



**Williamson County Engineering Department
Stormwater Management Program**

2017/2018 Annual Report
Page 1

List of Waters with Unavailable Parameters / TMDLs
Page 7

List of Exceptional Tennessee Waters
Page 13

Stormwater Management Plan
Page 17

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to submit to the State of Tennessee a MS4 Annual Report with additional supporting documents as outlined within the Stormwater Management Plan.



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: Williamson County		MS4 Permit Number: TNS075795
Contact Person: Michael Scott		Email Address: michael@williamson-tn.org
Telephone: (615) 790-5809		MS4 Program Web Address: williamsoncounty-tn.gov
Mailing Address: 1320 West Main Street, Suite 400		
City: Franklin	State: TN	ZIP code: 37064

What is the current population of your MS4? 55,707

What is the reporting period for this annual report? July 1 2017 to June 30 2018

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/wr-ws-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: Outlined in the attached Storm Water Management Plan 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: Siltation, Habitat Alteration and Nutrients Yes No
- C. Do you have a webpage dedicated to your stormwater program? If yes, provide a link/URL: williamsoncounty-tn.gov/stormwater Yes No
- D. Summarize how you advertise and publicize your public education, outreach, involvement and participation opportunities: Storm Water Appeals Board Meetings, which are generally open to the public, are facilitated in the Main Auditorium of the Williamson County Administrative Complex, and are advertised and publicized in the newspaper as specified in the Storm Water Management Regulations.

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

- E. Summarize the public education, outreach, involvement and participation activities you completed during this reporting period: Outlined in the attached Storm Water Management Plan
- 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: An increase in public awareness

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? 5,400 (approximately)
- 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 Engineering Department performs annual dry weather screening of outfalls and Visual Stream Assessments in Williamson County. Yes No
- F. How many illicit discharge related complaints were received this reporting period? 0
- G. How many illicit discharge investigations were performed this reporting period? n/a
- H. Of those investigations performed, how many resulted in valid illicit discharges that were addressed and/or eliminated? n/a

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
- 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

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

- E. How many construction sites disturbing at least one acre or greater were active in your jurisdiction this reporting period? 72
- F. How many active priority and non-priority construction sites were inspected this reporting period? All sites were inspected.
- G. How many construction related complaints were received this reporting period? 36

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
- 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: Waterway Natural Areas are applied as 50', 75' or 100' perpendicular from the top of bank depending on drainage area and additional buffers may be applied on impaired streams as outlined in CGP. For additional info, see Section 4 of the Williamson County Storm Water Management Regulations. 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.)? A stormwater plan review is required where projects are subject to Land Disturbance Permits, which includes: 1) Activities resulting in greater than one (1) acre of land disturbance. 2) Activities that result in the disturbance of less than one (1) acre if it is part of a larger common plan of development or sale. 3) Activities resulting in the addition of ten thousand (10,000) square feet or greater of impervious surface. 4) Where land disturbance activities pose a threat to water, public health or safety. 5) Acceptance of fill material exceeding 10,000 square feet or more of associated disturbance. 6) Borrow Pits.
- D. How many development and redevelopment project plans were reviewed for this reporting period? 28
- E. How many development and redevelopment project plans were approved? 26
- F. How many permanent stormwater related complaints were received this reporting period? 5
- G. How many enforcement actions were taken to address improper installation or maintenance? 0
- 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. A fee in lieu of detention as described in Section 3:F. of the Storm Water Management Regulations. 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? Yes No
 - Municipal parking lots? Yes No

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

- | | | |
|---|---|--|
| 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 checked="" type="checkbox"/> Yes | <input 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? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> No |
| If yes, are new applicable employees trained within six months, and existing applicable employees trained and/or retrained within the permit term? | <input checked="" type="checkbox"/> Yes | <input type="checkbox"/> 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. Previously, annual dry weather screening included field review of 100% of the Williamson county MS4. However, after reviewing the efficiency and effectiveness of that practice, and due to increase stream assessment requirements, it seemed prudent to make the following modification to the dry weather screening: Therefore, approximately 25% of the County MS4 will be screened annually, so that the entire system will be reviewed within the permit cycle, and, Visual Stream Assessment will be performed as part of the dry weather screening assessment and consistent with the Stream Monitoring Plan as described in the Storm Water Management Plan.

Changes to the program as required by the division to satisfy permit requirements. n/a

Information (e.g. additional acreage, outfalls, BMPs) on newly annexed areas and any resulting updates to your program. n/a

- 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 program appears to be very effective, and a new electronic system in development will improve the inventories, documentation, and reporting.
- 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. _____ 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	#10	#0	#0	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Written notices	#65	#0	#5	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Citations with administrative penalties	#81	#0	#11	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Stop work orders	#17	#0	#1	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Withholding of plan approvals or other authorizations	#17	#0	#1	<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No
Additional Measures	#n/a	#n/a	#n/a	Describe: _____	

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?
Notice of Violation, Civil Penalty, Cease and Desist

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. Currently have consultant developing the comprehensive stream monitoring plan.

B. Summarize any non-analytical monitoring activities (e.g., planning, collection, evaluation of results) performed during this reporting period. Performance of seven (7) Visual Stream Assessments (VSAs) in northwestern Williamson County.

C. If applicable, are monitoring records for activities performed during this reporting period submitted with this report. Yes No

11. Certification

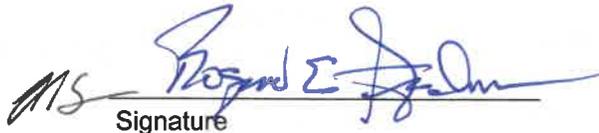
Phase II Small Municipal Separate Storm Sewer System (MS4) Annual Report

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."

Rogers Anderson
County Mayor

Printed Name and Title


Signature

9/26/18

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

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

Cheatham Reservoir Watershed This basin contains the following USGS Hydrologic Unit Code: 05130202 (Cheatham Lake)									
Waterbody ID	Impacted Waterbody	County	Miles Impaired	Cause / TMDL Priority	Pollutant Source	Comments	Municipality	Predominate Agriculture /Forest	Proposed Sampling
TN05130202 007 – 0900 & 920	OWL CREEK	Williamson Davidson	15.96	Total Phosphorus L Loss of biological integrity due to siltation L Alteration of stream-side or littoral vegetation L	Discharges from MS4 area	Stream is Category 5. (One or more uses impaired.)	Brentwood	NA	NA
TN05130202 007 – 1100	HOLT CREEK	Davidson Williamson	6.2	Nitrate+Nitrite L Total Phosphorus L Escherichia coli L	Discharges from MS4 area	Stream is Category 5. (One or more uses impaired.)	Davidson Co	NA	NA
TN05130202 007 – 5000	MILL CREEK	Davidson Williamson	8.1	Total Phosphorus L Loss of biological integrity due to siltation L Low dissolved oxygen L Escherichia coli NA	Unrestricted Cattle Access Pasture Grazing	Category 5 Provides habitat for the federally listed Nashville crayfish (O. shoupi).Epa approved a pathogen TMDL addresses some of the known pollutants.	Nolensville	NA	NA
Harpeth River Watershed This basin contains the following USGS Hydrologic Unit Code: 05130204 (Harpeth River)									
TN05130204 009 – 0600	MURRAY BRANCH	Williamson	3.6	Alteration in stream-side or littoral vegetation cover NA Loss of biological integrity due to siltation NA	Pasture Grazing Non-irrigated Crop Production	Category 4a. EPA approved siltation/ habitat alteration TMDLs for the known pollutants.	Williamson County	Yes	No
TN05130204 009 – 0700	BROWN CREEK	Williamson	5.3	Loss of biological integrity due to siltation L	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

TN05130204 009 – 0800	UNNAMED TRIB TO HARPETH RIVER	Williamson	2.1	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	L NA	Pasture Grazing Land Development	Stream is Category 5. (One or more uses impaired.) 16% developed	Williamson County	Yes	No
TN05130204 009 – 0900	TRACE CREEK	Davidson Williamson	4.9	Physical substrate habitat alteration Loss of biological integrity due to siltation	NA L	Land Development	Stream is Category 5. (One or more uses impaired.)	Williamson County	No	Yes
TN05130204 009 – 3000	HARPETH RIVER	Davidson Williamson	16.8	Total Phosphorus Low dissolved oxygen	M M	Municipal Point Sources Discharges from MS4 area	Stream is Category 5. (One or more uses impaired.)	Williamson County	No	Yes
TN05130204 010 – 0720	ARKANSAS CREEK	Williamson	11.17	Escherichia coli	NA	Pasture Grazing	Category 4a. A pathogen TMDL addresses the known pollutant.	Williamson County	Yes	No
TN05130204 013 – 0100	HATCHER SPRING CREEK	Williamson	6.5	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	L L	Pasture Grazing Land Development	Stream is Category 5. (One or more uses impaired.)	Franklin	NA	NA
TN05130204 013 – 0200	POLK CREEK	Williamson	8.8	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation Escherichia coli	NA NA L	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 013 – 0300	UNNAMED TRIB TO WEST HARPETH RIVER	Williamson	1.8	Loss of biological integrity due to siltation	L	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 013 – 0400	UNNAMED TRIB TO WEST HARPETH RIVER	Williamson	1.3	Loss of biological integrity due to siltation	L	Highways, Roads, Bridge, Infrastructure Construction	Stream is Category 5. (One or more uses impaired.)	Thompson Station	NA	NA
TN05130204 013 – 0500	KENNEDY CREEK	Williamson	4.8	Physical substrate habitat alterations Loss of biological integrity due to siltation	NA NA	Land Development	Category 4a. EPA approved a siltation/habitat alteration TMDL for the known pollutants. I-840 / Thompson Station	Williamson County	Yes	No
TN05130204 013 – 0600	UNNAMED TRIB TO WEST HARPETH RIVER	Williamson	6.5	Loss of biological integrity due to siltation Alteration in stream-side or littoral vegetative cover	L L	Land Development Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Thompson Station	NA	NA

