2) above, the City may recover; (a) all damages proximately caused by the violator to the City, which may include any reasonable expenses incurred in

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investigating violations of, and enforcing compliance with, this ordinance, or any other actual damages caused by the violation.

- (b) The costs of the City's maintenance of stormwater facilities when the user of such facilities fails to maintain them as required by this ordinance.
- (5). Other remedies. The City may bring legal action to enjoin the continuing violation of this ordinance, and the existence of any other remedy, at law or equity, shall be no defense to any such actions.
- (6). Remedies cumulative. The remedies set forth in this section shall be cumulative, not exclusive, and it shall not be a defense to any action, civil or criminal that one (1) or more of the remedies set forth herein has been sought or granted.

18-2142. Appeals. There is created a Public Works Stormwater Advisory Committee which shall consist of seven members. One member from the Public Works Committee of the Board of Mayor and Aldermen, one representative from the Hendersonville Utility District, the City Engineer, one builder or developer, three Hendersonville citizens of the general public appointed by the Public Works Committee..

- (a) Term. Appointed members shall serve for a term of two years and can be reappointed for two addition consecutive terms.
- (b) Organization. Within ten day after its appointment the Public Works Stormwater Committee shall organize itself by election of one chairman and vice chairman. The city engineer shall be the secretary of the committee to the committee and who shall be the custodian of the minutes and records of the proceedings of the committee.
- (c) Compensation. All appointed members shall serve without

compensation and be removed from the committee by the Public Works Committee for absence from meetings of the committee, physical disability, or other just cause.

(d) Replacement. Replacement of any appointed member of the committee resigning or dismissed from the committee shall be appointed by the Public Works Committee.

(e) Duties. The Public Works Stormwater Advisory Committee shall adopt such rules and regulations as it may deem necessary to conduct its business. The committee, in open meeting, shall hear all appeals, under the provisions of this ordinance and illicit discharges. The committee shall base its decisions on the written documentation presented before it. The committee shall meet at regular monthly intervals with the day and time to be determined by the committee's chairman. In the event no appeals have been filed and there is no business pending, the chairman may cancel the meeting five days before its scheduled date.

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(f) Voting. Three members of the Public Works Stormwater Advisory Committee shall constitute a quorum. A majority vote of the members present shall be required for actions by the committee. No member of the committee shall act in any case in which he/she has a personal financial interest.

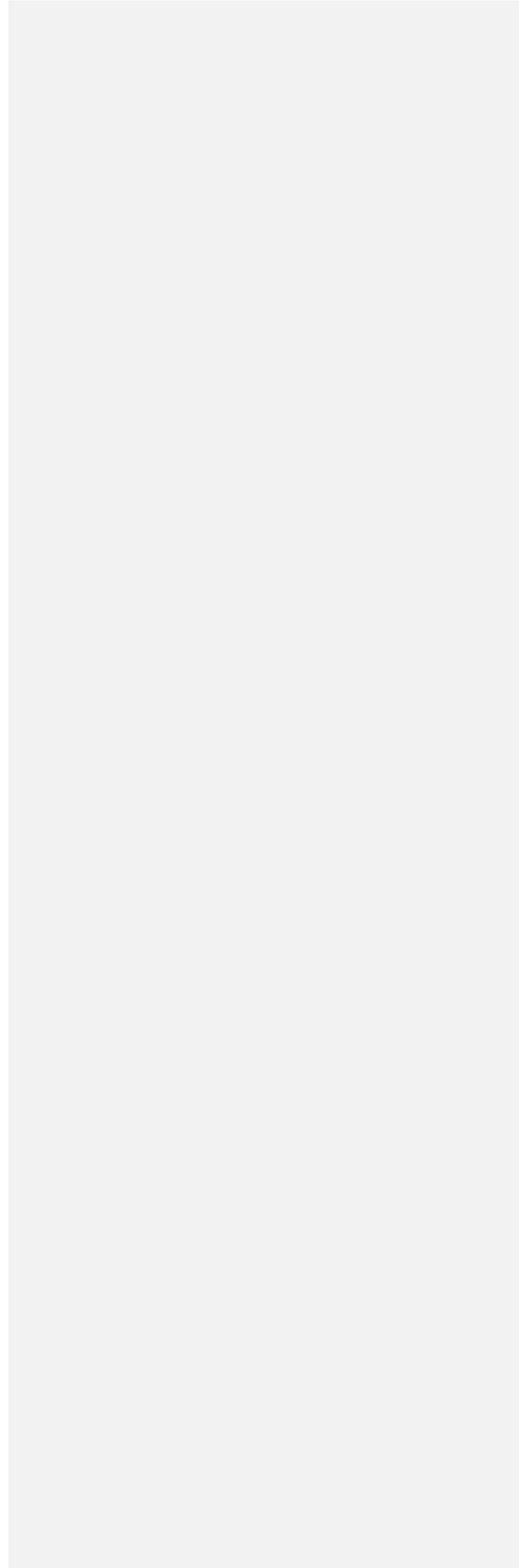
Pursuant to Tennessee Code Annotated Section 68-221-1106(d), any person aggrieved by the imposition of a civil penalty or damage assessment as provided by this ordinance may appeal said penalty or damage assessment to the Public Works Stormwater Advisory Committee.

(1). Appeals to be in writing. The appeal shall be in writing and filed with the Public Works secretary within fifteen (15) days after the civil penalty and/or damage assessment is served in any manner authorized by law.

(2). Public hearing. Upon receipt of an appeal, the Public Works Stormwater Advisory Committee shall hold a public hearing within thirty (30) days. Ten (10) days prior notice of the time, date, and location of said hearing shall be published in a daily newspaper of general circulation, place on the City's television channel, or place on the City's web page. Ten (10) days notice by registered mail shall also be provided to the aggrieved party, such notice to be sent to the address provided by the aggrieved party at the time of appeal. The decision of the Public Works Advisory Committee shall be final.

(3). Appealing decisions of the Public Works Stormwater Advisory Committee. Any alleged violator may appeal a decision of the Public Works Stormwater Advisory Committee pursuant to the provisions of Tennessee Code Annotated, Title 27, Chapter 9. (Ord. 2003-47, Oct. 2003)

18-32



CHAPTER 3

POST CONSTRUCTION RUNOFF AND ILLICIT DISCHARGE AND CONNECTIONS TO STORMWATER REGULATIONS**SECTION**

- 18-301. Purpose/Intent
- 18-302. Definitions
- 18-303. Applicability
- 18-304. Responsibility for administration
- 18-305. Severability
- 18-306. Ultimate responsibility
- 18-307. Post construction and inspection
- 18-308. Illicit discharges
- 18-309. Enforcement
- 18-310. Penalties
- 18-311. Appeals

18-301. Purpose/Intent. The language of this ordinance does not replace the Land Disturbance Ordinance; rather it is to be used in conjunction with the Land Disturbance Ordinance. The purpose of this ordinance is to provide for the health, safety, and general welfare of the citizens of the City of Hendersonville through the regulation of non-storm water discharges to the storm drainage system to the maximum extent practicable as required by federal and state law and to establish long term, post construction runoff management. This ordinance establishes methods for controlling the introduction of pollutants into the municipal separate storm sewer system (MS4) in order to comply with requirements of the National Pollutant Discharge Elimination System (NPDES) permit process. The objectives of this ordinance are:

- (1) to regulate the contribution of pollutants to the municipal separate storm sewer system (MS4) by stormwater discharges by any user;
- (2) to prohibit Illicit Connections and Discharges to the municipal separate storm sewer system;
- (3) to establish legal authority to carry out all inspection, surveillance and monitoring procedures necessary to ensure compliance with this ordinance;
- (4) minimize increases in stormwater runoff from any development in order to reduce flooding, siltation, increases in stream temperature, stream bank erosion, and maintain the integrity of stream channels;

(5) minimize increases in non-point source pollution caused by stormwater runoff from development which would otherwise degrade local water quality;

(6) minimize the total annual volume of surface water runoff which flows from any specific site during and following development to not exceed the pre-development hydrologic regime to the maximum extent practicable; and

(7) reduce stormwater runoff rates and volumes, soil erosion and nonpoint source pollution, wherever possible, through stormwater management controls and to ensure that these management controls are properly maintained and pose no threat to public safety.

18-302. Definitions. For the purposes of this ordinance, the following shall mean:

(1) Authorized Enforcement Agency: The Hendersonville Director of Public Works shall administer, and the City Engineer shall enforce the provisions of this ordinance.

(2) Best Management Practices (BMPs): schedules of activities, prohibitions of practices, general good house keeping practices, pollution prevention and educational practices, maintenance procedures, and other management practices to prevent or reduce the discharge of pollutants directly or indirectly to stormwater, receiving waters, or stormwater conveyance systems. BMPs also include treatment practices, operating procedures, and practices to control site runoff, spillage or leaks, sludge or water disposal, or drainage from raw materials storage include in the Hendersonville Construction Manual, Metro Nashville, Tennessee Department Environment Conservation and Environment Protection Agency Regulations.

(3) BMP Treatment Train: A technique for progressively selecting various stormwater management practices to address water quality, by which groups of practices may be used to achieve a treatment goal while optimizing effectiveness, maintenance needs and space.

(4) Clean Water Act: The federal Water Pollution Control Act (33 U.S.C. ' 1251 et seq.), and any subsequent amendments thereto.

(5) Construction Activity: activities subject to NPDES Construction Permits. These include construction projects resulting in land disturbance. Such activities include but are not limited to clearing and grubbing, grading, excavating, and demolition.

(6) Hazardous Materials: Any material, including any substance, waste, or combination thereof, which because of its quantity, concentration, or physical, chemical, or infectious characteristics may cause, or significantly contribute to, a substantial present or potential hazard to human health, safety, property, or the environment when improperly treated, stored, transported, disposed of, or otherwise managed.

(7) Hotspot (~~"priority area"~~): means an area where land use or activities generate highly contaminated runoff, with concentrations of pollutants in excess of those typically found in stormwater.

(8) Illegal Discharge: Any direct or indirect non-storm water discharge to the storm drain system, except as exempted in Section 8 of this ordinance.

(9) **Illicit Connections:** An illicit connection is defined as either of the following: Any drain or conveyance, whether on the surface or subsurface, which allows an illegal discharge to enter the storm drain system including but not limited to any conveyances which allow any non-storm water discharge including sewage, process wastewater, and wash water to enter the storm drain system and any connections to the storm drain system from indoor drains and sinks, regardless of whether said drain or connection had been previously allowed, permitted, or approved by an authorized enforcement agency or, Any drain or conveyance connected from a commercial or industrial land use to the storm drain system which has not been documented in plans, maps, or equivalent records and approved by an authorized enforcement agency.

(10) **Industrial Activity:** Activities subject to NPDES Industrial Permits as defined in 40 CFR, Section 122.26 (b)(14).

(11) **Maintenance:** means any activity that is necessary to keep a stormwater facility in good working order so as to function as designed. Maintenance shall include complete reconstruction of a stormwater facility if reconstruction is needed in order to restore the facility to its original operational design parameters. Maintenance shall also include the correction of any problem on the site property that may directly impair the functions of the stormwater facility.

(12) **Maintenance agreement:** means a document recorded in the land records that acts as a property deed restriction, and which provides for long-term maintenance of stormwater management practices.

(13) **Municipal separate storm sewer system (MS4)** ("Municipal separate stormwater system"): means the conveyances owned or operated by the municipality for the collection and transportation of stormwater, including the roads and streets and their drainage systems, catch basins, curbs, gutters, ditches, man-made channels, and storm drains.

(14) **National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit.** means a permit issued by EPA (or by a State under authority delegated pursuant to 33 USC ' 1342(b)) that authorizes the discharge of pollutants to waters of the United States, whether the permit is applicable on an individual, group, or general area-wide basis.

(15) **Non-Storm Water Discharge:** Any discharge to the storm drain system that is not composed entirely of storm water.

(16) **Person:** means any individual, association, organization, partnership, firm, corporation or other entity recognized by law and acting as either the owner or as the owner's agent.

(17) **Pollutant:** Anything which causes or contributes to pollution. Pollutants may include, but are not limited to: paints, varnishes, and solvents; oil and other automotive fluids; non-hazardous liquid and solid wastes and yard wastes; refuse, rubbish, garbage, litter, or other discarded or abandoned objects, and accumulations, so that same may

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cause or contribute to pollution; floatables; pesticides, herbicides, and fertilizers; hazardous substances and wastes; sewage, fecal coliform and pathogens; dissolved and

particulate metals; animal wastes; wastes and residues that result from constructing a building or structure; and noxious or offensive matter of any kind.

(18) Premises: Any building, lot, parcel of land, or portion of land whether improved or unimproved including adjacent sidewalks and parking strips.

(19) Stormwater design or BMP manual: The City defines its stormwater design and best management practices (BMP) manual as the following publications, which are incorporated by reference in the Land Disturbance Ordinance as is fully set out herein: TDEC Sediment and Erosion Control Manual; TDEC Manual for Post Construction Runoff Control; Hendersonville Construction Manual; and the Metro Nashville Stormwater Management Manual. This manual includes a list of acceptable BMP's including the specific design performance criteria and operation and maintenance requirements for each stormwater practice. Stormwater facilities that are designed, constructed, operated and maintained in accordance with these BMP criteria will be presumed to meet the minimum water quality performance standards. Failures to properly design, install, or maintain BMP's shall constitute a violation of this ordinance.

(20) Storm Drainage System: Publicly-owned facilities by which storm water is collected and/or conveyed, including but not limited to any roads with drainage systems, municipal streets, gutters, curbs, inlets, piped storm drains, pumping facilities, retention and detention basins, natural and human-made or altered drainage channels, reservoirs, and other drainage structures.

(21) Storm Water: Any surface flow, runoff, and drainage consisting entirely of water from any form of natural precipitation, and resulting from such precipitation.

(22) Stormwater Pollution Prevention Plan: A document which describes the Best Management Practices and activities to be implemented by a person or business to identify sources of pollution or contamination at a site and the actions to eliminate or reduce pollutant discharges to Stormwater, Stormwater Conveyance Systems, and/or Receiving Waters to the Maximum Extent Practicable.

(23) Wastewater: means any water or other liquid, other than uncontaminated storm water, discharged from a facility.

18-303. Applicability. (1) This ordinance shall apply to all water entering the storm drain system generated on any developed and undeveloped lands unless explicitly exempted by an authorized enforcement agency.

(2) This ordinance shall be applicable to all subdivision or site plan applications, unless eligible for an exemption or granted a waiver by the City.

(3) The ordinance also applies to land development activities that are smaller than the minimum applicability criteria if such activities are part of a larger common plan of development that meets the following applicability criteria, even though multiple separate and distinct land development activities may take place at different times on different schedules.

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(4) In addition, all plans must also be reviewed by local environmental protection

officials to ensure that established water quality standards will be maintained during and after development of the site and that post construction runoff levels are consistent with any local and regional watershed plans.

(5) To prevent the adverse impacts of stormwater runoff, the City has developed a set of performance standards that must be met at new development sites. These standards apply to any construction activity disturbing one acre or more of land. The following activities may be exempt from these stormwater performance criteria:

(a) Any logging and agricultural activity which is consistent with an approved soil conservation plan or a timber management plan prepared or approved by the appropriate state or federal agency as applicable.

(b) Additions or modifications to existing single family structures

(c) Developments that do not disturb more than one acre of land, provided they are not part of a larger common development plan and in the discretion of the City Engineer if such activity does not pose a unique threat to water, public health or safety.

(d) Repairs to any stormwater treatment practice deemed necessary by the City.

(6) When a site development plan is submitted that qualifies as a redevelopment project, decisions on permitting and on-site stormwater requirements shall be governed by special stormwater sizing criteria found in the current stormwater design manual as defined in Section 5 of the Land Disturbance Ordinance. This criteria is dependent on the amount of impervious area created by the redevelopment and its impact on water quality. Final authorization of all redevelopment projects will be determined after a review by the City.

18-304. Responsibility for Administration. The Hendersonville Director of Public Works shall administer, and the City Engineer shall enforce the provisions of this ordinance. Any powers granted or duties imposed upon the authorized enforcement agency may be delegated.

18-305. Severability. The provisions of this ordinance are hereby declared to be severable. If any provision, clause, sentence, or paragraph of this Ordinance or the application thereof to any person, establishment, or circumstances shall be held invalid, such invalidity shall not affect the other provisions or application of this Ordinance.

18-306. Ultimate responsibility. The standards set forth herein and promulgated pursuant to this ordinance are minimum standards; therefore this ordinance does not intend nor imply that compliance by any person will ensure that there will be no contamination, pollution, nor unauthorized discharge of pollutants.

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18-307. Post construction and Inspection. (1). Permitting requirements, procedures and fees. Permitting shall be prepared and submitted as provided for in Section 3 of the City of Hendersonville Land Disturbance Ordinance. The Storm Water

Management Plan and the Sediment and Erosion Control Plan shall be prepared to meet the requirements of Section 5 of the City of Hendersonville Land Disturbance Ordinance.

(2). Waivers. Waivers to the stormwater management plan requirements shall be in accordance with Section 4 of the City of Hendersonville Land Disturbance Ordinance.

(3). Performance Criteria for Stormwater Management. Unless granted a waiver or judged by the City Engineer to be exempt, the following performance criteria shall be addressed for stormwater management at all sites:

(a) All site designs shall control the peak flow rates of stormwater discharge associated with design storms specified in this ordinance or in the BMP manual as defined in Section 5 of the Land Disturbance Ordinance and reduce the generation of post construction stormwater runoff to pre-construction levels. These practices should seek to utilize pervious areas for stormwater treatment and to infiltrate stormwater runoff from driveways, sidewalks, rooftops, parking lots, and landscaped areas to the maximum extent practical to provide treatment for both water quality and quantity.

(b) Stormwater detention facilities shall be designed to control the rate at which flow is released over the entire runoff discharge period and the volume of discharge over the critical design-storm period to predevelopment conditions. This shall be applied for the 24 hour: 2-, 10-, 25-, and 100-year design-storm events.

(c) New development shall meet a stormwater quantity level of service defined by:

(1) Designing road catch basins and connecting culverts to convey the 25-year design-storm runoff.

(2) Designing bridges, culverts, channels and cross-drains to pass the 25- year design-storm runoff.

(d) Stormwater infrastructure shall be designed in a way that:

(1) Collector roads are not inundated by a 100-year design-storm event.

(2) Other existing roads (as impacted by new or existing development) shall be designed to have no overtopping the road under a 25-year design-storm event.

(3) Other new roads shall be designed to have no overtopping at the 25-year design-storm event.

(e) Development will be required to minimize the impact to stormwater quality by applying structural and/or nonstructural management practices selected to address site-specific conditions. The goal for water quality treatment shall be 90% total suspended solids removal of the first flush, defined by land use characteristics or at least 0.5-inches where not defined, through a

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BMP Treatment Train.

(f) To protect stream channels from degradation, specific channel protection criteria shall be provided as prescribed in the BMP manual.

(g) ~~A waterway buffer shall be applied to all major waterways that are~~

~~shown by F.E.M.A.~~

~~(1) Automatic exemptions are applied provided erosion protection and soil control, water quality and cut-fill policies are adequately addressed. They shall be permitted for: roads and utilities crossing waterways, and pedestrian trails and walkways proximate to waterways.~~

~~(2) The waterway buffer shall be defined as area contained within a boundary established 25 feet beyond the floodplain boundary as defined by F.E.M.A. or the City which ever is larger.~~

~~(h) The City may apply incentives for floodplain management strategies applied beyond those required by this ordinance.~~

~~(1) Strategies beyond those required may include, but not limited to:~~

~~(a) Extra (20 percent more than required) floodplain storage developed~~

~~(b) Greenways that are dedicated to the City~~

~~(c) Eroding waterways are restored or stabilized with bioengineering or "green" approaches~~

~~(d) New and innovative technologies are applied to address water quantity or quality.~~

(2) If the above management strategies are applied in a manner

acceptable to the City Engineer, then the City may apply incentives including, but not limited to: modification to the drainage plan or other development requirements acceptable to the City Engineer.

(i) Stormwater discharges to critical areas with sensitive resources (i.e., cold water fisheries, shellfish beds, swimming beaches, recharge areas, water supply reservoirs) may be subject to additional performance criteria, or may need to utilize or restrict certain stormwater management practices.

(j) Stormwater discharges from "hot spots" may require the application of specific structural BMPs and pollution prevention practices.

(k) Prior to or during the site design process, applicants for land disturbance permits shall consult with the City Engineer to determine if they are subject to additional stormwater design requirements.

(l) The calculations for determining peak flows as found in the BMP manual shall be used for sizing all stormwater facilities.

(4) Minimum control requirements. (a) Design of stormwater facilities shall meet the multi-stage storm frequency storage requirements as identified in the

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BMP manual unless the City has granted the applicant a full or partial waiver for a particular BMP.

(b) If hydrologic or topographic conditions warrant greater control than that provided by the minimum control requirements, the City may impose

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any and all additional requirements deemed necessary to control the volume, timing, and rate of runoff.

(5) Site Design Feasibility. Stormwater management practices for a site shall be chosen based on the physical conditions of the site. Among the factors that should be considered:

- (a) Topography.
- (b) Maximum Drainage Area.
- (c) Depth to Water Table.
- (d) Soils.
- (e) Slopes.
- (f) Terrain.
- (g) Location in relation to environmentally sensitive features or urban areas

Applicants shall consult the Stormwater Design or BMPs as defined in Section 5 of the Land Disturbance Ordinance for guidance on the factors that determine site design feasibility when selecting a best management practice.

(6) Conveyance issues. All best management practices shall be designed to convey stormwater to allow for the maximum removal of pollutants and reduction in flow velocities. This shall include, but not be limited to:

- a. Maximizing of flowpaths from inflow points to outflow points.
- b. Protection of inlet and outfall structures.
- c. Elimination of erosive flow velocities.
- d. Providing of underdrain systems, where applicable.

The Stormwater Design Manual shall provide detailed guidance on the requirements for conveyance for each of the approved stormwater management practices.

(7) Pretreatment requirements. (1) Every BMP shall have an acceptable form of water quality pretreatment, in accordance with the pretreatment requirements found in the current stormwater design manual. Certain stormwater treatment practices, as specified in the Stormwater Design Manual, are prohibited even with pretreatment in the following circumstances:

- a. Stormwater is generated from highly contaminated source areas known as "hotspots".

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- b. Stormwater is carried in a conveyance system that also carries contaminated, non- stormwater discharges.

- c. Stormwater is being managed in a designated groundwater recharge area.

d. Certain geologic conditions exist (e.g., karst) that prohibit the proper pretreatment of stormwater.

(8) Treatment/Geometry conditions. All BMP's shall be designed to capture and treat stormwater runoff according to the specifications outlined in the Stormwater Design Manual. These specifications will designate the water quantity and quality treatment criteria that apply to an approved stormwater management practice.

(9) Non-Structural Stormwater Practices. The use of non-structural stormwater treatment practices, such as increased green space, is encouraged in order to minimize the reliance on structural practices. Credit in the form of reductions in the amount of stormwater that must be managed can be earned through the use of non-structural practices that reduce the generation of stormwater from the site. These non-structural practices are explained in detail in the stormwater design manual and applicants wishing to obtain credit for use of non-structural practices must ensure that these practices are documented and remain unaltered by subsequent property owners.

(10). Notice of construction commencement. The applicant must notify the City ten (10) working days in advance of the commencement of construction. The City shall conduct regular inspections of the stormwater management system construction.

All inspections shall be documented and written reports prepared that contain the following information:

- (1) The date and location of the inspection.
- (2) Whether construction is in compliance with the approved stormwater management plan.
- (3) Variations from the approved construction specifications.
- (4) Any violations that exist.

(11). As built plans. All applicants are required to submit actual as built plans for any structures located on-site after final construction is completed. The plan must show the final design specifications for all stormwater management facilities and must be sealed by a registered professional engineer licensed to practice in Tennessee. A final detailed inspection report by the engineer of record is required. The City Engineer shall have the discretion to adopt provisions for a partial pro-rata release of the performance security on the completion of various stages of development. In addition, occupation permits shall not be granted until corrections to all BMPs have been made and accepted by the City Engineer.

(12). Land cover and stabilization requirements. (1) Any area of land from which the natural vegetative cover has been either partially or wholly cleared by

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development activities shall be revegetated according to a schedule approved by the City Engineer. The following criteria shall apply to revegetation efforts:

- a. Reseeding must be done with an annual or perennial cover crop accompanied by placement of straw mulch or its

equivalent of sufficient coverage to control erosion until such time as the cover crop is established over ninety percent (90%) of the seeded area.

(b) Replanting with native woody and herbaceous vegetation must be accompanied by placement of straw mulch or its equivalent of sufficient coverage to control erosion until the plantings are established and are capable of controlling erosion.

~~(d)~~(a) Any area of revegetation must exhibit survival of a

minimum of ninety percent (90%) of the cover crop throughout the year immediately following revegetation. Revegetation must be repeated in successive years until the minimum ninety percent (90%) survival for one (1) year is achieved.

(2) In addition to the above requirements, a landscaping plan, in accordance to Section 5 of the City of Hendersonville Land Disturbance Ordinance, must be submitted to the City Engineer with the final design describing the vegetative stabilization and management techniques to be used at a site after construction is completed. This plan will explain not only how the site will be stabilized after construction, but who will be responsible for the maintenance of vegetation at the site and what practices will be employed to ensure that adequate cover. The plan shall include plant materials approved by the City Engineer that are in addition to grasses that ensure vegetative cover is preserved. All requirements of this ordinance shall be in addition to that required by other regulations and ordinances.

(13). Maintenance Easement. Prior to the issuance of any permit that has a stormwater management facility as one of the requirements of the permit, the applicant or owner of the site must execute a maintenance easement agreement that shall be binding on all subsequent owners of land served by the stormwater management facility. The agreement shall provide for access to the facility at reasonable times for periodic inspection by the City, or their contractor or agent, and for regular or special assessments of property owners to ensure that the facility is maintained in proper working condition to meet design standards and any other provisions established by this ordinance. The easement 14). agreement shall be recorded by the City in the land records.

(14.) Maintenance. Maintenance of all stormwater management facilities shall be ensured through the creation of a formal maintenance easement that must be approved by the City and recorded into the land records as a final plat. As part of maintenance, a schedule shall be developed for when and how often maintenance will occur to ensure proper function of the stormwater management facility. The final plat shall as include
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notes for periodic inspections to ensure proper performance of the facility between scheduled cleanouts.

The City, in lieu of an maintenance plan, may accept dedication of any existing or future stormwater management facility for maintenance, provided such

facility meets all the requirements of this chapter and includes adequate and perpetual access and sufficient area, by easement or otherwise, for inspection and regular maintenance.

(14). Requirements for Maintenance. All stormwater management facilities must undergo, at the minimum, an annual inspection by owner to document maintenance and repair needs and ensure compliance with the requirements of this ordinance and accomplishment of its purposes. These needs may include; removal of silt, litter and other debris from all catch basins, inlets and drainage pipes, grass cutting and vegetation removal, and necessary replacement of landscape vegetation. Any maintenance needs found must be addressed in a timely manner, as determined by the City, and the inspection and maintenance requirement may be increased as deemed necessary to ensure proper functioning of the stormwater management facility.

(15). Inspection of Stormwater Facilities. Inspection programs may be established on any reasonable basis, including but not limited to: routine inspections; random inspections; inspections based upon complaints or other notice of possible violations; inspection of drainage basins or areas identified as higher than typical sources of sediment or other contaminants or pollutants; inspections of businesses or industries of a type associated with higher than usual discharges of contaminants or pollutants or with discharges of a type which are more likely than the typical discharge to cause violations of state or federal water or sediment quality standards or the NPDES stormwater permit; and joint inspections with other agencies inspecting under environmental or safety laws. Inspections may include, but are not limited to: reviewing maintenance and repair records; sampling discharges, surface water, groundwater, and material or water in drainage control facilities; and evaluating the condition of drainage control facilities and other stormwater treatment practices.

(16). Right-of-Entry for Inspection. When any new drainage control facility is installed on private property, or when any new connection is made between private property and a public drainage control system or sanitary sewer, the property owner shall grant to the City the right to enter the property at reasonable times and in a reasonable manner for the purpose of inspection. This includes the right to enter a property when it has a reasonable basis to believe that a violation of this ordinance is occurring or has occurred, and to enter when necessary for abatement of a public nuisance or correction of a violation of this ordinance.

(17). Inspection of stormwater management facilities. Periodic inspections of facilities shall be performed as provided for in Section 6 of the City of Hendersonville Land Disturbance Ordinance and the Hendersonville Construction Manual.

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(18). Records of installation and maintenance activities. Parties responsible for the operation and maintenance of a stormwater management facility shall make weekly records during construction and monthly records after acceptance of the installation of the

stormwater facility, and of all maintenance and repairs to the facility, and shall retain the records for at least three (3) years. These records shall be made available to the City during inspection of the facility and at other reasonable times upon request.

(19). Failure to meet or maintain design or maintenance standards. If a responsible party fails or refuses to meet the design or maintenance standards required for stormwater facilities under this ordinance, the City Engineer, after twenty day (20) notice,

may correct a violation of the design standards or maintenance needs by performing all necessary work to place the facility in proper working condition. In the event that the stormwater management facility becomes a danger to public safety or public health, the City Engineer shall notify in writing the party responsible for maintenance of the stormwater management facility. Upon receipt of that notice, the responsible person shall have ten (10) days to effect maintenance and repair of the facility in an approved manner.

In the event that corrective action is not undertaken within that time, the City Engineer may take necessary corrective action. The cost of any action by the City under this section shall be charged to the responsible party and /or impose a minimum fine of five hundred (500) dollars per day up to ten thousand (10,000) dollars per day.

138-308. Illicit discharges. (1). Prohibition of Illegal Discharges. No person shall discharge or cause to be discharged into the municipal storm drain system or ~~watereoursecommunity water~~ any materials, including but not limited to pollutants or waters containing any pollutants that cause or contribute to a violation of applicable water quality standards, other than storm water.

The commencement, conduct or continuance of any illegal discharge to the storm drain system is prohibited except as described as follows:

- (a) Uncontaminated discharges from the following sources:
 - (1) Water line flushing or other potable water sources,
 - (2) Lawn watering with potable water,
 - (3) Diverted stream flows,
 - (4) Rising ground water,
 - (5) Groundwater infiltration to storm drains,
 - (6) Pumped groundwater,
 - (7) Foundation or footing drains,
 - (8) Crawl space pumps,
 - (9) Air conditioning condensation,

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- (10) Springs,
- (11) Non-commercial washing, for example vehicles,
- (12) Natural riparian habitat or wet-land flows,

(13) Swimming pools (if de-chlorinated - typically less than one PPM chlorine),

(14) Fire fighting activities such as hydrant testing, and

(15) Any other uncontaminated water source.

(b) Discharges specified in writing by the authorized enforcement agency as being necessary to protect public health and safety.

(c) Biodegradable dye testing is an allowable discharge, but requires a verbal notification to the authorized enforcement agency prior to the time of the test and may require a permit from other agencies.

(d) The prohibition shall not apply to any non-storm water discharge permitted under an NPDES permit, waiver, or waste discharge order issued to the discharger and administered under the authority of the Federal Environmental Protection Agency, provided that the discharger is in full compliance with all requirements of the permit, waiver, or order and other applicable laws and regulations, and provided that written approval has been granted for any discharge to the storm drain system.

(2). Prohibition of Illicit Connections.

(a) The construction, use, maintenance or continued existence of illicit connections to the storm drain system is prohibited.

(b) This prohibition expressly includes, without limitation, illicit connections made in the past, regardless of whether the connection was permissible under law or practices applicable or prevailing at the time of connection.

(c) A person is considered to be in violation of this ordinance if the person connects a line conveying sewage to the MS4, or allows such a connection to continue.

(3). Reduction of stormwater pollutants by the use of best management practices. Any person responsible for a property or premises, which is, or may be, the source of an illicit discharge, may be required to implement, at the person's expense, the BMPs necessary to prevent the further discharge of pollutants to the municipal separate storm sewer system. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of stormwater associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section.

(4). Notification of spills. Notwithstanding other requirements of law, as soon as any person responsible for a facility or operation, or responsible for emergency response for a facility or operation has information of any known or suspected release of materials which are resulting in, or may result in, illicit discharges or

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pollutants discharging into stormwater, the municipal separate storm sewer system, the person shall take all necessary steps to ensure the discovery, containment, and cleanup of such release. In the event of such a release of hazardous materials the person shall immediately notify emergency response agencies of the occurrence via emergency

dispatch services and contact the City Engineer no later than the next business days. In the event of a release of non-hazardous materials, the person shall notify the City Engineer in person or by telephone or facsimile no later than the next business day. Notifications in person or by telephone shall be confirmed by written notice addressed and mailed to the City Engineer within three (3) business days of the telephone notice. If the discharge of prohibited materials emanates from a commercial or industrial establishment, the owner or operator of such establishment shall also retain an on-site written record of the discharge and the actions taken to prevent its recurrence. Such records shall be retained for at least five (5) years.

(5). Suspension of MS4 Access. (a) Suspension due to Illicit Discharges in Emergency Situations. The City may, without prior notice, suspend MS4 discharge access to a person when such suspension is necessary to stop an actual or threatened discharge which presents or may present imminent and substantial danger to the environment, or to the health or welfare of persons, or to the MS4 or Waters of the United States. If the violator fails to comply with a suspension order issued in an emergency, the authorized enforcement agency may take such steps as deemed necessary to prevent or minimize damage to the MS4 or Waters of the United States, or to minimize danger to persons.

(b) Suspension due to the Detection of Illicit Discharge. Any person discharging to the MS4 in violation of this ordinance may have their MS4 access terminated. The authorized enforcement agency will notify a violator of the proposed termination of its MS4 access. The violator may petition the authorized enforcement agency for reconsideration and hearing as outlined in the Land Disturbance Ordinance.

A person commits an offense if the person reinstates MS4 access to premises terminated pursuant to this Section, without the prior approval of the authorized enforcement agency.

(6). Industrial or construction activity discharge. Any person subject to an industrial or construction activity NPDES storm water discharge permit shall comply with all provisions of such permit. Proof of compliance with said permit may be required in a form acceptable to the City prior to the allowing of discharges to the MS4.

(7). Monitoring of discharges. Applicability. This section applies to all facilities that have storm water discharges associated with industrial activity, including construction activity.

(b) Access to Facilities.

(1) The City shall be permitted to enter and inspect facilities subject to regulation under this ordinance as often as may be necessary to

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determine compliance with this ordinance. If a discharger has security measures in force which require proper identification and clearance before entry into its premises, the discharger shall make the necessary arrangements to allow access to representatives of the authorized enforcement agency.

(2) Facility operators shall allow the City ready access to all parts of the premises

for the purposes of inspection, sampling, examination and copying of records that must be kept under the conditions of an NPDES permit to discharge storm water, and the performance of any additional duties as defined by state and federal law.

(3) The City shall have the right to set up on any permitted facility such devices as are necessary in the opinion of the authorized enforcement agency to conduct monitoring and/or sampling of the facility's storm water discharge.

(4) The City has the right to require the discharger to install monitoring equipment as necessary. The facility's sampling and monitoring equipment shall be maintained at all times in a safe and proper operating condition by the discharger at its own expense. All devices used to measure stormwater flow and quality shall be calibrated to ensure their accuracy.

(5) Any temporary or permanent obstruction to safe and easy access to the facility to be inspected and/or sampled shall be promptly removed by the operator at the written or oral request of the City and shall not be replaced unless otherwise notified by the City. The costs of clearing such access shall be borne by the operator.

(6) Unreasonable delays in allowing the City access to a permitted facility are a violation of a storm water discharge permit and of this ordinance. A person who is the operator of a facility with an NPDES permit to discharge storm water associated with industrial activity commits an offense if the person denies the authorized enforcement agency reasonable access to the permitted facility for the purpose of conducting any activity authorized or required by this ordinance.

(7) If the City has been refused access to any part of the premises from which stormwater is discharged, and is able to demonstrate probable cause to believe that there may be a violation of this ordinance, or that there is a need to inspect and/or sample as part of a routine inspection and sampling program designed to verify compliance with this ordinance or any order issued hereunder, or to protect the overall public health, safety, and welfare of the community, then the authorized enforcement agency may seek issuance of a search warrant from any court of competent jurisdiction.

(8). Requirement to prevent, control and reduce storm water pollutants by the

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use of best management practices. The City requires identifying Best Management Practices for any activity, operation, or facility which may cause or contribute to pollution or contamination of storm water, the storm drain system, or waters of the U.S. The owner or operator of a commercial or industrial establishment shall provide, at their own expense, reasonable protection from accidental discharge of prohibited materials or other wastes into the municipal storm drain system or ~~watercourse~~community waters

through the use of these structural and non-structural BMPs. Further, any person responsible for a property or premise, which is, or may be, the source of an illicit discharge, may be required to implement, at said person's expense, additional structural and non-structural BMPs to prevent the further discharge of pollutants to the MS4. Compliance with all terms and conditions of a valid NPDES permit authorizing the discharge of storm water associated with industrial activity, to the extent practicable, shall be deemed compliance with the provisions of this section. These BMPs shall be part of a stormwater pollution prevention plan (SWPPP) as necessary for compliance with requirements of the NPDES permit.