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

TN05130204 013 – 0700	MURFREES FORK	Williamson	6.2	Escherichia coli	L	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 013 – 0710	RATTLESNAKE BRANCH	Williamson	6.5	Alteration in stream-side or littoral vegetative cover Nutrients Escherichia coli	NA M L	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 013 – 0720	CAYCE BRANCH	Williamson	5.9	Physical substrate habitat alteration Loss of biological integrity due to siltation	NA NA	Pasture Grazing Unrestricted Cattle Access	Category 4a. Impaired, but EPA has approved a siltation/ habitat alteration TMDL for the known pollutants.	Williamson County	Yes	No
TN05130204 013 – 0730	WEST PRONG MURFREES FORK	Williamson	6	Escherichia coli	NA	Pasture Grazing	Category 4a. Impaired but EPA approved a pathogen TMDL for the known pollutants	Williamson County	Yes	No
TN05130204 013 – 0750	MURFREES FORK	Williamson	18.4	Total Phosphorus Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation Escherichia coli	M L L NA	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 013 – 2000	WEST HARPETH RIVER	Williamson	10.9	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation Escherichia coli	L L NA	Pasture Grazing	Stream is Category 5. (One or more uses impaired.)	Williamson County	Yes	No
TN05130204 016 – 0100	LYNWOOD CREEK	Williamson	5.4	Nutrients Alteration in stream-side or littoral vegetation Loss of biological integrity due to siltation	M NA NA	Pasture Grazing Land Development Discharges from MS4 area	Category 5. One or more uses impaired.	Williamson County	No	Yes
TN05130204 016 – 0200	SPENCER CREEK	Williamson	13.98	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation Escherichia coli	L NA L	Discharges from MS4 area	Category 5. EPA approved siltation/habitat alteration TMDLs for the known pollutants.	Franklin	NA	NA
TN05130204 016 – 0210	SOUTH PRONG SPENCER CREEK	Williamson	5.76	Loss of biological integrity due to siltation Alteration in stream-side or littoral vegetative cove	NA NA	Land Development	Category 4a. EPA approved a siltation/habitat alteration TMDL for the known pollutants.	Franklin	NA	NA

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

TN05130204 016 – 0300	LIBERTY CREEK	Williamson	0.54	Toluene Low Dissolved Oxygen Loss of biological integrity due to siltation	L M L	Industrial Point Source Discharges from MS4 area	Category 5. Liberty Creek is impacted in part due to accidental releases of toluene. These substances indirectly affect aquatic life and directly impact the aesthetics of the stream.	Franklin	NA	NA
TN05130204 016 – 0350	LIBERTY CREEK	Williamson	1.31	Alteration of stream-side or littoral vegetative cover	L	Discharges from MS4 area	Category 5. One or more uses impaired.	Franklin	NA	NA
TN05130204 016 – 0400	UNNAMED TRIB TO HARPETH RIVER	Williamson	2.94	Loss of biological integrity due to siltation or littoral vegetation	L	Discharges from MS4 area	Category 5. One or more uses impaired.	Franklin	NA	NA
TN05130204 016 – 0500	WATSON BRANCH	Williamson	6.8	Loss of biological integrity due to siltation	NA	Land Development	Category 4a. EPA approved a siltation TMDL for the known pollutant.	Franklin	NA	NA
TN05130204 016 – 0810	PAIGE BRANCH	Williamson	3.08	Loss of biological integrity due to siltation or littoral vegetation	L	Pasture Grazing	This stream is Category 5. One or more uses impaired.	Williamson County	Yes	No
TN05130204 016 – 1000	HARPETH RIVER	Williamson	6.8	Loss of biological integrity due to siltation Low dissolved oxygen Total Phosphorus	L M M	Municipal Point Source Discharges from MS4 area	Category 5. One or more uses impaired.	Williamson County	No	Yes
TN05130204 016 – 1300	FIVEMILE CREEK	Williamson	5.75	Loss of biological integrity due to siltation Escherichia coli	NA NA	Land Development Pasture Grazing	Category 4a. EPA approved siltation and pathogen TMDLs for the known pollutants.	Williamson County	No	Yes
TN05130204 016 – 1350	FIVEMILE CREEK	Williamson	8.56	Escherichia coli	NA	Pasture Grazing	Category 4a. EPA approved pathogen TMDLs for the known pollutants.	Williamson County	Yes	No
TN05130204 016 – 1400	DONELSON CREEK	Williamson	3.4	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	L NA	Discharges from MS4 area	Category 5. One or more uses impaired.	Williamson County	No	Yes
TN05130204 016 – 1500	UNNAMED TRIB TO HARPETH RIVER	Williamson	4	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Land Development	Category 4a. The stream is impaired, but EPA approved a siltation/ habitat alteration TMDL for the known pollutants.	Franklin	NA	NA
TN05130204 016 – 1600	SHARPS CREEK (formerly called Sparks Branch)	Williamson	4.9	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Discharges from MS4 area	Category 4a. EPA approved a siltation/ habitat alteration TMDL for the known pollutants.	Franklin	NA	NA

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

TN05130204 016 – 2000	HARPETH RIVER	Williamson	3.9	Low Dissolved Oxygen Total Phosphorus Loss of biological integrity due to siltation Escherichia coli	M M NA NA	Discharges from MS4 area Pasture Grazing	Category 5. One or more uses impaired.	Franklin	NA	NA
TN05130204 016 – 3000	HARPETH RIVER	Williamson	9	Low Dissolved Oxygen Loss of biological integrity due to siltation	M NA	Pasture Grazing	Category 5. One or more uses impaired.	Williamson County	No	Yes
TN05130204 016 – 4000	HARPETH RIVER	Williamson	7.5	Low Dissolved Oxygen Loss of biological integrity due to siltation	M NA	Pasture Grazing	Category 5. One or more uses impaired.	Williamson County	Yes	No
TN05130204 018 – 2000	HARPETH RIVER	Williamson Rutherford	2.7	Lead	NA	Industrial Point Source Discharge Contaminated Sediment	Category 4a. Impaired, but EPA has approved a lead TMDL for the known pollutant.	Williamson County	NA	NA
TN05130204 021 – 0200	UNNAMED TRIB TO LITTLE HARPETH RIVER	Williamson	2.46	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Discharges from MS4 area	Category 4a. Impaired, but EPA has approved a siltation/ habitat alteration TMDL for the known pollutants.	Brentwood	NA	NA
TN05130204 021 – 0300	UNNAMED TRIB TO LITTLE HARPETH RIVER	Williamson	4.93	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Discharges from MS4 area	Category 4a. The stream is impaired, but EPA has approved a siltation/ habitat alteration TMDL for the known pollutants.	Brentwood	NA	NA
TN05130204 021 – 0400	BEECH CREEK	Williamson	7.7	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Land Development	Category 4a. The stream is impaired, but EPA has approved a siltation/ habitat alteration TMDL for the known pollutants.	Brentwood	NA	NA
TN05130204 021 – 1000	LITTLE HARPETH RIVER	Davidson Williamson	4.1	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation Escherichia coli	NA NA NA	Land Development Collection System Failure	Category 4a. Impaired, but EPA has approved pathogen, siltation/ habitat alteration, and organic enrichment TMDLs for the known pollutants.	Williamson County	No	Yes
TN05130204 021 – 2000	LITTLE HARPETH RIVER	Williamson	12.1	Alteration in stream-side or littoral vegetative cover Loss of biological integrity due to siltation	NA NA	Pasture Grazing Discharges from MS4 area	Category 4a. Impaired, but EPA has approved siltation/ habitat alteration TMDLs for the known pollutants.	Brentwood	NA	NA

Item 2. A/B. – Williamson County 2018 Proposed TDEC 303(d) listing / TMDLs

Duck River Basin This basin contains the following USGS Hydrologic Unit Codes: 06040002 (Upper Duck River) and 06040003 (Lower Duck River).										
TN06040002 049 - 0400	WALLACE BRANCH	Maury Williamson	3.8	Escherichia coli	NA	Pasture Grazing	Category 4a. EPA approved a pathogen TMDL that addresses the known pollutant.	Williamson County	Yes	No
TN06040003 034_0300	MCCUTCHEON CREEK	Maury Williamson	12.27	Loss of biological integrity due to siltation	NA	Land Development Pasture Grazing	Category 4a. EPA approved a siltation TMDL that addresses the known pollutant.	Spring Hill	NA	NA
TN06040003 034 -- 0410	GRASSY BRANCH	Maury Williamson	7.18	Alteration in Stream-side or littoral vegetative cover Loss of biological integrity due to siltation	L L	Discharges from MS4 area	Stream is Category 5. One or more uses are impaired.	Spring Hill	NA	NA

**Item 2.C. - Exceptional TN Waters (ETWs) / Outstanding National Resource (ONRWs)
Located Within Unincorporated Williamson County**