(9). WatercourseCommunity water protection. Every person owning property through which a watercoursecommunity water passes, or such person's lessee, shall keep and maintain that part of the watercoursecommunity water within the property free of trash, debris, excessive vegetation, and other obstacles that would pollute, contaminate, or significantly retard the flow of water through the watercoursecommunity water. In addition, the owner or lessee shall maintain existing privately owned structures within or adjacent to a watercoursecommunity water, so that such structures will not become a hazard to the use, function, or physical integrity of the watercoursecommunity water.

18-309. Enforcement. (1). Notice of Violation.

(a) Written Notice. Whenever the City finds that any permittee or any other person has violated or is violating this ordinance or a permit or order issued hereunder, the City may serve upon such person written notice of the violation. Within ten (10) days of this notice, an explanation of the violation and a plan for the satisfactory correction and prevention thereof, to include specific required actions, shall be submitted to the City Engineer. Submission of this plan in no way relieves the discharger of liability for any violations occurring before or after receipt of the notice of violation.

(b) Consent orders. The City Engineer is empowered to enter into consent orders, assurances of voluntary compliance, or other similar documents establishing an agreement with the person responsible for the noncompliance. Such orders will include specific action to be taken by the person to correct the noncompliance within a time period also specified by the order. Consent orders shall have the same force and effect as administrative orders issued pursuant to paragraphs (d) and (e) below.

(c) Show cause hearing. The City Engineer may order any person who violates this ordinance or permit or order issued hereunder, to
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 show cause why a proposed enforcement action should not be taken.

Notice shall be served on the person specifying the time and place for the meeting, the proposed enforcement action and the reasons for such action, and a request that the violator show cause why this proposed

enforcement action should not be taken. The notice of the meeting shall be served personally or by registered or certified mail (return receipt requested) at least ten (10) days prior to the hearing.

(d) Compliance order. When the City Engineer finds that any person has violated or continues to violate this ordinance or a permit or order issued there under, he may issue an order to the violator directing that, following a specific time period, adequate structures, devices, be installed or procedures implemented and properly operated. Orders may also contain such other requirements as might be reasonably necessary and appropriate to address the noncompliance, including the construction of appropriate structures, installation of devices, self-monitoring, and management practices.

(e) Cease and desist orders. When the City Engineer finds that any person has violated or continues to violate this ordinance or any permit or order issued hereunder, the City Engineer may issue an order to cease and desist all such violations and direct those persons in noncompliance to:

- (1) Comply forthwith; or
- (2) Take such appropriate remedial or preventive action as may be needed to properly address a continuing or threatened violation, including halting operations and terminating the discharge.

(2). Conflicting standards. Whenever there is a conflict between any standard contained in this ordinance and in the Land Disturbance Ordinance and the BMP practices adopted by the municipality under the Land Disturbance Ordinance, the strictest standard shall prevail.

18-310. Penalties. (1). Violations. Any person who shall commit any act declared unlawful under this ordinance, who violates any provision of this ordinance, who violates the provisions of any permit issued pursuant to this ordinance, or who fails or refuses to comply with any lawful communication or notice to abate or take corrective action by the City, shall be guilty of a civil offense.

(2). Penalties. Under the authority provided in The federal Water Pollution Control Act (33 U.S.C. ' 1251 et seq.), and Tennessee Code Annotated '68-221-1106, the municipality declares that any person violating the provisions of this ordinance may be assessed a civil penalty by the City Engineer of not less than five hundred dollars (500)

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and not more than ten thousand dollars (10,000) per day or the maximum allowed by law for each day of violation. Each day of violation shall constitute a separate violation. Funds received by this ordinance and the Land Disturbance Ordinance shall be received and designate to the City's drainage improvements account unless specified by separate

ordinance.

(3). Measuring civil penalties. In assessing a civil penalty, the City Engineer may consider:

- (a) The harm done to the public health or the environment;
- (b) Whether the civil penalty imposed will be a substantial economic deterrent to the illegal activity;
- (c) The economic benefit gained by the violator;
- (d) The amount of effort put forth by the violator to remedy this violation;
- (e) Any unusual or extraordinary enforcement costs incurred by the municipality;
- (f) The amount of penalty established by ordinance or resolution for specific categories of violations; and
- (g) Any equities of the situation that outweigh the benefit of imposing any penalty or damage assessment.

(4). Recovery of damages and costs. In addition to the civil penalty in subsection (2) above, the City may recover;

(a) all damages proximately caused by the violator to the City, which may include any reasonable expenses incurred in investigating violations of, and enforcing compliance with, this ordinance, or any other actual damages caused by the violation.

(b) The costs of the City's maintenance of stormwater facilities when the user of such facilities fails to maintain them as required by this ordinance.

(5). Other remedies. The City may bring legal action to enjoin the continuing violation of this ordinance, and the existence of any other remedy, at law or equity, shall be no defense to any such actions.

(6). Remedies cumulative. The remedies set forth in this section shall be cumulative, not exclusive, and it shall not be a defense to any action, civil or criminal that one (1) or more of the remedies set forth herein has been sought or granted.

18-311. Appeals. There is created a Public Works Stormwater Advisory Committee which shall consist of seven members. One member from the public works committee, one person from the utility district, the city engineer, one builder or developer, three Hendersonville citizens of the general public appointed by the Public Works Committee.

- (1) Term. Appointed members shall serve for a term of two years and

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can be reappointed for two addition consecutive terms.

(2) Organization. Within ten (10) days after its appointment the Public Works Stormwater Committee shall organize itself by election of one chairman and vice chairman. The City Engineer shall be the secretary to the committee and

who shall be the custodian of the minutes and records of the proceedings of the committee.

(3) **Compensation.** All appointed members shall serve without compensation and be removed from the committee by the Public Works Committee for absence from meetings of the committee, or other just cause.

(4) **Replacement.** Replacement of any appointed member of the committee resigning or dismissed from the committee shall be appointed by the Public Works Committee.

(5) **Duties.** The Public Works Stormwater Advisory Committee shall adopt such rules and regulations as it may deem necessary to conduct its business. The committee, in open meeting, shall hear all appeals, under the provisions of this ordinance and the Land Disturbance Ordinance. The committee shall base its decisions on the written documentation presented before it. The committee shall meet at regular monthly intervals with the day and time to be determined by the committee's chairman. In the event no appeals have been filed and there is no business pending, the chairman may cancel the meeting five days before its scheduled date.

(6) **Voting.** Three members of the Public Works Stormwater Advisory Committee shall constitute a quorum. A majority vote of the members present shall be required for actions by the committee. No member of the committee shall act in any case in which he/she has a personal financial interest.

(7) Pursuant to Tennessee Code Annotated §68-221-1106(d) any person aggrieved by the imposition of a civil penalty or damage assessment as provided by this ordinance may appeal said penalty or damage assessment to the Public Works Stormwater Advisory Committee.

(a). **Appeals to be in writing.** The appeal shall be in writing and filed with the Public Works secretary within fifteen (15) days after the civil penalty and/or damage assessment is served in any manner authorized by law.

(b). **Public hearing.** Upon receipt of an appeal, the Public Works Stormwater Advisory Committee should hold a public hearing within thirty (30) days. Ten (10) days prior notice of the time, date, and location of said hearing shall be published in a daily newspaper of general circulation, placed on the City's television channel, or placed on the City's web page. Ten (10) days notice by registered mail shall also be provided to the aggrieved party, such notice to be sent to the address provided by the aggrieved party at the time of appeal. The decision of the Public Works Advisory Committee shall be final.

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(8). **Appealing decisions of the Public Works Stormwater Advisory Committee.** Any alleged violator may appeal a decision of the Public Works Stormwater Advisory Committee pursuant to the provisions of Tennessee Code Annotated, Title 27, Chapter 9 and the federal Water Pollution Control Act (33 U.S.C. 1251 et seq.). (Ord. 2004-27, August 2004)

CHAPTER 4**NATIONAL FLOOD INSURANCE PROGRAM REGULATIONS****SECTION**

- 18-401. Statutory Authorization.
- 18-402. Findings of Fact.
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- 18.404. Objectives.
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- 18-421. Standards for Streams Without Established Base Flood Elevations and Floodways (A Zones).
- 18-422. Standards for Areas of Shallow Flooding (AO and AH Zones).
- 18-423. Standards for Areas Protected by Flood Protection System (A-99 Zones).
- 18-424. Standards for Unmapped Streams.
- 18-425. Municipal Board of Zoning Appeals.
- 18-426. Conditions for Variances.
- 18-427. Legal Status Provisions.

18-401. Statutory Authorizations. The Legislature of the State of Tennessee has in Section 13-70201 through 13-7-210, Tennessee Code Annotated delegated the responsibility to local governmental units to adopt regulations designed to promote the public health, safety and general welfare of its citizenry.

18-402. Findings of Fact. (1) The City wishes to maintain eligibility in the National Flood Insurance Program (NFIP) and in order to do so must meet the NFIP regulations found in Title 44 of the Code of Federal Regulations (CFR), Ch.1, Section 60.3

(2) Areas of the City of Hendersonville, Tennessee are subject to periodic inundation which could result in loss of life and property, health and safety hazards, disruption of commerce and governmental services, extraordinary public expenditures for flood protection and relief, and impairment of the tax base, all of which adversely affect the public health, safety and general welfare.

(3) Flood losses are caused by the cumulative effect of obstructions in floodplains, causing increases in flood heights and velocities; by uses in flood hazard areas which are vulnerable to floods; or construction which is inadequately elevated, floodproofed, or otherwise unprotected from flood damages.

18-403. Statement of Purpose. It is the purpose of this Ordinance to promote the public health, safety and general welfare and to minimize public and private losses due to flood conditions in specific areas. This Ordinance is designed to:

(1) Restrict or prohibit uses which are vulnerable to flooding or erosion hazards, or which result in damaging increases in erosion, flood heights, or velocities;

(2) Require that uses vulnerable to floods, including community facilities, be protected against flood damage at the time of initial construction;

(3) Control the alteration of natural floodplains, stream channels, and natural protective barriers which are involved in the accommodation of floodwaters;

(4) Control filling, grading, dredging and other development which may increase flood

(5) Prevent or regulate the construction of flood barriers which will unnaturally divert flood waters or which may increase flood hazards to other lands.

18.404. Objectives. The objectives of this Ordinance are:

(1) To protect human life, health, safety and property;

(2) To minimize expenditure of public funds for costly flood control projects;

(3) To minimize the need for rescue and relief efforts associated with flooding and generally undertaken at the expense of the general public;

(4) To minimize prolonged business interruptions;

(5) To minimize damage to public facilities and utilities such as water and gas mains, electric, telephone and sewer lines, streets and bridges located in floodprone areas;

(6) To help maintain a stable tax base by providing for the sound use and development of floodprone areas to minimize blight in flood areas;

(7) To ensure that potential homebuyers are notified that property is in a floodprone area;

(8) To maintain eligibility for participation in the NFIP.

18-405. Definitions. Unless specifically defined below, words or phrases used in this Ordinance shall be interpreted as to give them the meaning they have in common usage and to give this Ordinance its most reasonable application given its stated purpose and objectives.

(1) "Accessory Structure" means a subordinate structure to the principal structure on the same lot and, for the purpose of this Ordinance, shall conform to the following:

(a) Accessory structures shall only be used for parking of vehicles and

storage.

(b) Accessory structures shall be designed to have low flood damage potential.

(c) Accessory structures shall be constructed and placed on the building site so as to offer the minimum resistance to the flow of floodwaters.

(d) Accessory structures shall be firmly anchored to prevent flotation, collapse, and lateral movement, which otherwise may result in damage to other structures.

(e) Utilities and service facilities such as electrical and heating equipment shall be elevated or otherwise protected from intrusion of floodwaters.

(2) "Addition (to an existing building)" means any walled and roofed expansion to the perimeter or height of a building.

(3) "Appeal" means a request for a review of the local enforcement officer's interpretation of any provision of this Ordinance or a request for a variance.

(4) "Area of Shallow Flooding" means a designated AO or AH Zone on a community's Flood Insurance Rate Map (FIRM) with one percent or greater annual chance of flooding to an average depth of one to three feet where a clearly defined channel does not exist, where the path of flooding is unpredictable and indeterminate; and where velocity flow may be evident. Such flooding is characterized by ponding or sheet flow.

(5) "Area of Special Flood-related Erosion Hazard" is the land within a community which is most likely to be subject to severe flood-related erosion losses. The area may be designated as Zone E on the Flood Hazard Boundary Map (FHBM). After the detailed evaluation of the special flood-related erosion hazard area in preparation for publication of the FIRM, Zone E may be further refined.

(6) "Area of Special Flood Hazard" see "Special Flood Hazard Area".

(7) "Base Flood" means the flood having a one percent chance of being equaled or exceeded in any given year. This term is also referred to as the 100-year flood or the one (1)-percent annual chance flood.

(8) "Basement" means any portion of a building having its floor subgrade (below ground level) on all sides.

(9) "Building" see "Structure".

(10) "Development" means any man-made change to improved or unimproved real estate, including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavating, drilling operations, or storage of equipment or materials.

(11) "Elevated Building" means a non-basement building built to have the lowest floor of the lowest enclosed area elevated above the ground level by means of solid foundation perimeter walls with openings sufficient to facilitate the unimpeded movement of floodwater, pilings, columns, piers, or shear walls adequately anchored so as not to impair the structural integrity of the building during a base flood event.

(12) "Emergency Flood Insurance Program" or "Emergency Program" means the program as implemented on an emergency basis in accordance with Section 1336 of the Act. It is intended as a program to provide a first layer amount of insurance on all insurable structures before the effective date of the initial FIRM.

(13) "Erosion" means the process of the gradual wearing away of land masses. This peril is not "per se" covered under the Program.

(14) "Exception" means a waiver from the provisions of this Ordinance which relieves the applicant from the requirements of a rule, regulation, order or other determination made or issued pursuant to this Ordinance.

(15) "Existing Construction" means any structure for which the "start of construction" commenced before the effective date of the initial floodplain management code or ordinance adopted by the community as a basis for that community's participation in the NFIP.

(16) "Existing Manufactured Home Park or Subdivision" means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including, at a minimum, the installation of utilities, the construction of streets, final site grading or the pouring of concrete pads) is completed before the effective date of the first floodplain management code or ordinance adopted by the community as a basis for that community's participation in the NFIP.

(17) "Existing Structures" see "Existing Construction".

(18) "Expansion to an Existing Manufactured Home Park or Subdivision" means the preparation of additional sites by the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads).

(19) "Flood" or "Flooding" means a general and temporary condition of partial or complete inundation of normally dry land areas from:

(a) The overflow of inland or tidal waters.

(b) The unusual and rapid accumulation or runoff of surface waters from any source.

(20) "Flood Elevation Determination" means a determination by the Federal Emergency Management Agency (FEMA) of the water surface elevations of the base flood, that is, the flood level that has a one percent or greater chance of occurrence in any given year.

(21) "Flood Elevation Study" means an examination, evaluation and determination of flood hazards and, if appropriate, corresponding water surface elevations, or an examination, evaluation and determination of mudslide (i.e., mudflow) or flood-related erosion hazards.

(22) "Flood Hazard Boundary Map (FHBM)" means an official map of a community, issued by FEMA, where the boundaries of areas of special flood hazard have been designated as Zone A.

(23) "Flood Insurance Rate Map (FIRM)" means an official map of a community, issued by FEMA, delineating the areas of special flood hazard or the risk premium zones applicable to the community.

(24) "Flood Insurance Study" is the official report provided by FEMA, evaluating flood hazards and containing flood profiles and water surface elevation of the base flood.

(25) "Floodplain" or "Floodprone Area" means any land area susceptible to being inundated by water from any source (see definition of "flooding").

(26) "Floodplain Management" means the operation of an overall program of corrective and preventive measures for reducing flood damage, including but not limited to emergency preparedness plans, flood control works and floodplain management regulations.

(27) "Flood Protection System" means those physical structural works for which funds have been authorized, appropriated, and expended and which have been constructed specifically to modify flooding in order to reduce the extent of the area within a community subject to a "special flood hazard" and the extent of the depths of associated flooding. Such a system typically includes hurricane tidal barriers, dams, reservoirs, levees or dikes. These specialized flood modifying works are those constructed in conformance with sound engineering standards.

(28) "Floodproofing" means any combination of structural and nonstructural additions, changes, or adjustments to structures which reduce or eliminate flood damage to real estate or improved real property, water and sanitary facilities and structures and their contents.

(29) "Flood-related Erosion" means the collapse or subsidence of land along the shore of a lake or other body of water as a result of undermining caused by waves or currents of water exceeding anticipated cyclical levels or suddenly caused by an unusually high water level in a natural body of water, accompanied by a severe storm, or by an unanticipated force of nature, such as a flash flood, or by some similarly unusual and unforeseeable event which results in flooding.

(30) "Flood-related Erosion Area" or "Flood-related Erosion Prone Area" means a land area adjoining the shore of a lake or other body of water, which due to the composition of the shoreline or bank and high water levels or wind-driven currents, is likely to suffer flood-related erosion damage.

(31) "Flood-related Erosion Area Management" means the operation of an overall program of corrective and preventive measures for reducing flood-related erosion damage, including but not limited to emergency preparedness plans, flood-related erosion control works and floodplain management regulations.

(32) "Floodway" means the channel of a river or other [watercoursecommunity](#) water and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

(33) "Freeboard" means a factor of safety usually expressed in feet above a flood level for purposes of floodplain management. "Freeboard" tends to compensate for the many unknown factors that could contribute to flood heights greater than the height calculated for a selected size flood and floodway conditions, such as wave action, blockage of bridge or culvert openings, and the hydrological effect of urbanization of the watershed.

(34) "Functionally Dependent Use" means a use which cannot perform its intended purpose unless it is located or carried out in close proximity to water. The term includes only docking facilities, port facilities that are necessary for the loading and unloading of cargo or passengers, and ship building and ship repair facilities, but does not include long-term storage or related manufacturing facilities.

(35) "Highest Adjacent Grade" means the highest natural elevation of the ground surface, prior to construction, adjacent to the proposed walls of a structure.

(36) "Historic Structure" means any structure that is:

(a.) Listed individually in the National Register of Historic Places (a listing maintained by the U.S. Department of Interior) or preliminarily determined by the Secretary of the Interior as meeting the requirements for individual listing on the National Register;

(b) Certified or preliminarily determined by the Secretary of the Interior as contributing to the historical significance of a registered historic district or a district preliminarily determined by the Secretary to qualify as a registered historic district;

(c) Individually listed on the Tennessee inventory of historic places and determined as eligible by states with historic preservation programs which have been approved by the Secretary of the Interior; or

(d) Individually listed on the City of Hendersonville, Tennessee inventory of historic places and determined as eligible by communities with historic preservation programs that have been certified either:

(i.) By the approved Tennessee program as determined by the

Secretary of the Interior or

(ii) Directly by the Secretary of the Interior.

(37) "Levee" means a man-made structure, usually an earthen embankment, designed and constructed in accordance with sound engineering practices to contain, control or divert the flow of water so as to provide protection from temporary flooding.

(38) "Levee System" means a flood protection system which consists of a levee, or levees, and associated structures, such as closure and drainage devices, which are constructed and operated in accordance with sound engineering practices.

(39) "Lowest Floor" means the lowest floor of the lowest enclosed area, including a basement. An unfinished or flood resistant enclosure used solely for parking of vehicles, building access or storage in an area other than a basement area is not considered a building's lowest floor; provided, that such enclosure is not built so as to render the structure in violation of the applicable non-elevation design requirements of this Ordinance.

(40) "Manufactured Home" means a structure, transportable in one or more sections, which is built on a permanent chassis and designed for use with or without a permanent foundation when attached to the required utilities. The term "Manufactured Home" does not include a "Recreational Vehicle".

(41) "Manufactured Home Park or Subdivision" means a parcel (or contiguous parcels) of land divided into two or more manufactured home lots for rent or sale.

(42) "Map" means the Flood Hazard Boundary Map (FHBM) or the Flood Insurance Rate Map (FIRM) for a community issued by FEMA.

(43) "Mean Sea Level" means the average height of the sea for all stages of the tide. It is used as a reference for establishing various elevations within the floodplain. For the purposes of this Ordinance, the term is synonymous with the National Geodetic Vertical Datum (NGVD) of 1929, the North American Vertical Datum (NAVD) of 1988, or other datum, to which Base Flood Elevations shown on a community's Flood Insurance Rate Map are referenced.

(44) "National Geodetic Vertical Datum (NGVD)" means, as corrected in 1929, a vertical control used as a reference for establishing varying elevations within the floodplain.

(45) "New Construction" means any structure for which the "start of construction" commenced on or after the effective date of the initial floodplain management Ordinance and includes any subsequent improvements to such structure.

(46) "New Manufactured Home Park or Subdivision" means a manufactured home park or subdivision for which the construction of facilities for servicing the lots on which the manufactured homes are to be affixed (including at a minimum, the installation of utilities, the construction of streets, and either final site grading or the pouring of concrete pads) is completed on or after the effective date of this ordinance or the effective date of the initial floodplain management ordinance and includes any subsequent improvements to such structure.

(47) "North American Vertical Datum (NAVD)" means, as corrected in 1988, a vertical control used as a reference for establishing varying elevations within the floodplain.

(48) "100-year Flood" see "Base Flood".

(49) "Person" includes any individual or group of individuals, corporation, partnership, association, or any other entity, including State and local governments and agencies.

(50) "Reasonably Safe from Flooding" means base flood waters will not inundate the land or damage structures to be removed from the Special Flood Hazard Area and that any subsurface waters related to the base flood will not damage existing or proposed structures.

- (51) "Recreational Vehicle" means a vehicle which is:
- (a) Built on a single chassis;
 - (b) 400 square feet or less when measured at the largest horizontal projection;
 - (c) Designed to be self-propelled or permanently towable by a light duty truck;
 - (d) Designed primarily not for use as a permanent dwelling but as temporary living quarters for recreational, camping, travel, or seasonal use.

(52) "Regulatory Floodway" means the channel of a river or other ~~watercourse~~ community water and the adjacent land areas that must be reserved in order to discharge the base flood without cumulatively increasing the water surface elevation more than a designated height.

(53) "Riverine" means relating to, formed by, or resembling a river (including tributaries), stream, brook, etc.

(54) "Special Flood Hazard Area" is the land in the floodplain within a community subject to a one percent or greater chance of flooding in any given year. The area may be designated as Zone A on the FHBM. After detailed ratemaking has been completed in preparation for publication of the FIRM, Zone A usually is refined into Zones A, AO, AH, A1-30, AE or A99.

(55) "Special Hazard Area" means an area having special flood, mudslide (i.e., mudflow) and/or flood-related erosion hazards, and shown on an FHBM or FIRM as Zone A, AO, A1-30, AE, A99, or AH.

(56) "Start of Construction" includes substantial improvement, and means the date the building permit was issued, provided the actual start of construction, repair, reconstruction, rehabilitation, addition, placement, or other improvement was within 180 days of the permit date. The actual start means either the first placement of permanent construction of a structure (including a manufactured home) on a site, such as the pouring of slabs or footings, the installation of piles, the construction of columns, or any work beyond the stage of excavation; and includes the placement of a manufactured home on a foundation. Permanent construction does not include initial land preparation, such as clearing, grading and filling; nor does it include the installation of streets and/or walkways; nor does it include excavation for a basement, footings, piers, or foundations or the erection of temporary forms; nor does it include the installation on the property of accessory buildings, such as garages or sheds, not occupied as dwelling units or not part of the main structure. For a substantial improvement, the actual start of construction means the first alteration of any wall, ceiling, floor, or other structural part of a building, whether or not that alteration affects the external dimensions of the building.

(57) "State Coordinating Agency" the Tennessee Department of Economic and Community Development, as designated by the Governor of the State of Tennessee at the request of FEMA to assist in the implementation of the NFIP for the State.

(58) "Structure" for purposes of this Ordinance, means a walled and roofed building, including a gas or liquid storage tank, that is principally above ground, as well as a manufactured home.

(59) "Substantial Damage" means damage of any origin sustained by a structure whereby the cost of restoring the structure to its before damaged condition would equal or exceed fifty percent (50%) of the market value of the structure before the damage occurred.

(60) "Substantial Improvement" means any reconstruction, rehabilitation, addition, alteration or other improvement of a structure in which the cost equals or exceeds fifty percent (50%) of the market value of the structure before the "start of construction" of the

initial improvement. This term includes structures which have incurred "substantial damage", regardless of the actual repair work performed. The market value of the structure should be:

- (1) the appraised value of the structure prior to the start of the initial improvement, or
- (2) in the case of substantial damage, the value of the structure prior to the damage occurring.

The term does not, however, include either:

- (1) Any project for improvement of a structure to correct existing violations of State or local health, sanitary, or safety code specifications which have been pre-identified by the local code enforcement official and which are the minimum necessary to assure safe living conditions and not solely triggered by an improvement or repair project or;
- (2) Any alteration of a "historic structure", provided that the alteration will not preclude the structure's continued designation as a "historic structure".
- (61) "Substantially Improved Existing Manufactured Home Parks or Subdivisions" is where the repair, reconstruction, rehabilitation or improvement of the streets, utilities and pads equals or exceeds fifty percent (50%) of the value of the streets, utilities and pads before the repair, reconstruction or improvement commenced.
- (62) "Variance" is a grant of relief from the requirements of this Ordinance.
- (63) "Violation" means the failure of a structure or other development to be fully compliant with the community's floodplain management regulations. A structure or other development without the elevation certificate, other certification, or other evidence of compliance required in this Ordinance is presumed to be in violation until such time as that documentation is provided.
- (64) "Water Surface Elevation" means the height, in relation to the National Geodetic Vertical Datum (NGVD) of 1929, the North American Vertical Datum (NAVD) of 1988, or other datum, where specified, of floods of various magnitudes and frequencies in the floodplains of riverine areas.

18-406. Application. This Ordinance shall apply to all areas within the incorporated area of the City of Hendersonville, Tennessee.

18-407. Basis for Establishing the Areas of Special Flood Hazard. The Areas of Special Flood Hazard identified on the City of Hendersonville, Tennessee, as identified by FEMA, and in its Flood Insurance Study (FIS) dated April 17, 2012 and Flood Insurance Rate Map (FIRM), Community Panel Numbers 47165C0383G, 47165C0384G, 47165C0391G, 47165C0392G, 47165C0394G, 47165C0401G, 47165C0402G, 47165C0403G, 47165C0404G, 47165C0406G, 47165C0407G, 47165C0408G, 47165C0409G, 47165C0411G, 47165C0412G, 47165C0413G, 47165C0414G, 47165C0416G, 47165C0418G, 47165C0476G and 47165C0477G, dated April 17, 2012, along with all supporting technical data, are adopted by reference and declared to be a part of this Ordinance.

18-408. Requirement for Development Permit. A development permit shall be required in conformity with this Ordinance prior to the commencement of any development activities.

18-409. Compliance. No land, structure or use shall hereafter be located, extended, converted or structurally altered without full compliance with the terms of this Ordinance and other applicable regulations.

18-410. Abrogation and Greater Restrictions. This Ordinance is not intended to repeal, abrogate, or impair any existing easements, covenants or deed restrictions. However, where this Ordinance conflicts or overlaps with another regulatory instrument, whichever imposes the more stringent restrictions shall prevail.

18-411. Interpretation. In the interpretation and application of this Ordinance, all provisions shall be: (1) considered as minimum requirements; (2) liberally construed in favor of the governing body and; (3) deemed neither to limit nor repeal any other powers granted under Tennessee statutes.

18-412. Warning and Disclaimer of Liability. The degree of flood protection required by this Ordinance is considered reasonable for regulatory purposes and is based on scientific and engineering considerations. Larger floods can and will occur on rare occasions. Flood heights may be increased by man-made or natural causes. This Ordinance does not imply that land outside the Areas of Special Flood Hazard or uses permitted within such areas will be free from flooding or flood damages. This Ordinance shall not create liability on the part of the City of Hendersonville, Tennessee or by any officer or employee thereof for any flood damages that result from reliance on this Ordinance or any administrative decision lawfully made hereunder.

18-413. Penalties for Violation. Violation of the provisions of this Ordinance or failure to comply with any of its requirements, including violation of conditions and safeguards established in connection with grants of variance shall constitute an offense punishable as other offenses as provided by law. Any person who violates this ordinance or fails to comply with any of its requirements shall, upon adjudication therefore, be fined as prescribed by Tennessee statutes, and in addition, shall pay all costs and expenses involved in the case. Each day such violation continues shall be considered a separate offense. Nothing herein contained shall prevent the City of Hendersonville, Tennessee from taking such other lawful actions to prevent or remedy any violation.

18-414. Designation of Ordinance Administrator. The City Engineer is hereby appointed as the Administrator to implement the provisions of this Ordinance.

18-415. Permit Procedures. Application for a development permit shall be made to the Administrator on forms furnished by the community prior to any development activities. The development permit may include, but is not limited to the following: plans in duplicate drawn to scale and showing the nature, location, dimensions, and elevations of the area in question; existing or proposed structures, earthen fill placement, storage of materials or equipment, and drainage facilities. Specifically, the following information is required:

- (1) Application stage
 - (a) Elevation in relation to mean sea level of the proposed lowest floor, including basement, of all buildings where Base Flood Elevations are available, or to certain height above the highest adjacent grade when applicable under this Ordinance.
 - (b) Elevation in relation to mean sea level to which any non

residential building will be floodproofed where Base Flood Elevations are available, or to certain height above the highest adjacent grade when applicable under this Ordinance.

(c) A FEMA Floodproofing Certificate from a Tennessee registered professional engineer or architect that the proposed non-residential floodproofed building will meet the floodproofing criteria in Article V, Sections A and B.

(d) Description of the extent to which any ~~waterecourse~~community water will be altered or relocated as a result of proposed development.

(2) Construction Stage. Within AE Zones, where Base Flood Elevation data is available, any lowest floor certification made relative to mean sea level shall be prepared by or under the direct supervision of, a Tennessee registered land surveyor and certified by same. The Administrator shall record the elevation of the lowest floor on the development permit. When floodproofing is utilized for a non-residential building, said certification shall be prepared by, or under the direct supervision of, a Tennessee registered professional engineer or architect and certified by same.

Within approximate A Zones, where Base Flood Elevation data is not available, the elevation of the lowest floor shall be determined as the measurement of the lowest floor of the building relative to the highest adjacent grade. The Administrator shall record the elevation of the lowest floor on the development permit. When floodproofing is utilized for a non-residential building, said certification shall be prepared by, or under the direct supervision of, a Tennessee registered professional engineer or architect and certified by same.

For all new construction and substantial improvements, the permit holder shall provide to the Administrator an as-built certification of the lowest floor elevation or floodproofing level upon the completion of the lowest floor or floodproofing.

Any work undertaken prior to submission of the certification shall be at the permit holder's risk. The Administrator shall review the above-referenced certification data. Deficiencies detected by such review shall be corrected by the permit holder immediately and prior to further work being allowed to proceed. Failure to submit the certification or failure to make said corrections required hereby, shall be cause to issue a stop-work order for the project.

18-416. Duties and Responsibilities of the Administrator. Duties of the Administrator shall include, but not be limited to, the following:

(1) Review all development permits to assure that the permit requirements of this Ordinance have been satisfied, and that proposed building sites will be reasonably safe from flooding.

(2) Review proposed development to assure that all necessary permits have been received from those governmental agencies from which approval is required by Federal or State law, including Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. 1334.

(3) Notify adjacent communities and the Tennessee Department of Economic and

Community Development, Local Planning Assistance Office, prior to any alteration or relocation of a waterecoursecommunity water and submit evidence of such notification to FEMA.

(4) For any altered or relocated waterecoursecommunity water, submit engineering data/analysis within six (6) months to FEMA to ensure accuracy of community FIRM's through the Letter of Map Revision process.

(5) Assure that the flood carrying capacity within an altered or relocated portion of any waterecoursecommunity water is maintained.

(6) Record the elevation, in relation to mean sea level or the highest adjacent grade, where applicable, of the lowest floor (including basement) of all new and substantially improved buildings, in accordance with Article IV, Section B.

(7) Record the actual elevation, in relation to mean sea level or the highest adjacent grade, where applicable to which the new and substantially improved buildings have been floodproofed, in accordance with Article IV, Section B.

(8) When floodproofing is utilized for a nonresidential structure, obtain certification of design criteria from a Tennessee registered professional engineer or architect, in accordance with Article IV, Section B.

(9) Where interpretation is needed as to the exact location of boundaries of the Areas of Special Flood Hazard (for example, where there appears to be a conflict between a mapped boundary and actual field conditions), make the necessary interpretation. Any person contesting the location of the boundary shall be given a reasonable opportunity to appeal the interpretation as provided in this Ordinance.

(10) When Base Flood Elevation data and floodway data have not been provided by FEMA, obtain, review, and reasonably utilize any Base Flood Elevation and floodway data available from a Federal, State, or other sources, including data developed as a result of these regulations, as criteria for requiring that new construction, substantial improvements, or other development in Zone A on the City of Hendersonville, Tennessee FIRM meet the requirements of this Ordinance.

(11) Maintain all records pertaining to the provisions of this Ordinance in the office of the Administrator and shall be open for public inspection. Permits issued under the provisions of this Ordinance shall be maintained in a separate file or marked for expedited retrieval within combined files.

18-417. General Standards. In all areas of special flood hazard, the following provisions are required:

(1) New construction and substantial improvements shall be anchored to prevent flotation, collapse and lateral movement of the structure;

(2) Manufactured homes shall be installed using methods and practices that minimize flood damage. They must be elevated and anchored to prevent flotation, collapse and lateral movement. Methods of anchoring may include, but are not limited to, use of over-the-top or frame ties to ground anchors. This requirement is in addition to applicable State of Tennessee and local anchoring requirements for resisting wind forces.

(3) New construction and substantial improvements shall be constructed with materials and utility equipment resistant to flood damage;

(4) New construction and substantial improvements shall be constructed by methods and practices that minimize flood damage;

(5) All electrical, heating, ventilation, plumbing, air conditioning equipment, and other service facilities shall be designed and/or located so as to prevent water from entering or accumulating within the components during conditions of flooding;

(6) New and replacement water supply systems shall be designed to minimize or eliminate infiltration of flood waters into the system;

(7) New and replacement sanitary sewage systems shall be designed to minimize or eliminate infiltration of flood waters into the systems and discharges from the systems into flood waters;

(8) On-site waste disposal systems shall be located and constructed to avoid impairment to them or contamination from them during flooding;

(9) Any alteration, repair, reconstruction or improvements to a building that is in compliance with the provisions of this Ordinance, shall meet the requirements of "new construction" as contained in this Ordinance;

(10) Any alteration, repair, reconstruction or improvements to a building that is not in compliance with the provision of this Ordinance, shall be undertaken only if said non-conformity is not further extended or replaced;

(11) All new construction and substantial improvement proposals shall provide copies of all necessary Federal and State permits, including Section 404 of the Federal Water Pollution Control Act amendments of 1972, 33 U.S.C. 1334;

(12) All subdivision proposals and other proposed new development proposals shall meet the standards of Article V, Section B;

(13) When proposed new construction and substantial improvements are partially located in an area of special flood hazard, the entire structure shall meet the standards for new construction;

(14) When proposed new construction and substantial improvements are located in multiple flood hazard risk zones or in a flood hazard risk zone with multiple Base Flood Elevations, the entire structure shall meet the standards for the most hazardous flood hazard risk zone and the highest Base Flood Elevation.

18.418. Specific Standards. In all Areas of Special Flood Hazard, the following provisions, in addition to those set forth in Article V, Section A, are required:

(1) Residential Structures.

In AE Zones where Base Flood Elevation data is available, new construction and substantial improvement of any residential building (or manufactured home) shall have the lowest floor, including basement, elevated to no lower than two (2) feet above the Base Flood Elevation. Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate equalization of flood hydrostatic forces on both sides of exterior walls shall be provided in accordance with the standards of this section: "Enclosures".

Within approximate A Zones where Base Flood Elevations have not been established and where alternative data is not available, the administrator shall require the lowest floor of a building to be elevated to a level of at least three (3) feet above the highest adjacent grade (as defined in Article II). Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate equalization of flood hydrostatic forces on both sides of exterior walls shall be provided in accordance with the standards of this section: "Enclosures"

(2) Non-Residential Structures

In AE Zones, where Base Flood Elevation data is available, new construction

and substantial improvement of any commercial, industrial, or non-residential building, shall have the lowest floor, including basement, elevated or floodproofed to no lower than two (2) feet above the level of the Base Flood Elevation. Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate equalization of flood hydrostatic forces on both sides of exterior walls shall be provided in accordance with the standards of this section: "Enclosures"

In approximate A Zones, where Base Flood Elevations have not been established and where alternative data is not available, new construction and substantial improvement of any commercial, industrial, or non-residential building, shall have the lowest floor, including basement, elevated or floodproofed to no lower than three (3) feet above the highest adjacent grade (as defined in Article II). Should solid foundation perimeter walls be used to elevate a structure, openings sufficient to facilitate equalization of flood hydrostatic forces on both sides of exterior walls shall be provided in accordance with the standards of this section: "Enclosures"

Non-Residential buildings located in all A Zones may be floodproofed, in lieu of being elevated, provided that all areas of the building below the required elevation are watertight, with walls substantially impermeable to the passage of water, and are built with structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. A Tennessee registered professional engineer or architect shall certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the provisions above, and shall provide such certification to the Administrator as set forth in Article IV, Section B.

(3) Enclosures.

All new construction and substantial improvements that include fully enclosed areas formed by foundation and other exterior walls below the lowest floor that are subject to flooding, shall be designed to preclude finished living space and designed to allow for the entry and exit of flood waters to automatically equalize hydrostatic flood forces on exterior walls.

(a) Designs for complying with this requirement must either be certified by a Tennessee professional engineer or architect or meet or exceed the following minimum criteria.

(i) Provide a minimum of two openings having a total net area of not less than one (1) square inch for every square foot of enclosed area subject to flooding;

(ii) The bottom of all openings shall be no higher than one (1) foot above the finished grade;

(iii) Openings may be equipped with screens, louvers, valves or other coverings or devices provided they permit the automatic flow of floodwaters in both directions.

(b) The enclosed area shall be the minimum necessary to allow for parking of vehicles, storage or building access.

(c) The interior portion of such enclosed area shall not be finished or partitioned into separate rooms in such a way as to impede the movement of floodwaters and all such partitions shall comply with the provisions of Article V, Section B.

(4) Standards for Manufactured Homes and Recreational Vehicles

(a) All manufactured homes placed, or substantially improved, on: (1)

individual lots or parcels, (2) in expansions to existing manufactured home parks or subdivisions, or (3) in new or substantially improved manufactured home parks or subdivisions, must meet all the requirements of new construction.

(b) All manufactured homes placed or substantially improved in an existing manufactured home park or subdivision must be elevated so that either:

(i) In AE Zones, with Base Flood Elevations, the lowest floor of the manufactured home is elevated on a permanent foundation to no lower than two (2) feet above the level of the Base Flood Elevation or

(ii) In approximate A Zones, without Base Flood Elevations, the manufactured home chassis is elevated and supported by reinforced piers (or other foundation elements of at least equivalent strength) that are at least

three (3) feet in height above the highest adjacent grade (as defined in Article II).

(c) Any manufactured home, which has incurred "substantial damage" as the result of a flood, must meet the standards of Article V, Sections A and B.

(d) All manufactured homes must be securely anchored to an adequately anchored foundation system to resist flotation, collapse and lateral movement.

(e) All recreational vehicles placed in an identified Special Flood Hazard Area must either:

(i) Be on the site for fewer than 180 consecutive days;

(ii) Be fully licensed and ready for highway use (a recreational vehicle is ready for highway use if it is licensed, on its wheels or jacking system, attached to the site only by quick disconnect type utilities and security devices, and has no permanently attached structures or additions), or;

(iii) The recreational vehicle must meet all the requirements for new construction.

(5) Standards for Subdivisions and Other Proposed New Development Proposals. Subdivisions and other proposed new developments, including manufactured home parks, shall be reviewed to determine whether such proposals will be reasonably safe from flooding. All subdivision and other proposed new development proposals shall be consistent with the need to minimize flood damage.

(a) All subdivision and other proposed new development proposals shall have public utilities and facilities such as sewer, gas, electrical and water systems located and constructed to minimize or eliminate flood damage.

(b) All subdivision and other proposed new development proposals shall have adequate drainage provided to reduce exposure to flood hazards.

(c.) In all approximate A Zones require that all new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, include within such proposals Base Flood Elevation data (See Article V, Section E).

18-419. Standards for Special Flood Hazard Areas with Established Base Flood Elevations and With Floodways Designated. Located within the Special Flood Hazard Areas established in Article III, Section B, are areas designated as floodways. A floodway may be an extremely hazardous area due to the velocity of floodwaters, debris or erosion potential. In addition, the area must remain free of encroachment in order to allow for the discharge of the base flood without increased flood heights and velocities. Therefore, the following provisions shall apply:

(1) Encroachments are prohibited, including earthen fill material, new

construction, substantial improvements or other development within the regulatory floodway. Development may be permitted however, provided it is demonstrated through hydrologic and hydraulic analyses performed in accordance with standard engineering practices that the cumulative effect of the proposed encroachments or new development shall not result in any increase in the water surface elevation of the Base Flood Elevation, velocities, or floodway widths during the occurrence of a base flood discharge at any point within the community. A

Tennessee registered professional engineer must provide supporting technical data, using the same methodologies as in the effective Flood Insurance Study for the City of Hendersonville, Tennessee and certification, thereof.

(2) New construction and substantial improvements of buildings, where permitted, shall comply with all applicable flood hazard reduction provisions of Article V, Sections A and B.

18-420. Standards for Areas of Special Flood Hazard Zones AE with Established Base Flood Elevations but Without Floodways Designated. Located within the Special Flood Hazard Areas established in Article III, Section B, where streams exist with base flood data provided but where no floodways have been designated (Zones AE), the following provisions apply:

(1) No encroachments, including fill material, new construction and substantial improvements shall be located within areas of special flood hazard, unless certification by a Tennessee registered professional engineer is provided demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point within the community. The engineering certification should be supported by technical data that conforms to standard hydraulic engineering principles.

(2) New construction and substantial improvements of buildings, where permitted, shall comply with all applicable flood hazard reduction provisions of Article V, Sections A and B.

18-421. Standards for Streams without Established Base Flood Elevations and Floodways (A Zones). Located within the Special Flood Hazard Areas established in Article III, Section B, where streams exist, but no base flood data has been provided and where a Floodway has not been delineated, the following provisions shall apply:

(1) The Administrator shall obtain, review, and reasonably utilize any Base Flood Elevation and floodway data available from any Federal, State, or other sources, including data developed as a result of these regulations (see 2 below), as criteria for requiring that new construction, substantial improvements, or other development in approximate A Zones meet the requirements of Article V, Sections A and B.

(2) Require that all new subdivision proposals and other proposed developments (including proposals for manufactured home parks and subdivisions) greater than 50 lots or 5 acres, whichever is the lesser, include within such proposals Base Flood Elevation data.

(3) Within approximate A Zones, where Base Flood Elevations have not been established and where such data is not available from other sources, require the lowest floor of a building to be elevated or floodproofed to a level of at least three (3) feet above the highest adjacent grade (as defined in Article II). All applicable data including elevations or floodproofing certifications shall be recorded as set forth in Article IV, Section B. Openings

sufficient to facilitate automatic equalization of hydrostatic flood forces on exterior walls shall be provided in accordance with the standards of Article V, Section B.

(4) Within approximate A Zones, where Base Flood Elevations have not been established and where such data is not available from other sources, no encroachments, including structures or fill material, shall be located within an area equal to the width of the stream or twenty feet (20), whichever is greater, measured from the top of the stream bank, unless certification by a Tennessee registered professional engineer is provided demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point within the City of Hendersonville, Tennessee. The engineering certification should be supported by technical data that conforms to standard hydraulic engineering principles.

(5) New construction and substantial improvements of buildings, where permitted, shall comply with all applicable flood hazard reduction provisions of Article V, Sections A and B. Within approximate A Zones, require that those subsections of Article V Section B dealing with the alteration or relocation of a ~~watereoursecommunity water~~, assuring ~~watereoursecommunity water~~ carrying capacities are maintained and manufactured homes provisions are complied with as required.

18-422. Standards For Areas of Shallow Flooding (AO and AH Zones). Located within the Special Flood Hazard Areas established in Article III, Section B, are areas designated as shallow flooding areas. These areas have special flood hazards associated with base flood depths of one (1) to three (3) feet where a clearly defined channel does not exist and where the path of flooding is unpredictable and indeterminate; therefore, the following provisions, in addition to those set forth in Article V, Sections A and B, apply:

(1) All new construction and substantial improvements of residential and non-residential buildings shall have the lowest floor, including basement, elevated to at least two (2) feet above as many feet as the depth number specified on the FIRM's, in feet, above the highest adjacent grade. If no flood depth number is specified on the FIRM, the lowest floor, including basement, shall be elevated to at least three (3) feet above the highest adjacent grade. Openings sufficient to facilitate automatic equalization of hydrostatic flood forces on exterior walls shall be provided in accordance with standards of Article V, Section B.

(2) All new construction and substantial improvements of non-residential buildings may be floodproofed in lieu of elevation. The structure together with attendant utility and sanitary facilities must be floodproofed and designed watertight to be completely floodproofed to at least two (2) feet above the flood depth number specified on the FIRM, with walls substantially impermeable to the passage of water and with structural components having the capability of resisting hydrostatic and hydrodynamic loads and the effects of buoyancy. If no depth number is specified on the FIRM, the structure shall be floodproofed to at least three (3) feet above the highest adjacent grade. A Tennessee registered professional engineer or architect shall certify that the design and methods of construction are in accordance with accepted standards of practice for meeting the provisions of this Ordinance and shall provide such certification to the Administrator as set forth above and as required in accordance with Article IV, Section B.

(3) Adequate drainage paths shall be provided around slopes to guide floodwaters around and away from proposed structures.

18-423. Standards For Areas Protected by Flood Protection System (A-99 Zones). Located within the Areas of Special Flood Hazard established in Article III, Section

B, are areas of the 100-year floodplain protected by a flood protection system but where Base Flood Elevations have not been determined. Within these areas (A-99 Zones) all provisions of Article IV and Article V shall apply.

18-424. Standards for Unmapped Streams. Located within the Hendersonville, Tennessee, are unmapped streams where areas of special flood hazard are neither indicated nor identified. Adjacent to such streams, the following provisions shall apply:

(1) No encroachments including fill material or other development including structures shall be located within an area of at least equal to twice the width of the stream, measured from the top of each stream bank, unless certification by a Tennessee registered professional engineer is provided demonstrating that the cumulative effect of the proposed development, when combined with all other existing and anticipated development, will not increase the water surface elevation of the base flood more than one (1) foot at any point within the locality.

(2) When a new flood hazard risk zone, and Base Flood Elevation and floodway data is available, new construction and substantial improvements shall meet the standards established in accordance with Articles IV and V.

18-425. Municipal Board of Zoning Appeals.

(1) Authority. The City's Municipal Board of Zoning Appeals shall hear and decide appeals and requests for variances from the requirements of this Ordinance.

(2) Procedure. Meetings of the Municipal Board of Zoning Appeals shall be held at such times, as the Board shall determine. All meetings of the Municipal Board of Zoning Appeals shall be open to the public. The Municipal Board of Zoning Appeals shall adopt rules of procedure and shall keep records of applications and actions thereof, which shall be a public record. Compensation of the members of the Municipal Board of Zoning Appeals, if any, shall be set by the Legislative Body.

(3) Appeals: How Taken. An appeal to the Municipal Board of Zoning Appeals may be taken by any person, firm or corporation aggrieved or by any governmental officer, department, or bureau affected by any decision of the Administrator based in whole or in part upon the provisions of this Ordinance. Such appeal shall be taken by filing with the Municipal Board of Zoning Appeals a notice of appeal, specifying the grounds thereof. In all cases where an appeal is made by a property owner or other interested party, a fee of One Hundred Dollars (\$100.00) shall be paid by the appellant for the costs of publishing a notice of the hearing. The Administrator shall transmit to the Municipal Board of Zoning Appeals all papers constituting the record upon which the appeal action was taken. The Municipal Board of Zoning Appeals shall fix a reasonable time for the hearing of the appeal, give public notice thereof, as well as due notice to parties in interest and decide the same within a reasonable time which shall not be more than thirty (30) days from the date of the hearing. At the hearing, any person or party may appear and be heard in person or by agent or by attorney.

(3) Powers. The Municipal Board of Zoning Appeals shall have the following powers:

(a) Administrative Review. To hear and decide appeals where it is alleged by the applicant that there is error in any order, requirement, permit, decision, determination, or refusal made by the Administrator or other administrative official in carrying out or enforcement of any provisions of this Ordinance.

(b) Variance Procedures. In the case of a request for a variance the following shall apply:

(i) The City of Hendersonville, Tennessee Municipal Board of Zoning Appeals shall hear and decide appeals and requests for variances from the requirements of this Ordinance.

(ii) Variances may be issued for the repair or rehabilitation of historic structures as defined, herein, upon a determination that the proposed repair or rehabilitation will not preclude the structure's continued designation as a historic structure and the variance is the minimum necessary deviation from the requirements of this Ordinance to preserve the historic character and design of the structure.

(iii) In passing upon such applications, the Municipal Board of Zoning Appeals shall consider all technical evaluations, all relevant factors, all standards specified in other sections of this Ordinance, and:

- a) The danger that materials may be swept onto other property to the injury of others;
- b) The danger to life and property due to flooding or erosion;
- c) The susceptibility of the proposed facility and its contents to flood damage;
- d) The importance of the services provided by the proposed facility to the community;
- e) The necessity of the facility to a waterfront location, in the case of a functionally dependent use;
- f) The availability of alternative locations, not subject to flooding or erosion damage, for the proposed use;
- g) The relationship of the proposed use to the comprehensive plan and floodplain management program for that area;
- h) The safety of access to the property in times of flood for ordinary and emergency vehicles;
- i) The expected heights, velocity, duration, rate of rise and sediment transport of the flood waters and the effects of wave action, if applicable, expected at the site;
- j) The costs of providing governmental services during and after flood conditions including maintenance and repair of public utilities and facilities such as sewer, gas, electrical, water systems, and streets and bridges.

(iv) Upon consideration of the factors listed above, and the purposes of this Ordinance, the Municipal Board of Zoning Appeals may attach such conditions to the granting of variances, as it deems necessary to effectuate the purposes of this Ordinance.

(v) Variances shall not be issued within any designated floodway if any increase in flood levels during the base flood discharge would result.

14-426. Conditions for Variances. (1) Variances shall be issued upon a determination that the variance is the minimum relief necessary, considering the flood hazard and the factors listed in Article VI, Section A.

(2) Variances shall only be issued upon: a showing of good and sufficient cause, a determination that failure to grant the variance would result in exceptional hardship; or a determination that the granting of a variance will not result in increased flood heights, additional threats to public safety, extraordinary public expense, create nuisance, cause fraud on or victimization of the public, or conflict with existing local laws or Ordinances.

(3) Any applicant to whom a variance is granted shall be given written notice that

the issuance of a variance to construct a structure below the Base Flood Elevation will result in increased premium rates for flood insurance (as high as \$25 for \$100) coverage, and that such construction below the Base Flood Elevation increases risks to life and property.

(4) The Administrator shall maintain the records of all appeal actions and report any variances to FEMA upon request.

14-427. Legal Status Provisions. (1) Conflict with Other Ordinances. In case of conflict between this Ordinance or any part thereof, and the whole or part of any existing or future Ordinance of the City of Hendersonville, Tennessee, the most restrictive shall in all cases apply.

(2) Severability. If any section, clause, provision, or portion of this Ordinance shall be held to be invalid or unconstitutional by any court of competent jurisdiction, such holding shall not affect any other section, clause, provision, or portion of this Ordinance which is not of itself invalid or unconstitutional.

(Ord. 2017-16, April 2017)

CHAPTER 5
STORMWATER UTILITY

SECTION

- 18-501. Policy.
- 18-502. Creation of stormwater utility.
- 18-503. Definitions.
- 18-504. Funding of stormwater utility.
- 18-505. Stormwater fund.
- 18-506. Operating budget.
- 18-507. Stormwater user's fees established.
- 18-508. Equivalent residential unit (ERU).
- 18-509. Property classification for stormwater user's fee.
- 18-510. Base rate.
- 18-511. Adjustments to stormwater user's fees.
- 18-512. Property owners to pay charges.
- 18-513. Billing procedures and penalties for late payment.
- 18-514. Appeal of fees.
- 18-515. Calculating stormwater user fees.

18-501. Policy. The Board of Mayor and Aldermen finds, determines and declares that the stormwater system which provides for the collection, treatment, storage and disposal of stormwater provides benefits and services to all property within the incorporated city limits. Such benefits include but are not limited to:

- (1) The provision of adequate systems of collection, conveyance, detention, treatment and release of stormwater.
- (2) The reduction of hazards to property and life resulting from stormwater runoff.
- (3) Improvements in general health and welfare through reduction of undesirable stormwater conditions.
- (4) Improvements to the water quality in the stormwater and surface water system and its receiving waters.

18-502. Creation of stormwater utility. For those purposes of the Federal Clean Water Act and of Tennessee Code Annotated, § 68-221-1101 et seq., there is created a stormwater utility which shall consist of a manager or director and such staff as the municipality's governing body shall authorize.

The stormwater utility shall be directed by the Public Works Director, who shall administer it through the City Design Engineer and Stormwater Coordinator.

The stormwater utility, under the legislative policy, supervision and control of the

governing body of the city, shall:

- (1) Administer the acquisition, design, construction, maintenance and operation of the stormwater utility system, including capital improvements designated in the capital improvement program;
- (2) Administer and enforce this ordinance and all regulations and procedures adopted relating to the design, construction, maintenance, operation and alteration of the utility stormwater system, including, but not limited to, the quantity, quality or velocity of the stormwater conveyed thereby;
- (3) Advise the municipality's governing body and other city departments on matters relating to the utility;
- (4) Prepare and revise a drainage plan for adoption by the municipality's governing body;
- (5) Review plans and approve or deny, inspect and accept extensions and connections to the system;
- (6) Enforce regulations to protect and maintain water quality and quantity within the system in compliance with water quality standards established by state, regional or federal agencies as now adopted or hereafter amended;
- (7) Annually analyze the cost of services and benefits provided, and the system and structure of fees, charges, civil penalties and other revenues of the utility.

18-503. Definitions. For the purpose of this ordinance, the following definitions shall apply: Words used in the singular shall include the plural, and the plural shall include the singular; words used in the present tense shall include the future tense. The word "shall" is mandatory and not discretionary. The word "may" is permissive. Words not defined in this section shall be construed to have the meaning given by common and ordinary use as defined in the latest edition of Webster's Dictionary.

- (1) "Base rate" means the stormwater user's fee for a detached single family residential property in the city.
- (2) "Construction" means the erection, building, acquisition, alteration, reconstruction, improvement or extension of stormwater facilities; preliminary planning to determine the economic and engineering feasibility of stormwater facilities; the engineering, architectural, legal, fiscal and economic investigations and studies, surveys, designs, plans, working drawings, specifications, procedures, and other action necessary in the construction of stormwater facilities; and the inspection and supervision of the construction of stormwater facilities;
- (3) "Developed property" means real property which has been altered from its natural state by the creation or addition of impervious areas, by the addition of any buildings, structures, pavement or other improvements.
- (4) "Equivalent residential unit" or "ERU" means the average square footage of a detached single family residential property determined pursuant to this ordinance.
- (5) "Exempt property" means all properties of the federal, state, county, and city governments, and any of their divisions or subdivisions, and portions of property that does not discharge stormwater runoff into the stormwater or flood control facilities of the

municipality.

(6) "Fee" or "Stormwater user's fee" means the charge established under this ordinance and levied on owners or users of parcels or pieces of real property to fund the costs of stormwater management and of operating, maintaining, and improving the stormwater system in the municipality. The stormwater user's fee is in addition to any other fee that the municipality has the right to charge under any other rule or regulation of the municipality.

(7) "Fiscal year" means July 1 of a calendar year to June 30 of the next calendar year, both inclusive.

(8) "Impervious surface" means a surface which is compacted or covered with material that is resistant to infiltration by water, including, but not limited to, most conventionally surfaced streets, roofs, sidewalks, patios, driveways, parking lots, and any other oiled, graveled, graded, compacted, or any other surface which impedes the natural infiltration of surface water.

(9) "Impervious surface area" means the number of square feet of horizontal surface covered by buildings, and other impervious surfaces. All building measurements shall be made between exterior faces of walls, foundations, columns or other means of support or enclosure.

(10) "Other developed property" means developed property other than single-family residential property. Such property shall include, but not be limited to, commercial properties, industrial properties, parking lots, hospitals, schools, recreational and cultural facilities, hotels, offices, and churches.

(11) "Person" means any and all persons, natural or artificial, including any individual, firm or association, and any municipal or private corporation organized or existing under the laws of this or any other state or country.

(12) "Property owner" means the property owner of record as listed in the county's assessment roll. A property owner includes any individual, corporation, firm, partnership, or group of individuals acting as a unit, and any trustee, receiver, or personal representative.

(13) "Single family residential property" means a developed property which serves the primary purpose of providing a permanent dwelling unit to a single family. A single family detached dwelling or a townhouse containing an accessory apartment or second dwelling unit is included in this definition.

(14) "Stormwater" means stormwater runoff, snow melt runoff, surface runoff, street wash waters related to street cleaning or maintenance, infiltration, and drainage.

(15) "Stormwater management fund" or "fund" means the fund created by this ordinance to operate, maintain, and improve the city's stormwater system.

(16) "Stormwater management" means the planning, design, construction, regulation, improvement, repair, maintenance, and operation of facilities and programs relating to water, flood plains, flood control, grading, erosion, tree conservation, and sediment control.

(17) "Surface water" includes waters upon the surface of the earth in bounds created naturally or artificially including, but not limited to, streams, other water courses, lakes and reservoirs.

(18) "User" shall mean the owner of record of property subject to the stormwater

user's fee imposed by this ordinance.

18-504. Funding of stormwater utility. Funding for the stormwater utility's activities may include, but not be limited to, the following:

- (1) Stormwater user's fees.
- (2) Civil penalties and damage assessments imposed for or arising from the violation of the city's stormwater management ordinance.
- (3) Other funds or income obtained from federal, state, local, and private grants, or revolving funds, and from the Local Government Public Obligations Act of 1986 (Tennessee Code Annotated, Title 9, Chapter 21).

To the extent that the stormwater drainage fees collected are insufficient to construct needed stormwater drainage facilities, the cost of the same may be paid from such city funds as may be determined by the municipality's governing body.

18-505. Stormwater fund. All revenues generated by or on behalf of the stormwater utility shall be deposited in a stormwater utility fund and used exclusively for the stormwater utility.

18-506. Operating budget. The municipality's governing body shall adopt an operating budget for the stormwater utility each fiscal year. The operating budget shall set forth for such fiscal year the estimated revenues and the estimated costs for operations and maintenance, extension and replacement and debt service.

18-507. Stormwater user's fees established. There shall be imposed on each and every developed property in the city, except exempt property, a stormwater user's fee, which shall be set from time to time by ordinance or resolution, and in the manner and amount prescribed by this ordinance.

Prior to establishing or amending user's fees, the municipality shall advertise its intent to do so by publishing notice in a newspaper of general circulation in the city at least thirty (30) days in advance of the meeting of the municipality's governing body which shall consider the adoption of the fee or its amendment.

18-508. Equivalent residential unit (ERU). (1) Establishment. There is established for purposes of calculating the stormwater user's fee the equivalent residential unit (ERU).

(2) Definition. The ERU is the average square footage of a detached single family residential property.

(3) Setting the ERU. The ERU shall be set by the municipality's governing body from time to time by ordinance or resolution.

(4) Source of ERU. The municipality's governing body shall have the discretion to determine the source of the data from which the ERU is established, taking into consideration the general acceptance and use of such source on the part of other stormwater

systems, and the reliability and general accuracy of the source. The municipality's governing body shall have the discretion to determine the impervious surface area of other developed property through property tax assessor's rolls or site examination, mapping information, aerial photographs, and other reliable information.

18-509. Property classification for stormwater user's fee. (1) Property classifications. For purposes of determining the stormwater user's fee, all properties in the city are classified into one of the following classes:

- (a) Single family residential property;
- (b) Other developed property;
- (c) Exempt property.

(2) Single family residential fee. The municipality's governing body finds that the intensity of development of most parcels of real property in the municipality classified as single family residential is similar and that it would be excessively and unnecessarily expensive to determine precisely the square footage of the improvements (such as buildings, structures, and other impervious areas) on each such parcel. Therefore, all single family residential properties in the city shall be charged a flat stormwater management fee, equal the base rate, regardless of the size of the parcel or the improvements.

(3) Other developed property fee. The fee for other developed property (i.e., non-single-family residential property) in the municipality shall be the base rate multiplied by the numerical factor obtained by dividing the total impervious area (square feet) of the property by one ERU. The impervious surface area for other developed property is the square footage for the buildings and other improvements on the property. The minimum stormwater management fee for other developed property shall equal the base rate for single family residential property.

(4) Exempt property. There shall be no stormwater user's fee for exempt property.

18-510. Base rate. The municipality's governing body shall, by ordinance or resolution, establish the base rate for the stormwater user's fee. The base rate shall be calculated to insure adequate revenues to fund the costs of stormwater management and to provide for the operation, maintenance, and capital improvements of the stormwater system in the city. The base rate for the stormwater user shall be \$6.00 per month per ERU.

18-511. Adjustments to stormwater user's fees. The stormwater utility shall have the right on its own initiative to adjust upward or downward the stormwater user's fees with respect to any property, based on the approximate percentage on any significant variation in the volume or rate of stormwater, or any significant variation in the quality of stormwater, emanating from the property, compared to other similar properties. In making determinations of the similarity of property, the stormwater utility shall take into consideration the location, geography, size, use, impervious area, stormwater facilities on the property, and any other factors that have a bearing on the variation.

18-512. Property owners to pay charges. The owner of each non-exempt lot or parcel shall pay the stormwater user's fees and charges as provided in this ordinance.

18-513. Billing procedures and penalties for late payment. (1) Rate and collection schedule. The stormwater user's fee must be set at a rate, and collected on a schedule, established by ordinance.

(2) Delinquent bills. The stormwater user's fee shall be paid in person or by mail at The City of Hendersonville, Public Works Department, 101 Maple Drive North, Hendersonville, TN 37075 and shall become delinquent as of 28 days following the billing.

(3) Penalties for late payment. Stormwater user's fees shall be subject to a late fee of \$50. The municipality shall be entitled to recover fees incurred in collecting delinquent drainage fees. Any charge due under this ordinance which shall not be paid may be recovered at law by the municipality.

(4) Mandatory statement. Pursuant to Tennessee Code Annotated § 68-221-1112, each bill that shall contain stormwater user's fees shall contain the following statement in bold:

THIS FEE HAS BEEN MANDATED BY CONGRESS.

18-514. Appeals of fees. (1) Generally. Any person who disagrees with the calculation of the stormwater user's fee, as provided in this ordinance, or who seeks a stormwater user's fee adjustment based upon stormwater management practices, may appeal such fee determination to the stormwater utility within thirty (30) days from the date of the last bill containing stormwater user's fees charges. Any appeal shall be filed in writing and shall state the grounds for the appeal. The stormwater utility director may request additional information from the appealing party.

(2) Adjustments. Stormwater user's fee adjustments for stormwater management practices may be considered for: reductions in runoff volume including discharge to non-city drainage system; and properly designed constructed and maintained existing retention facilities, i.e. evaporation and recharge. Based upon the information provided by the utility and the appealing party, the stormwater utility shall make a final calculation of the stormwater drainage fee. The stormwater utility shall notify the parties, in writing, of its decision.

18-515. Calculating stormwater user fee. Calculating Stormwater User Fees can be done in a simple, equitable manner. The annual budget of the Stormwater Utility is divided by the total number of Equivalent Residential Units (ERU's) in the Stormwater System limits. Division of the result by 12 would yield the monthly fee per ERU. An Equivalent Residential Unit is based on the average square footage of a detached single residential family property. This average can be obtained from a variety of sources. If the average is not available through your tax assessor or another internal department, averages may be obtained from the U.S. Census Bureau, your local Area Association of Realtors, or some other credible source. Each detached single residential family property would be one (1) ERU. Other developed proposer users would divide their total amount of impervious

surface area (in square feet) by the number of square feet in an ERU, to get the number of ERU's for that property. The sum of all other developed property ERU's and single family residential ERU's would be the total number of ERU's.

(1) Annual Budget. The annual costs for the storm drainage system includes permitting, maintaining, planning, designing, reconstructing, constructing, environmentally restoring, regulating, testing, inspection of the system, management and administration, and the establishment of a reserve balance.

(2) Equivalent Residential Unit (ERU). The average square footage of a single family residential property is equivalent to one ERU. This has been determined to be 3,930 square feet.

(3) Total ERU's. The Total ERU's within the limits of the stormwater utility is calculated according to the following formula: Total ERU's = Other Developed Property ERU's + Single Family Residential ERU's.

(4) Single Family Residential User Fee. The fee that residential users within the limits of the stormwater utility pay for their share of the annual budget. The fee is calculated according to the following formula: Single Family Residential User Fee = Annual Budget Total ERU's within Stormwater Utility limits. This number should be calculated as a yearly fee. If billed differently from an annual fee, it shall be divided by 12 to establish the monthly User Fee: Single Family Residential User Fee / 12 = Monthly Single Family Residential User Fee.

(5) Other Developed Property User Fee. The fee that other developed property users within the limits of the stormwater utility pay for their share of the annual budget. The fee is calculated according to the following formula: Other Developed Property ERU's = Impervious Surface Area square feet / ERU square feet. Other Developed Property User Fee = Single Family Residential User Fee x Other Developed Property ERU's; Other Developed Property User Fee / 12 = Monthly Other Developed Property User Fee.

(6) Users whose stormwater runoff is not discharged into or through the stormwater or flood control facilities of the municipality shall be exempted from the payment of the graduated stormwater user fee authorized by this section.

(7) The fee structure shall provide adjustments for users who construct facilities to retain and control the quantity of stormwater runoff. (Ord. 2017-42, Feb. 2018)



Civil & Environmental Consultants, Inc.

117 Seaboard Lane | Suite E-100 | Franklin, Tennessee 37067

Phone: (615) 333-7797 | Fax: (615) 333-7751

Date: 2/25/2020

Subject: Progress & Annual Review Meeting Minutes (DRAFT)

CEC Project No. 190-706 & 192-267

Participants:

Duane Allen (City of Hendersonville)
Helen Morrison (City of Hendersonville)
Steve Casey (CEC)
Janette Wolf (CEC)

Discussion:

Review of Gap Analysis dated June 2019 (Progress & Remaining Items):

1. Inventory and tracking of Best Management Practices (now called Stormwater Control Measures or SCMs)
 - a. Duane thinks he knows most basin/SCM locations from 2004 onward
 - b. Duane to provide CEC with lat/long and add business name to develop inventory
 - c. CEC to create GIS layer to initiate completion of this item.

Lat/long of detention pond locations was provided by Duane to CEC shortly after the meeting. CEC developed a GIS layer and provided a draft map to the City on 3/4/2020. Remaining items that still need to be captured per the permit include:

- *The responsible party contact information*
 - *Inspection schedules*
 - *Maintenance procedures and frequency*
 - *Maintenance and inspection records*
2. Develop a Public Information and Education (PIE) plan
 - a. City provided CEC with a draft PIE plan dated April 3, 2019. CEC to review and provide comments, if any, to the City.
 3. Develop and implement an Illicit Discharge Detection and Elimination (IDDE) Standard Operating Procedure (SOP) & mechanism for the public to report suspected illicit discharges
 - a. City provided CEC with a draft IDDE SOP. CEC to review and provide comments, if any, to the City.
 - b. Currently, City maintains a spreadsheet of complaints & responses

- c. Add annual outfall screening (% of outfalls per year) or develop plan that targets representative outfalls and hotspots; representative outfalls could be those main outfalls that discharge to the lake (think this is what the City is currently doing).
 - i. ID hotspot locations and create map (compile from Duane's list of SCM locations) (see permit definition and ID businesses/complexes). Possible locations include the following:
 - 1. Merchant Point
 - 2. Industrial areas
 - 3. MGM
 - 4. Metal works
 - 5. Marina
 - d. Based on outfall mapping field work, CEC to develop and provide outfall map to City.
 - e. City to check with Health Department as to how many septic system failures are repaired each year (add to IDDE SOP?)
 - f. Consider identifying locations of all septic systems
- 4. Develop and implement an Enforcement Response Plan (ERP)
 - a. Helen to resend draft ERP that incorporated Justin's comments.
 - b. Not going to use the 4 page checklist currently included in the draft.
 - c. City to develop one page inspection checklist with inspection decision at bottom – NOV, fine, in compliance etc. CEC will review draft when provided by the City.
 - i. Construction
 - ii. Do they have a permit?
 - iii. IDDE
- 5. Define "Priority Construction Activity" in the Ordinance
 - a. To be completed with ordinance revision with estimated completion by July 2020.
- 6. Develop and implement a Construction Inspection Standard Operating Procedure (SOP)
 - a. Completed by the City.
- 7. Include requirements for construction site operators to control waste materials in Ordinance
 - a. To be completed with ordinance revision with scheduled completion by July 2020.
- 8. Add buffer requirements to Ordinance
 - a. To be completed with ordinance revision with scheduled completion by July 2020.
- 9. Develop Operation and Maintenance (O&M) plans for municipal operations & train employees on O&M plans
 - a. In progress
 - b. See additional notes on status of O&M site visits and plans below.

10. Storm sewer system map
 - a. Field work for outfall mapping is complete, CEC is currently performing a quality review on the data. Information is currently captured on a GIS layer. Once quality review is complete, CEC will provide the City with a map of outfalls.
 - b. Input Mapping (Permit Section 4.2.3.b) – City to consider input mapping at a later date
 - i. City believes that they have Public ROW input mapping only as of 2017, City to confirm.
 - c. Rick Mayo finalizing As-Built requirements, need to ask for compatible format where it can be imported to GIS. Helen emailed the latest version to CEC on 2/24/2020. CEC to review and advise on recommended format necessary for incorporation with GIS layer.
11. Develop and/or document existing guidelines for interagency coordination of spill response
 - a. City to ask Fire Department/Police Department for HAZMAT procedures and incorporate.
12. Ordinance Update for construction site runoff pollutant control program consistent with requirements of reissued NPDES general permit for construction stormwater runoff
 - a. To be completed with ordinance revision with scheduled completion by July 2020.
13. Set up a Stormwater Appeals Committee
 - a. City to determine necessary actions to address this item.
14. Employee training on IDDE and O&M plans
 - a. See additional discussion on training below.
15. Create an “Annual Review Meeting Agenda” to evaluate program effectiveness
 - a. This meeting served as the Annual Review of the program.

Status of O&M Plans:

- City currently has draft O&M plans in place for Parks Department and Roads Department.
- CEC has performed site visits at Roads Department, City Hall, Police Department and the Fire Department (except for Station #2 which is under construction with a scheduled completion date at the end of February 2020).
- Remaining site visits necessary include:
 - Mulch Facility
 - Batey House Farm
 - Horse Barn (Police Department)
 - Parks Department – City requested re-review of existing plan.
 - Fire Station #2 (after construction completion)
- CEC will prepare O&M plans for the following:

- Police Department (pending horse barn site visit)
- Fire Department (pending completion of Fire Station #2)
- City Hall/Batey House Farm (one plan) (pending site visit at Batey House)
- Mulch Facility (pending site visit)
- City also owns several properties that are leased:
 - Golf Course
 - Monthaven Mansion
 - Senior Citizen House
 - CEC suggests that lease agreement be reviewed for language pertaining to stormwater pollution prevention. If lease agreement does not have this language, then agreement should be updated at the next available time to include language along the lines of the following: “Work performed under this contract shall be performed in such a way to prevent stormwater pollution”.
 - City to follow up on current lease agreement language.
- Priority is to develop O&M plans for locations that currently do not have one; following completion of these plans Roads Department and Parks Department Draft O&M Plans will be reviewed by CEC and modified as needed for a more applicable/simpler approach.
- CEC to develop a specific O&M inspection checklist for each location. This will need to address disposal of materials, among other items.
- CEC to provide formal summary of Roads Department site visit conducted on 12/10/2019.
- Reeves Septic Service, Ashland City, 1030 Marks Creek Hill Road performs maintenance at current OWS.
- City provided CEC plans of three of the Fire Halls. CEC to review plans to determine Oil Water Separator (OWS) connection (sewer or stormwater). Connection to be noted within the O&M plan.
- City to consider adding OWS with sump to Fire Station #1 at outlet of floor drain discharge.