<u>Watershed</u>	<u>Waterbody</u>	<u>County</u>	<u>Description</u>	<u>Basis for Inclusion</u>	<u>From Lat</u>	<u>To Lat</u>	<u>From Long</u>	<u>To Long</u>
Harpeth	Boston Branch	Williamson	From RM 1.6 to origin.	Exceptional biological diversity.	35.8303	35.826	-87.0545	-87.055
Harpeth	Burns Branch	Williamson	Portion in Natchez Trace Parkway National Park	Natchez Trace Parkway National Park.	35.8505	35.836	-87.0527	-87.066
Harpeth	Copperas Branch	Williamson	From Greens Hollow tributary to origin	Exceptional biological diversity.	35.9055	35.887	-87.098	-87.127
Harpeth	Dobbins Branch	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.9046	35.907	-87.0047	-87.008
Harpeth	Garrison Creek	Williamson	From Natchez Trace Parkway to headwaters.	Exceptional biological diversity. Portion in Natchez Trace NP.	35.8749	35.857	-87.0298	-87.085
Harpeth	Harpeth River	Williamson	From Nelson Creek to unnamed tributary just downstream Hwy 31A.	Exceptional biological diversity. WPC ecoregion reference stream for 71i.	35.8428	35.8	-86.707	-86.665
Harpeth	Kelley Creek including unnamed tributaries.	Williamson	From South Harpeth Creek to headwaters.	Exceptional biological diversity. Kelley Creek watershed has been designated by the Nature Conservancy as a "Priority Area for Freshwater Biodiversity Conservation" in 2002.	35.9246	35.878	-87.0923	-87.092
Harpeth	Little East Fork	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.9877	35.982	-86.9965	-86.989

**Item 2.C. - Exceptional TN Waters (ETWs) / Outstanding National Resource (ONRWs)
Located Within Unincorporated Williamson County**

Harpeth	Pinewood Branch	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.8906	35.893	-87.0179	-87.026
Harpeth	South Garrison Creek Unnamed Tributary	Williamson	Headwater tributary from confluence with South Garrison Creek to origin.	Exceptional biological diversity.	35.8495	35.85	-87.0715	-87.076
Harpeth	South Harpeth Creek	Williamson	From Arkansas Creek to confluence of headwaters.	Exceptional biological diversity. WPC ecoregion reference stream for 71f.	35.9305	35.91	-87.08	-87.134
Harpeth	Wilkie Branch	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.8931	35.896	-87.0145	-87.016
Duck-Lower	Litton Branch	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.8297	35.831	-87.0919	-87.091
Duck-Lower	South Fork Lick Creek	Williamson	Portion in Natchez Trace Parkway National Park.	Natchez Trace Parkway National Park	35.8531	35.834	-87.074	-87.074
Harpeth	Inman Branch Unnamed Tributary at boy scout camp	Williamson	From Inman Branch to headwaters.	Exceptional biological diversity.	35.9121	35.9112	-87.0649	-87.0561
Harpeth	Harpeth Creek Tributary	Williamson	Unnamed tributary to Harpeth Creek. The entire tributary is considered high quality	Exceptional biological diversity	35.9102	35.8907	-87.1341	-87.1383

**Item 2.C. - Exceptional TN Waters (ETWs) / Outstanding National Resource (ONRWs)
Located Within Unincorporated Williamson County**

Cumberland-Lower-Sycamore (Cheatham Lake)	Mill Creek Unnamed Tributary	Williamson	From Mill Creek d/s of Nolensville to confluence of headwaters	Federal endangered Crayfish	35.9569	35.933	-86.6725	-86.7015
Cumberland-Lower-Sycamore (Cheatham Lake)	Rock Springs Branch	Williamson	From Mill Creek to Williamson County Line	Federal endangered Nashville Crayfish	35.9433	35.9539	-86.6444	-86.625
Harpeth	Boston Branch Unnamed Tributary	Williamson	From RM 0.01 to origin	Exceptional Biological Diversity	35.8308	35.8325	-87.0578	-87.0622
Harpeth	Burns Branch Unnamed Tributary	Williamson	From Burns Branch to origin	Exceptional Biological Diversity	35.8392	35.836	-87.0599	-87.0603
Harpeth	South Garrison Creek Unnamed Tributary	Williamson	Headwater tributary from confluence with South Garrison Creek to origin	Exceptional biological integrity	35.8496	35.8417	-87.0715	-87.0697
Harpeth	South Harpeth Creek Unnamed Tributary	Williamson	Unnamed Tributary to South Harpeth Creek from confluence with unnamed tributary to origin.	Exceptional biological diversity.	35.9025	35.9011	-87.1367	-87.1501
Harpeth	Whiteoak Branch	Williamson	From confluence with Kelly Creek to origin.	Kelley Creek watershed has been designated by the Nature Conservancy as a "Priority Area for Freshwater Biodiversity Conservation" in 2002.	35.8884	35.883	-87.1058	-87.108

**Item 2.C. - Exceptional TN Waters (ETWs) / Outstanding National Resource (ONRWs)
 Located Within Unincorporated Williamson County**

Harpeth	Flatrock Branch	Williamson	From u/s Fairview WWTP to above first unnamed tributary upstream of Horn Tavern Rd.	Flatrock Branch has consistently exhibited exceptional biological diversity upstream of Fairview WWTP. Family level bioecon scored a 15 on 8/29/06 with 23 total taxa, 10 EPT and 9 intolerant families. Family level bioecon scored a 15 on 4/16/99 with 31 total taxa, 16 EPT and 9 intolerant families. SQSH sample collected on 1/04/2012 scored 42.	36.0308	35.9996	-87.116	-87.1304
---------	-----------------	------------	---	--	---------	---------	---------	----------



Williamson County Engineering Department Stormwater Management Program Stormwater Management Plan

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to develop a compilation of the elements of the Stormwater Management Program consisting of separate components which are outlined within the Stormwater Management Plan.

Table of Contents:

Best Management Practices Programs and Processes-----	19
Public Information and Education Plan (PIE)-----	29
Stream Monitoring Summary-----	33
Enforcement Response Plan (ERP)-----	65
Operation and Maintenance Program-----	71



Williamson County Engineering Department Stormwater Management Program Best Management Practices Programs and Processes

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to develop specific goals and public information events/activities that will occur over the permit cycle, which are outlined within the Best Management Practices (BMP) Programs and Processes.

The Best Management Practices include the following:

1. Public Education and Public Participation
2. Illicit Discharge Detection and Elimination
3. Construction Site Runoff Program
4. Permanent (Post-Construction) Stormwater Management Program
5. Municipal Pollution Prevention and Good Housekeeping

All BMPs will be implemented by the Williamson County Engineering Department and/or other Departments as needed and will be coordinated by the Williamson County Storm Water Quality Coordinator. For a summary of the best management practices measurable goals and milestones, see Table 1.

2017/2018 BMP Summary

BMP 1A. Public Information and Education Plan (PIE)

The PIE has been completed and is being implemented.

BMP 1B. Education and Outreach activities on stormwater

A stream clean-up event was hosted by Williamson County on June 15, 2018 involving public participation. Approximately five river miles of the Harpeth River from Kinnie Road to Moran Road was targeted. The following is a summary of the goals of the clean up event:

- a. Visually assess bank stabilization and possible failures,
- b. Record the location of specific areas that need additional attention, such as heavy debris, log jams, etc.,
- c. Identify possible solutions for the safe extraction of objects within the channel,
- d. Detection of possible illicit discharges, and
- e. Remove trash that has been deposited in river/banks.

BMP 1C. Web Site

The web site is updated with information on the storm water program, regulations, and educational material.

BMP 1D. Public Service Announcements

Williamson County contracted with the TAB program for the 2017/2018 fiscal year for PSAs (public Service Announcements). TAB provides stormwater PSAs for Tennessee on local broadcasting stations including many in the Middle Tennessee area which serves Williamson County residents.

Williamson County mailed 340 brochures entitled “Williamson County Guide to Waterway Natural Areas.” Residents along streams listed as having unavailable parameters (impaired) in the northern portion of the Williamson County were targeted. This included properties along the Harpeth River, Little Harpeth River, Lynnwood Creek and Trace Creek.

BMP 2A. Storm Sewer Systems Map

The most current storm sewer map is available.

BMP 2B. Hot Spots

Each Village in Williamson County is also designated a Hot Spot Area, where zoning regulations are tailored and education is targeted because of more intense uses and increased potential for stormwater contamination.

BMP 2C. Stream Monitoring

The stream sampling plan for this current permit cycle is being developed. Previous sampling reporting for the Harpeth River, Little Harpeth River, Owl Creek and Rutherford Creek is available online at williamsoncounty-tn.gov/stormwater.

Seven (7) Visual Stream Assessments (VSAs) were performed this permit cycle and are included in the Storm Water Management Plan.

BMP 2D. Dry Weather Screening

MS4 outfalls have been inspected during dry weather for evidence of illicit discharges.

BMP 3A. Regulations / Manual

The Storm Water Regulations are updated and consistent with State requirements regarding stream buffers, storm water system long-term operation and maintenance, etc. The Storm Water Regs and Storm Water Management Manual are available online.

BMP 3B. Enforcement Response Plan (ERP)

The ERP has been completed and is being implemented.

BMP 3C. Inventory

Active construction sites requiring a Land Disturbance Permit are being tracked electronically with GIS coordinates.

BMP 3D. Inspections and Enforcement

Inspections of sites with active Land Disturbance Permits are inspected monthly and enforcement is performed in accordance with the Storm Water Regulations and Enforcement Response Plan (ERP).

BMP 4A. Ordinance / Manual

The Storm Water Regulations have been updated to be consistent with State requirements with regards to Runoff Reduction (green infrastructure). The Storm Water Regulations and Storm Water Management Manual are available online.

BMP 4B. Runoff Reduction

The requirements for implementation of runoff reduction practices have been evaluated and are in effect as of July 1, 2013.