Training:

- City would like to develop/incorporate training to address the following:
 - Construction inspection
 - IDDE
 - SPCC/O&M
- Training to include lot of photos (good and bad)
- Use TNSA IDDE training for basis (Steve working on expanding on this training for TNSA presentation in October 2020).
- Construction addressed by TDEC Level 1 Course but City may want to expand on this to include:
 - Plans review
 - Site assessment for active construction project
 - IDDE inspection
- City and CEC need to revisit this and finalize City’s goals and CEC’s potential involvement.

Stormwater Ordinance:

- City to hold on mass overhaul of ordinance and wants CEC to just modify the existing ordinance to address the deficiencies as noted in the Gap Analysis.
 - Buffer requirements will be incorporated per the draft rule.
 - Revision will not include post construction “requirement” proposed in the permit but currently under litigation.
- Ordinance is due to TDEC by July 1, 2020.

Visual Stream Assessment:

- CEC to update VSA report to include an appendix with definitions of Fish Barrier, Erosion Site etc. per Maryland Protocol.
- City believes that there is continued erosion damage including trail damage and stream bank damage near a pedestrian crossing near Site #8 as identified in the VSA report. These locations would be good target areas for the City for potential improvement since they are located within Drakes Creek Park.

Action Items for next steps:

City Action Items:

1. Provide CEC with lat/long & business names of known SCMs within the City. (*Reach out to property owners/HOAs for responsible party's name, inspection schedule, inspection/maintenance records*).
2. Check with Health Department on number of septic system failures which are repaired each year (incorporate into IDDE SOP)
3. Consider identifying locations of all septic systems within the City.
4. Resend draft ERP with Justin's comments incorporated to CEC for review.
5. Develop one page ERP inspection checklist to replace 4 page checklist currently in document.
6. Follow up on public ROW input mapping through 2017. Consider future input mapping needs to meet the permit requirement.
7. Advise on hotspot locations, develop business list/inventory.
8. Check with Fire Department/Police Department for HAZMAT procedures and incorporate as spill response plan.
9. Discuss needs for Stormwater Appeals Committee (permit requirement)
10. City to consider adding OWS with sump to Fire Station #1 at outlet of floor drain discharge.
11. Revisit training needs with CEC at a later date.

CEC Action Items:

1. Revise existing ordinance to meet deficiencies only; schedule date for follow up meeting with the City to discuss/finalize revisions.
2. Review PIE plan, ERP, IDDE SOP and As-Built Plan Requirements and provide comments to the City.
3. Identify hotspot locations and incorporate as a GIS layer.
4. Finalize outfall map and provide to the City.
5. Schedule remaining O&M site visits. Complete O&M plans.

6. Prepare formal summary report on Roads Department, City Hall and Sanders Ferry Road Maintenance Shop. Schedule follow up site visit at Roads Department in regards to SPCC after progress towards noted deficiencies from 12/10/2019 site visit.
7. Issue revised VSA report.

These notes represent my understanding of items discussed and conclusions reached. Participants are requested to review these items and advise of corrections or revisions.

City of Hendersonville



101 Maple Drive North

Hendersonville, TN 37075
www.hvilletn.org

Telephone (615) 822-1000

PUBLIC NOTICE

September 16, 2019

City of Hendersonville Storm Sewer System Mapping, Analytical & Non-analytical Stream Monitoring (TNS075353)

The City of Hendersonville will start stream monitoring and mapping of the municipal separate storm sewer system (MS4) starting in October 2019. The City has contracted with Civil and Environmental Consultants, Inc (CEC) to complete this mapping. Two employees with CEC will walk the streams in or near the City (approximately 71 miles including walking the shoreline along Old Hickory Lake) to collect data for our storm sewer system map and complete permit required stream monitoring. CEC employees will be driving company vehicles, wearing high visibility vests, and ID tags.

In some cases, CEC will be making contact with property owners to access portions of streams to collect data. The City of Hendersonville appreciates your participation and cooperation as we complete the required MS4 permit mapping and monitoring. If, at any time, you have a question or concern about this process please notify the City of Hendersonville Stormwater Division at 615-822-1016 or stormwater@hvilletn.org.

Sincerely,

Helen Morrison
Stormwater Coordinator

Mayor
Jamie Clary

Ward One

Ward Two

Ward Three

Ward Four

Ward Five

Ward Six

Vice Mayor

Arlene Cunningham

Mark A. Skidmore
Peg Petrelli

Pat Campbell
Scott Sprouse

Arlene Cunningham
Russ Edwards

Steve Brown
Andy Bolt

Darrell Woodcock
Jonathan Hayes

Jim Waters
Dr. Eddie Roberson



April 20, 2020

Mr. Duane Allen, Design Engineer
City of Hendersonville
101 Maple North Drive
Hendersonville, Tennessee 37075

Dear Mr. Allen:

Subject: Professional Engineering Services
Analytical Stream Monitoring, *E. coli* Sampling
City of Hendersonville, Sumner County, Tennessee
CEC Project 192-267

Civil & Environmental Consultants, Inc. (CEC) performed *E. coli* sampling on Manskers Creek for the City of Hendersonville per our proposal dated May 9, 2019.

The General Water Quality Criteria of Tennessee, which establishes thresholds for the various use classifications for streams in Tennessee, lists a geometric mean exceedance of 126 cfu/100 mL as impairment for recreational use. In other words, exceeding an *E. coli* concentration of 126 cfu/100 mL for the geometric mean indicates the stream does not meet the recreational use classification. The *E. coli* threshold for the recreational use classification is the lowest allowable *E. coli* threshold for designated uses.

Due to the presence of right censored data (i.e. >2,419.6 cfu/100 mL) and because the data are not normally distributed, the statistical method Regression-On-Order Statistics (ROS) method was used to derive a single adjusted geometric mean value for Manskers Creek of **230 cfu/100 mL**. The Kaplan-Meier method was also used to determine the 95% confidence interval about the right-censored-adjusted geometric mean: [48 to 922 cfu/100 mL].

Mr. Allen – The City of Hendersonville
CEC Project 192-267
Page 2
April 20, 2020

Please contact Janette Wolf at 615-333-7797 or jwolf@cecinc.com if you should have any questions regarding this deliverable.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



Lindsay Wilson-Kokes
Assistant Project Manager

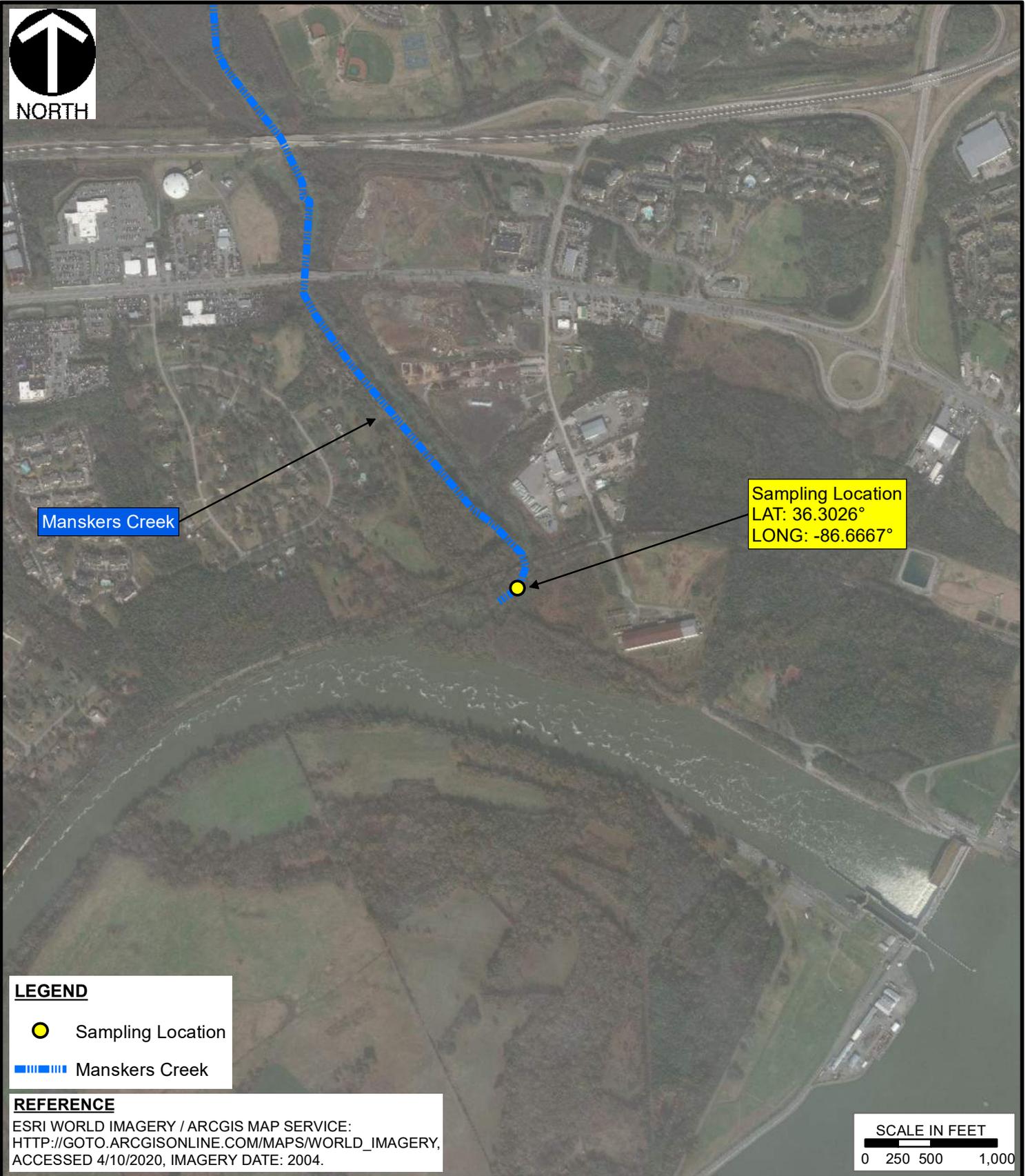


Janette L. Wolf, P.E., CPESC, CPSWQ
Project Manager

Enclosures: Attachment A – Figure 1 – Sample Collection Site Map
Attachment B – Summary of Sampling Results
Attachment C – Photographic Documentation
Attachment D – Field Data Sheets
Attachment E – Lab Results

ATTACHMENT A

FIGURE 1 – SAMPLE COLLECTION SITE MAP



LEGEND

-  Sampling Location
-  Mankers Creek

REFERENCE

ESRI WORLD IMAGERY / ARCGIS MAP SERVICE:
HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_IMAGERY,
ACCESSED 4/10/2020, IMAGERY DATE: 2004.



Civil & Environmental Consultants, Inc.

117 Seaboard Lane, Ste. E100 Franklin, Tennessee

615-333-7797 • 800-763-2326

www.cecinc.com

**ANALYTICAL STREAM MONITORING
E. COLI SAMPLING
CITY OF HENDERSONVILLE
SUMNER COUNTY, TENNESSEE**

E. COLI SAMPLE LOCATION

DRAWN BY:	JTM	CHECKED BY:	JLW	APPROVED BY:	JLW	FIGURE NO:	1
DATE:	4/10/2020	SCALE:	1" = 1,000'	PROJECT NO:	192-267		

ISVR-NASHI.P:\2019\192-267-GIS\Maps\E_coli_Sampling_Location.mxd (4/10/2020 1:05:36 PM)

ATTACHMENT B

SUMMARY OF SAMPLING RESULTS

Hendersonville E. coli Monitoring 2020										
Stream	Date	3/9/2020	3/13/2020	3/16/2020	3/18/2020	4/1/2020	Minimum	Arithmetic Mean	Maximum	
Manskers Creek	Weather	54°F - Overcast	57°F - Partly Sunny	43°F - Overcast	63°F - Overcast	54°F - Partly Cloudy				
	Personnel	LWK; JTM	JTM; KMS	JTM; KMS	JTM; KMS	LWK; JTM				
	Sample Time	10:50 AM	10:40 AM	10:50 AM	10:15 AM	2:30 PM				
	Temp (°C)	10.4	13.1	11.1	10.8	13.9	10.4	11.9	13.9	
	DO (mg/L)	9.08	8.20	8.16	8.71	7.80	7.80	8.39	9.08	
	pH	6.25	6.93	6.90	7.54	7.63	6.25	7.05	7.63	
	Cond. (µS/cm)	142.9	310.7	235.2	216.6	325.4	142.9	246.2	325.4	
	E. coli (MPN/100 mL)	224.7	33.1	57.6	>2419.6	387.3	33.1	624.5	>2419.6	*Geometric Mean 230

CEC Project # 192-267

* Regression-On-Order Statistics (ROS) Method used to determine geometric mean

ATTACHMENT C

PHOTOGRAPHIC DOCUMENTATION



Downstream Manskers Creek
March 13, 2020



Opposite Bank Manskers Creek
March 13, 2020



Upstream Manskers Creek
March 13, 2020

ATTACHMENT D
FIELD DATA SHEETS



E. COLI SAMPLING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 117 Seaboard Lane, Suite E-100 Franklin, Tennessee 37067

STREAM NAME	Manskers Creek	DATE/WEATHER	3/9/2020; 54°F; Overcast
SAMPLES TAKEN	(2) No Dilution; (2) 1:100	EVENT FREQUENCY	1 of 5
NOTES	36.3026, -86.6667	FIELD REPRESENTATIVE	LWK; JTM

Time Collected	°C	DO (mg/L)	pH	Conductivity (µs/cm)	Flow Area (sq ft)	Flow (cfs)
10:50 AM	10.4	9.08	6.25	142.9	N/A	N/A

STREAM CROSS SECTION MEASUREMENTS					STREAM CROSS SECTION DIAGRAM	
Station (ft)	Depth of Water (ft)	Velocity (ft/s)	Area (sq ft)	Flow (cfs)	Station	
NOT RECORDED DUE TO HIGH FLOW CONDITIONS						



E. COLI SAMPLING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 117 Seaboard Lane, Suite E-100 Franklin, Tennessee 37067

STREAM NAME	Manskers Creek	DATE/WEATHER	3/13/2020; 57°F, Partly Sunny
SAMPLES TAKEN	(2) No Dilution	EVENT FREQUENCY	2 of 5
NOTES	36.3026, -86.6667	FIELD REPRESENTATIVE	JTM; KMS

Time Collected	°C	DO (mg/L)	pH	Conductivity (µs/cm)	Flow Area (sq ft)	Flow (cfs)
10:40 AM	13.1	8.20	6.93	310.7	N/A	N/A

STREAM CROSS SECTION MEASUREMENTS					STREAM CROSS SECTION DIAGRAM	
Station (ft)	Depth of Water (ft)	Velocity (ft/s)	Area (sq ft)	Flow (cfs)	Station	
NOT RECORDED DUE TO HIGH FLOW CONDITIONS						



E. COLI SAMPLING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 117 Seaboard Lane, Suite E-100 Franklin, Tennessee 37067

STREAM NAME	Manskers Creek	DATE/WEATHER	3/16/2020; 43°F; Overcast
SAMPLES TAKEN	(2) No Dilution	EVENT FREQUENCY	3 of 5
NOTES	36.3026, -86.6667	FIELD REPRESENTATIVE	KMS; JTM

Time Collected	°C	DO (mg/L)	pH	Conductivity (µs/cm)	Flow Area (sq ft)	Flow (cfs)
10:50 AM	11.1	8.16	6.90	235.2	N/A	N/A

STREAM CROSS SECTION MEASUREMENTS					STREAM CROSS SECTION DIAGRAM	
Station (ft)	Depth of Water (ft)	Velocity (ft/s)	Area (sq ft)	Flow (cfs)	Station	
NOT RECORDED DUE TO HIGH FLOW CONDITIONS						



E. COLI SAMPLING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 117 Seaboard Lane, Suite E-100 Franklin, Tennessee 37067

STREAM NAME	Manskers Creek	DATE/WEATHER	3/18/20; 63°F; Overcast
SAMPLES TAKEN	(2) No Dilution	EVENT FREQUENCY	4 of 5
NOTES	36.3026, -86.6667	FIELD REPRESENTATIVE	KMS; JTM

Time Collected	°C	DO (mg/L)	pH	Conductivity (µs/cm)	Flow Area (sq ft)	Flow (cfs)
10:15 AM	10.8	8.71	7.54	216.6	N/A	N/A

STREAM CROSS SECTION MEASUREMENTS					STREAM CROSS SECTION DIAGRAM	
Station (ft)	Depth of Water (ft)	Velocity (ft/s)	Area (sq ft)	Flow (cfs)	Station	
NOT RECORDED DUE TO HIGH FLOW CONDITIONS						



E. COLI SAMPLING FIELD INFORMATION LOG

Civil & Environmental Consultants, Inc. 117 Seaboard Lane, Suite E-100 Franklin, Tennessee 37067

STREAM NAME	Manskers Creek	DATE/WEATHER	04/01/2020; 54F; Partly Cloudy
SAMPLES TAKEN	(2) No Dilution	EVENT FREQUENCY	5 of 5
NOTES	36.3026, -86.6667	FIELD REPRESENTATIVE	LWK; JTM

Time Collected	°C	DO (mg/L)	pH	Conductivity (µs/cm)	Flow Area (sq ft)	Flow (cfs)
14:30	13.9	7.80	7.63	325.4	N/A	N/A

STREAM CROSS SECTION MEASUREMENTS					STREAM CROSS SECTION DIAGRAM	
Station (ft)	Depth of Water (ft)	Velocity (ft/s)	Area (sq ft)	Flow (cfs)	Station	
NOT RECORDED DUE TO HIGH FLOW CONDITIONS						

ATTACHMENT E

LAB RESULTS

March 12, 2020

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

Civil & Environmental Consultants - TN

Sample Delivery Group: L1196929
Samples Received: 03/09/2020
Project Number: 192-267
Description: Hendersonville E. coli

Report To: Lindsay Wilson-Kokes
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Entire Report Reviewed By:



Chris McCord
Project Manager

Results relate only to the items tested or calibrated and are reported as rounded values. This test report shall not be reproduced, except in full, without written approval of the laboratory. Where applicable, sampling conducted by Pace Analytical National is performed per guidance provided in laboratory standard operating procedures ENV-SOP-MTJL-0067 and ENV-SOP-MTJL-0068. Where sampling conducted by the customer, results relate to the accuracy of the information provided, and as the samples are received.





Cp: Cover Page	1	
Tc: Table of Contents	2	
Ss: Sample Summary	3	
Cn: Case Narrative	4	
Sr: Sample Results	5	
MANSKERS CREEK L1196929-01	5	
MANSKERS CREEK (1:100) L1196929-02	6	
FIELD BLANK L1196929-03	7	
Gl: Glossary of Terms	8	
Al: Accreditations & Locations	9	
Sc: Sample Chain of Custody	10	

SAMPLE SUMMARY



MANSKERS CREEK L1196929-01 WW

Collected by: Lindsay W.K.
 Collected date/time: 03/09/20 10:50
 Received date/time: 03/09/20 11:48

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1441807	1	03/09/20 13:16	03/09/20 13:16	RLC	Mt. Juliet, TN

1 Cp

2 Tc

3 Ss

MANSKERS CREEK (1:100) L1196929-02 WW

Collected by: Lindsay W.K.
 Collected date/time: 03/09/20 10:50
 Received date/time: 03/09/20 11:48

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1441807	1	03/09/20 13:16	03/09/20 13:16	RLC	Mt. Juliet, TN

4 Cn

5 Sr

FIELD BLANK L1196929-03 WW

Collected by: Lindsay W.K.
 Collected date/time: 03/09/20 10:50
 Received date/time: 03/09/20 11:48

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1441807	1	03/09/20 13:16	03/09/20 13:16	RLC	Mt. Juliet, TN

6 Gl

7 Al

8 Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris McCord
Project Manager

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	224.7		1	03/09/2020 13:16	WG1441807

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Gl
- ⁷ Al
- ⁸ Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	195.6		1	03/09/2020 13:16	WG1441807

Sample Narrative:

L1196929-02 WG1441807: Reporting at a 1x dilution due to lab error.





Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	<1		1	03/09/2020 13:16	WG1441807

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Gl
- ⁷ Al
- ⁸ Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 A
- 8 Sc

Qualifier Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
 * Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico ¹	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	90010	South Carolina	84004
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
Louisiana ¹	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ⁶ Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

Civil & Environmental Consultants - TN

117 Seaboard Ln.

Billing Information:

Accounts Payable
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Pres
Chk

Report to:
Lindsay Wilson-Kokes

Email To: lwilsonkokes@cecinc.com;
jwolf@cecinc.com

Project
Description: **Hendersonville E. coli**

City/State
Collected: **Hendersonville, TN**

Please Circle:
PT MT CT ET

Phone: **615-333-7797**
Fax: **615-333-7751**

Client Project #
192-267

Lab Project #
CEC-HENDERSON-ECOLI

Collected by (print):
Lindsay Wilson-Kokes
Collected by (signature):
[Signature]

Site/Facility ID #

P.O. #

Rush? (Lab MUST Be Notified)
 Same Day Five Day
 Next Day 5 Day (Rad Only)
 Two Day 10 Day (Rad Only)
 Three Day

Quote #

Date Results Needed
3-12-20

No.
of
Cntrs

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs
-----------	-----------	----------	-------	------	------	--------------

MANSKERS CREEK	Grab	WW	Ø	3-9-20	1050	2
MANSKERS CREEK (1:100)		WW				2
FIELD BLANK		WW				2
		WW				2

COLILERT Microbiological

Analysis / Container / Preservative

Chain of Custody Page ___ of ___



12065 Lebanon Rd
Mount Juliet, TN 37122
Phone: 615-758-5858
Phone: 800-767-5859
Fax: 615-758-5859



SDG # **L19629**
G107

Acctnum: **CEC**
Template: **T158174**
Prelogin: **P737417**
PM: **526 - Chris McCord**
PB: **10-25-196**
Shipped Via: **Courier**

Remarks | Sample # (lab only)

-01
-02
-03

* Matrix:
SS - Soil AIR - Air F - Filter
GW - Groundwater B - Bioassay
WW - WasteWater
DW - Drinking Water
OT - Other _____

Remarks:

pH _____ Temp _____
Flow _____ Other _____

Samples returned via:
 UPS FedEx Courier **CH** Tracking # _____

Sample Receipt Checklist
 COC Seal Present/Intact: NP Y N
 COC Signed/Accurate: Y N
 Bottles arrive intact: Y N
 Correct bottles used: Y N
 Sufficient volume sent: Y N
 If Applicable
 VOA Zero Headpace: Y N
 Preservation Correct/Checked: Y N
 RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature) *[Signature]* Date: **3-9-20** Time: **1148** Received by: (Signature) _____

Trip Blank Received: Yes (No)
HCL/MeOH
TBR

Relinquished by: (Signature) _____ Date: _____ Time: _____ Received by: (Signature) _____

Temp: **0.9 ± 1.0°C** Bottles Received: **5**

Relinquished by: (Signature) _____ Date: _____ Time: _____ Received for lab by: (Signature) *[Signature]*

Date: **3-9-20** Time: **1148**

If preservation required by Login: Date/Time
Hold: _____ Condition: **NCF / OK**

March 20, 2020

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc

Civil & Environmental Consultants - TN

Sample Delivery Group: L1198826
Samples Received: 03/13/2020
Project Number: 192-267
Description: Hendersonville E. coli

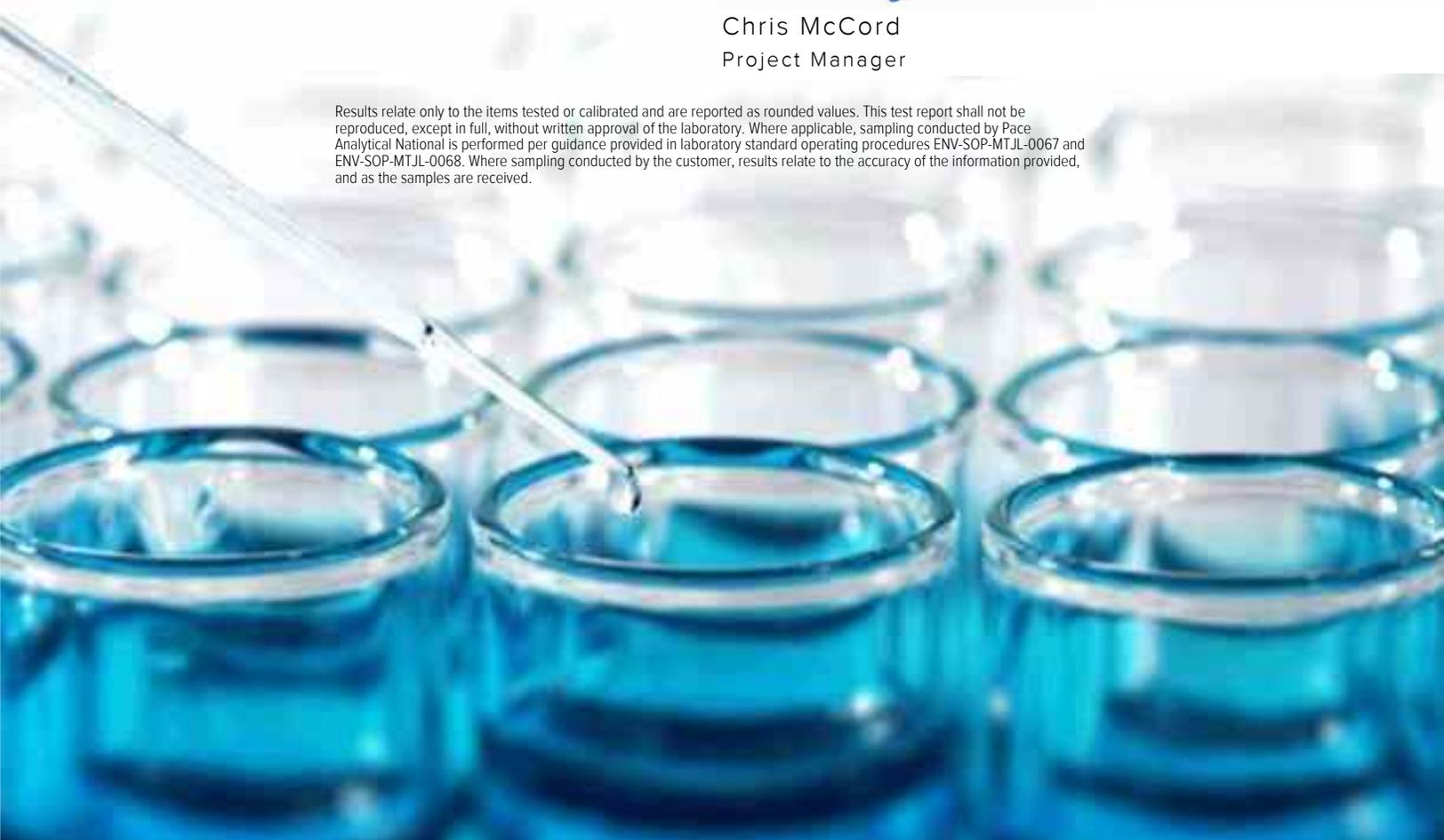
Report To: Lindsay Wilson-Kokes
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Entire Report Reviewed By:



Chris McCord
Project Manager

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Tc: Table of Contents	2	2 Tc
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FIELD BLANK L1198826-02	6	
Gl: Glossary of Terms	7	6 Gl
Al: Accreditations & Locations	8	7 Al
Sc: Sample Chain of Custody	9	8 Sc

SAMPLE SUMMARY



MANSKERS CREEK L1198826-01 WW

Collected by Kelli Straka	Collected date/time 03/13/20 10:40	Received date/time 03/13/20 11:34
------------------------------	---------------------------------------	--------------------------------------

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1445046	1	03/13/20 15:05	03/13/20 15:05	BGE	Mt. Juliet, TN

1
Cp

2
Tc

3
Ss

4
Cn

5
Sr

6
Gl

7
Al

8
Sc

FIELD BLANK L1198826-02 WW

Collected by Kelli Straka	Collected date/time 03/13/20 10:40	Received date/time 03/13/20 11:34
------------------------------	---------------------------------------	--------------------------------------

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1445046	1	03/13/20 15:05	03/13/20 15:05	BGE	Mt. Juliet, TN



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Chris McCord
Project Manager

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	33.1		1	03/13/2020 15:05	WG1445046

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	<1		1	03/13/2020 15:05	WG1445046

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc



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Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 A
- 8 Sc

Qualifier Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



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State Accreditations

Alabama	40660	Nebraska	NE-OS-15-05
Alaska	17-026	Nevada	TN-03-2002-34
Arizona	AZ0612	New Hampshire	2975
Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico ¹	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	90010	South Carolina	84004
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
Louisiana ¹	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
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Third Party Federal Accreditations

A2LA – ISO 17025	1461.01	AIHA-LAP,LLC EMLAP	100789
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Civil & Environmental Consultants - TN

Sample Delivery Group: L1199494
Samples Received: 03/16/2020
Project Number: 192-267
Description: Hendersonville E. coli

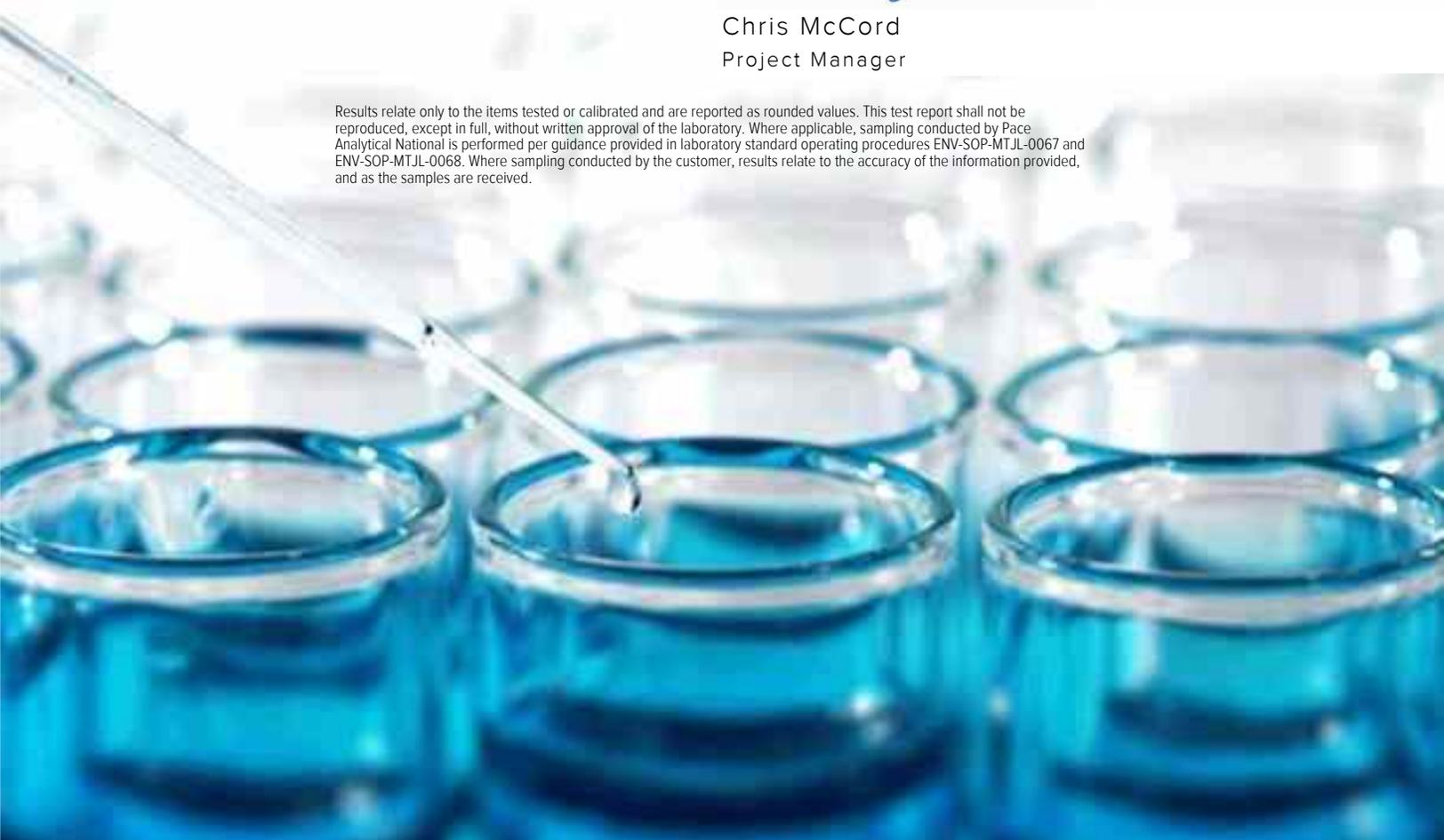
Report To: Lindsay Wilson-Kokes
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Entire Report Reviewed By:



Chris McCord
Project Manager

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Cp: Cover Page	1	¹Cp
Tc: Table of Contents	2	²Tc
Ss: Sample Summary	3	³Ss
Cn: Case Narrative	4	⁴Cn
Sr: Sample Results	5	⁵Sr
MANSKERS CREEK L1199494-01	5	
FIELD BLANK L1199494-02	6	
DUPLICATE L1199494-03	7	
Gl: Glossary of Terms	8	⁶Gl
Al: Accreditations & Locations	9	⁷Al
Sc: Sample Chain of Custody	10	⁸Sc

SAMPLE SUMMARY



MANSKERS CREEK L1199494-01 WW

Collected by: Kelli Straka
 Collected date/time: 03/16/20 10:50
 Received date/time: 03/16/20 11:44

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1445051	1	03/16/20 13:53	03/16/20 13:53	BGE	Mt. Juliet, TN

1 Cp

2 Tc

3 Ss

FIELD BLANK L1199494-02 WW

Collected by: Kelli Straka
 Collected date/time: 03/16/20 10:50
 Received date/time: 03/16/20 11:44

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1445051	1	03/16/20 13:53	03/16/20 13:53	BGE	Mt. Juliet, TN

4 Cn

5 Sr

DUPLICATE L1199494-03 WW

Collected by: Kelli Straka
 Collected date/time: 03/16/20 10:50
 Received date/time: 03/16/20 11:44

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1445051	1	03/16/20 13:53	03/16/20 13:53	BGE	Mt. Juliet, TN

6 Gl

7 Al

8 Sc



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris McCord
Project Manager

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	57.6		1	03/16/2020 13:53	WG1445051

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	<1		1	03/16/2020 13:53	WG1445051

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	63.1		1	03/16/2020 13:53	WG1445051

- ¹ Cp
- ² Tc
- ³ Ss
- ⁴ Cn
- ⁵ Sr
- ⁶ Gl
- ⁷ Al
- ⁸ Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

Qualifier Description

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1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 A

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Kentucky ²	16	South Dakota	n/a
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Louisiana ¹	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

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A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

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Civil & Environmental Consultants - TN

117 Seaboard Ln.

Billing Information:
Accounts Payable
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Report to:
Lindsay Wilson-Kokes

Email To: lwilsonkokes@cecinc.com;
jwolf@cecinc.com

Project Description: **Hendersonville E. coli** City/State Collected: **Hendersonville, TN** Please Circle: PT MT **CT** ET

Phone: **615-333-7797** Client Project # **192-267** Lab Project # **CEC-HENDERSON-ECOLI**
 Fax: **615-333-7751**

Collected by (print): **Kelli Straka** Site/Facility ID # P.O. #

Collected by (signature): *[Signature]* **Rush?** (Lab MUST Be Notified)
 ___ Same Day ___ Five Day ___ Next Day ___ 5 Day (Rad Only) ___ Two Day ___ 10 Day (Rad Only) ___ Three Day
 Date Results Needed
 Immediately Packed on Ice N ___ Y **X** No. of Cntrs

Sample ID	Comp/Grab	Matrix *	Depth	Date	Time	No. of Cntrs
-----------	-----------	----------	-------	------	------	--------------

MANSKERS CREEK	G	WW		3/16/20	10:50	2
FIELD BLANK	↓	WW		↓	↓	2
DUPLICATE	↓	WW		↓	↓	1

COLLERT Microbiological

Analysis / Container / Preservative

Chain of Custody Page ___ of ___



12065 Lebanon Rd
 Mount Juliet, TN 37122
 Phone: 615-758-5858
 Phone: 800-767-5859
 Fax: 615-758-5859



SDG # **L199494**

G096

Acctnum: **CEC**
 Template: **T158175**
 Prelogin: **P737421**
 PM: **526 - Chris McCord**
 PB: **10-25-96**

Shipped Via: **Courier**
 Remarks Sample # (lab only)

* Matrix:
 SS - Soil AIR - Air F - Filter
 GW - Groundwater B - Bioassay
 WW - WasteWater
 DW - Drinking Water
 OT - Other

Remarks: pH _____ Temp _____
 Flow _____ Other _____

Samples returned via: **CT** Tracking #

Sample Receipt Checklist
 COC Seal Present/Intact: Y N
 COC Signed/Accurate: Y N
 Bottles arrive intact: Y N
 Correct bottles used: Y N
 Sufficient volume sent: Y N
 If Applicable
 VOA Zero Headspace: Y N
 Preservation Correct/Checked: Y N
 RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature) <i>[Signature]</i>	Date: 3/16/20	Time: 11:44	Received by: (Signature)	Trip Blank Received: Yes/No HCL/MeOH TBR
Relinquished by: (Signature)	Date:	Time:	Received by: (Signature)	Temp: °C 3.3-3.5 Bottles Received: 5
Relinquished by: (Signature)	Date:	Time:	Received for lab by: (Signature) <i>[Signature]</i>	Date: 3/16/20 Time: 1144 Hold: Condition: NCF / OK

March 24, 2020

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

Civil & Environmental Consultants - TN

Sample Delivery Group: L1200186
Samples Received: 03/18/2020
Project Number: 192-267
Description: Hendersonville E. coli

Report To: Lindsay Wilson-Kokes
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Entire Report Reviewed By:



Chris McCord
Project Manager

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Tc: Table of Contents	2	²Tc
Ss: Sample Summary	3	³Ss
Cn: Case Narrative	4	⁴Cn
Sr: Sample Results	5	⁵Sr
MANSKERS CREEK L1200186-01	5	
FIELD BLANK L1200186-02	6	
Gl: Glossary of Terms	7	⁶Gl
Al: Accreditations & Locations	8	⁷Al
Sc: Sample Chain of Custody	9	⁸Sc



MANSKERS CREEK L1200186-01 WW

Collected by: Kelli Straka
 Collected date/time: 03/18/20 10:15
 Received date/time: 03/18/20 11:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1447012	1	03/18/20 15:53	03/18/20 15:53	JTS	Mt. Juliet, TN

¹ Cp

² Tc

³ Ss

FIELD BLANK L1200186-02 WW

Collected by: Kelli Straka
 Collected date/time: 03/18/20 10:15
 Received date/time: 03/18/20 11:20

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1447012	1	03/18/20 15:53	03/18/20 15:53	JTS	Mt. Juliet, TN

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc



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Chris McCord
Project Manager

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	>2419.6		1	03/18/2020 15:53	WG1447012

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	<1		1	03/18/2020 15:53	WG1447012

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
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- 7 A
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Idaho	TN00003	Ohio-VAP	CL0069
Illinois	200008	Oklahoma	9915
Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	90010	South Carolina	84004
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
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Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
Montana	CERT0086	Wyoming	A2LA

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Canada	1461.01	USDA	P330-15-00234
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April 03, 2020

¹ Cp

² Tc

³ Ss

⁴ Cn

⁵ Sr

⁶ Gl

⁷ Al

⁸ Sc

Civil & Environmental Consultants - TN

Sample Delivery Group: L1204668
Samples Received: 04/01/2020
Project Number: 192-267
Description: Hendersonville E. coli

Report To: Lindsay Wilson-Kokes
117 Seaboard Ln.
Suite E100
Franklin, TN 37067

Entire Report Reviewed By:



Chris McCord
Project Manager

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Cp: Cover Page	1	
Tc: Table of Contents	2	
Ss: Sample Summary	3	
Cn: Case Narrative	4	
Sr: Sample Results	5	
MANSKERS CREEK L1204668-01	5	
FIELD BLANK L1204668-02	6	
Gl: Glossary of Terms	7	
Al: Accreditations & Locations	8	
Sc: Sample Chain of Custody	9	

SAMPLE SUMMARY



MANSKERS CREEK L1204668-01 WW

Collected by Lindsay Wilson-Kokes	Collected date/time 04/01/20 14:30	Received date/time 04/01/20 15:20
---	---------------------------------------	--------------------------------------

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1454093	1	04/01/20 16:20	04/01/20 16:20	NY	Mt. Juliet, TN

1
Cp

2
Tc

3
Ss

4
Cn

5
Sr

6
Gl

7
Al

8
Sc

FIELD BLANK L1204668-02 WW

Collected by Lindsay Wilson-Kokes	Collected date/time 04/01/20 14:30	Received date/time 04/01/20 15:20
---	---------------------------------------	--------------------------------------

Method	Batch	Dilution	Preparation date/time	Analysis date/time	Analyst	Location
Microbiology by Method 9223B-2004	WG1454093	1	04/01/20 16:20	04/01/20 16:20	NY	Mt. Juliet, TN



All sample aliquots were received at the correct temperature, in the proper containers, with the appropriate preservatives, and within method specified holding times, unless qualified or notated within the report. Where applicable, all MDL (LOD) and RDL (LOQ) values reported for environmental samples have been corrected for the dilution factor used in the analysis. All Method and Batch Quality Control are within established criteria except where addressed in this case narrative, a non-conformance form or properly qualified within the sample results. By my digital signature below, I affirm to the best of my knowledge, all problems/anomalies observed by the laboratory as having the potential to affect the quality of the data have been identified by the laboratory, and no information or data have been knowingly withheld that would affect the quality of the data.