BMP 4C. Maintenance Agreements

Maintenance Agreements are submitted to Williamson County where permanent storm water runoff control facilities are involved and the procedures for the establishment of maintenance agreements and required inspections will be reviewed as needed.

BMP 4D. Inventory / Tracking

BMPs deployed at new development and redevelopment projects are being tracked electronically with GIS coordinates.

BMP 5A. Operation and Maintenance Program

An Operation and Maintenance Program has been developed and implemented with the goal of preventing or reducing pollutant runoff from municipal operations.

BMP 5B. Inspections

Inspections have been performed at all facilities/operations within the County that are not individually covered by a NPDES permit.

BMP 5C. Education

Employee education is performed in conjunction with the pollution prevention and good housekeeping inspections at county facilities/operations and may include discussions with the director/operator, providing guidance material, and/or training videos.

BMP 5D. Roadway and MS4 Development

Procedures for development of new roadways and MS4 are being evaluated and revised as needed. For example, the Williamson County Engineering Department currently assists the Highway Department as needed for identifying intermittent/perennial streams located within the County right-of way.

Table 1: Best Management Practices Measurable Goals and Milestones

BEST MANAGEMENT PRACTICES FOR PUBLIC EDUCATION AND PUBLIC PARTICIPATION	
BMP 1A	MEASURABLE GOALS AND MILESTONES
Goal(s)	Public Information and Education Plan (PIE)
Milestone Year 1	Review effectiveness of PIE plan and continue to develop and implement specific goals and public information events/activities related to storm water.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue
BMP 1B	MEASURABLE GOALS AND MILESTONES
Goal(s)	Education and Outreach activities on storm water
Milestone Year 1	Review effectiveness of current educational materials and outreach activities and continue to develop new materials/activities including videos, books, or other media as well as field demonstrations or other projects such as stream clean-up event.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue
BMP 1C	MEASURABLE GOALS AND MILESTONES
Goal(s)	Web-site
Milestone Year 1	Provide information on the storm water program, regulations, educational material, etc.
Milestone Year 2	Maintain
Milestone Year 3	Maintain
Milestone Year 4	Maintain
Milestone Year 5	Maintain
BMP 1D	MEASURABLE GOALS AND MILESTONES
Goal(s)	Public Service Announcement
Milestone Year 1	Develop and/or review materials to be broadcast via TV, radio or other media.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue

Table 1: Best Management Practices Measurable Goals and Milestones (continued)

BEST MANAGEMENT PRACTICES FOR ILLICIT DISCHARGE DETECTION AND ELIMINATION	
BMP 2A	MEASURABLE GOALS AND MILESTONES
Goal(s)	Storm Sewer System Map
Milestone Year 1	Continue to develop and maintain a map that shows the location of outfalls where the municipal storm sewer system discharges into waters of the state.
Milestone Year 2	Update
Milestone Year 3	Update
Milestone Year 4	Update
Milestone Year 5	Update
BMP 2B	MEASURABLE GOALS AND MILESTONES
Goal(s)	Hot Spots
Milestone Year 1	Continue to develop and implement more specific practices to prohibit contamination from hot spot areas.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue
BMP 2C	MEASURABLE GOALS AND MILESTONES
Goal(s)	Stream Monitoring
Milestone Year 1	Update monitoring plan for analytical and non-analytical stream monitoring.
Milestone Year 2	Begin collecting field data.
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue
BMP 2D	MEASURABLE GOALS AND MILESTONES
Goal(s)	Dry Weather Screening
Milestone Year 1	Inspect MS4 outfalls, during dry weather, for evidence of non storm water discharges.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue

Table 1: Best Management Practices Measurable Goals and Milestones (continued)

BEST MANAGEMENT PRACTICES FOR CONSTRUCTION SITE RUNOFF PROGRAM	
BMP 3A	MEASURABLE GOALS AND MILESTONES
Goal(s)	Regulations / Manual
Milestone Year 1	Review the construction site runoff requirements in the Storm Water Management Regulations.
Milestone Year 2	Update the Storm Water Management Regulations if necessary to maintain consistency with the State construction site runoff requirements.
Milestone Year 3	Evaluate
Milestone Year 4	Evaluate
Milestone Year 5	Evaluate
BMP 3B	MEASURABLE GOALS AND MILESTONES
Goal(s)	Enforcement Response Plan (ERP)
Milestone Year 1	Evaluate and update the ERP as needed.
Milestone Year 2	Evaluate and update
Milestone Year 3	Evaluate and update
Milestone Year 4	Evaluate and update
Milestone Year 5	Evaluate and update
BMP 3C	MEASURABLE GOALS AND MILESTONES
Goal(s)	Inventory
Milestone Year 1	Continue to develop and maintain an inventory of all active construction sites which require a Land Disturbance Permit.
Milestone Year 2	Update
Milestone Year 3	Update
Milestone Year 4	Update
Milestone Year 5	Update
BMP 3D	MEASURABLE GOALS AND MILESTONES
Goal(s)	Inspections & Enforcement
Milestone Year 1	Conduct inspections on construction sites at specified intervals and perform enforcement actions as specified within the regulations.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue

Table 1: Best Management Practices Measurable Goals and Milestones (continued)

BEST MANAGEMENT PRACTICES FOR PERMANENT (POST-CONSTRUCTION) STORMWATER MANAGEMENT PROGRAM	
BMP 4A	MEASURABLE GOALS AND MILESTONES
Goal(s)	Ordinance / Manual
Milestone Year 1	Review the post construction water quality requirements in the Storm Water Management Regulations and/or Storm Water Management Manual.
Milestone Year 2	Update the Storm Water Management Regulations and/or Storm Water Management Manual if necessary to maintain consistency with State post-construction runoff requirements.
Milestone Year 3	Review and update if necessary
Milestone Year 4	Review and update if necessary
Milestone Year 5	Review and update if necessary
BMP 4B	MEASURABLE GOALS AND MILESTONES
Goal(s)	Runoff Reduction
Milestone Year 1	Continue to implement the State standards for runoff reduction practices.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue
BMP 4C	MEASURABLE GOALS AND MILESTONES
Goal(s)	Maintenace Agreements
Milestone Year 1	Continue to improve the procedures for establishment of maintenance agreements and required inspections.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue
BMP 4D	MEASURABLE GOALS AND MILESTONES
Goal(s)	Inventory / Tracking
Milestone Year 1	Continue to develop a system designed to track BMPs deployed at new development and redevelopment projects.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue

Table 1: Best Management Practices Measurable Goals and Milestones (continued)

BEST MANAGEMENT PRACTICES FOR MUNICIPAL POLLUTION PREVENTION AND GOOD HOUSEKEEPING	
BMP 5A	MEASURABLE GOALS AND MILESTONES
Goal(s)	Operation and Maintenance Program
Milestone Year 1	Continue development and implementation of an operation and maintenance program that has the goal of preventing or reducing pollutant runoff from municipal operations.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue
BMP 5B	MEASURABLE GOALS AND MILESTONES
Goal(s)	Inspections
Milestone Year 1	Perform inspections at facilities/operations within the County that are not individually covered by a TN Multi-Sector permit.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue
BMP 5C	MEASURABLE GOALS AND MILESTONES
Goal(s)	Education
Milestone Year 1	Evaluate and perform employee education with the goal of minimizing storm water pollution potential from land disturbance activities as well as fleet, building, park, and MS4 maintenance.
Milestone Year 2	Continue
Milestone Year 3	Continue
Milestone Year 4	Continue
Milestone Year 5	Continue
BMP 5D	MEASURABLE GOALS AND MILESTONES
Goal(s)	Roadway and MS4 Development
Milestone Year 1	Evaluate procedures for development of new roadways and MS4 to ensure that these activities are performed in accordance with appropriate regulatory permits.
Milestone Year 2	Evaluate and continue
Milestone Year 3	Evaluate and continue
Milestone Year 4	Evaluate and continue
Milestone Year 5	Evaluate and continue



Williamson County Engineering Department Storm Water Management Program Public Information and Education Plan

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to develop specific goals and public information events/activities that will occur over the permit cycle, which are outlined within the Public Information and Education Plan (PIE).

On an annual basis, Williamson County will perform public education and outreach activities. The activities may target local students, citizen/church groups and the general public, and may focus on Hot Spot areas and areas that discharge stormwater into impaired streams. The activities will emphasize various stormwater issues associated with water quality/water quantity.

The anticipated public education and outreach activities may include the following:

- Targeted mailings
- Stream Clean-up
- Public Service Announcement broadcasts
- Educational Day(s) for local school
- Stormwater information on County website

For more information on targeted educational campaigns, goals and results/effectiveness, see Table 2.

Additionally, Williamson County has developed a “Guide to Waterway Natural Areas” brochure which is distributed to residents whose property is adjacent to stream segment that may be impaired due to MS4 discharges. See Figure 1.

Table 2: Educational Campaigns, Goals and Results/Effectiveness

Storm Water Management Program Public Information and Education Plan (PIE)		
Targeted Educational Campaign	Goals	Results / Effectiveness
a. General public awareness on the impacts on water quality from general housekeeping maintenance/activities.	Provide awareness via the County website, broadcasting public service announcements, and/or targeted mailings to hot spots, areas that discharge stormwater into impaired streams or other areas of concern.	County website is kept up to date with stormwater information, PSAs are broadcast on WC-TV Channel 3 or other media, and brochures are sent to targeted areas such as hot spots or areas that discharge stormwater into impaired streams.
b. Home owner associations and other operators of permanent BMPs awareness of the importance of maintenance activities.	Develop more informative operation and maintenance agreement standards for homeowner's associations.	Continue to monitor operation and maintenance agreements and make modifications as needed.
c. Local engineering and development community awareness of the stormwater ordinances, regulations, and guidance materials related to long-term water quality impacts.	Conduct meetings with developers/engineers discussing water quality issues prior to issuance of land disturbance permits on large construction projects.	Meetings are held with developers/engineers prior to issuance of the land disturbance permits on developments/non-residential projects.
d. General public and professional chemical applicators awareness on the proper storage, use, and disposal of pesticides, herbicides, and fertilizers use.	Provide awareness via the County website, broadcasting public service announcements, and/or targeted mailings to hot spots, areas that discharge stormwater into impaired streams or other areas of concern.	County website is kept up to date with stormwater information, PSAs are broadcast on WC-TV Channel 3 or other media, and brochures are sent to targeted areas such as hot spots or areas that discharge stormwater into impaired streams.
e. General public and professional chemical applicators awareness on the proper storage, use, and disposal of oil and other automotive-related fluids.	Provide awareness via the County website, broadcasting public service announcements, and/or targeted mailings to hot spots, areas that discharge stormwater into impaired streams or other areas of concern.	County website is kept up to date with stormwater information, PSAs are broadcast on WC-TV Channel 3 or other media, and brochures are sent to targeted areas such as hot spots or areas that discharge stormwater into impaired streams.
f. General public and municipal employees on the awareness of identifying and reporting procedures for illicit connections/discharges, sanitary sewer seepage, spills, etc.	Provide awareness via the County website, broadcasting public service announcements, and/or targeted mailings to hot spots, areas that discharge stormwater into impaired streams or other areas of concern.	County website is kept up to date with stormwater information, PSAs are broadcast on WC-TV Channel 3 or other media, and brochures are sent to targeted areas such as hot spots or areas that discharge stormwater into impaired streams.
g. Local engineering, development, and construction community awareness of stormwater ordinances, regulations and guidance materials related to construction phase water quality impacts.	Provide access to the County Storm Water Management Regulations and the Storm Water Management Manual via the County website.	County website has the current Storm Water Regulations and the Storm Water Management Manual available to the public.
h. Municipal employee/contractor awareness of water quality impacts from daily operations.	Perform inspections at County facilities / operations that are not individually covered by a NPDES permit.	Inspections are performed at County facilities / operations on an annual basis.

Figure 1: Guide to Waterway Natural Areas

What Can You Do?

- 1) Maintain a vegetated buffer along streams and rivers to filter sediment, nutrients and pesticides.
- 2) Reduce fertilizer waste and potential transport to waterways by testing the soil, calibrating application equipment and applying only what is needed.
- 3) For agricultural operations, consider measures to improve water quality such as: implementing no-till or conservation tillage, utilizing rotational grazing when possible, providing an alternate source of water for livestock to keep them away from the stream, and planting cover crops.
- 4) Never dump wastes into the stream buffer or into a storm drain or roadside ditch, which may lead to a stream.
- 5) When performing grading activities on a site:
 - Do not encroach into a Waterway Natural Area
 - Provide erosion / sediment controls on site
 - Acquire necessary permits and abide by all State and Local regulations

Additional Resources:

- For more information regarding the Williamson County Storm Water Regulations, you can visit <https://www.williamsoncounty-tn.gov/stormwater>. For specific information about Waterway Natural Areas or assistance in determining the required width, please contact the Williamson County Engineering Department at (615) 790-5809.
- Additionally, the State of Tennessee also has specific guidelines and restrictions for activities within the stream channel, which can be found by visiting <https://www.tn.gov/environment> and clicking the Aquatic Resource Alteration Permit (ARAP) link. Also, you can contact the TDEC Division of Water Resources at (615) 687-7000.
- If you would like technical assistance regarding establishment or maintenance of a riparian buffer located within property utilized for agriculture, contact the local USDA Natural Resources Conservation Service at (615) 794-8488, ext. 3.



Williamson County Guide to Waterway Natural Areas

Williamson County TN



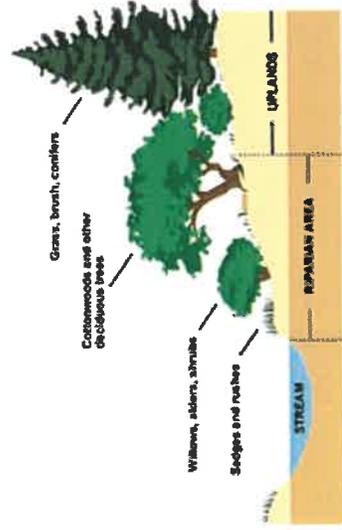
Engineering Department
1320 West Main Street, Suite 400
Franklin, TN 37064
Phone: 615-790-5809
E-mail: engineering@williamson-tn.org

Figure 1: Guide to Waterway Natural Areas

What is a Waterway Natural Area?

- A Waterway Natural Area is a vegetated area, or riparian buffer, along a waterway. Generally, the riparian buffer is forested, which assists in providing shade and protection to a stream from the impact of adjacent land uses. The width of a Waterway Natural Area depends on the tributary area, or how many acres drain to a point on the stream, and widths can range from 50' from the top of the bank to 100'.
- Waterway Natural Areas play a key role in improving water quality, and the primary function is to physically protect and separate a stream, river, or lake from future disturbance or encroachment. A riparian buffer can assist with storm water management and can help in sustaining the integrity of stream ecosystems and habitats.
- In 2005, new regulations became effective in Williamson County establishing the widths as well as the permitted uses within Waterway Natural Areas. Activities such as clearing, grading, construction or disturbance of vegetation within Waterway Natural Areas are regulated.

Typical Riparian Buffer



Source: NEMO (Nonpoint Education for Municipal Officials)



A stream bank that is highly eroded

How do Waterway Natural Areas help?

Waterway Natural Areas provide:

1. An ecosystem / habitat for aquatic life
2. Bank stability
3. A canopy over the stream, which keeps the water cool
4. A natural buffer to assist in filtering pollutants
5. Sustaining floodplain storage
6. Allowing for natural stream meandering
7. And much more!



A stream bank that has been restored

Agricultural Land Management

While Waterway Natural Area buffers are enforced as pertaining to new construction and/or development activities and other land disturbance activities not associated with agricultural activities, agricultural land management practices are encouraged to apply riparian buffer protection where possible, with the goal of not only improving water quality, but providing bank stabilization which will help to prevent valuable land from continued soil erosion.

Additional Information:

1. Williamson County is located within three Watersheds: The Cheatham Reservoir Watershed in the northeast, The Duck River Watershed in the south, and The Harpeth River Watershed.
2. The Harpeth River in Williamson County is listed as impaired by the State 303d list for causes such as: low dissolved oxygen, phosphorus, siltation, and E-coli.
3. Alterations to the riparian buffer, siltation from construction or agricultural practices, and excess nutrient loads from fertilizer application or livestock are notable sources of water quality impairment.

 <p>Williamson County TN</p>	<p>Engineering Department 1320 West Main Street, Suite 400 Franklin, TN 37064 Phone: 615-790-5809 E-mail: engineering@williamson-tn.org</p>
--	--



Williamson County Engineering Department Stormwater Management Program Stream Monitoring Summary

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to implement a stream monitoring plan for impaired streams that may be associated with discharges from the MS4.

Stream Monitoring Overview

Williamson County is currently working on a stream monitoring plan to meet the requirements established within the new MS4 permit. Our intention is to perform analytical monitoring as described in Option 2 in section 5.1 of the MS4 Permit as well as non-analytical monitoring. We will develop a jurisdiction-specific analytical monitoring plan, which will allow us to focus our resources on the streams segments that have the most potential to be impacted by MS4 discharges. Per that Stream Monitoring requirements, three types of monitoring will be performed:

1. Non-analytical Visual Stream Surveys and Impairment Inventories,
2. Analytical Biological Stream Sampling, and
3. Analytical Chemical Sampling.

Proposed Option 2 Sampling Plan

The previous permit (2010 MS4 Permit) was specific in outlining the stream segments that must be sampled, which was based on the pollutant source being listed as Discharges from MS4 area. During that permit cycle, Williamson County performed analytical stream monitoring on the Harpeth River, Little Harpeth River, Owl Creek and Rutherford Creek. The current permit, however, allows the permittee to choose between 2 options.

Option 1 requires analytical monitoring on all streams listed on the 303d list as waters with unavailable parameters for nutrients, pathogens, siltation or other MS4 pollutants. That option is not the most suitable for Williamson County. Predominately, the unincorporated areas of Williamson County have historically been agricultural. Upon reviewing the 303d list, many of the sources of pollutants are agricultural related, such as pasture grazing. Even when specific causes are known such as E-coli from animal waste, nutrients from fertilizer

application, habitat alteration from tilling/planting fields up to the top of bank, and siltation from farming practices, agricultural uses are exempt from the stormwater regulations.

Additionally, much of the development that Williamson County is currently experiencing is occurring in the incorporated areas of Franklin, Brentwood, Nolensville, Fairview, Thompson Station and Spring Hill. There are several stream segments that run through incorporated and unincorporated areas. Because several of these jurisdictions are already sampling those segments, it would be unnecessary to perform additional monitoring on streams that are being monitored by adjacent jurisdictions, especially when based on land uses, the areas of development are focused within the incorporated areas.

Option 2, as described in the MS4 permit, is a jurisdictional-specific monitoring plan. Williamson County has developed the methodology used to determine the stream segments that will be monitored, and outlines specifically which stream segments Williamson County will sample. An evaluation of the areas of land development and agricultural uses within unincorporated Williamson County has been compiled and summarized in the attached exhibits.