Chris McCord
Project Manager

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc

Project Narrative

Coliert test ended beyond the 24hr incubation period. - SWS 4/3/2020



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	387.3		1	04/01/2020 16:20	WG1454093

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 Al
- 8 Sc



Microbiology by Method 9223B-2004

Analyte	Result	Qualifier	Dilution	Analysis date / time	Batch
E.Coli	<1		1	04/01/2020 16:20	WG1454093

1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc



Guide to Reading and Understanding Your Laboratory Report

The information below is designed to better explain the various terms used in your report of analytical results from the Laboratory. This is not intended as a comprehensive explanation, and if you have additional questions please contact your project representative.

Results Disclaimer - Information that may be provided by the customer, and contained within this report, include Permit Limits, Project Name, Sample ID, Sample Matrix, Sample Preservation, Field Blanks, Field Spikes, Field Duplicates, On-Site Data, Sampling Collection Dates/Times, and Sampling Location. Results relate to the accuracy of this information provided, and as the samples are received.

Abbreviations and Definitions

SDG	Sample Delivery Group.
Analyte	The name of the particular compound or analysis performed. Some Analyses and Methods will have multiple analytes reported.
Dilution	If the sample matrix contains an interfering material, the sample preparation volume or weight values differ from the standard, or if concentrations of analytes in the sample are higher than the highest limit of concentration that the laboratory can accurately report, the sample may be diluted for analysis. If a value different than 1 is used in this field, the result reported has already been corrected for this factor.
Qualifier	This column provides a letter and/or number designation that corresponds to additional information concerning the result reported. If a Qualifier is present, a definition per Qualifier is provided within the Glossary and Definitions page and potentially a discussion of possible implications of the Qualifier in the Case Narrative if applicable.
Result	The actual analytical final result (corrected for any sample specific characteristics) reported for your sample. If there was no measurable result returned for a specific analyte, the result in this column may state "ND" (Not Detected) or "BDL" (Below Detectable Levels). The information in the results column should always be accompanied by either an MDL (Method Detection Limit) or RDL (Reporting Detection Limit) that defines the lowest value that the laboratory could detect or report for this analyte.
Uncertainty (Radiochemistry)	Confidence level of 2 sigma.
Case Narrative (Cn)	A brief discussion about the included sample results, including a discussion of any non-conformances to protocol observed either at sample receipt by the laboratory from the field or during the analytical process. If present, there will be a section in the Case Narrative to discuss the meaning of any data qualifiers used in the report.
Quality Control Summary (Qc)	This section of the report includes the results of the laboratory quality control analyses required by procedure or analytical methods to assist in evaluating the validity of the results reported for your samples. These analyses are not being performed on your samples typically, but on laboratory generated material.
Sample Chain of Custody (Sc)	This is the document created in the field when your samples were initially collected. This is used to verify the time and date of collection, the person collecting the samples, and the analyses that the laboratory is requested to perform. This chain of custody also documents all persons (excluding commercial shippers) that have had control or possession of the samples from the time of collection until delivery to the laboratory for analysis.
Sample Results (Sr)	This section of your report will provide the results of all testing performed on your samples. These results are provided by sample ID and are separated by the analyses performed on each sample. The header line of each analysis section for each sample will provide the name and method number for the analysis reported.
Sample Summary (Ss)	This section of the Analytical Report defines the specific analyses performed for each sample ID, including the dates and times of preparation and/or analysis.

- 1 Cp
- 2 Tc
- 3 Ss
- 4 Cn
- 5 Sr
- 6 Gl
- 7 A
- 8 Sc

Qualifier Description

The remainder of this page intentionally left blank, there are no qualifiers applied to this SDG.



Pace National is the only environmental laboratory accredited/certified to support your work nationwide from one location. One phone call, one point of contact, one laboratory. No other lab is as accessible or prepared to handle your needs throughout the country. Our capacity and capability from our single location laboratory is comparable to the collective totals of the network laboratories in our industry. The most significant benefit to our one location design is the design of our laboratory campus. The model is conducive to accelerated productivity, decreasing turn-around time, and preventing cross contamination, thus protecting sample integrity. Our focus on premium quality and prompt service allows us to be YOUR LAB OF CHOICE.

* Not all certifications held by the laboratory are applicable to the results reported in the attached report.
 * Accreditation is only applicable to the test methods specified on each scope of accreditation held by Pace National.

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Alaska	17-026	Nevada	TN-03-2002-34
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Arkansas	88-0469	New Jersey-NELAP	TN002
California	2932	New Mexico ¹	n/a
Colorado	TN00003	New York	11742
Connecticut	PH-0197	North Carolina	Env375
Florida	E87487	North Carolina ¹	DW21704
Georgia	NELAP	North Carolina ³	41
Georgia ¹	923	North Dakota	R-140
Idaho	TN00003	Ohio-VAP	CL0069
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Indiana	C-TN-01	Oregon	TN200002
Iowa	364	Pennsylvania	68-02979
Kansas	E-10277	Rhode Island	LA000356
Kentucky ^{1,6}	90010	South Carolina	84004
Kentucky ²	16	South Dakota	n/a
Louisiana	AI30792	Tennessee ^{1,4}	2006
Louisiana ¹	LA180010	Texas	T104704245-18-15
Maine	TN0002	Texas ⁵	LAB0152
Maryland	324	Utah	TN00003
Massachusetts	M-TN003	Vermont	VT2006
Michigan	9958	Virginia	460132
Minnesota	047-999-395	Washington	C847
Mississippi	TN00003	West Virginia	233
Missouri	340	Wisconsin	9980939910
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A2LA – ISO 17025 ⁵	1461.02	DOD	1461.01
Canada	1461.01	USDA	P330-15-00234
EPA-Crypto	TN00003		

¹ Drinking Water ² Underground Storage Tanks ³ Aquatic Toxicity ⁴ Chemical/Microbiological ⁵ Mold ⁶ Wastewater n/a Accreditation not applicable

Our Locations

Pace National has sixty-four client support centers that provide sample pickup and/or the delivery of sampling supplies. If you would like assistance from one of our support offices, please contact our main office. Pace National performs all testing at our central laboratory.



1 Cp

2 Tc

3 Ss

4 Cn

5 Sr

6 Gl

7 Al

8 Sc

Civil & Environmental Consultants - TN

117 Seaboard Ln.

Billing Information:
Accounts Payable
 117 Seaboard Ln.
 Suite E100
 Franklin, TN 37067

Pres
 Chk

Analysis / Container / Preservative

Chain of Custody Page ___ of ___



12065 Lebanon Rd
 Mount Juliet, TN 37122
 Phone: 615-758-5858
 Phone: 800-767-5859
 Fax: 615-758-5859



Report to:
Lindsay Wilson-Kokes

Email To: lwilsonkokes@cecinc.com;
 jwolf@cecinc.com

Project
 Description: **Hendersonville E. coli**

City/State
 Collected: **Hendersonville**

Please Circle:
 PT MT CT ET

Phone: **615-333-7797**
 Fax: **615-333-7751**

Client Project #
192-267

Lab Project #
CEC-HENDERSON-ECOLI

Collected by (print):
Lindsay Wilson-Kokes

Site/Facility ID #

P.O. #

Collected by (signature):
[Signature]

Rush? (Lab MUST Be Notified)
 ___ Same Day ___ Five Day
 ___ Next Day ___ 5 Day (Rad Only)
 ___ Two Day ___ 10 Day (Rad Only)
 ___ Three Day

Quote #

Date Results Needed

No.
 of
 Cntrs

Packed on Ice N ___ Y

Sample ID

Comp/Grab

Matrix *

Depth

Date

Time

COLILERT Microbiological

MANSKERS CREEK

Grab

WW

Ø

4/1/20

1430

2

X

FIELD BLANK

1

WW

Ø

1

1

2

X

DUPLICATE

WW

SDG # **L1204608**
D151

Acctnum: **CEC**

Template: **T158175**

Prelogin: **P737420**

PM: **526 - Chris McCord**

PB: **10-25-196**

Shipped Via: **Courier**

Remarks | Sample # (lab only)

-01
 -02

* Matrix:
 SS - Soil AIR - Air F - Filter
 GW - Groundwater B - Bioassay
 WW - WasteWater
 DW - Drinking Water
 OT - Other

Remarks:

pH _____ Temp _____

Flow _____ Other _____

Samples returned via:
 ___ UPS ___ FedEx ___ Courier **CH**

Tracking #

Sample Receipt Checklist
 COC Seal Present/Intact: Y N
 COC Signed/Accurate: Y N
 Bottles arrive intact: Y N
 Correct bottles used: Y N
 Sufficient volume sent: Y N
 If Applicable
 VOA Zero Headspace: Y N
 Preservation Correct/Checked: Y N
 RAD Screen <0.5 mR/hr: Y N

Relinquished by: (Signature)

Date:

Time:

Received by: (Signature)

Trip Blank Received: Yes / No

HCL / MeOH
 TBR

Temp: **23 °C** Bottles Received: **4**

If preservation required by Login: Date/Time

Relinquished by: (Signature)

Date:

Time:

Received by: (Signature)

Temp: **18 °C**

Relinquished by: (Signature)

Date:

Time:

Received for lab by: (Signature)

Date:

Time:

Hold:

Condition:
 NCF / **OK**

[Signature]

4-1-20 1520

[Signature]

[Signature]

[Signature]

4-1-20 1520



July 15, 2020

Mr. Duane Allen
Design Engineer
City of Hendersonville
101 Maple Drive North
Hendersonville, TN 37075

Dear Mr. Allen:

Subject: Benthic Macroinvertebrate Monitoring and Assessment
City of Hendersonville
CEC Project 192-267.0003

Attached, please find our report from the benthic macroinvertebrate samples collected on April 2-3 and May 15, 2020 to fulfill the requirements of the City's Phase II NPDES permit – TNS075353, issued by the Tennessee Department of Environment and Conservation (TDEC). This report details the site locations, methods, data analyses, and results of the survey.

Benthic macroinvertebrates were sampled at six sites in streams identified by TDEC as waters with unavailable parameters for siltation, habitat alteration, nutrients, and/or pathogens. Streams sampled include an unnamed tributary to Cumberland River, two unnamed tributaries to Drake's Creek, Center Point Branch, Madison Creek, and Mansker Creek.

If you have any questions, please feel free to contact us at 615-333-7797. Thank you very much for the opportunity to work on this project.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.

Casey Hertwig, QHP
Project Manager

Tim Nehus
Principal Ecologist

**BENTHIC MACROINVERTEBRATE SURVEYS
CITY OF HENDERSONVILLE
SUMNER COUNTY, TENNESSEE**

**PREPARED FOR:
CITY OF HENDERSONVILLE
101 MAPLE DRIVE NORTH
HENDERSONVILLE, TN 37075**

**PREPARED BY:
CIVIL & ENVIRONMENTAL CONSULTANTS, INC.
FRANKLIN, TENNESSEE**

CEC PROJECT 192-267.0003

JULY 2020



Civil & Environmental Consultants, Inc.

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Table 1 Water Quality Measurements and Habitat Assessment Scores
Table 2 Values for Biological Measures
Table 3 Biological Measure Scores

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Appendix A Photographs of Sampling Sites
Appendix B Field Data Sheets and Habitat Assessment
Appendix C Taxa List

1.0 INTRODUCTION

Civil & Environmental Consultants, Inc. (CEC) conducted biological surveys as part of the City of Hendersonville's Municipal Separate Storm Sewer System (MS4) Phase II NPDES permit – TNS075353 (Permit), issued by the Tennessee Department of Environment and Conservation (TDEC). According to the permit, the City is required to perform benthic macroinvertebrate surveys in streams identified by TDEC as waters with unavailable parameters for siltation, habitat alteration, nutrients, and/or pathogens within a five year permit cycle. Six biomonitoring sites were sampled for benthic macroinvertebrate community composition, physical and chemical composition (pH, temperature, conductivity, and dissolved oxygen) as well as habitat characterization. The six stream sampling locations are identified as: UT to Drake's Creek (DRAKE6.1T0.2SR), UT to Drake's Creek (DRAKE5.3T0.4SR), UT to Cumberland River (CUMBE215.7T0.3SR), Center Point Branch (CPOIN000.4SR), Madison Creek (no DWR station ID), and Mansker Creek (no DWR station ID). Sampling locations are identified on Figure 1. The sampling locations for the two unnamed tributaries to Drake's Creek are located in the Old Hickory Lake Watershed (HUC-8 – 05130201) and the Level III Ecoregion 71h – Outer Nashville Basin. The sampling locations for the unnamed tributary to Cumberland River, Center Point Branch, Madison Creek, and Mansker Creek are located in the Cheatham Lake Watershed (HUC-8 – 05130202) and the Level III Ecoregion 71h – Outer Nashville Basin.

2.0 METHODS

2.1 FIELD

Five benthic macroinvertebrate samples were collected on April 2-3, 2020 and the Mansker Creek sample was collected on May 15, 2020, in accordance with TDEC's *Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys* (SOP 2017) for macroinvertebrates. In each sampling reach (site), a square meter net (500- μ m mesh) was used to collect approximately one square meter of material from two different locations in riffle habitat (SQKICK). The two samples were then composited. The combined material collected at each site was emptied into a labeled heavy-duty plastic bag, and fixed with 80 percent ethanol. Appendix A contains photos of upstream and downstream views of each site.

In conjunction with the benthic macroinvertebrate sampling, habitat assessments were performed at each site, following the procedures outlined in the SOP. Parameters such as substratum, embeddedness, velocity, depth, bank characteristics, and land use were assessed and rated to determine if, and to what extent, the habitat is capable of supporting a diverse benthic community. Other site characteristics such as sketches of the site, important features, weather, sampling personnel, methods, and other aquatic life were recorded on TDEC's field data sheets. *In-situ* water quality measurements were taken for dissolved oxygen, pH, conductivity, and temperature using a YSI Professional Plus portable meter. Water velocity and depth at each specific sampling site were measured using a Marsh-McBirney flow meter. All meters were calibrated prior to field use. All data, including habitat assessments and sketches of each site, can be found in Appendix B.

2.2 LABORATORY

Each sample was washed using a US Series No. 35 (500 μ m mesh) sieve to remove ethanol and excess detritus. The samples contained a large amount of material (detritus and organisms) and were subsampled using the Caton (1991) method recommended by the SOP. This procedure consists of dividing the sample into 30 equal portions (grids) using a specified subsampling device, then sorting at least four of these grids (which have been randomly selected) to obtain 200 ± 20 percent (160-240) organisms. If sorting a grid had been started, it was finished in its entirety. The benthic organisms removed from the sample were placed by major groupings (e.g., mayflies, worms, snails) into glass vials containing 70 percent ethanol. Each vial was labeled with information such as date of collection, location, specific sample identification, name of taxonomic group and number of organisms. The residue from the sorted portion of a sample was preserved separately from the portion that was not sorted. Organisms were identified using either a dissecting or compound microscope. The compound microscope was used for identifying chironomids (midgefly larvae) and oligochaetes (aquatic segmented worms) after these organisms were mounted on microscope slides using CMCP mounting medium. Most organisms were identified to the generic level, unless the specimens were too small or damaged to allow identification to this level. Identifications were recorded on laboratory bench sheets. The benthic laboratory data can be found in Appendix C.

2.3 DATA ANALYSIS

When identifications were complete, the raw benthic data were used to calculate values for seven individual metrics. The following metrics are required by the SOP and are all based on generic level identifications:

1. **TR** (Taxa Richness) – total number of distinct taxa identified.
2. **EPT** (Ephemeroptera Plecoptera Trichoptera) **Richness** – total number of genera of mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera).
3. **%EPT-Cheum** (EPT abundance excluding *Cheumatopsyche spp.*) – total number of individuals of EPT taxa minus number of *Cheumatopsyche*, divided by the total number of individuals in the sample.
4. **%OC** (Percent Oligochaeta and Chironomidae) – total number of individuals in these two groups, divided by total number of individuals in the sample.
5. **NCBI** (North Carolina Biotic Index) – calculated as $NCBI = \sum \frac{x_i t_i}{N}$ where:

 x_i = number of individuals in a taxon
 t_i = tolerance value of a taxon
 N = total number of individuals in sample that have an assigned tolerance value
6. **%Clingers** (Percent Clingers) – total number of individuals that build fixed retreats (or have adaptations to attach to surfaces in flowing water), divided by the total number of individuals in the sample.
7. **%TNUTOL** (Percent TN Nutrient Tolerant Organisms) – total number of Tennessee nutrient tolerant organisms divided by the total number of organisms in the sample. The Tennessee nutrient tolerant organisms include *Cheumatopsyche*, *Stenelmis*, *Polypedilum*, *Cricotopus*, *Cricotopus/Orthocladius*, *Lirceus*, *Caenis*, *Elimia*, *Nais*, *Dero*, and undetermined (immature) Tubificidae.

Upon completion of the individual metric calculations, each metric is assigned a score of 0, 2, 4, or 6 based on comparison to the ecoregion reference database which is separated based on ecoregion, sampling period, and drainage area. The resulting total of all metrics is the Tennessee Macroinvertebrate Index (TMI) score (TDEC 2017). The drainage area for UT to Drakes Creek (DRAKE6.1T0.2SR) and Mansker Creek at the sampling locations is >2.5 square miles, while the drainage area for UT to Drakes Creek (DRAKE5.3T0.4SR), UT to Cumberland River (CUMBE215.7T0.3SR), Center Point Branch (CPOIN000.4SR), and Madison Creek at the sampling locations is <2.5 square miles. All samples are located in Ecoregion 71h – Outer Nashville Basin, and the sampling period is between January and June.

3.0 RESULTS

Measurements of *in-situ* water quality parameters, water velocity, and habitat assessment are presented in Table 1 below.

Table 1. <i>In-situ</i> Water Quality Monitoring and Habitat Assessment City of Hendersonville, TN						
Site	UT to Drakes Creek (DRAKE6.1T0.2SR)	UT to Drakes Creek (DRAKE5.3T0.4SR)	UT to Cumberland River (CUMBE215.7T0.3SR)	Center Point Branch (CPOIN000.4SR)	Madison Creek	Mansker Creek
pH (su)	8.49	8.47	8.51	8.6	8.54	7.68
Conductivity (uS/cm)	403.6	478	555	481.9	314.7	405
Temperature (C°)	11.5	14.5	16	17.2	14.1	19.2
Dissolved Oxygen (mg/L)	11.92	11.75	10.3	10.04	11.04	6.87
Flow (cfs)	5.49	3.39	0.29	5.01	2.53	20.5
Habitat Assessment	123	113	149	107	109	120

In-situ water quality parameters give a general sense of water quality at each of the benthic sampling locations. The pH ranged from 7.68 in Mansker Creek to 8.6 at Center Point Branch. The normal range for pH in freshwater streams is 6.5 to 8.5. The alkaline pH (>7.0) values are reflective of the karst limestone geology of the area. Conductivity is the ability of water to carry an electric current and indicates the physical presence of dissolved minerals in the water. The conductivity readings ranged from 314.7 in Madison Creek to 555 in the UT to Cumberland River. Dissolved oxygen refers to the level of free oxygen in the stream. Dissolved oxygen is produced primarily by agitation (riffles) and plant photosynthesis. Aquatic life depends on dissolved oxygen to survive. The dissolved oxygen (mg/L) levels in the sampled streams ranged from 6.87 at Mansker Creek to 11.92 in UT to Drakes Creek (DRAKE6.1T0.2SR). All samples had a dissolved oxygen reading above 10 except Mansker Creek which is a large, slow moving stream with very little riffle habitat at the sampling location. All streams had a dissolved oxygen reading sufficient to support aquatic life.

Results from the calculations of the biological measures are presented in Table 2, with the corresponding TMI scores shown in Table 3.

Table 2. Values for Biological Measures City of Hendersonville, TN						
Site	UT to Drakes Creek (DRAKE6.1T0.2SR)	UT to Drakes Creek (DRAKE5.3T0.4SR)	UT to Cumberland River (CUMBE215.7T0.3SR)	Center Point Branch (CPOIN000.4SR)	Madison Creek	Mansker Creek
Total # of individuals	201	182	217	183	225	196
Taxa Richness	19	23	25	11	19	33
EPT Richness	5	5	7	3	8	4
Percent Oligochaeta/ Chironomidae	16.42	59.89	48.39	8.74	18.67	74.49
Percent EPT- <i>Cheumatopsyche</i>	6.47	13.74	27.65	6.56	30.22	15.31
NC Biotic Index	5.61	6.1	5.24	7.12	5.43	6.58
Percent Nutrient Tolerant	72.14	60.44	42.86	93.44	63.11	19.39
Percent Clingers- <i>Cheumatopsyche</i>	78.11	58.24	53.46	12.57	40.44	7.65

The total number of individuals identified ranged from 182 to 225 organisms. A total of 70 taxa were identified from the samples with a range of 11 to 33 taxa per sample. Twenty-two taxa were categorized as intolerant (tolerance values < 4.51) and twelve taxa were categorized as tolerant (tolerance values \geq 7.50); those between these two values are considered facultative. Tolerance values ranged from 0 (*Dibusa sp.*) to 9.3 (*Chironomus sp.* and *Limonia sp.*), and there were twenty-two (22) taxa classified as clingers. A phylogenetic list of taxa identified from the benthic samples is provided in Appendix C.

**Table 3. Biological Measure Scores (TMI scores)
City of Hendersonville, Tennessee**

Site	UT to Drakes Creek (DRAKE6.1T0.2SR)	UT to Drakes Creek (DRAKE5.3T0.4SR)	UT to Cumberland River (CUMBE215.7T0.3SR)	Center Point Branch (CPOIN000.4SR)	Madison Creek	Mansker Creek
Drainage Area at Sampling Site (square miles)	3.45	1.62	0.27	2.46	1.31	43.19
Bioregion	71h	71h	71h	71h	71h	71h
Taxa Richness	4	4	4	2	2	6
EPT Richness	2	2	2	0	4	2
Percent Oligochaeta/ Chironomidae	6	2	4	6	6	2
Percent EPT- <i>Cheumatopsyche</i>	0	0	2	0	2	0
NC Biotic Index	4	4	4	2	4	4
Percent Nutrient Tolerant	2	2	4	0	2	6
Percent Clingers- <i>Cheumatopsyche</i>	6	6	6	0	6	0
Total (TMI)	24	20	26	10	26	20

The values for Taxa Richness ranged from 11 to 33, resulting in TMI individual metric scores ranging from 2 to 6, with Center Point Branch and Madison Creek having the lowest score and Mansker Creek having the highest score. EPT Richness values ranged from 4 to 9, resulting in TMI individual metric scores ranging from 0 to 4, with Center Point Branch having the lowest score for this metric (0). Percent EPT-*Cheumatopsyche* values were highest at UT to Cumberland River and Madison Creek resulting in a TMI score of 2 for these streams. The other four streams had a low percentage of EPT-*Cheumatopsyche* resulting in a TMI score of 0. UT to Drakes Creek (DRAKE6.1T0.2SR), Center Point Branch, and Madison Creek had the lowest percentage of *Oligochaeta + Chironomidae* resulting in a TMI score of 6 for this metric with values ranging from 8.74 to 18.67. The remaining streams had a higher percentage of *Oligochaeta + Chironomidae* resulting in TMI metric scores of 2 and 4. Center Point Branch had the lowest NC Biotic Index individual metric score of 2 while the other five streams all had a metric score of 4. Center Point Branch and Mansker Creek had the lowest percentage of clingers resulting in a TMI metric score of 0. The other four streams all had a high percentage of clingers, resulting in a TMI metric score of 6. Percent nutrient tolerant values ranged from 19.39 to 93.44, resulting in TMI

individual metric scores ranging from 0 to 6, with Center Point Branch having the highest value of 93.44 and lowest metric score of 0.

A determination of biological condition is determined from the TMI bio-criteria scores as follows:

- >32 – Non-impaired (Supporting)
- 21-31 – Slightly impaired (Partially Supporting)
- 10-20 – Moderately impaired (Partially Supporting)
- <10 – Severely impaired (Non-supporting)

The target TMI score for bioregion 71h is 32, which indicates no impairment. The habitat assessment reference score for Ecoregion 71h in watersheds greater than 2.5 square miles is 114 or greater, and the reference score in watersheds less than or equal to 2.5 square miles is 123 or greater.

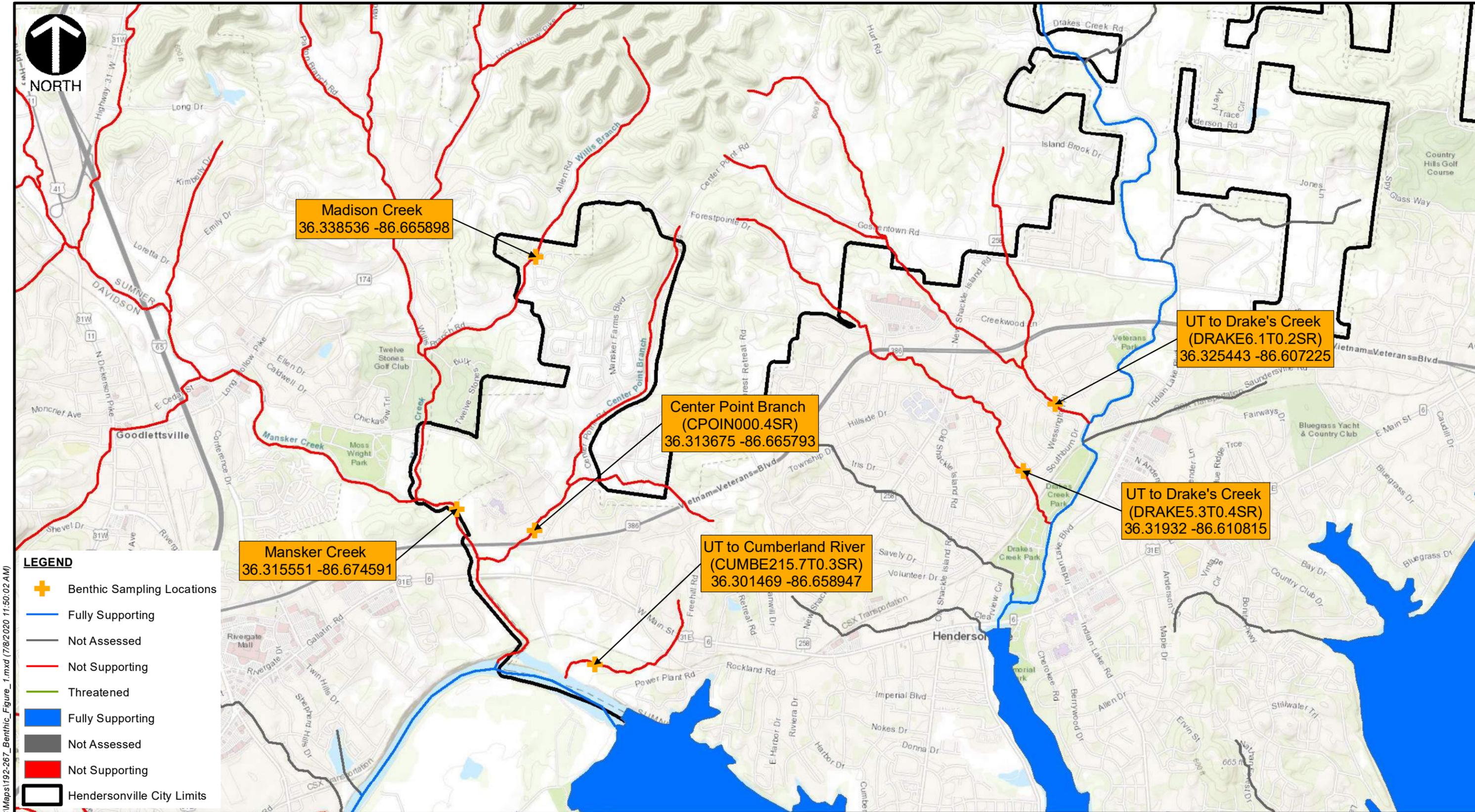
There were no samples that had a TMI score of 32 or greater. UT to Cumberland River and Madison Creek had a TMI score of 26, and UT to Drakes Creek (DRAKE6.1T0.2SR) had a TMI score of 24, which are all considered slightly impaired (partially supporting). The habitat assessment scores for these streams were 149 for UT to Cumberland River, 109 for Madison Creek, and 123 for UT to Drakes Creek (DRAKE6.1T0.2SR), indicating suboptimal to optimal habitat. UT to Cumberland River and Madison Creek are on the higher end of the spectrum of slightly impaired and could be recovering from historic impairment in their watersheds. UT to Drakes Creek (DRAKE5.3T0.45SR) and Mansker Creek had a TMI score of 20, which is on the higher end of the moderately impaired (partially supporting) category. The habitat assessment score for these streams were 113 for UT to Drakes Creek (DRAKE5.3T0.45SR) and 120 for Mansker Creek, indicating suboptimal habitat. Substrate and habitat availability at the sampling locations, appear to be the main reason why the TMI scores are lower for these two streams. Center Point Branch had the lowest TMI score of 10 which is the lowest score you can get and still be in the moderately impaired (partially supporting) category. Center Point Branch is a large, bedrock stream with very little available habitat to support benthic macro-invertebrates. The habitat assessment score of 107 reflects this marginal habitat for Center Point Branch.

4.0 LITERATURE CITED

Tennessee Department of Environment and Conservation. 2017. Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys, Nashville. 3 sections + appendices.

Caton, L.W. 1991. Improved subsampling methods for the EPA “Rapid Bioassessment” benthic protocols. Bull. N. Am. Benthol. Soc. 8:317-319.

FIGURES



Madison Creek
36.338536 -86.665898

UT to Drake's Creek
(DRAKE6.1T0.2SR)
36.325443 -86.607225

Center Point Branch
(CPOIN000.4SR)
36.313675 -86.665793

UT to Drake's Creek
(DRAKE5.3T0.4SR)
36.31932 -86.610815

Mansker Creek
36.315551 -86.674591

UT to Cumberland River
(CUMBE215.7T0.3SR)
36.301469 -86.658947

LEGEND

- Benthic Sampling Locations
- Fully Supporting
- Not Assessed
- Not Supporting
- Threatened
- Fully Supporting
- Not Assessed
- Not Supporting
- Hendersonville City Limits

REFERENCE
 ESRI WORLD TOPOGRAPHY / ARCGIS MAP SERVICE:
[HTTP://GOTO.ARCGISONLINE.COM/MAPS/WORLD_TOPOGRAPHY](http://gto.arcgis.com/maps/world_topography), ACCESSED 7/8/2020.
<https://tnmap.tn.gov/arcgis/rest/services>



Civil & Environmental Consultants, Inc.
 117 Seaboard Lane, Suite E100 Franklin, Tennessee 37067
 615-333-7797 • 800-763-2326
www.cecinc.com

CITY OF HENDERSONVILLE
 2020 BENTHIC MACROINVERTEBRATE SURVEY
 HENDERSONVILLE, SUMNER CO., TN

SITE LOCATION MAP
 SAMPLING LOCATION MAP

DRAWN BY: CDH	CHECKED BY: TJN	APPROVED BY: TJN <small>* Hand signature on file</small>	FIGURE NO: 1
DATE: 7/8/2020	SCALE: 1" = 3,000'	PROJECT NO: 192-267.0003	

I:\SVR-NASHI\P\192-267-GIS\Maps\192-267_Benthic_Figure_1.mxd (7/8/2020 11:50:02 AM)

APPENDIX A
PHOTOGRAPHS OF SAMPLING SITES



Photo 1. View of UT to Drake's Creek (DRAKE6.1T0.2SR) looking upstream (36.325443, -86.607225).



Photo 2. View of UT to Drake's Creek (DRAKE6.1T0.2SR) looking downstream (36.325443, -86.607225).



Photo 3. View of UT to Drake's Creek (DRAKE5.3T0.4SR) looking upstream (36.31932, -86.610815).



Photo 4. View of UT to Drake's Creek (DRAKE5.3T0.4SR) looking downstream (36.31932, -86.610815).



Photo 5. View of UT to Cumberland River (CUMBE215.7T0.3SR) looking upstream (36.301469, -86.658947).

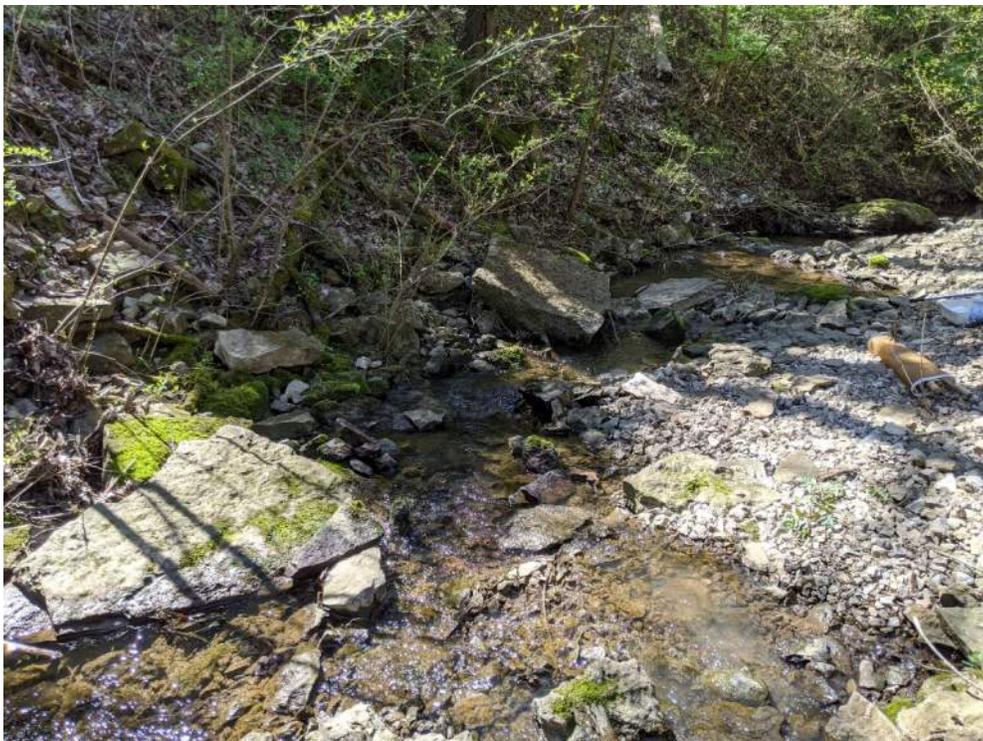


Photo 6. View of UT to Cumberland River (CUMBE215.7T0.3SR) looking downstream (36.301469, -86.658947).



Photo 7. View of Center Point Branch (CPOIN000.4SR) looking upstream (36.313675, -86.665793).



Photo 8. View of Center Point Branch (CPOIN000.4SR) looking downstream (36.313675, -86.665793).



Photo 9. View of Madison Creek looking upstream (36.338536, -86.665898).



Photo 10. View of Madison Creek looking downstream (36.338536, -86.665898).



Photo 11. View of Mansker Creek looking upstream (36.315551, -86.674591).



Photo 12. View of Mansker Creek looking downstream (36.315551, -86.674591).

APPENDIX B
FIELD DATA SHEETS AND HABITAT ASSESSMENTS

STREAM SURVEY INFORMATION

DWR Station ID: <u>Drake 6.1 TQ.2 SR</u>	Samplers: <u>C. Hentwig / K. Straka</u>	
Monitoring Location Name: <u>UT to Drakes Creek</u>	Date: <u>4/2/2020</u>	Time: <u>10:40</u>
Monitoring Location: <u>Wessington Pl. near Satch St.</u>	Organization: <u>CEC</u>	Drainage Area: <u>3.45</u>
County: <u>Sumner</u>	Ecoregion: <u>71h</u>	u/s ECO:
Latitude: <u>36.324788</u>	HUC: <u>051302010603</u>	WS Grp:
Longitude: <u>-86.606960</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other: MS4

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: <input checked="" type="checkbox"/> Collected <input type="checkbox"/> Seasonally Dry <input type="checkbox"/> Frequently Dry <input type="checkbox"/> No Channel <input type="checkbox"/> Too Deep (Not Wadeable) <input type="checkbox"/> Too Deep (Temporary) <input type="checkbox"/> Permanent Barrier <input type="checkbox"/> Fenced <input type="checkbox"/> Landowner Denial: <input type="checkbox"/> Temporary Barrier <input type="checkbox"/> Posted Plan to revisit? <input type="checkbox"/> Yes <input type="checkbox"/> No
Flow Conditions: <input type="checkbox"/> Dry <input type="checkbox"/> Isolated Pools <input type="checkbox"/> Stagnant <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Bankful <input type="checkbox"/> Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	X		Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used: YSI Pro Plus

pH (su)	<u>8.49</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>403.6</u>	Turbidity (NTU)	
Temperature (C°)	<u>11.5</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>11.92</u>	Flow (cfs)	<u>5.49</u>

Meter Problems? No

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 56

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input type="checkbox"/> Small (1.5-3yd) <input type="checkbox"/> Med. (3-10yd) <input checked="" type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd) <u>4.5ft</u> <u>4.5-9ft</u> <u>9-30ft</u> <u>30-75ft</u>
Maximum Stream Depth: <input type="checkbox"/> Shallow (<0.3yd) <input checked="" type="checkbox"/> Medium (0.3-0.6yd) <input type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd) <u>0.4ft</u> <u>0.4-1.8ft</u> <u>1.8-3ft</u> <u>3ft</u>
% Canopy Cover Estimated for Reach: <u>50</u> %
% Canopy Cover Measured (mid-reach): _____ u/s + _____ d/s + _____ LDB + _____ RDB = Total/384*100 _____

Channel Characteristics:

Bank Height: <u>0.5</u> (yd.) High Water Mark: _____ (yd.)
Bank Slope LDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Bank Slope RDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Manmade Modification: <input checked="" type="checkbox"/> None <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input type="checkbox"/> Diatoms <input type="checkbox"/> Green <input checked="" type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: 4/2/2020 Assessors: C. Herkins / K. Straka

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input checked="" type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock |
| <input checked="" type="checkbox"/> Sand | <input type="checkbox"/> Sand | <input type="checkbox"/> Sand |
| <input checked="" type="checkbox"/> Silt (not gritty) | <input type="checkbox"/> Silt (not gritty) | <input type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

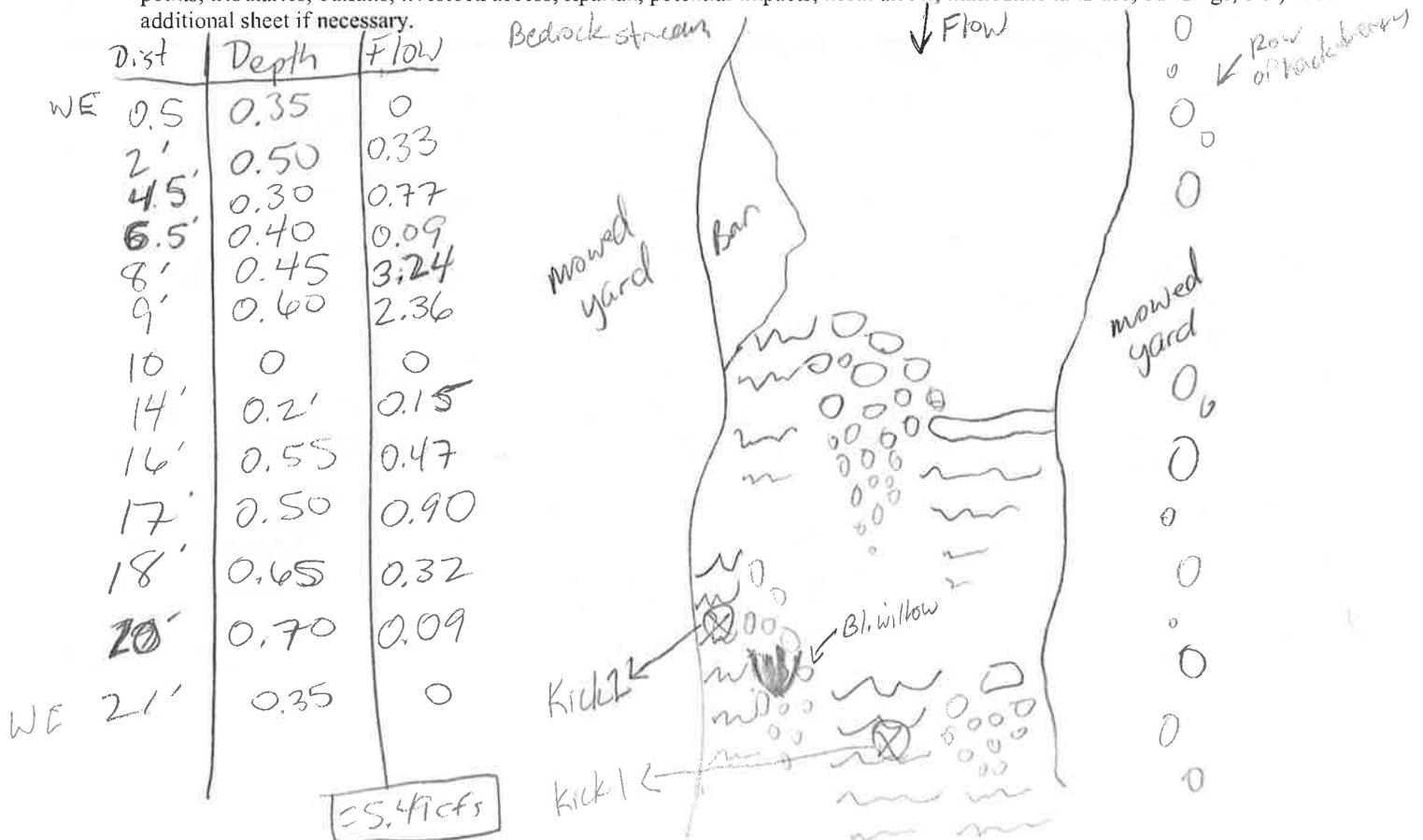
- | | | | | |
|-------------------------------------|-------------------------------------|---|--|---------------------------------------|
| <input type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input type="checkbox"/> ATV/OHV |
| <input type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input checked="" type="checkbox"/> Residential | <input type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

Riparian Loss	<input checked="" type="checkbox"/> Logging	<input type="checkbox"/> Industry	<input type="checkbox"/> ATV/OHV
Channelization	<input checked="" type="checkbox"/> Urban	<input type="checkbox"/> Mining/ Dredging	<input type="checkbox"/> Golf Course
Active Grazing	<input type="checkbox"/> Commercial	<input type="checkbox"/> Road/Hwy/RR	<input type="checkbox"/> Garbage/Trash
Row Crops	<input type="checkbox"/> Residential	<input checked="" type="checkbox"/> Construction	<input type="checkbox"/> Landfill
CAFO/Dairy	<input type="checkbox"/> STP/WWTP	<input type="checkbox"/> Impoundment	<input type="checkbox"/> Water Withdrawal

Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersonville Branch</i>		HABITAT ASSESSED BY: <i>C. Herwig</i>	
STA:		DATE: <i>4-2-2020</i>	TIME: <i>11:00 am</i>
STREAM NAME: <i>W of Drakes Cr.</i>		ECOREGION:	
MAP LABEL: <i>DRAKE 6.170.2.SR</i>		QC: Consensus / Duplicate	
HUC:			

	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)	Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)	Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments:				
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.	Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.	Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.	Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.
SCORE	20 19 18 17 16	15 14 (13) 12 11	10 9 8 7 6	5 4 3 2 1
Comments:				
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.	Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).	Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.
SCORE	20 19 18 17 16	(15) 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments:				
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.	Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.	Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.
SCORE	20 19 18 17 16	15 14 13 12 11	(10) 9 8 7 6	5 4 3 2 1
Comments:				
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.	Water covers > 75% of streambed or 25% of productive habitat is exposed.	Water covers 25-75% of streambed and/or productive habitat is mostly exposed.	Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.
SCORE	20 19 18 (17) 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments:				

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL: <i>Wt to Drakes Cr.</i>		DATE: <i>4/2/2020</i>					ASSESSOR INITIALS: <i>CH/KS</i>																		
6. Channel Alteration	OPTIMAL	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.					SUBOPTIMAL	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.					MARGINAL	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.					POOR	Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.					
	SCORE	20	19	18	<u>17</u>	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1				
Comments:																									
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	OPTIMAL	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.					SUBOPTIMAL	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.					MARGINAL	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.					POOR	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.					
	SCORE	20	19	18	17	16	<u>15</u>	14	13	12	11	10	9	8	7	6	5	4	3	2	1				
Comments:																									
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	OPTIMAL	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					SUBOPTIMAL	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.					MARGINAL	Moderately unstable: 30-60 % of bank in reach has areas of erosion; high erosion potential during floods. If approaching 60% score poor if banks steep.					POOR	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.					
	SCORE (LDB)	LEFT	10	9	<u>8</u>	7	6	5	4	3	2	1	0	SCORE (RDB)	RIGHT	10	9	<u>8</u>	7	6	5	4	3	2	1
Comments:																									
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	OPTIMAL	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.					SUBOPTIMAL	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).					MARGINAL	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).					POOR	Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).					
	SCORE (LDB)	LEFT	10	9	8	7	6	5	4	3	<u>2</u>	1	0	SCORE (RDB)	RIGHT	10	9	8	7	6	5	4	3	<u>2</u>	1
Comments:																									
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	OPTIMAL	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.					SUBOPTIMAL	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.					MARGINAL	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.					POOR	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.					
	SCORE (LDB)	LEFT	10	9	8	7	6	5	4	3	2	<u>1</u>	0	SCORE (RDB)	RIGHT	10	9	8	7	6	5	4	3	2	1
Comments:																									
TOTAL SCORE <i>123</i>		Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW																							
If score is below guidelines. result of (circle)										Natural Conditions					Human Disturbance										
Comments:																									

STREAM SURVEY INFORMATION

DWR Station ID: <u>DRAKE 5.370.4SR</u>	Samplers: <u>C. Hertwig / K. Straka</u>	
Monitoring Location Name: <u>UT to Drakes Cr.</u>	Date: <u>4-2-2020</u>	Time: <u>12:45pm</u>
Monitoring Location: <u>Wessington Pl.</u>	Organization: <u>CEC</u>	Drainage Area: <u>1.62</u>
County: <u>Sumner Co.</u>	Ecoregion: <u>7h</u>	u/s ECO:
Latitude: <u>36.318698</u>	HUC: <u>051302010603</u>	WS Grp:
Longitude: <u>-86.610983</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other: MS4

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: <input checked="" type="checkbox"/> Collected <input type="checkbox"/> Seasonally Dry <input type="checkbox"/> Frequently Dry <input type="checkbox"/> No Channel <input type="checkbox"/> Too Deep (Not Wadeable) <input type="checkbox"/> Too Deep (Temporary) <input type="checkbox"/> Permanent Barrier <input type="checkbox"/> Fenced <input type="checkbox"/> Landowner Denial: <input type="checkbox"/> Temporary Barrier <input type="checkbox"/> Posted Plan to revisit? <input type="checkbox"/> Yes <input type="checkbox"/> No
Flow Conditions: <input type="checkbox"/> Dry <input type="checkbox"/> Isolated Pools <input type="checkbox"/> Stagnant <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Bankful <input type="checkbox"/> Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	<input checked="" type="checkbox"/>	<u>mod</u>	Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used: YSI Pro Plus

pH (su)	<u>8.47</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>478</u>	Turbidity (NTU)	
Temperature (C°)	<u>14.5</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>11.75</u>	Flow (cfs)	<u>3.39</u>

Meter Problems? No

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 61°

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input type="checkbox"/> Small (1.5-3yd) <input checked="" type="checkbox"/> Med. (3-10yd) <input type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd)
Maximum Stream Depth: <input type="checkbox"/> Shallow (<0.3yd) <input checked="" type="checkbox"/> Medium (0.3-0.6yd) <input type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd)
% Canopy Cover Estimated for Reach: <u>30</u> %
% Canopy Cover Measured (mid-reach): _____ u/s + _____ d/s + _____ LDB + _____ RDB = Total/384*100 _____

Channel Characteristics:

Bank Height: <u>2'</u> (yd.) High Water Mark: <u>5-6'</u> (yd.)
Bank Slope LDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Bank Slope RDB: <input checked="" type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Manmade Modification: <input type="checkbox"/> None <input checked="" type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input checked="" type="checkbox"/> Diatoms <input type="checkbox"/> Green <input type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: 4/2/2020 Assessors: CH/KS

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input checked="" type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock |
| <input checked="" type="checkbox"/> Sand | <input type="checkbox"/> Sand | <input checked="" type="checkbox"/> Sand |
| <input checked="" type="checkbox"/> Silt (not gritty) | <input type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

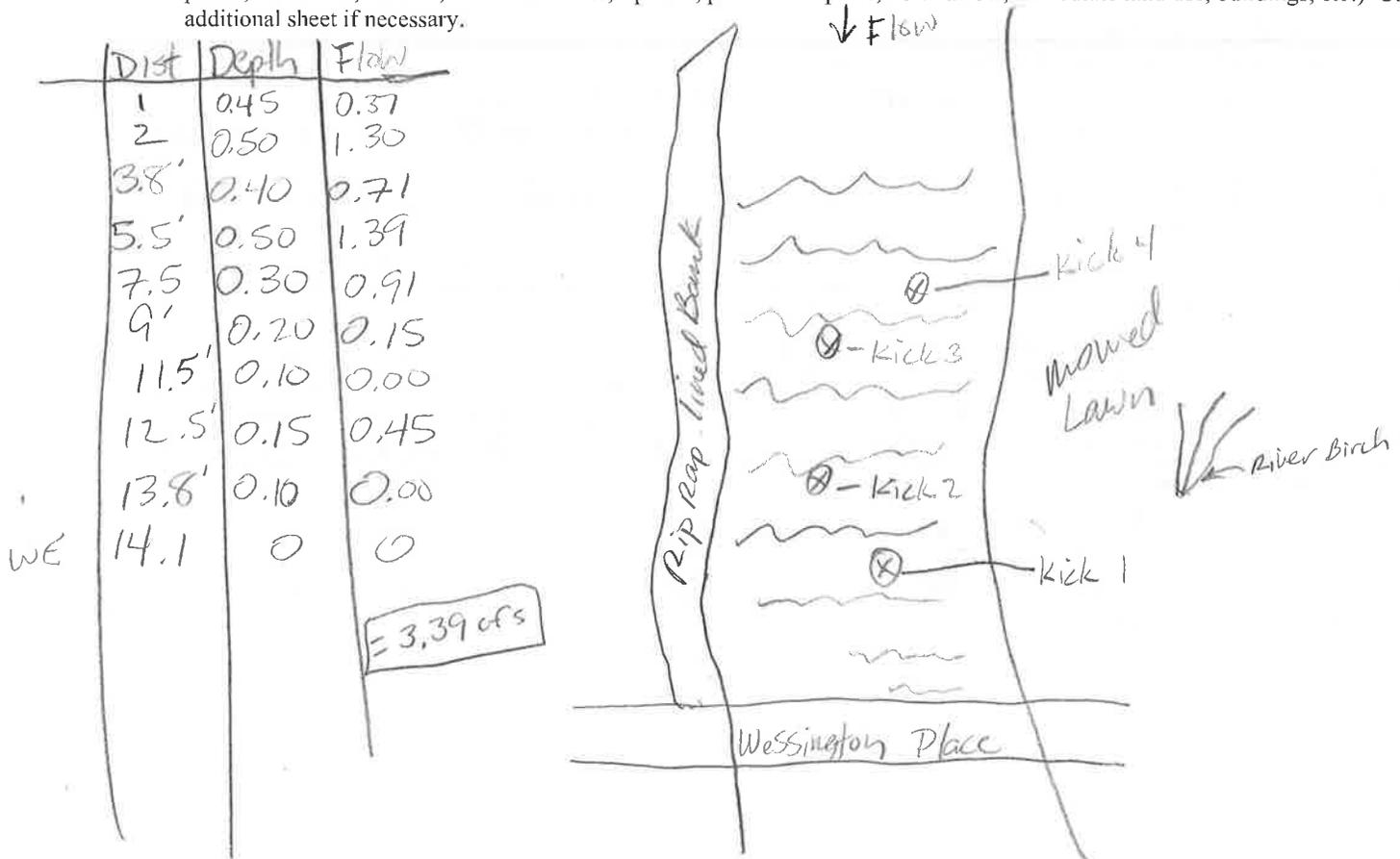
- | | | | | |
|-------------------------------------|-------------------------------------|---|---|---------------------------------------|
| <input type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input type="checkbox"/> ATV/OHV |
| <input type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input checked="" type="checkbox"/> Residential | <input checked="" type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

Riparian Loss	H	Logging		Industry		ATV/OHV	
Channelization	S	Urban		Mining/ Dredging		Golf Course	
Active Grazing		Commercial		Road/Hwy/RR	S	Garbage/Trash	
Row Crops		Residential	M	Construction		Landfill	
CAFO/Dairy		STP/WWTP		Impoundment		Water Withdrawal	

Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersonville MS4</i>																				
STA:						HABITAT ASSESSED BY: <i>C. Hertwig</i>														
STREAM NAME: <i>WT to Drakes Cr.</i>						DATE: <i>4-2-2020</i>						TIME: <i>1:00pm</i>								
MAP LABEL: <i>DRAKES.3TO.4 SR</i>						ECOREGION:														
HUC:						QC: Consensus / Duplicate														
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL:		DATE: 4-2-2020										ASSESSOR INITIALS: CA/KS										
6. Channel Alteration	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR						
	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.					Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.					Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.					Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.						
SCORE		20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Comments:																						
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR						
	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.					Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.					Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.					Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.						
SCORE		20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	
Comments:																						
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR						
	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.					Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.					Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.						
SCORE (LDB)		LEFT	10	9			8	7	6			5	4	3			2	1	0			
SCORE (RDB)		RIGHT	10	9			8	7	6			5	4	3			2	1	0			
Comments:																						
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR						
	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.					70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).					50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).					Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).						
SCORE (LDB)		LEFT	10	9			8	7	6			5	4	3			2	1	0			
SCORE (RDB)		RIGHT	10	9			8	7	6			5	4	3			2	1	0			
Comments:																						
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR						
	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.					Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.					Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.					Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.						
SCORE (LDB)		LEFT	10	9			8	7	6			5	4	3			2	1	0			
SCORE (RDB)		RIGHT	10	9			8	7	6			5	4	3			2	1	0			
Comments:																						
TOTAL SCORE		X 113					Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW															
If score is below guidelines, result of (circle)											Natural Conditions					Human Disturbance						
Comments:																						

STREAM SURVEY INFORMATION

DWR Station ID: <u>CUMCE215.7T0.3SR</u>	Samplers: <u>C. Hertwig / K. Straka</u>	
Monitoring Location Name: <u>UT to Cumberland R.</u>	Date: <u>4-2-2020</u>	Time: <u>2:30 pm</u>
Monitoring Location: <u>@ Coe Archer Range</u>	Organization: <u>CEC</u>	Drainage Area: <u>0.27</u>
County: <u>Sumner</u>	Ecoregion: <u>71h</u>	u/s ECO:
Latitude: <u>36.301309</u>	HUC: <u>051302020302</u>	WS Grp:
Longitude: <u>-86.659019</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other: MS4

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: <input checked="" type="checkbox"/> Collected <input type="checkbox"/> Seasonally Dry <input type="checkbox"/> Frequently Dry <input type="checkbox"/> No Channel <input type="checkbox"/> Too Deep (Not Wadeable) <input type="checkbox"/> Too Deep (Temporary) <input type="checkbox"/> Permanent Barrier <input type="checkbox"/> Fenced <input type="checkbox"/> Landowner Denial: <input type="checkbox"/> Temporary Barrier <input type="checkbox"/> Posted Plan to revisit? <input type="checkbox"/> Yes <input type="checkbox"/> No
Flow Conditions: <input type="checkbox"/> Dry <input type="checkbox"/> Isolated Pools <input type="checkbox"/> Stagnant <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Bankful <input type="checkbox"/> Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	<input checked="" type="checkbox"/>	<u>Mod.</u>	Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used: YSI Pro Plus

pH (su)	<u>8.51</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>555</u>	Turbidity (NTU)	
Temperature (C°)	<u>16</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>10.3</u>	Flow (cfs)	<u>0.29</u>

Meter Problems? No

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 63°

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input checked="" type="checkbox"/> Small (1.5-3yd) <input type="checkbox"/> Med. (3-10yd) <input type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd)
Maximum Stream Depth: <input checked="" type="checkbox"/> Shallow (<0.3yd) <input type="checkbox"/> Medium (0.3-0.6yd) <input type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd)
% Canopy Cover Estimated for Reach: <u>80</u> %
% Canopy Cover Measured (mid-reach): ___ u/s + ___ d/s + ___ LDB + ___ RDB = Total/384*100 ___

Channel Characteristics:

Bank Height: <u>12-15'</u> (yd.) High Water Mark: <u>3-4'</u> (yd.)
Bank Slope LDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Bank Slope RDB: <input type="checkbox"/> Deeply incised <input checked="" type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Manmade Modification: <input type="checkbox"/> None <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input checked="" type="checkbox"/> Diatoms <input type="checkbox"/> Green <input checked="" type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: 4-2-2020 Assessors: CH/KS

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input checked="" type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock |
| <input checked="" type="checkbox"/> Sand | <input checked="" type="checkbox"/> Sand | <input checked="" type="checkbox"/> Sand |
| <input checked="" type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|-------------------------------------|--------------------------------------|--|---------------------------------------|
| <input checked="" type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input checked="" type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input type="checkbox"/> ATV/OHV |
| <input type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input type="checkbox"/> Residential | <input type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

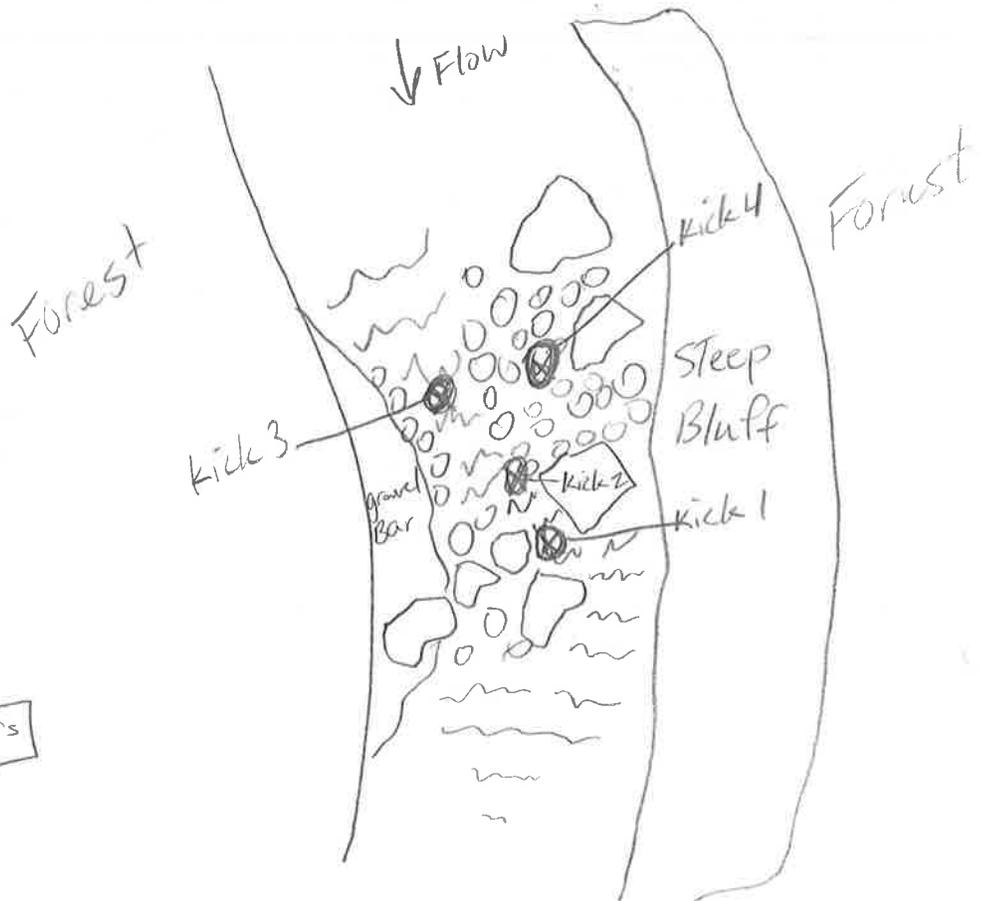
Riparian Loss	Logging	Industry	ATV/OHV
Channelization	Urban	Mining/ Dredging	Golf Course
Active Grazing	Commercial	Road/Hwy/RR	Garbage/Trash
Row Crops	Residential	Construction	Landfill
CAFO/Dairy	STP/WWTP	Impoundment	Water Withdrawal

Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.

Dist	Depth	Flow
1.8	0.1	0.08
3	0.15	0.07
4.5	0.05	0
6	0.05	0.05
7	0.10	0.44
8.2	0.10	0.30
9	0.05	0
11	0.15	0.15
12	0.30	0.26
13	0.30	0.20
13.7	0.35	0.12
14.2	0	0

= 0.29 cfs



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersonville Benthic M54</i>																				
STA:					HABITAT ASSESSED BY: <i>CHertwig</i>															
STREAM NAME: <i>UT to Cumberland River</i>					DATE: <i>4-2-2020</i>						TIME: <i>2:30pm</i>									
MAP LABEL: <i>CUMBERLAND RIVER</i>					ECOREGION:															
HUC:					QC: Consensus / Duplicate															
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL:				DATE: 4-2-2020							ASSESSOR INITIALS: CH/KS													
6. Channel Alteration	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR								
	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.					Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.					Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.					Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1				
Comments:																								
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR								
	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.					Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.					Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.					Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.								
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1				
Comments:																								
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR								
	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.					Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.					Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.								
SCORE (LDB)	LEFT	10	9	8	7	6	5	4	3	2	1	0	LEFT	10	9	8	7	6	5	4	3	2	1	0
SCORE (RDB)	RIGHT	10	9	8	7	6	5	4	3	2	1	0	RIGHT	10	9	8	7	6	5	4	3	2	1	0
Comments:																								
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR								
	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.					70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).					50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).					Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).								
SCORE (LDB)	LEFT	10	9	8	7	6	5	4	3	2	1	0	LEFT	10	9	8	7	6	5	4	3	2	1	0
SCORE (RDB)	RIGHT	10	9	8	7	6	5	4	3	2	1	0	RIGHT	10	9	8	7	6	5	4	3	2	1	0
Comments:																								
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR								
	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.					Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.					Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.					Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.								
SCORE (LDB)	LEFT	10	9	8	7	6	5	4	3	2	1	0	LEFT	10	9	8	7	6	5	4	3	2	1	0
SCORE (RDB)	RIGHT	10	9	8	7	6	5	4	3	2	1	0	RIGHT	10	9	8	7	6	5	4	3	2	1	0
Comments:																								
TOTAL SCORE X 149				Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW																				
If score is below guidelines, result of (circle)				Natural Conditions										Human Disturbance										
Comments:																								

STREAM SURVEY INFORMATION

DWR Station ID: <u>CPOFN000.4 SR</u>	Samplers: <u>C. Herdaway / B. Straka</u>	
Monitoring Location Name: <u>Center Point Branch</u>	Date: <u>4-2-2020</u>	Time: <u>3:45</u>
Monitoring Location: <u>D/S Caldwell Rd.</u>	Organization: <u>CEC</u>	Drainage Area: <u>2.46</u>
County: <u>Sumner</u>	Ecoregion: <u>71b</u>	u/s ECO:
Latitude: <u>36.313428</u>	HUC: <u>051302020301</u>	WS Grp:
Longitude: <u>-86.665786</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other: MS4

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: <input checked="" type="checkbox"/> Collected <input type="checkbox"/> Seasonally Dry <input type="checkbox"/> Frequently Dry <input type="checkbox"/> No Channel <input type="checkbox"/> Too Deep (Not Wadeable) <input type="checkbox"/> Too Deep (Temporary) <input type="checkbox"/> Permanent Barrier <input type="checkbox"/> Fenced <input type="checkbox"/> Landowner Denial: <input type="checkbox"/> Temporary Barrier <input type="checkbox"/> Posted Plan to revisit? <input type="checkbox"/> Yes <input type="checkbox"/> No
Flow Conditions: <input type="checkbox"/> Dry <input type="checkbox"/> Isolated Pools <input type="checkbox"/> Stagnant <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Bankful <input type="checkbox"/> Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	<input checked="" type="checkbox"/>		Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used:

pH (su)	<u>8.60</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>481.9</u>	Turbidity (NTU)	
Temperature (C°)	<u>17.2</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>10.04</u>	Flow (cfs)	<u>5.01</u>

Meter Problems? No

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 64°

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input type="checkbox"/> Small (1.5-3yd) <input checked="" type="checkbox"/> Med. (3-10yd) <input type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd)
Maximum Stream Depth: <input type="checkbox"/> Shallow (<0.3yd) <input checked="" type="checkbox"/> Medium (0.3-0.6yd) <input type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd)
% Canopy Cover Estimated for Reach: <u>40</u> %
% Canopy Cover Measured (mid-reach): _____ u/s + _____ d/s + _____ LDB + _____ RDB = Total/384*100 _____

Channel Characteristics:

Bank Height: <u>2-6'</u> (yd.) High Water Mark: <u>6'</u> (yd.)
Bank Slope LDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Bank Slope RDB: <input checked="" type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Manmade Modification: <input checked="" type="checkbox"/> None <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input type="checkbox"/> Slight <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input checked="" type="checkbox"/> Diatoms <input type="checkbox"/> Green <input checked="" type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: 4-2-2020 Assessors: CH/KS

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input checked="" type="checkbox"/> Boulders (>10") | <input checked="" type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock |
| <input checked="" type="checkbox"/> Sand | <input type="checkbox"/> Sand | <input checked="" type="checkbox"/> Sand |
| <input checked="" type="checkbox"/> Silt (not gritty) | <input type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|-------------------------------------|--------------------------------------|---|---|
| <input type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input checked="" type="checkbox"/> ATV/OHV |
| <input checked="" type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input type="checkbox"/> Residential | <input checked="" type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

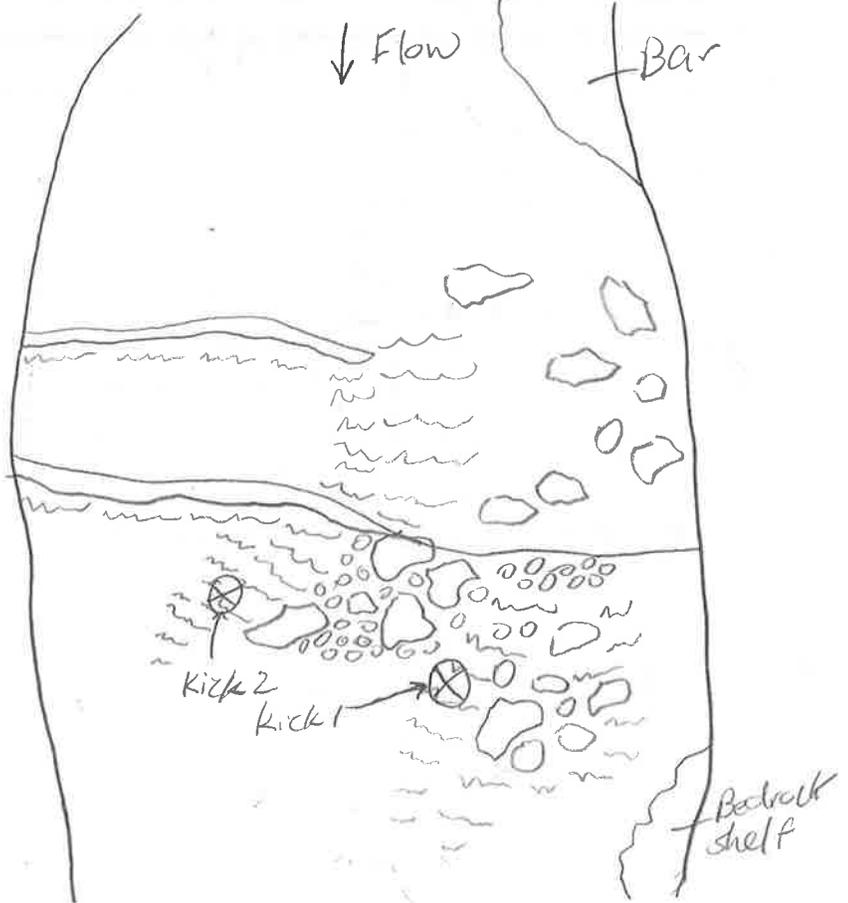
Riparian Loss	M	Logging		Industry		ATV/OHV	M
Channelization		Urban		Mining/ Dredging		Golf Course	
Active Grazing		Commercial		Road/Hwy/RR	S	Garbage/Trash	
Row Crops		Residential		Construction		Landfill	
CAFO/Dairy		STP/WWTP		Impoundment		Water Withdrawal	

Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.