There are eight (8) stream segments within unincorporated Williamson County that we would propose sampling (Figure 2). The streams segments are:

- Trace Creek
- Harpeth River, 3 segments
- Lynwood Creek
- Fivemile Creek
- Donelson Creek
- Little Harpeth River

Visual Stream Assessments (VSAs)

Williamson County has begun collecting Visual Stream Assessment data in the field. The VSAs include a stream survey for each MS4 outfall location, which includes field parameters, physical characteristics & light penetration, channel characteristics, stream characteristics, dominant substrates, surrounding uses, human disturbance and any other relevant information or stressors. Additionally, habitat assessments are performed at each MS4 outfall, which includes information relating to epifaunal substrate / available cover, embeddedness of riffles, velocity / depth regime, sediment deposition, channel flow status, channel alteration, frequency of re-oxygenation zones, bank stability, vegetative protection and riparian vegetative zone widths. Eighty-two (82) VSA are proposed for this permit cycle as shown in Figure 3. Seven VSAs were completed, and the field data is attached in Figure 4.

Figure 2: Proposed Stream Sampling

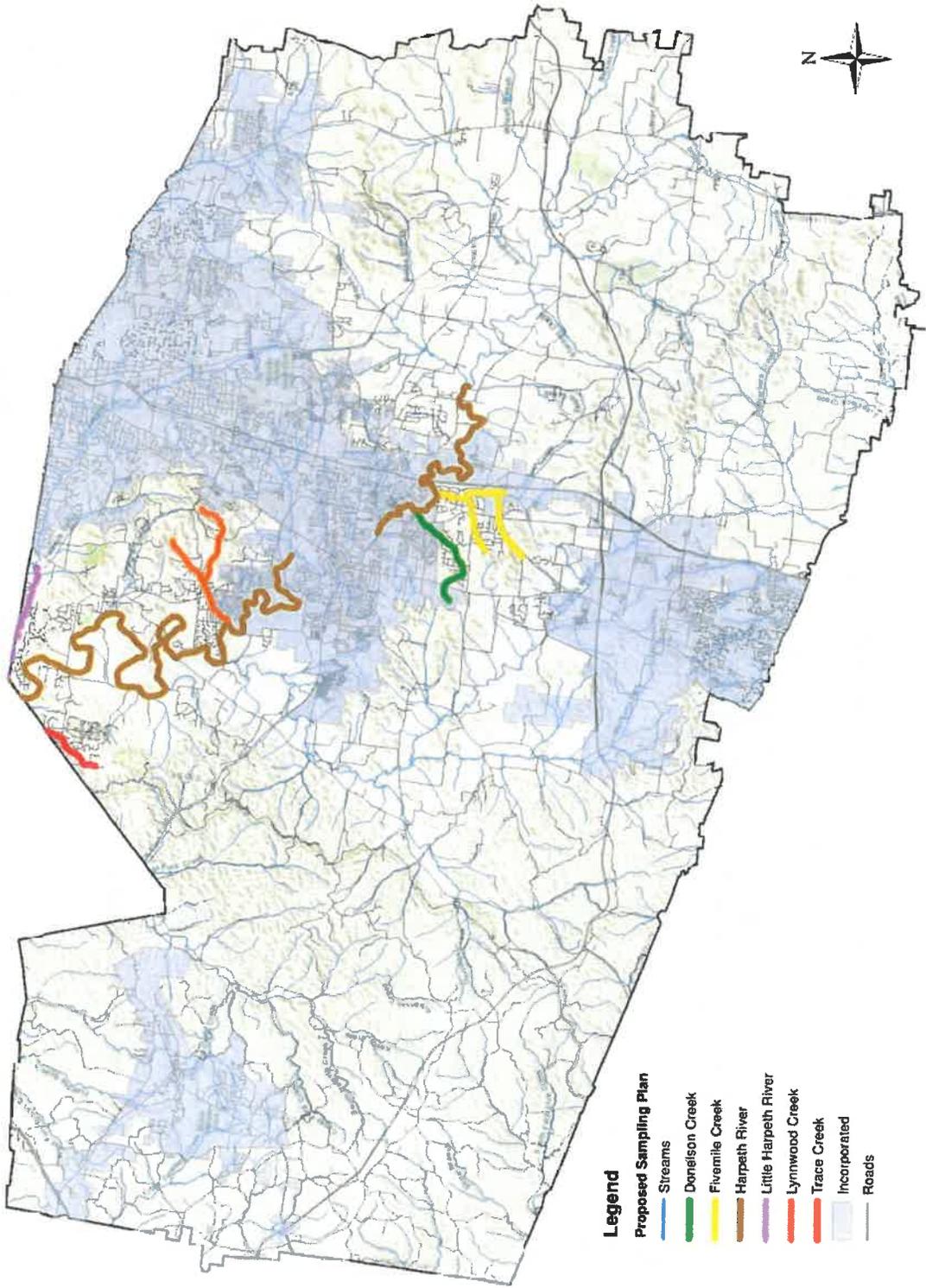


Figure 3: Visual Site Assessments

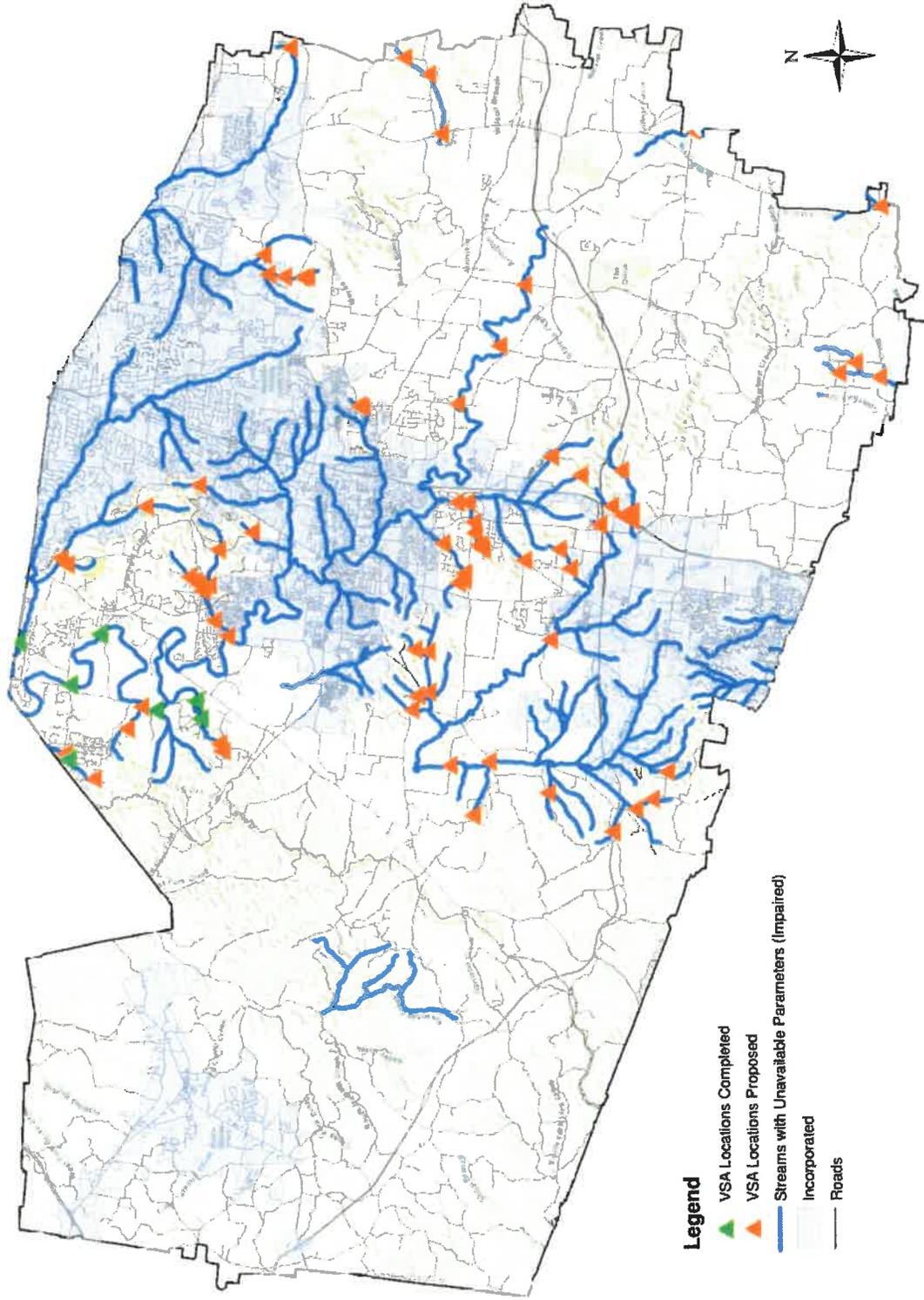


Figure 4: Visual Site Assessments Field Data

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: <u>6-17-AR-P0018w1</u>	Samplers: <u>M.S./W.M./A.T.</u>	
Monitoring Location Name: <u>VSA Site 1</u>	Date: <u>6-26-18</u>	Time: <u>09:45</u>
Monitoring Location: <u>Vaughn Rd. at M...</u>	Organization: <u>Will. Co.</u>	Drainage Area: <u>43.61 m²</u>
County: <u>Williamson</u>	Ecoregion: <u>71a</u>	u/s ECO: <u>N/A</u>
Latitude: <u>36.04898</u>	HUC: <u>0513004</u>	WS Grp: <u>N/A</u>
Longitude: <u>-96.90337</u>	WBID: <u>0513004021-1a</u>	Field Log #: <u>N/A</u>
Project Name: <input type="checkbox"/> Watershed <input type="checkbox"/> 303(d) <input type="checkbox"/> Antideg <input type="checkbox"/> ECO <input type="checkbox"/> FECO Other: <u>VSA</u>		