Dist	Depth	Flow
NE 0.4	0.2	0.46
2'	0.3	0.9
4'	0.2	0
6'	0.25	0.02
8'	0.2	0.09
10'	0.3	0.23
12'	0.45	0.44
14'	0.40	0.92
16'	0.45	1.35
18'	0.50	1.45
20'	0.30	0.91
22'	0.10	0
22.8	0.25	0
WE		

= 5.01 cfs



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersonville Benthic MS4</i>		HABITAT ASSESSED BY: <i>C. Herwig</i>																		
STA:		DATE: <i>4-2-2010</i>										TIME: <i>3:45pm</i>								
STREAM NAME: <i>Center Point Branch</i>		ECOREGION:																		
MAP LABEL: <i>CROEN000, YSR</i>		HUC:																		
HUC:		QC: Consensus / Duplicate																		
	OPTIMAL						SUBOPTIMAL						MARGINAL						POOR	
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL						SUBOPTIMAL						MARGINAL						POOR	
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL						SUBOPTIMAL						MARGINAL						POOR	
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL						SUBOPTIMAL						MARGINAL						POOR	
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL						SUBOPTIMAL						MARGINAL						POOR	
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL:		DATE: 4-2-2020					ASSESSOR INITIALS: CH/RS									
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR												
6. Channel Alteration	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.	Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.												
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1												
Comments:																
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR												
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.												
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1												
Comments:																
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR												
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.	Moderately unstable: 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.												
SCORE (LDB)	LEFT 10 9	8 7 6	5 4 3	2 1 0												
SCORE (RDB)	RIGHT 10 9	8 7 6	5 4 3	2 1 0												
Comments:																
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR												
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).	Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).												
SCORE (LDB)	LEFT 10 9	8 7 6	5 4 3	2 1 0												
SCORE (RDB)	RIGHT 10 9	8 7 6	5 4 3	2 1 0												
Comments:																
	OPTIMAL	SUBOPTIMAL	MARGINAL	POOR												
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.												
SCORE (LDB)	LEFT 10 9	8 7 6	5 4 3	2 1 0												
SCORE (RDB)	RIGHT 10 9	8 7 6	5 4 3	2 1 0												
Comments:																
TOTAL SCORE	X 107				Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW											
If score is below guidelines, result of (circle)					Natural Conditions					Human Disturbance						
Comments:																

STREAM SURVEY INFORMATION

DWR Station ID: <u>NA</u>	Samplers: <u>C. Hertwig / K. Straka</u>	
Monitoring Location Name: <u>Madison Creek</u>	Date: <u>4-3-2020</u>	Time: <u>12:00 pm</u>
Monitoring Location: <u>Trail Ridge Dr.</u>	Organization: <u>CFC</u>	Drainage Area: <u>1.31</u>
County: <u>Sumner</u>	Ecoregion: <u>71h</u>	u/s ECO:
Latitude: <u>36.338511</u>	HUC: <u>051302020301</u>	WS Grp:
Longitude: <u>-86.165893</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other: MSH

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: <input checked="" type="checkbox"/> Collected <input type="checkbox"/> Seasonally Dry <input type="checkbox"/> Frequently Dry <input type="checkbox"/> No Channel <input type="checkbox"/> Too Deep (Not Wadeable) <input type="checkbox"/> Too Deep (Temporary) <input type="checkbox"/> Permanent Barrier <input type="checkbox"/> Fenced <input type="checkbox"/> Landowner Denial: <input type="checkbox"/> Temporary Barrier <input type="checkbox"/> Posted Plan to revisit? <input type="checkbox"/> Yes <input type="checkbox"/> No
Flow Conditions: <input type="checkbox"/> Dry <input type="checkbox"/> Isolated Pools <input type="checkbox"/> Stagnant <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Bankful <input type="checkbox"/> Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	<input checked="" type="checkbox"/>		Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used: YSI Pro Plus

pH (su)	<u>8.54</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>34.7</u>	Turbidity (NTU)	
Temperature (C°)	<u>14.1</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>11.04</u>	Flow (cfs)	<u>2.53</u>

Meter Problems? No

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 64°

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input type="checkbox"/> Low <input checked="" type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input type="checkbox"/> Small (1.5-3yd) <input checked="" type="checkbox"/> Med. (3-10yd) <input type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd)
Maximum Stream Depth: <input checked="" type="checkbox"/> Shallow (<0.3yd) <input type="checkbox"/> Medium (0.3-0.6yd) <input type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd)
% Canopy Cover Estimated for Reach: <u>70</u> %
% Canopy Cover Measured (mid-reach): _____ u/s + _____ d/s + _____ LDB + _____ RDB = Total/384*100 _____

Channel Characteristics:

Bank Height: <u>2-3'</u> (yd.) High Water Mark: <u>3-5'</u> (yd.)
Bank Slope LDB: <input checked="" type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Bank Slope RDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input checked="" type="checkbox"/> Gentle Slope
Manmade Modification: <input checked="" type="checkbox"/> None <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input checked="" type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input checked="" type="checkbox"/> Clear <input type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input checked="" type="checkbox"/> Diatoms <input type="checkbox"/> Green <input checked="" type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: Madison Creek Date: 4-3-2020 Assessors: CH/KS

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock | <input checked="" type="checkbox"/> Bedrock |
| <input type="checkbox"/> Sand | <input type="checkbox"/> Sand | <input checked="" type="checkbox"/> Sand |
| <input type="checkbox"/> Silt (not gritty) | <input type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|-------------------------------------|---|--|---------------------------------------|
| <input checked="" type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input type="checkbox"/> ATV/OHV |
| <input type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input checked="" type="checkbox"/> Residential | <input type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

	Blank	S	M	H
Riparian Loss			M	
Channelization				
Active Grazing				
Row Crops			M	
CAFO/Dairy				
Logging				
Urban				
Commercial				
Construction				
Impoundment				
Industry				
Mining/Dredging				
Road/Hwy/RR				
ATV/OHV				
Golf Course				
Garbage/Trash				
Landfill				
Water Withdrawal				

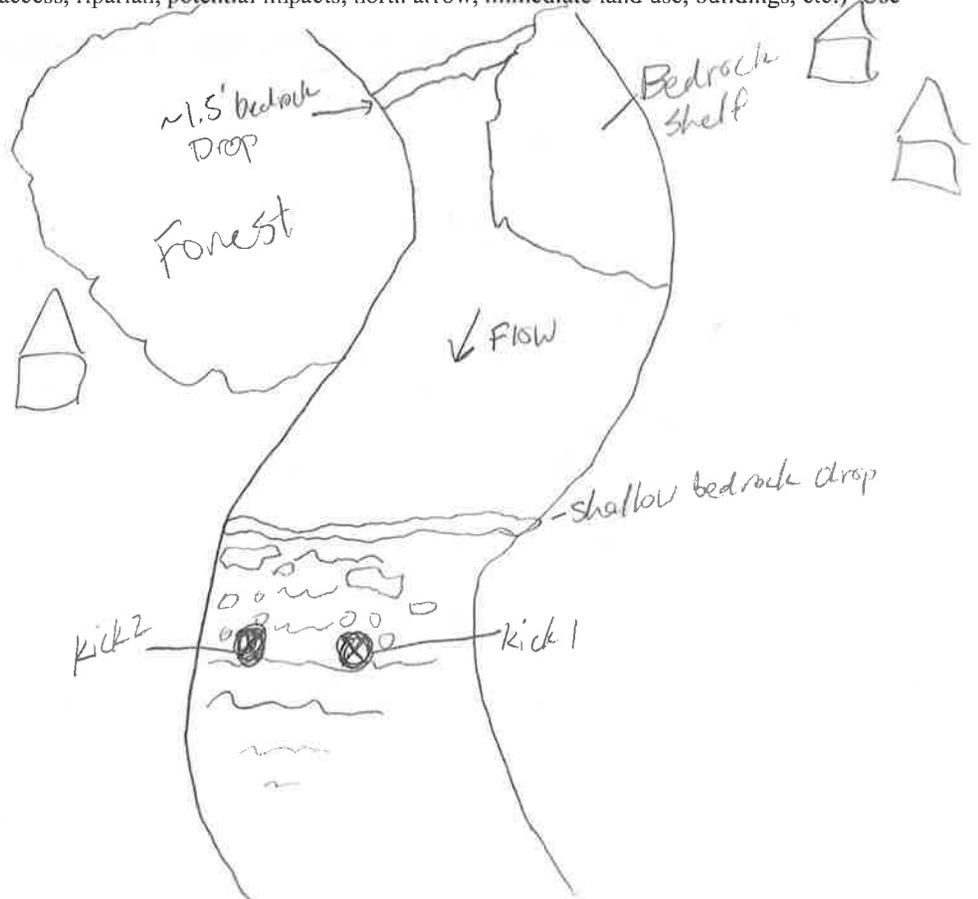
Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.

Dist	Depth	Flow
0.4	0.1	0
2.0	0.15	0.80
3	0.05	0.74
4'	0.30	0.24
6'	0.55	0.89
8'	0.40	0.75
10'	0.30	0.83
12'	0.55	0.16
14'	0.45	0.14
15'	0.15	0.00
15.8	0	0

WE

Σ = 2.53 cfs



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersville Benthic MSF</i>																			
STA:		HABITAT ASSESSED BY: <i>C. Hertwig</i>																	
STREAM NAME: <i>Madison Cr. @ Trail Ridge Dr.</i>		DATE: <i>11-3-2020</i>									TIME: <i>12:00 pm</i>								
MAP LABEL: <i>Madison Cr.</i>		ECOREGION:																	
HUC:		QC: Consensus / Duplicate																	
	OPTIMAL	SUBOPTIMAL					MARGINAL					POOR							
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1															
Comments:																			
	OPTIMAL	SUBOPTIMAL					MARGINAL					POOR							
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.	Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1															
Comments:																			
	OPTIMAL	SUBOPTIMAL					MARGINAL					POOR							
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).	Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1															
Comments:																			
	OPTIMAL	SUBOPTIMAL					MARGINAL					POOR							
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.	Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1															
Comments:																			
	OPTIMAL	SUBOPTIMAL					MARGINAL					POOR							
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.	Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.							
SCORE	20 19 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1															
Comments:																			

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL:				DATE: 4-3-2020							ASSESSOR INITIALS: CH/KS									
6. Channel Alteration	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.					Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.					Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.					Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.					Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.					Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.					Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.					Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods, If approaching 60% score poor if banks steep.					Unstable; many eroded area: raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.				
SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0		
Comments:																				
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.					70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).					50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).					Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).				
SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0		
Comments:																				
10. Riparian Vegetative Zone Width (score each bank.) Zone begins at top of bank.	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.					Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.					Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.					Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.				
SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0		
Comments:																				
TOTAL SCORE 2x 109				Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW																
If score is below guidelines, result of (circle)										Natural Conditions					Human Disturbance					
Comments:																				

STREAM SURVEY INFORMATION

DWR Station ID: <u>NA</u>	Samplers: <u>JMS & KMS</u>	
Monitoring Location Name: <u>Marrakesh Creek</u>	Date: <u>May 15, 2020</u>	Time: <u>11:30</u>
Monitoring Location: <u>@ Pope John Paul II</u>	Organization: <u>DES</u>	Drainage Area: <u>43.19</u>
County: <u>Sumner</u>	Ecoregion: <u>71h</u>	u/s ECO:
Latitude: <u>36.315540</u>	HUC: <u>051302020301</u>	WS Grp:
Longitude: <u>-86.674595</u>	WBID:	Field Log #:

Project Name: Watershed 303(d) Antideg ECO FECO Other:

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID

Sample Status: Collected Seasonally Dry Frequently Dry No Channel
 Too Deep (Not Wadeable) Too Deep (Temporary) Permanent Barrier Fenced
 Landowner Denial: Temporary Barrier Posted Plan to revisit? Yes No

Flow Conditions: Dry Isolated Pools Stagnant Low Moderate High Bankful Flooding

backwater from lake

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon			Periphyton		
SQKICK	<input checked="" type="checkbox"/>	<i>mod</i>	Other		
SQBANK			Describe Other Sample:		<i>Composite</i>

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____

Field Parameters: Meter(s) Used:

pH (su)	<u>7.68</u>	Dissolved Oxygen %	
Conductivity (umhos)	<u>405</u>	Turbidity (NTU)	
Temperature (C°)	<u>19.2</u>	TDS (mg/L)	
Dissolved Oxygen (ppm = mg/L)	<u>6.87</u>	Flow (cfs)	<u>20.5</u>

Meter Problems? _____

Photos Taken? No Yes: Description: _____

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 75°

Physical Characteristics & Light Penetration:

Gradient (sample reach): <input type="checkbox"/> Flat <input checked="" type="checkbox"/> Low <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Cascades
Average Stream Width: <input type="checkbox"/> Very Small (<1.5yd) <input type="checkbox"/> Small (1.5-3yd) <input type="checkbox"/> Med. (3-10yd) <input checked="" type="checkbox"/> Large (10-25yd) <input type="checkbox"/> Very Large (>25yd)
Maximum Stream Depth: <input type="checkbox"/> Shallow (<0.3yd) <input type="checkbox"/> Medium (0.3-0.6yd) <input checked="" type="checkbox"/> Deep (0.6 - 1yd) <input type="checkbox"/> Very Deep (>1yd)
% Canopy Cover Estimated for Reach: <u>20</u> %
% Canopy Cover Measured (mid-reach): _____ u/s + _____ d/s + _____ LDB + _____ RDB = Total/384*100 _____

Channel Characteristics:

Bank Height: _____ (yd.) High Water Mark: _____ (yd.)
Bank Slope LDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input checked="" type="checkbox"/> Undercut <input type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Bank Slope RDB: <input type="checkbox"/> Deeply incised <input type="checkbox"/> Bluff/Wall <input checked="" type="checkbox"/> Undercut <input checked="" type="checkbox"/> Sloughing <input type="checkbox"/> Steep terrain <input type="checkbox"/> Gentle Slope
Manmade Modification: <input type="checkbox"/> None <input type="checkbox"/> Rip-Rap <input type="checkbox"/> Cement <input type="checkbox"/> Gabions <input type="checkbox"/> Channelized <input type="checkbox"/> Dam <input type="checkbox"/> Dredging <input type="checkbox"/> Bridge <input type="checkbox"/> ATV

Stream Characteristics:

Sediment Deposits: <input type="checkbox"/> None <input type="checkbox"/> Slight <input type="checkbox"/> Moderate <input checked="" type="checkbox"/> Excessive <input type="checkbox"/> Blanket
Sediment Type: <input type="checkbox"/> None <input type="checkbox"/> Sand <input checked="" type="checkbox"/> Silt <input type="checkbox"/> Mud <input type="checkbox"/> Clay <input type="checkbox"/> Sludge <input type="checkbox"/> Mn Precipitant <input type="checkbox"/> Orange Flocculent
Turbidity: <input type="checkbox"/> Clear <input checked="" type="checkbox"/> Slightly Turbid <input type="checkbox"/> Muddy <input type="checkbox"/> Milky <input type="checkbox"/> Tannic <input type="checkbox"/> Planktonic Algae <input type="checkbox"/> Dyed
Foam/Surface Sheen: <input checked="" type="checkbox"/> None <input type="checkbox"/> Nutrient <input type="checkbox"/> Surfactant <input type="checkbox"/> Bacteria
Algae: <input type="checkbox"/> None <input checked="" type="checkbox"/> Slight <input type="checkbox"/> Moderate <input type="checkbox"/> High <input type="checkbox"/> Choking Type: <input checked="" type="checkbox"/> Diatoms <input type="checkbox"/> Green <input type="checkbox"/> Filamentous <input type="checkbox"/> Blue-green

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: 5/15/20 Assessors: DMS/KS

Dominate Substrate: (More than 25%) Check all that apply

- | Riffle | Run | Pool |
|---|---|---|
| <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") | <input type="checkbox"/> Boulders (>10") |
| <input checked="" type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") | <input type="checkbox"/> Cobble (2.5-10") |
| <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input checked="" type="checkbox"/> Gravel (0.1-2.5") | <input type="checkbox"/> Gravel (0.1-2.5") |
| <input type="checkbox"/> Bedrock | <input type="checkbox"/> Bedrock | <input type="checkbox"/> Bedrock |
| <input type="checkbox"/> Sand | <input type="checkbox"/> Sand | <input type="checkbox"/> Sand |
| <input checked="" type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) | <input checked="" type="checkbox"/> Silt (not gritty) |
| <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) | <input type="checkbox"/> Clay (Slick) |

Surrounding Land Uses (list additional land uses under comments)

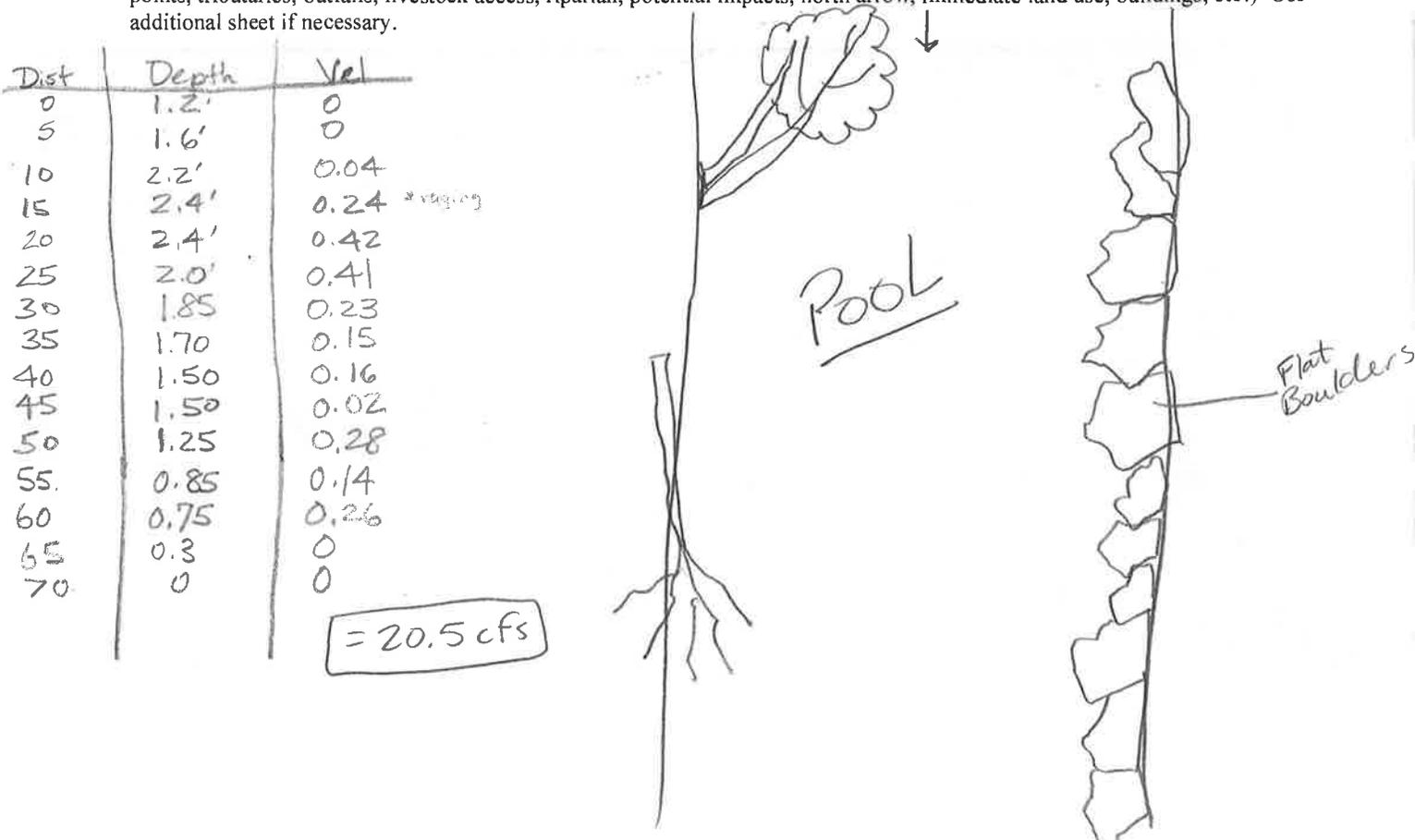
- | | | | | |
|--|-------------------------------------|--------------------------------------|--|---------------------------------------|
| <input checked="" type="checkbox"/> Forest | <input type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input type="checkbox"/> Row Crops | <input type="checkbox"/> Urban | <input type="checkbox"/> Industry | <input type="checkbox"/> Impoundment |
| <input type="checkbox"/> Park | <input type="checkbox"/> CAFO/Dairy | <input type="checkbox"/> Commercial | <input type="checkbox"/> Mining/Dredging | <input type="checkbox"/> ATV/OHV |
| <input type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input type="checkbox"/> Residential | <input type="checkbox"/> Road/Hwy/RR | <input type="checkbox"/> Golf Course |

Observed Human Disturbance to Stream: Blank (not observed) S (Slight) M (Moderate) H (High)

Riparian Loss	Logging	Industry	ATV/OHV
Channelization	Urban	Mining/ Dredging	Golf Course
Active Grazing	Commercial	Road/Hwy/RR	Garbage/Trash
Row Crops	Residential	Construction	Landfill
CAFO/Dairy	STP/WWTP	Impoundment	<input checked="" type="checkbox"/> Water Withdrawal

Other Stream Information and Stressors:

Stream Sketch: (include road name or landmark, flow direction, reach distance, distance from bridge or road, sampling points, tributaries, outfalls, livestock access, riparian, potential impacts, north arrow, immediate land use, buildings, etc.) Use additional sheet if necessary.



HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (FRONT)

(Refer to Protocol E for detailed descriptions and rank information)

PROJECT: <i>Hendersonville MS4</i>																				
STA:					HABITAT ASSESSED BY: <i>JMS</i>															
STREAM NAME: <i>Manster Cr.</i>					DATE: <i>5/15/20</i>					TIME: <i>11:45</i>										
MAP LABEL:					ECOREGION:															
HUC:					QC: Consensus / Duplicate															
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
1. Epifaunal Substrate / Available Cover	Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.					Natural stable habitat covers 40-70% of stream reach. Three or more productive habitats present. (If near 70% and more than 3 go to optimal.)					Natural stable habitat covers 20 -40% of stream reach or only 1-2 productive habitats present. (If near 40% and more than 2 go to suboptimal.)					Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
2. Embeddedness of Riffles	Gravel, cobble, and boulders 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. If near 25% drop to suboptimal if riffle not layered cobble.					Gravel, cobble and boulders 25-50% surrounded by fine sediment. Niches in bottom layers of cobble compromised. If near 50% & riffles not layered cobble drop to marginal.					Gravel, cobble, and boulders are 50-75% surrounded by fine sediment. Niche space in middle layers of cobble is starting to fill with fine sediment.					Gravel, cobble, and boulders are more than 75% surrounded by fine sediment. Niche space is reduced to a single layer or is absent.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
3. Velocity/ Depth Regime	All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow).					Only 3 of the 4 regimes present (if fast-shallow is missing score lower). If slow-deep missing score 15.					Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low).					Dominated by 1 velocity/depth regime. Others regimes too small or infrequent to support aquatic populations.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
4. Sediment Deposition	Sediment deposition affects less than 5% of stream bottom in quiet areas. New deposition on islands and point bars is absent or minimal.					Sediment deposition affects 5-30% of stream bottom. Slight deposition in pool or slow areas. Some new deposition on islands and point bars. Move to marginal if build-up approaches 30%.					Sediment deposition affects 30-50% of stream bottom. Sediment deposits at obstruction, constrictions and bends. Moderate pool deposition.					Heavy deposits of fine material, increased bar development; more than 50% of the bottom changing frequently; pools almost absent due to substantial sediment deposition.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				
	OPTIMAL					SUBOPTIMAL					MARGINAL					POOR				
5. Channel Flow Status	Water reaches base of both lower banks and streambed is covered by water throughout reach. Minimal productive habitat is exposed.					Water covers > 75% of streambed or 25% of productive habitat is exposed.					Water covers 25-75% of streambed and/or productive habitat is mostly exposed.					Very little water in channel and mostly present as standing pools. Little or no productive habitat due to lack of water.				
SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
Comments:																				

HABITAT ASSESSMENT FIELD DATA SHEET – MODERATE TO HIGH GRADIENT STREAM (BACK)

MAP LABEL:		DATE: 5/15/20					ASSESSOR INITIALS: JMS																	
6. Channel Alteration	OPTIMAL	Channelization, dredging rock removal or 4-wheel activity (past or present) absent or minimal; natural meander pattern. NO artificial structures in reach. Upstream or downstream structures do not affect reach.					SUBOPTIMAL	Channelization, dredging or 4-wheel activity up to 40%. Channel has stabilized. If larger reach, channelization is historic and stable. Artificial structures in or out of reach do not affect natural flow patterns.					MARGINAL	Channelization, dredging or 4-wheel activity 40-80% (or less that has not stabilized.) Artificial structures in or out of reach may have slight affect.					POOR	Over 80% of reach channelized, dredged or affected by 4-wheelers. In-stream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
Comments:																								
7. Frequency of re-oxygenation zones. Use frequency of riffles or bends for category. Rank by quality.	OPTIMAL	Occurrence of re-oxygenation zones relatively frequent; ratio of distance between areas divided by average stream width <7:1.					SUBOPTIMAL	Occurrence of re-oxygenation zones infrequent; distance between areas divided by average stream width is 7 - 15.					MARGINAL	Occasional re-oxygenation area. The distance between areas divided by average stream width is over 15 and up to 25.					POOR	Generally all flat water or flat bedrock; little opportunity for re-oxygenation. Distance between areas divided by average stream width >25.				
	SCORE	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1			
Comments:																								
8. Bank Stability (score each bank) Determine left or right side by facing downstream.	OPTIMAL	Banks stable; evidence of erosion or bank failure absent or minimal; little potential for future problems <5% of bank affected.					SUBOPTIMAL	Moderately stable; infrequent, small areas of erosion mostly healed over. 5-30% of bank in reach has areas of erosion. If approaching 30% score marginal if banks steep.					MARGINAL	Moderately unstable: 30-60 % of bank in reach has areas of erosion; high erosion potential during floods. If approaching 60% score poor if banks steep.					POOR	Unstable; many eroded area; raw areas frequent along straight sections and bends; obvious bank sloughing; 60-100% of bank has erosional scars.				
	SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0					
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0						
Comments:																								
9. Bank Vegetative Protection (score each bank) include vegetation from top of bank to base of bank. Determine left or right side by facing downstream.	OPTIMAL	More than 90% of the bank covered by undisturbed vegetation. All 4 classes (mature trees, understory trees, shrubs, groundcover) are represented and allowed to grow naturally. All plants are native.					SUBOPTIMAL	70-90% of the bank covered by undisturbed vegetation. One class may not be well represented. Disruption evident but not effecting full plant growth. Non-natives are rare (< 30%).					MARGINAL	50-70% of the bank covered by undisturbed vegetation. Two classes of vegetation may not be well represented. Non-native vegetation may be common (30-50%).					POOR	Less than 50% of the banks covered by undisturbed vegetation or more than 2 classes are not well represented or most vegetation has been cropped. Non-native vegetation may dominate (> 50%).				
	SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0					
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0						
Comments:																								
10. Riparian Vegetative Width (score each bank.) Zone begins at top of bank.	OPTIMAL	Average width of riparian zone > 18 meters. Unpaved footpaths may score 9 if run-off potential is negligible.					SUBOPTIMAL	Average width of riparian zone 12-18 meters. Score high if areas < 18 meters are small or are minimally disturbed.					MARGINAL	Average width of riparian zone 6-11 meters. Score high if areas less than 12 meters are small or are minimally disturbed.					POOR	Average width of riparian zone <6 meters. Score high if areas less than 6 meters are small or are minimally disturbed.				
	SCORE (LDB)	LEFT	10	9			8	7	6			5	4	3			2	1	0					
SCORE (RDB)	RIGHT	10	9			8	7	6			5	4	3			2	1	0						
Comments:																								
TOTAL SCORE 120		Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW																						
If score is below guidelines, result of (circle)										Natural Conditions					Human Disturbance									
Comments:																								

APPENDIX C
TAXA LIST

CEC , CITY OF HENDERSONVILLE, SUMNER CO., TN BENTHIC MACROINVERTEBRATES COLLECTED ON 4/2-3/2020 and 5/15/2020.

PAI ID NO				53787	53675	53676	53677	53678	53679
STATION				Mansker Creek	DRAK6.1T0.2SR	DRAKES.3T0.4SR	CUMBE215.7T0.3SR	CPOIN000.4SR	MADISON CRK
DATE				5/15/2020	4/2/2020	4/2/2020	4/2/2020	4/2/2020	4/3/2020
FRACTION				8/15	1/40	1/24	1/20	5/128	1/16
SPECIES	T.V.	F.F.G.	CL						
PLATYHELMINTHES						2			
MOLLUSCA									
Bivalvia									
Veneroida									
Sphaeriidae	6.9	FC							
<i>Pisidium sp.</i>	6.6	FC		1	6				
Gastropoda									
Mesogastropoda									
Pleuroceridae	6								
<i>Elimia sp.</i>	2.7	SC		2		6			2
ANNELIDA									
Clitellata									
Oligochaeta	8	CG							
Tubificida									
Naididae		CG							
Naidinae	8	CG							
<i>Nais sp.</i>	8.7	CG		5	1	6	2		
ARTHROPODA									
Arachnoidea									
Acariformes	5.5				4				
Crustacea									
Isopoda	7.4								
Asellidae	7.9	SH							
<i>Lirceus sp.</i>	7.4	CG		1	6	12	16	143	99
Amphipoda	7.2	CG							
Crangonyctidae	7.2								
<i>Crangonyx sp.</i>	7.2	CG							6
Decapoda	6								
Cambaridae	6								
<i>Cambarus sp.</i>	7.5	CG					1		
<i>Faxonius sp.</i>	2.7	SH							1
Insecta									
Ephemeroptera									
Baetidae	6	CG					1		

CEC , CITY OF HENDERSONVILLE, SUMNER CO., TN BENTHIC MACROINVERTEBRATES COLLECTED ON 4/2-3/2020 and 5/15/2020.

PAI ID NO				53787	53675	53676	53677	53678	53679
STATION				Mansker Creek	DRAK6.1T0.2SR	DRAKES.3T0.4SR	CUMBE215.7T0.3SR	CPOIN000.4SR	MADISON CRK
DATE				5/15/2020	4/2/2020	4/2/2020	4/2/2020	4/2/2020	4/3/2020
FRACTION				8/15	1/40	1/24	1/20	5/128	1/16
SPECIES	T.V.	F.F.G.	CL						
<i>Acentrella sp.</i>	2.5	CG			7	12	2		5
<i>Acerpenna sp.</i>	3.7	CG		1					
<i>Anafroptilum sp.</i>				11					
<i>Dipheter sp.</i>	1.2						22		8
Caenidae	6	CG							
<i>Caenis sp.</i>	6.8	CG		17	1			11	2
Heptageniidae	3	SC	CL						3
<i>Stenonema sp.</i>	6	SC	CL						1
<i>Stenacron sp.</i>	3.5	SC	CL						1
Leptophlebiidae	2.5	CG		1					
Odonata									
Coenagrionidae	8	P							
<i>Argia sp.</i>	8.3	P				3			
<i>Enallagma sp.</i>	8.5	P		2					
Plecoptera									
Capniidae	3	SH							
<i>Capniidae/Leuctridae</i>					1				
Perlodidae	2.2	P	CL						
<i>Isoperla sp.</i>	3.2	P	CL			1		1	14
Hemiptera									
Corixidae	8.7	PI		1					
Pleidae	6								
<i>Paraplea sp.</i>	6			1					
Megaloptera									
Sialidae	7	P							
<i>Sialis sp.</i>	7	P		1					
Trichoptera									
Hydropsychidae	4.1	FC	CL						
<i>Cheumatopsyche sp.</i>	6.6	FC	CL				5	1	
<i>Diplectrona sp.</i>	2.3	FC	CL				16		
<i>Hydropsyche sp.</i>	4.3	FC	CL			1	2		
Hydroptilidae	5.55	PI							
<i>Dibusa sp.</i>	0		CL		1				33
<i>Hydroptila sp.</i>	6.5	PI	CL			7	1		

CEC , CITY OF HENDERSONVILLE, SUMNER CO., TN BENTHIC MACROINVERTEBRATES COLLECTED ON 4/2-3/2020 and 5/15/2020.

PAI ID NO				53787	53675	53676	53677	53678	53679
STATION				Mansker Creek	DRAK6.1T0.2SR	DRAKES.3T0.4SR	CUMBE215.7T0.3SR	CPOIN000.4SR	MADISON CRK
DATE				5/15/2020	4/2/2020	4/2/2020	4/2/2020	4/2/2020	4/3/2020
FRACTION				8/15	1/40	1/24	1/20	5/128	1/16
SPECIES	T.V.	F.F.G.	CL						
Philopotamidae	2.2	FC	CL						
<i>Chimarra sp.</i>	3.3	FC	CL			4	16		
Polycentropodidae	3.68	FC	CL						1
Rhyacophilidae	1	P	CL						
<i>Rhyacophila sp.</i>	1	P	CL		3				
Coleoptera									
Dytiscidae	6.4	P					1		
Elmidae	4.41	CG	CL						
<i>Dubiraphia sp.</i>	5.5	SC	CL	7					
<i>Stenelmis sp.</i>	5.60	SC	CL	2	119	21	12	3	3
Haliplidae	8.4								
<i>Pelodytes sp.</i>	8.4	SH		2					
Psephenidae	3.3	SC	CL						
<i>Ectopria sp.</i>	4.3	SC	CL				3	1	
<i>Psephenus sp.</i>	2.3	SC	CL			2		5	3
Diptera									
Chironomidae									
<i>Ablabesmyia sp.</i>	7.1	P		7					
<i>Brillia sp.</i>	5.7	SH		1					
<i>Cardiocladius sp.</i>	6.2	P			2	5			
<i>Chironomus sp.</i>	9.3	CG		30					
<i>Cladotanytarsus sp.</i>	4	FC		4					
<i>Conchapelopia sp.</i>	8.4	P		2	6	5	7	1	5
<i>Cricotopus sp.</i>	7.44	CG	CL	1	14	57	57	13	31
<i>Eukiefferiella sp.</i>	3.45	CG			2	9	1		
<i>Microtendipes sp.</i>	4.6	CG	CL	3					
<i>Nanocladius sp.</i>	7.4	CG				1			
<i>Parametrioctenus sp.</i>	3.9	CG		26	3	4	33	2	
<i>Paratanytarsus sp.</i>	8	CG		7					
<i>Paratendipes sp.</i>	5.6			1					
<i>Phaenopsectra sp.</i>	6.85	SC	CL	1					
<i>Polypedilum sp.</i>	6.1	SH		10	4	8	1		5
<i>Pseudochironomus sp.</i>	4.9	CG		3					
<i>Rheotanytarsus sp.</i>	6.5	FC	CL	1		11	1		

CEC , CITY OF HENDERSONVILLE, SUMNER CO., TN BENTHIC MACROINVERTEBRATES COLLECTED ON 4/2-3/2020 and 5/15/2020.

PAI ID NO				53787	53675	53676	53677	53678	53679
STATION				Mansker Creek	DRAK6.1T0.2SR	DRAKES.3T0.4SR	CUMBE215.7T0.3SR	CPOIN000.4SR	MADISON CRK
DATE				5/15/2020	4/2/2020	4/2/2020	4/2/2020	4/2/2020	4/3/2020
FRACTION				8/15	1/40	1/24	1/20	5/128	1/16
SPECIES	T.V.	F.F.G.	CL						
<i>Stempellinella sp.</i>	5.6	CG		1					
<i>Stenochironomus sp.</i>	6.3	SH					3		
<i>Tanytarsus sp.</i>	6.6	FC		33		2			
<i>Thienemanniella sp.</i>	6.4	CG		1	1				
<i>Tribelos sp.</i>	6.4	CG		9					
<i>Tvetenia sp.</i>	3.55	CG				1			1
Empididae	7.6	P					1		
<i>Hemerodromia sp.</i>	6	P					1		
<i>Trichoclinocera sp.</i>	8						3		
Simuliidae	4.7	FC	CL						
<i>Prosimulium sp.</i>	4.5	FC	CL		2				
<i>Simulium sp.</i>	4.9	FC	CL		18	2	8		1
Tipulidae	5.3	SH							
<i>Limonia sp.</i>	9.3	SH					1		
<i>Tipula sp.</i>	7.5	SH						2	
TOTAL NO. OF ORGANISMS				196	201	182	217	183	225
TOTAL NO. OF TAXA				33	19	23	26	11	20
aTOTAL NO. OF TAXA				33	19	23	25	11	19
EPT				4	5	5	8	3	9
^aEPT				4	5	5	7	3	8
%OC				74.49%	16.42%	59.89%	48.39%	8.74%	18.67%
%EPT-CHEUM				15.31%	6.47%	13.74%	27.65%	6.56%	30.22%
NCBI				6.58	5.61	6.10	5.24	7.12	5.43
%TNUTOL				19.39%	72.14%	60.44%	42.86%	93.44%	63.11%
% CLINGERS-CHEUM				7.65%	78.11%	58.24%	53.46%	12.57%	40.44%



March 10, 2020

Mr. Duane Allen
Design Engineer
City of Hendersonville
101 Maple Drive North
Hendersonville, TN 37075

Dear Mr. Allen:

Subject: 2019 Visual Stream Assessment (VSA)
MS4 Permit – Non-Analytical Stream Monitoring
City of Hendersonville, Sumner County, Tennessee
CEC Project 192-267.03.2

Civil & Environmental Consultants, Inc. (CEC) performed a Visual Stream Assessment (VSA) on Center Point Branch (TN05130202220_0500), Madison Creek (TN05130202220_0400), Mankers Creek (TN05130202220_1000), Unnamed Tributary to Cheatham Reservoir (TN05130202001T_0600), Unnamed Tributary to Drakes Creek (TN05130201047_0100) and Unnamed Tributary to Drakes Creek (TN05130201047_0200) for the City of Hendersonville according to our proposal dated May 9, 2019. The VSA was conducted between October 10, 2019 and October 29, 2019 using the Maryland Department of Natural Resources’ Stream Corridor Assessment Survey (2001).

All visual survey locations have been logged into a geodatabase. Each location includes completed data fields, GPS location, and a photo. The geodatabase is included on the USB flash drive provided. The total mileage assessed for each stream is included in the following table.

Permit Year 4 Streams for Assessment	Miles
Center Point Branch (TN05130202220_0500)	3.26
Madison Creek (TN05130202220_0400)	0.34
Mankers Creek (TN05130202220_1000)	1.12
Unnamed Trib. to Cheatham Reservoir (TN05130202001T_0600)	1.13
Unnamed Trib. to Drakes Creek (TN05130201047_0100)	2.19
Unnamed Trib. to Drakes Creek (TN05130201047_0200)	2.28
Total	10.32

There were a few locations of concern that CEC wanted to bring to the City’s attention. These locations are described as follows:

1) Channel Alteration near W. Main St.

A 24” plastic pipe and cinder blocks have been placed in the stream channel of the Unnamed Tributary to Cheatham Reservoir. Approximately 15 linear feet (LF) of the stream channel has been altered. The alteration is located between two businesses approximately 350 LF southwest of W. Main St. CEC recommends the City inspect this location, as there is high potential for further channel loss or damage during storm events. This point is listed as a “Channel Alteration” (Object ID 2) in the geodatabase provided. Refer to Figure 1.



*Photo 1 - Aerial View of Channel Alteration
(Red Square Indicates Alteration Location)*



Photo 2 - View of Channel Alteration

2) Channel Alteration near Center Point Rd.

CEC personnel noted a channel alteration in Center Point Branch near Center Point Rd. The alteration consists of four 30” corrugated metal pipes with a concrete slab above the pipes. The alteration is located approximately 60 LF east of Center Point Rd. The pipes appeared to be in poor condition and were partially blocked with debris on the upstream side. CEC recommends the City inspect this location to determine if maintenance should be performed. This point is listed as a “Channel Alteration” point (Object ID 5) in the geodatabase provided. Refer to Figure 2.



*Photo 3 - Aerial View of Channel Alteration
(Red Square Indicates Alteration Location)*



Photo 4 - View of Channel Alteration and Debris

3) Near Stream Construction near Center Point Rd.

CEC personnel noted an area that appeared to have been recently cleared/grubbed up to Center Point Branch. No Erosion prevention or sediment control measures were observed. No sedimentation was observed in the stream at the time of the assessment. The disturbance is located approximately 260 LF northwest of Center Point Rd. This point is labeled as a “Near/In Stream Construction” point (Object ID 3) in the geodatabase provided. Refer to Figure 2.



*Photo 5 - Aerial View of Clearing/Grubbing
(Red Diamond Indicates Near Stream Construction Location)*

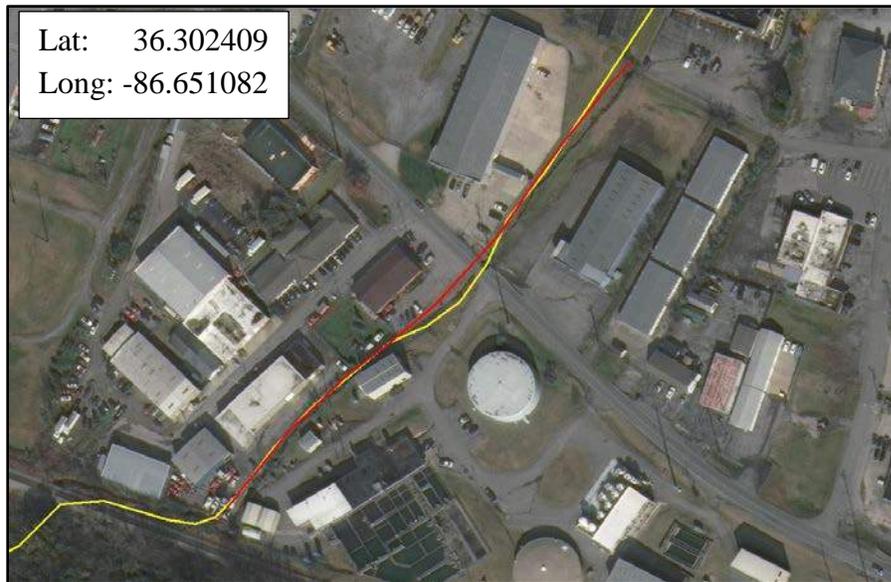


Photos 6 and 7 - View of Earth Disturbing Activity (Object ID 3)



4) Inadequate Buffer near Rockland Rd.

An inadequate buffer of approximately 900 LF was noted on both sides of the Unnamed Tributary to Cheatham Reservoir. The inadequate buffer is located between commercial properties to the northeast and southwest of Rockland Rd. Riparian buffers are an important component to stream health as they aid in streambank stabilization and the interception of non-point source pollutants. This point is an “Inadequate Buffer” point (Object ID 3) in the geodatabase provided. Refer to Figure 1.



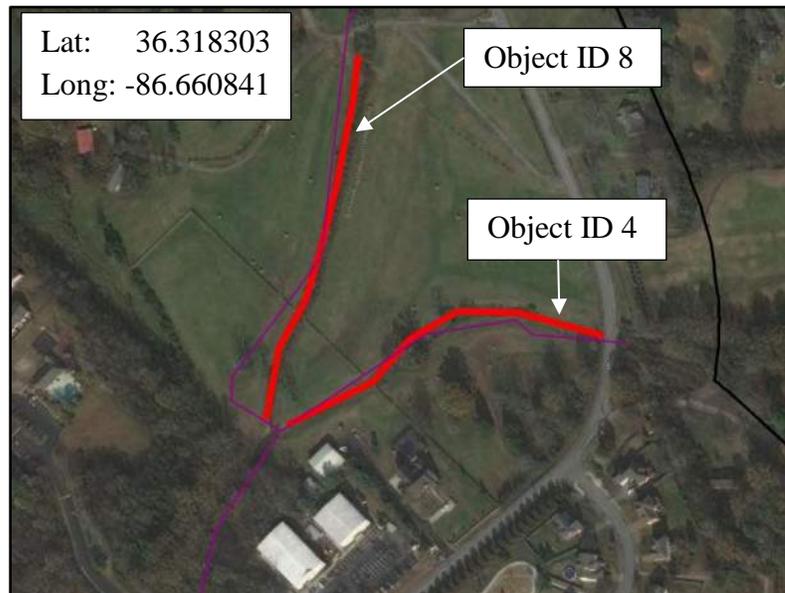
*Photo 8 - Aerial View of Inadequate Buffer
(Red Line Indicates Inadequate Buffer Location)*



Photo 9 - View of Inadequate Buffer

5) Inadequate Buffer near Center Point Rd.

Approximately 1,530 LF of inadequate buffer along both banks of Center Point Branch were noted. The inadequate buffers were located in a pasture west of Center Point Rd. These points are an “Inadequate Buffer” point (Object ID 4 and 8) in the geodatabase provided. Refer to Figure 2.



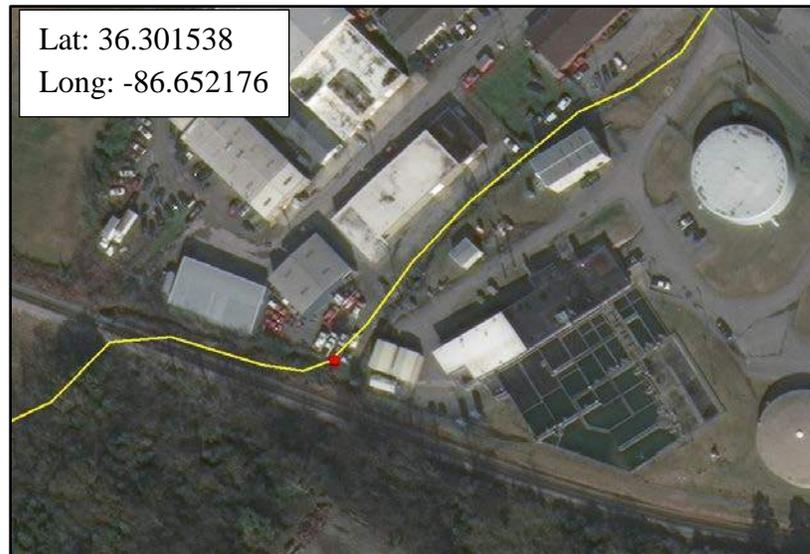
*Photo 10 - Aerial View of Inadequate Buffers
(Red Lines Indicate Inadequate Buffer Locations)*



Photo 11 - View of Inadequate Buffer

6) Trash Dumping near Rockland Rd.

Scrap vehicles were noted on the streambank and pieces of vehicles were observed in the stream of the Unnamed Tributary to Cheatham Reservoir. The scrap vehicles were parked less than 5 LF from the edge of the streambank. There was no apparent evidence of illicit discharge coming from the scrap vehicles at the time of the VSA. CEC recommends that the City inspect this site for potential issues. This point is a “Trash Dumping” point (Object ID 3) in the geodatabase provided. Refer to Figure 1.



*Photo 12 - Aerial View of Trash Dumping
(Red Pentagon Indicates Trash Location)*



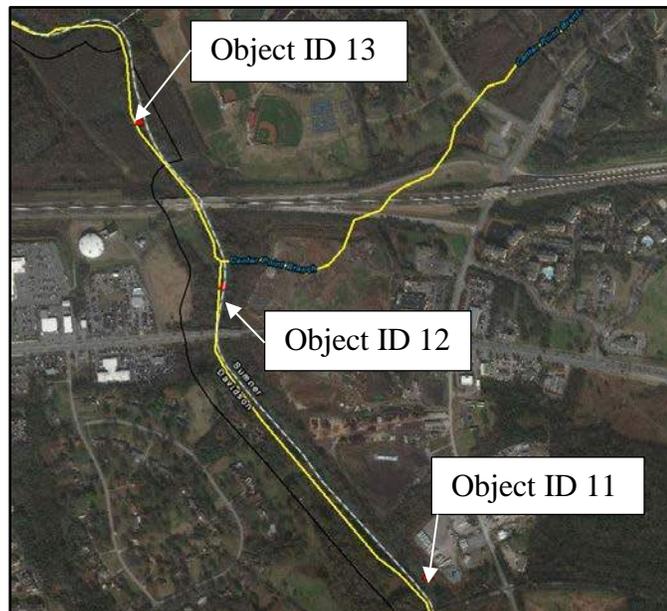
Photo 13 - View of Trash in the Stream



Photo 14 - View of Scrap Vehicles near the Stream

7) Erosion of Manskers Creek

CEC personnel noted severe streambank erosion along Manskers Creek. The bank erosion was observed on both sides of the stream for approximately 0.82 miles. The erosion begins near 36.316036, -86.674756 and ends near 36.304281, -86.666598. Sedimentation was observed throughout this section of the stream. These points are “Erosion Site” points (Object ID 11, 12 and 13) in the geodatabase provided. Refer to Figure 4.



*Photo 15 - Aerial View of Erosion Sites
(Red Triangles Indicate Erosion Locations)*



Photo 16 - View of Streambank Erosion



Photo 17 - View of Streambank Erosion

8) Erosion Site in Drakes Creek Park

Streambank erosion was noted in Drakes Creek Park along the Unnamed Tributary to Drakes Creek (0100). CEC recommends that the City inspect the erosion site for the consideration of streambank restoration or mitigation. This point is an “Erosion Site” point (Object ID 1) in the geodatabase provided. Refer to Figure 3.



*Photo 18 - Aerial View of the Erosion Site
(Red Triangle Indicates Erosion Location)*



Photo 19 - View of the Erosion Site in the Park



Photo 20 - View of the Erosion Site in the Park

9) Pipe Outfall near Sumner Meadows Ln.

CEC personnel noted a pipe outfall in the Unnamed Tributary to Drakes Creek (0100) that drains stormwater from Sumner Meadows Lane near the intersection of New Shackle Island Road. A nearby property owner approached the field crew with concerns about the volume of stormwater that exits the pipe during severe rain events. The CEC field crew observed some streambank erosion directly across from the pipe outfall. CEC recommends that the City inspect the site to determine if maintenance is needed. This point is a “Pipe Outfall” point (Object ID 5) in the geodatabase provided. Refer to Figure 3.



*Photo 21 - Aerial View of the Pipe Outfall
(Red Dot Indicates Outfall Location)*



Photo 22 - View of the Pipe Outfall



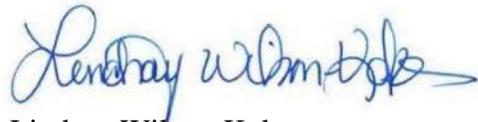
Photo 23 - View of the Streambank across from the Pipe Outfall

Mr. Allen – City of Hendersonville
CEC Project 192-267.03.2
Page 15
March 10, 2020

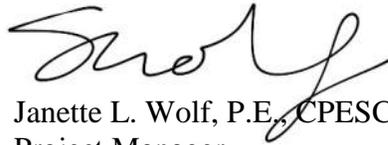
CEC appreciates this opportunity to perform this VSA and provide this summary report. Please contact Janette Wolf at 615-333-7797 or jwolf@cecinc.com if you should have any questions regarding this deliverable.

Sincerely,

CIVIL & ENVIRONMENTAL CONSULTANTS, INC.



Lindsay Wilson-Kokes
Assistant Project Manager

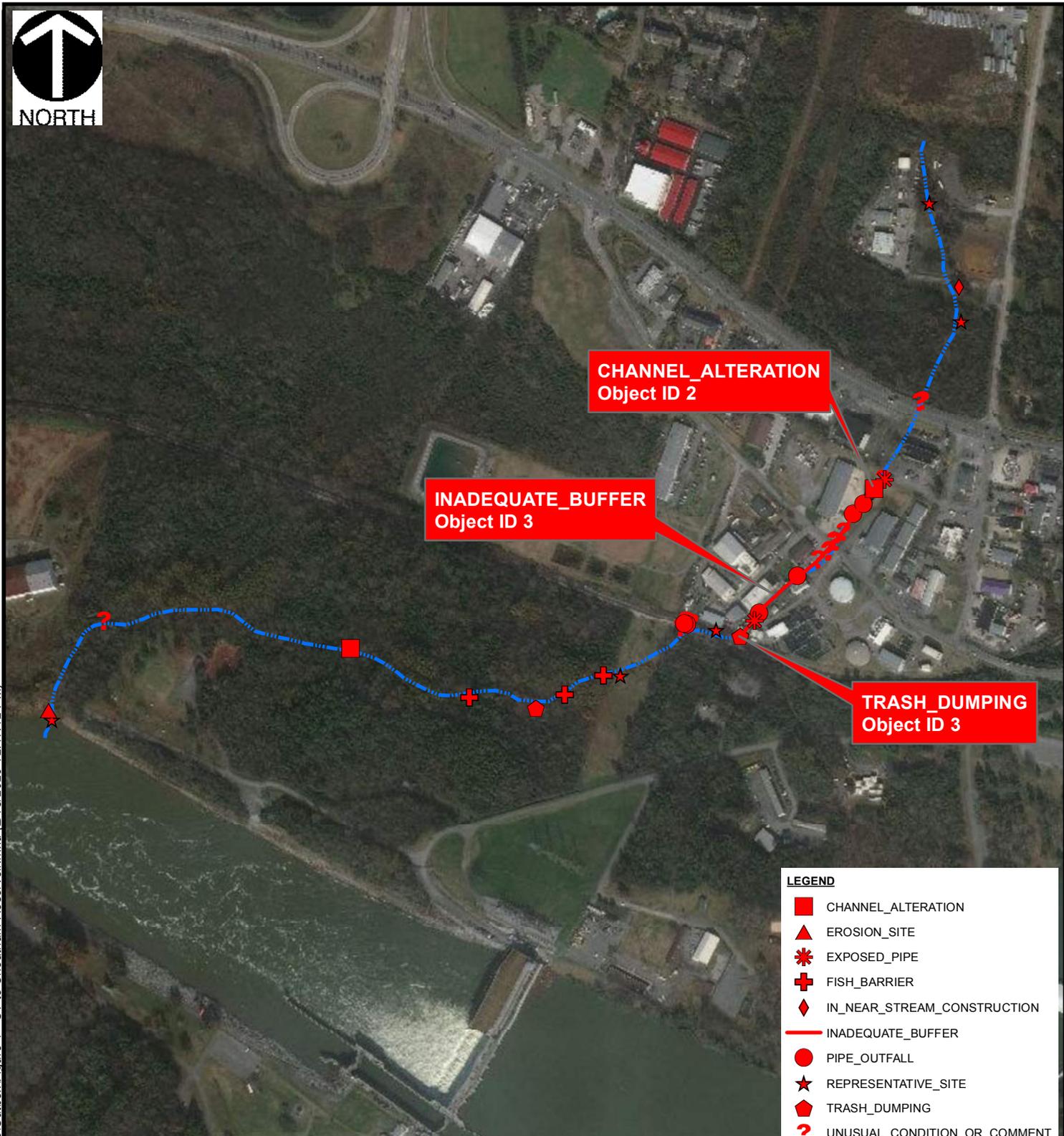


Janette L. Wolf, P.E., CPESC, CPSWQ
Project Manager

Enclosures: Appendix A: Figures
Figure 1 – Unnamed Trib. to Cheatham Reservoir
Figure 2 – Madison Creek and Center Point Branch
Figure 3 – Unnamed Tribs. to Drakes Creek (0100 and 0200)
Figure 4 – Manskers Creek
Appendix B: Maryland Department of Natural Resources' Stream Corridor
Assessment Survey Definitions
USB flash drive

APPENDIX A

FIGURES



LEGEND

- CHANNEL_ALTERATION
- ▲ EROSION_SITE
- ✱ EXPOSED_PIPE
- + FISH_BARRIER
- ◆ IN_NEAR_STREAM_CONSTRUCTION
- INADEQUATE_BUFFER
- PIPE_OUTFALL
- ★ REPRESENTATIVE_SITE
- ⬠ TRASH_DUMPING
- ? UNUSUAL_CONDITION_OR_COMMENT
- - - Impaired Stream

REFERENCE
 MICROSOFT VIRTUAL EARTH / BING IMAGERY
 PROVIDED BY ESRI, ACCESSED 2/13/2020

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

I:\SVR-NASH\projects\2019\192-267-GIS\Outbox\Figure 1 - UT to Cheatham Reservoir.mxd (2/13/2020 12:47:12 PM)



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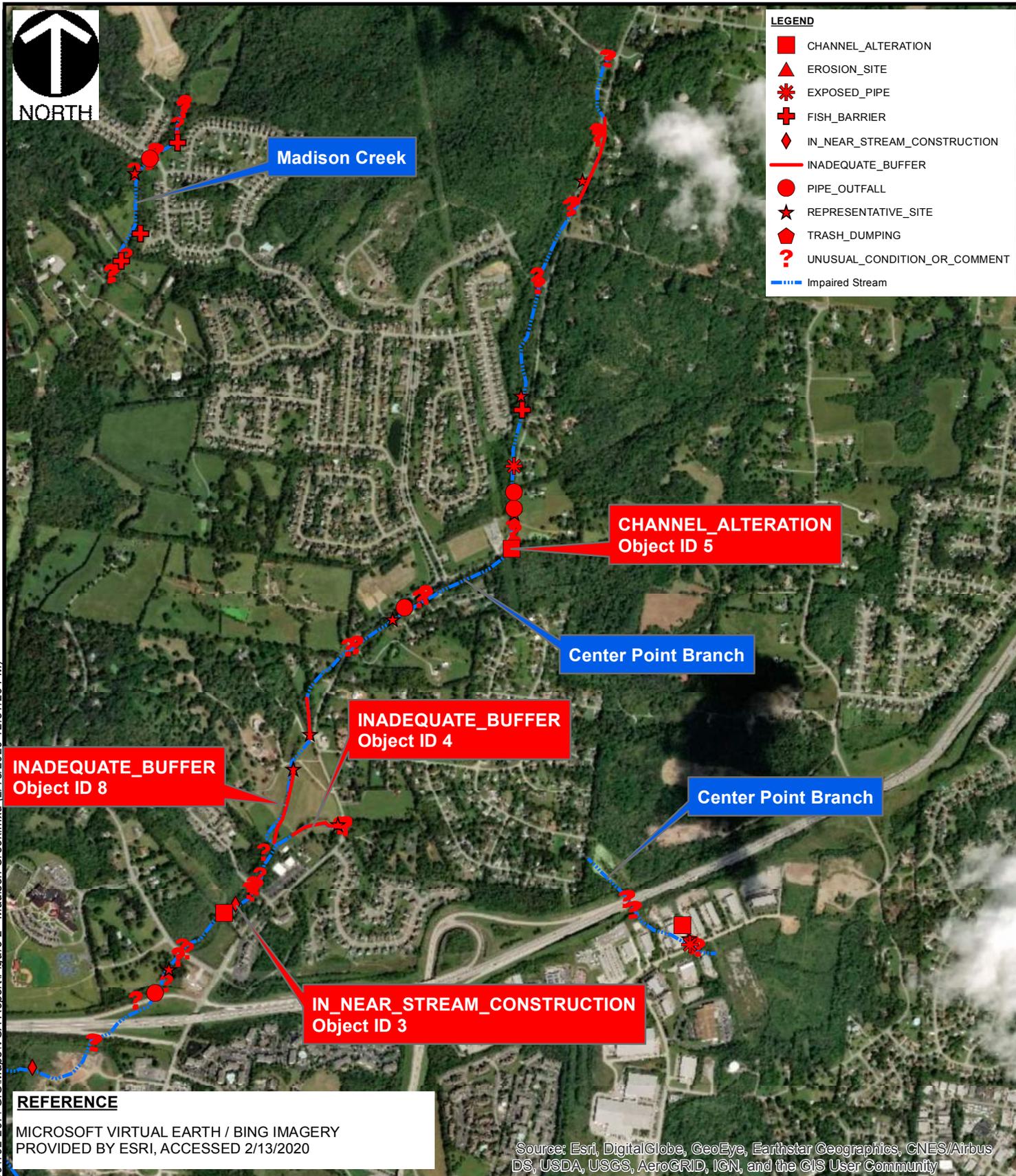
2019 VISUAL STREAM ASSESSMENT (VSA)
 MS4 PERMIT NON-ANALYTICAL STREAM MONITORING
 AREAS OF CONCERN
 CITY OF HENDERSONVILLE
 SUMNER COUNTY, TENNESSEE

UNNAMED TRIB. TO CHEATHAM RESERVOIR

DRAWN BY:	LWK	CHECKED BY:	JLW	APPROVED BY: <small>* Hand signature on file</small>	JLW	FIGURE NO:	1
DATE:	2/13/2020	SCALE:	1" = 583'	PROJECT NO:	192-267.03.2		



LEGEND	
■	CHANNEL_ALTERATION
▲	EROSION_SITE
✱	EXPOSED_PIPE
+	FISH_BARRIER
◆	IN_NEAR_STREAM_CONSTRUCTION
—	INADEQUATE_BUFFER
●	PIPE_OUTFALL
★	REPRESENTATIVE_SITE
⬠	TRASH_DUMPING
?	UNUSUAL_CONDITION_OR_COMMENT
—	Impaired Stream



I:\SVR-NASH\projects\2019\192-267-GIS\Maps\VSA Report\Figure 2 - Madison Creek.mxd (2/13/2020 12:51:26 PM)

REFERENCE
 MICROSOFT VIRTUAL EARTH / BING IMAGERY
 PROVIDED BY ESRI, ACCESSED 2/13/2020

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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2019 VISUAL STREAM ASSESSMENT (VSA)
 MS4 PERMIT NON-ANALYTICAL STREAM MONITORING
 AREAS OF CONCERN
 CITY OF HENDERSONVILLE
 SUMNER COUNTY, TENNESSEE

MADISON CREEK AND CENTER POINT BRANCH

DRAWN BY:	LWK	CHECKED BY:	JLW	APPROVED BY: <small>* Hand signature on file</small>	JLW	FIGURE NO:	2
DATE:	2/13/2020	SCALE:	1" = 1,417'	PROJECT NO:	192-267.03.2		



UT to Drakes Creek (0200)

UT to Drakes Creek (0100)

PIPE_OUTFALL
Object ID 5

EROSION_SITE
Object ID 1

LEGEND

- CHANNEL_ALTERATION
- ▲ EROSION_SITE
- ✱ EXPOSED_PIPE
- + FISH_BARRIER
- INADEQUATE_BUFFER
- PIPE_OUTFALL
- ★ REPRESENTATIVE_SITE
- ◆ TRASH_DUMPING
- ? UNUSUAL_CONDITION_OR_COMMENT
- ⋯ Impaired Stream

REFERENCE

MICROSOFT VIRTUAL EARTH / BING IMAGERY
PROVIDED BY ESRI, ACCESSED 2/13/2020

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



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117 Seaboard Lane, Ste. E100 Franklin, Tennessee

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2019 VISUAL STREAM ASSESSMENT (VSA)
MS4 PERMIT NON-ANALYTICAL STREAM MONITORING
AREAS OF CONCERN
CITY OF HENDERSONVILLE
SUMNER COUNTY, TENNESSEE

UNNAMED TRIBS. TO DRAKES CREEK (0100 AND 0200)

DRAWN BY:

LWK

CHECKED BY:

JLW

APPROVED BY: ^{* Hand signature}
on file

JLW

FIGURE NO:

3

DATE:

2/13/2020

SCALE:

1" = 1,125'

PROJECT NO:

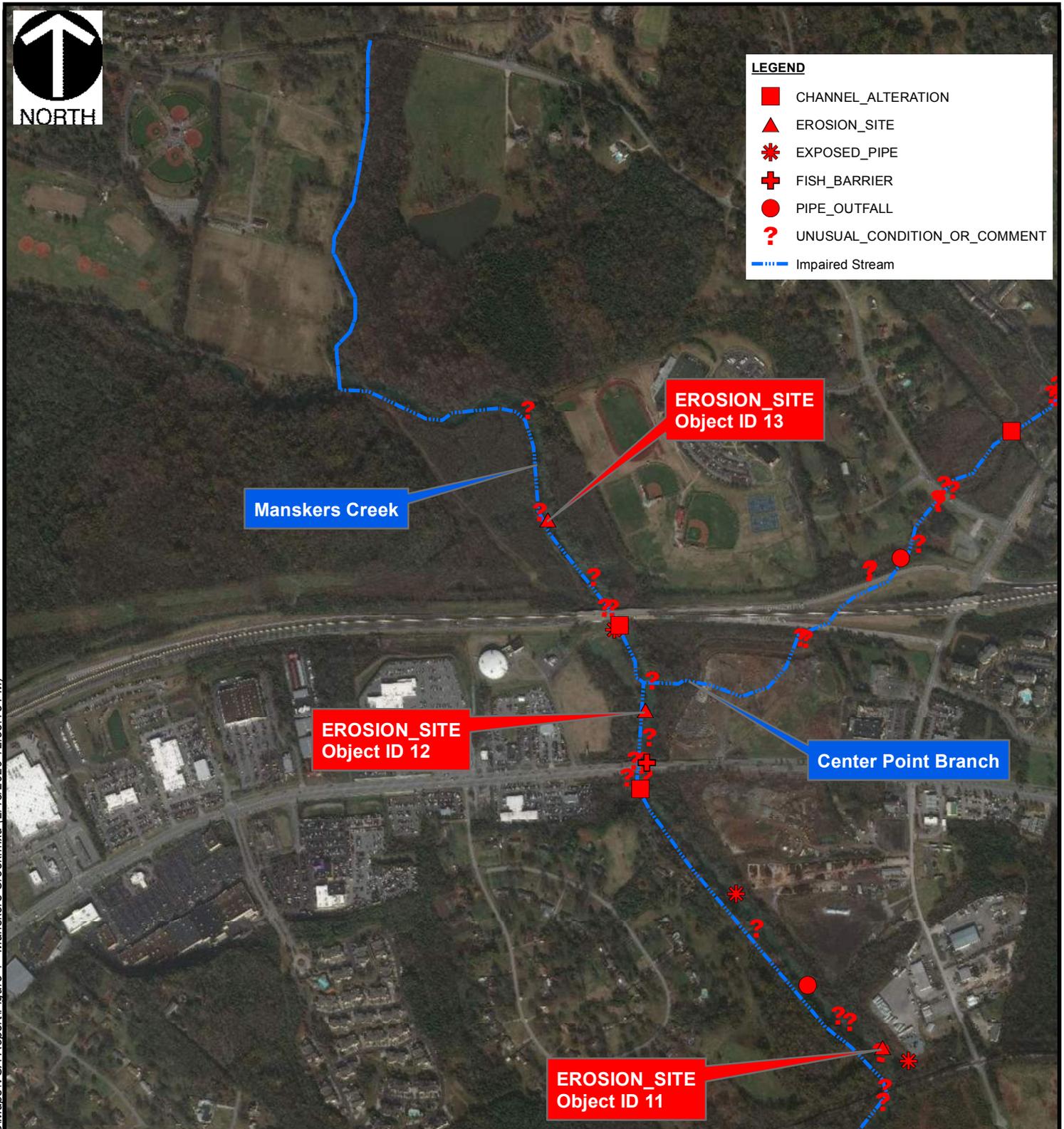
192-267.03.2

I:\SVR-NASH\projects\2019\192-267-GIS\Maps\VSA Report\Figure 4 - Unnamed Trib to Cheatham Reservoir.mxd (2/13/2020 12:54:04 PM)



LEGEND

- CHANNEL_ALTERATION
- ▲ EROSION_SITE
- ✱ EXPOSED_PIPE
- + FISH_BARRIER
- PIPE_OUTFALL
- ? UNUSUAL_CONDITION_OR_COMMENT
- Impaired Stream



REFERENCE
 MICROSOFT VIRTUAL EARTH / BING IMAGERY
 PROVIDED BY ESRI, ACCESSED 2/13/2020

Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community



Civil & Environmental Consultants, Inc.
 117 Seaboard Lane, Ste. E100 Franklin, Tennessee
 615-333-7797 • 800-763-2326
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2019 VISUAL STREAM ASSESSMENT (VSA)
 MS4 PERMIT NON-ANALYTICAL STREAM MONITORING
 AREAS OF CONCERN
 CITY OF HENDERSONVILLE
 SUMNER COUNTY, TENNESSEE

MANSKERS CREEK

DRAWN BY:	LWK	CHECKED BY:	JLW	APPROVED BY: <small>* Hand signature on file</small>	JLW	FIGURE NO:	4
DATE:	2/13/2020	SCALE:	1" = 917'	PROJECT NO:	192-267.03.2		

I:\SVR-NASH\Projects\2019\192-267-GIS\Maps\VSA Report\Figure 4 - Mankers Creek.mxd (2/13/2020 12:58:15 PM)

APPENDIX B

MARYLAND DEPARTMENT OF NATURAL RESOURCES' STREAM CORRIDOR
ASSESSMENT SURVEY DEFINITIONS

MARYLAND DEPARTMENT OF NATURAL RESOURCES' STREAM CORRIDOR ASSESSMENT SURVEY DEFINITIONS¹

1. *Channel Alteration*: Channelization refers to the once common practice of dredging, straightening, and/or widening stream channels in an attempt to reduce flooding or to lower ground water table. Survey teams should look not only for stream reaches that are in concrete channels but for any areas where the stream has been significantly altered. A good indication of this is an unusually straight stream channel for a fairly long stretch. Channel alteration does not include road crossing unless a significant amount of stream channelization has occurred either upstream of downstream of the road crossing.
2. *Erosion Site*: Erosion is a natural process and necessary to maintain good aquatic habitat in a stream. Too much erosion, however, can have the opposite effect, destabilizing stream banks, destroying in-stream habitat and causing significant sediment pollution problems downstream. Severe erosion problems occur when either a stream's hydrology and/or sediment supply have been significantly altered. When conducting the SCA survey, you are primarily interested in identifying unstable stream reaches that are experiencing a significant amount of erosion along the stream's banks.
3. *Exposed Pipes*: Exposed pipes are any pipes that are either in the stream or along the stream's immediate banks that could be damaged by a high flow event. It does not include pipe outfalls where only the open end of the pipe is exposed. Exposed pipes do include: 1) manhole stacks in or along the stream's banks; 2) pipes that are exposed along the stream's banks; 3) pipes that run under the stream's bed and have been exposed by stream down-cutting; and 4) pipes that are built over a stream but are low enough that they could be affected by occasional high storm flows. Pipes that are placed along the support beams of a bridge or suspended high enough above the stream to not be affected by very large storm events should not be included in this survey unless they are leaking.
4. *Pipe Outfalls*: Pipe outfalls include any pipes or small manmade channels that discharge into the stream through the stream corridor. Pipe outfalls are considered a potential environmental problem in the survey because they can carry uncontrolled runoff and pollutants such as oil, heavy metals, and nutrients to a stream system. Any pipes or manmade channels that are designed to discharge into the stream are considered pipe outfalls and must be included in the survey. This includes pipes with openings outside of the immediate stream corridor, but which discharge into a channel which eventually enters the stream.
5. *Fish Barrier*: Fish migration barriers are anything in the stream that significantly interferes with the upstream movement of fish. Unimpeded upstream movement is important for resident fish species, many of which also move both up and down stream during different parts of their life cycle. Fish blockages can be caused by man-made structures such as dams or road culverts, and by natural features such as waterfalls or beaver dams.
6. *Inadequate Buffer*: Forested stream buffers are very important for maintaining healthy streams. Forest buffers help shade the stream, preventing excessive solar heating, and the

roots stabilize the stream banks. Forest buffers remove nutrients, sediment and other pollutants from runoff, while the leaves of trees are a major component of the stream's food web. Because of the importance of stream buffers, not only in maintaining healthy streams, but also in reducing nutrient loading to the stream. For the purpose of this study, a buffer is generally considered inadequate if it is less than 50 feet wide from the edge of the stream.

7. *In/Near Stream Construction:* In or near stream construction data sheets are used to document the locations of major disturbances located in or near the stream corridor at the time of the survey. If construction is seen in or near the stream, indicate the location on the survey map and look at the general condition of the stream near and downstream of the construction site. Survey teams should be on alert for evidence of inadequate sediment control measures or if sediment pollution from the site has affected the stream.
8. *Trash Dumping:* The trash dumping data sheets are used to record the location of places where large amounts of trash have been dumped inside the stream corridor or to note places where trash tends to accumulate. The main purpose of identifying where trash is being dumped in or near the stream is so that steps can be taken to limit access to these areas by vehicles if possible. A second reason for noting trash dumping sites is to assist community volunteer groups looking for possible sites to do stream clean-ups.
9. *Unusual Condition or Comment:* The unusual condition or comment data sheets are used by survey teams to record the location of anything out of the ordinary or to provide some additional written comments on a specific problem.
10. *Representative Site:* Representative site data sheets are used to document the general condition of both in-stream habitat and the condition of the adjacent stream corridor.

Reference:

1: "Stream Corridor Assessment Survey: SCA Survey Protocols." Watershed Restoration Division & Coastal Watershed Services, Maryland Dept. of Natural Resources.