Project ID: TNPR
 Activity Type: Sample QC Sample Habitat QC habitat QC ID VSA
 Sample Status: Collected Seasonally Dry Frequently Dry No Channel
N/A 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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<u>No</u>	<u>VSA</u>	Periphyton	<u>---</u>	<u>VSA</u>
SQKICK	<u>---</u>		Other	<u>---</u>	
SQBANK	<u>---</u>		Describe Other Sample:	<u>---</u>	

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other 1
 Field Parameters: Meter(s) Used: YSI 556 / HF Scientific Inc. DRT-15CE / GP111

pH (su)	<u>8.13</u>		Dissolved Oxygen %	<u>84.7</u>	<u>---</u>
Conductivity (umhos/cm) <u>MS/cm</u>	<u>.542</u>		Turbidity (NTU)	<u>3.05</u>	<u>3.55</u>
Temperature (C°)	<u>25</u>		TDS (mg/L) <u>348 / 349</u>	<u>---</u>	<u>---</u>
Dissolved Oxygen (ppm = mg/L)	<u>6.88</u>		Flow (cfs)	<u>8.35</u>	<u>---</u>

Meter Problems? 41 ft width / 1.5 ft depth / 0.2 ft/sec
 Photos Taken? No Yes: Description: Normal up / down stream
 Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding
 Air Temperature (°F) 86

Physical Characteristics & Light Penetration:
 Gradient (sample reach): Flat Low Moderate High Cascades
 Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)
 Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)
 % Canopy Cover Estimated for Reach: 92.3 %
 % Canopy Cover Measured (mid-reach): 92.8 u/s + 92.7 d/s + 70.9 LDB + 96.9 RDB = Total/384*100 92.3

Channel Characteristics:
 Bank Height: 3.5 (yd.) High Water Mark: 1 (yd.)
 Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope
 Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope
 Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:
 Sediment Deposits: None Slight Moderate Excessive Blanket
 Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent
 Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed
 Foam/Surface Sheen: None Nutrient Surfactant Bacteria
 Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: L HARPE 2018 41 Date: 6/26/19 Assessors: MS/MS/OI

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|--|--|---|
| <p>Riffle</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Run</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Pool</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <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 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	Logging	Industry	ATV/OHV
Channelization <u>S</u>	Urban	Mining/ Dredging	Golf Course
Active Grazing	Commercial	Road/Hwy/RR	Garbage Trash
Row Crops	Residential <u>M</u>	Construction	Landfill
CAFO/Dairy	STP/WWTP	Impoundment	Water Withdrawal

Other Stream Information and Stressors: Surrounded by park / open space

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.

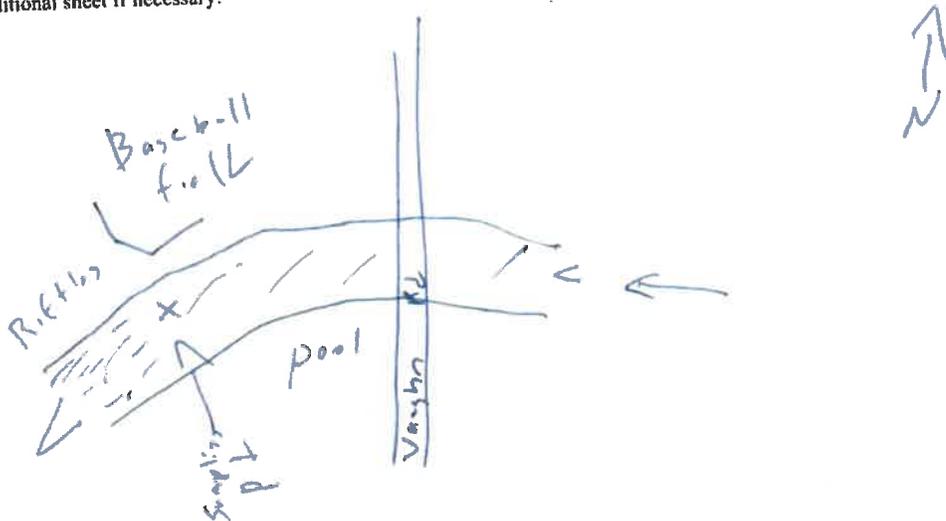


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)

(See Protocol E for detailed descriptions and rank information)

DWR Station ID: <u>LHARP 0012 r</u>		Habitat Assessment By: <u>MS / WM / AT</u>		
Monitoring Location Name: <u>Vaughan Rd VSA S.F. I</u>		Date: <u>6/25/18</u>		Time: <u>12:45 A.M.</u>
Monitoring Location: <u>Little Harpers @ Vaughn Rd</u>		Field Log Number:		
HUC: <u>0513020402-1000</u>		WS Group: <u>021-1000</u>	Ecoregion: <u>71 h</u>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 20 19 18 <u>17</u> 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <u>11</u>	10 9 8 7 6	5 4 3 2 1
Comments				
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 <u>11</u>	10 9 8 7 6	5 4 3 2 1
Comments				
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 <u>2</u> 1
Comments				
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 <u>17</u> 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date				Assessors <i>MS/WN/AT</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. Instream habitat greatly altered or removed. Artificial structures have greatly affected flow pattern.							
	SCORE	20	19	18	17	16	15	<u>4</u>	13	12	11	10	9	8	7	6	5	4	3	2	1
	Comments																				
7. Frequency of re-oxygenation zones. Use frequency of riffle 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	<u>13</u>	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 (LB)	Left Bank	10	<u>9</u>	8	<u>7</u>	6	5	4	3	2	1	0								
	SCORE (RB)	Right Bank	10	<u>9</u>	8	7	6	5	4	3	2	1	0								
	Comments																				
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	<u>9</u>	8	<u>7</u>	6	5	4	3	2	1	0								
	SCORE (RB)	Right Bank	10	<u>9</u>	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	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 (LB)	Left Bank	10	<u>9</u>	8	<u>7</u>	6	5	<u>4</u>	3	2	1	0								
	SCORE (RB)	Right Bank	10	<u>9</u>	8	7	6	5	<u>4</u>	3	2	1	0								
	Comments																				

Total Score 127 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: <i>N/A - Trace (ack)</i>	Samplers: <i>H.S./W.M./A.T.</i>	
Monitoring Location Name: <i>VSA Site 2</i>	Date: <i>6-26-18</i>	Time: <i>12:15</i>
Monitoring Location: <i>Timberline @ Trac G.</i>	Organization: <i>Will Co</i>	Drainage Area: <i>2.32 sq mi</i>
County: <i>Williamson</i>	Ecoregion: <i>716</i>	u/s ECO: <i>N/A</i>
Latitude: <i>36.02950° N</i>	HUC: <i>0513004</i>	WS Grp: <i>N/A</i>
Longitude: <i>-96.95897° W</i>	WBID: <i>009 0900</i>	Field Log #: <i>N/A</i>

Project Name: Watershed 303(d) Antideg ECO FECO Other: *VSA*

Project ID: *TNPR*
 Activity Type: Sample QC Sample Habitat QC habitat QC ID *VSA*

Sample Status: Collected Seasonally Dry Frequently Dry No Channel *VSA*
 Too Deep (Not Wadeable) Too Deep (Temporary) Permanent Barrier Fenced
N/A Landowner Denial: Temporary Barrier Posted Plan to revisit? Yes No

Flow Conditions: Dry Isolated Pools Stagnant Low Moderate High Bankful Flooding

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<i>No</i>	<i>VSA only</i>	Periphyton	<i>No</i>	<i>VSA only</i>
SQKICK	<i>1</i>		Other	<i>1</i>	
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other _____
 Field Parameters: Meter(s) Used:

pH (su)	<i>8.03</i>	<i>8.00</i>	Dissolved Oxygen %	<i>138.7</i>	<i>122.0</i>
Conductivity (umhos) <i>ms/cm</i>	<i>0.77</i>	<i>0.76</i>	Turbidity (NTU)	<i>1.96</i>	<i>2.6</i>
Temperature (C°)	<i>24.9</i>	<i>24.6</i>	TDS (mg/L)	<i>501</i>	<i>500</i>
Dissolved Oxygen (ppm = mg/L)	<i>11.4</i>	<i>10.01</i>	Flow (cfs)		

Meter Problems? _____
 Photos Taken? No Yes: Description: *20 ft width / 0.5 ft depth / slope of up & down stream*

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding
 Air Temperature (°F) *93*

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades
 Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)
 Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)
 % Canopy Cover Estimated for Reach: *80* %
 % Canopy Cover Measured (mid-reach): *79.2* u/s + *96.8* d/s + *78.6* LDB + *52.2* RDB = Total/384*100 *0.8 80%*

Channel Characteristics:

Bank Height: *1.3* (yd.) High Water Mark: *0.5* (yd.)
 Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope
 Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope
 Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket
 Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent
 Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed
 Foam/Surface Sheen: None Nutrient Surfactant Bacteria
 Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: *N/A - Trout Creek* Date: *6/26/12* Assessors: *ms/ym/AT*

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|--|--|---|
| <p>Riffle</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input type="checkbox"/> Cobble (2.5-10") <input type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Run</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input type="checkbox"/> Cobble (2.5-10") <input type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input checked="" type="checkbox"/> Clay (Slick) | <p>Pool</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input type="checkbox"/> Cobble (2.5-10") <input type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input checked="" 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 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 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	Logging	Industry	ATV/OHV
Channelization <i>M</i>	Urban	Mining/Dredging	Golf Course
Active Grazing	Commercial	Road/Hwy/RR	<i>M</i> Garbage Trash
Row Crops	Residential <i>M</i>	Construction	Landfill
CAFO/Dairy	STP WWTP	Impoundment	Water Withdrawal

Other Stream Information and Stressors: *Thin layer of algae covering stream bottom beneath layer of sediment. Water level very low. Next to no riparian buffer. Captures stormwater from school. Poured cement that crosses pipes acting as dam upstream of reach.*

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.

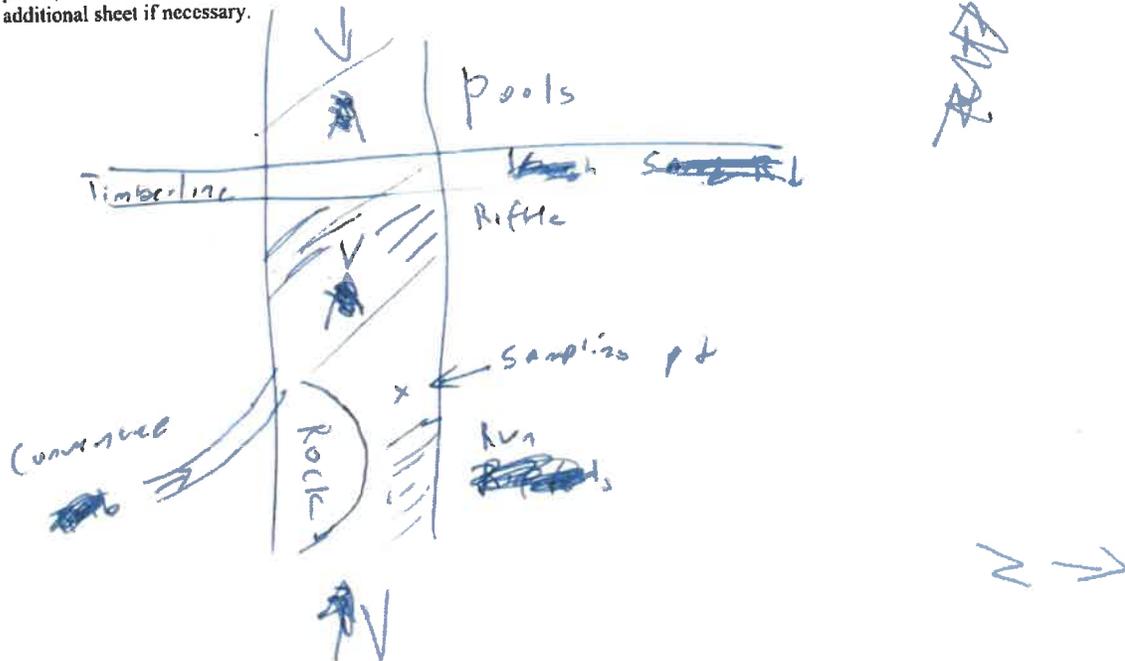


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)
 (See Protocol E for detailed descriptions and rank information)

DWR Station ID: <u>N/A</u>		Habitat Assessment By: <u>AS/AT/WM</u>		
Monitoring Location Name: <u>Timberline VSA site 2</u>		Date: <u>6/26/17</u>	Time: <u>17:15</u>	
Monitoring Location: <u>Trail Cr. @ Timberline</u>		Field Log Number:		
HUC: <u>05130204</u>	WS Group: <u>009.0900</u>	Ecoregion: <u>71b</u>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor 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				
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				
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				
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				
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				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors										
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. Instream 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 riffle 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																				
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 (LB)	Left Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
	SCORE (RB)	Right Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
Comments																					
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
	SCORE (RB)	Right Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
Comments																					
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 (LB)	Left Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
	SCORE (RB)	Right Bank	10	9	8	7	6	8	7	6	5	4	3	2	1	0	2	1	0		
Comments																					

Total Score 56 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: HARPE 065641	Samplers: H.S./W.M./A.T.
Monitoring Location Name: VSA Site 3	Date: 6-26-18 Time: 13:30
Monitoring Location: Sneed Rd	Organization: Will Co Drainage Area: 360 mi ²
County: Williamson	Ecoregion: 71h u/s ECO: N/A
Latitude: 36.02879° N	HUC: 05130204 WS Grp: N/A
Longitude: -86.92355° W	WBID: 009-3000 Field Log #: N/A

Project Name: Watershed 303(d) Antideg ECO FECO Other: VSA

Project ID: TNPR
 Activity Type: Sample QC Sample Habitat QC habitat QC ID VSA

Sample Status: Collected Seasonally Dry Frequently Dry No Channel
 N/A 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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	NO	VSA	Periphyton	NO	VSA
SQKICK			Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other

Field Parameters: Meter(s) Used: YSI 656 / HF Scientific DRT-15LE / Gw-FP11

pH (su)	8.21	8.20	Dissolved Oxygen %	104.5	103.7
Conductivity (umhos)	ms/cm 0.52	0.52	Turbidity (NTU)	14.5	17.0
Temperature (C°)	29.1	29.1	TDS (mg/L)	315	316
Dissolved Oxygen (ppm = mg/L)	8.02	7.95	Flow (cfs)	111	111

Meter Problems? None Yes: u/s depth / 3.5 ft / 31 width

Photos Taken? No Yes: Description: upstream / downstream

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 93°

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades

Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)

Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)

% Canopy Cover Estimated for Reach: 25.0 %

% Canopy Cover Measured (mid-reach): 26 u/s + 23 d/s + 0 LDB + 100 RDB = Total/384*100

Channel Characteristics:

Bank Height: 5 (yd.) High Water Mark: 1 (yd.)

Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket

Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent

Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed

Foam/Surface Sheen: None Nutrient Surfactant Bacteria

Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: MARPEOS.6 W Date: 6/26/18 Assessors: AS/AI/WM

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|---|---|---|
| <p>Riffle</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Run</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input checked="" type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Pool</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input type="checkbox"/> Cobble (2.5-10") <input type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) |
|---|---|---|

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|---|---|---|---------------------------------------|
| <input type="checkbox"/> Forest | <input checked="" type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input checked="" 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 checked="" 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		Logging		Industry		ATV/OHV	
Channelization	S	Urban		Mining/Dredging		Golf Course	
Active Grazing	M	Commercial		Road/Hwy/RR	M	Garbage/Trash	
Row Crops	M	Residential	S	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.

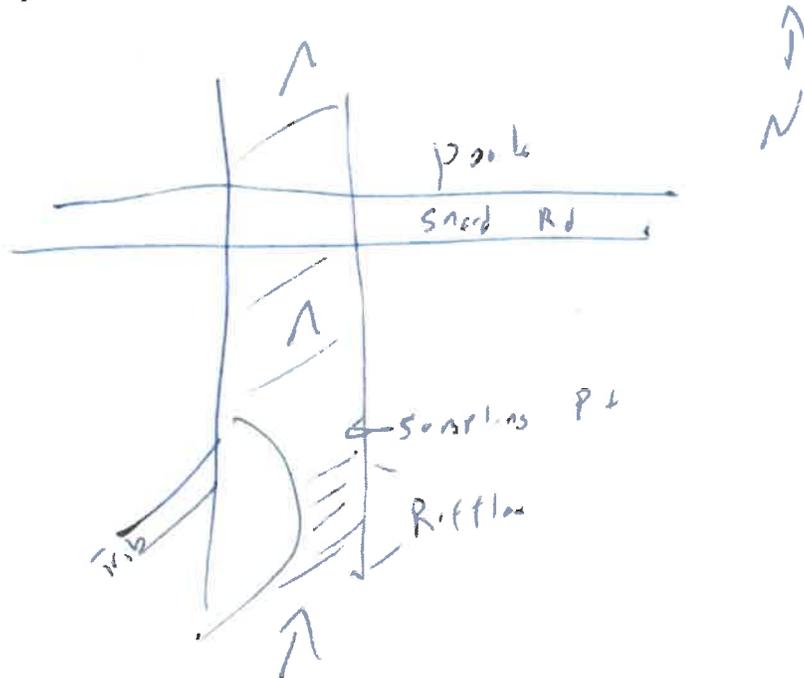


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)
 (See Protocol E for detailed descriptions and rank information)

DWR Station ID: <u>17ARPE AG 5.641</u>		Habitat Assessment By: <u>MS/AT</u>		
Monitoring Location Name: <u>VSA Site 3</u>		Date: <u>6/26/18</u>	Time: <u>13:30</u>	
Monitoring Location: <u>Sneed Rd</u>		Field Log Number:		
HUC: <u>0313 0204</u>	WS Group: <u>009-3000</u>	Ecoregion: <u>714</u>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor 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				
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				
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				
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				
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				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6. DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors											
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. Instream 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 riffle 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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	Comments																					
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1	0	2	1	0						
	Comments																					

Total Score 163. Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION *Harpeth @ Moron*

DWR Station ID: XXXXXXXXXX	Samplers: <i>NS/WM</i>
Monitoring Location Name: <i>VSA Site 4</i>	Date: <i>6/26/19</i> Time: <i>3:00</i>
Monitoring Location: <i>Moron RJO</i>	Organization: <i>VC</i> Drainage Area: <i>56 mi²</i>
County: <i>Williamson</i>	Ecoregion: <i>71b</i> u/s ECO: <i>N/A</i>
Latitude: <i>36.01715° N</i>	HUC: <i>05130204</i> WS Grp: <i>N/A</i>
Longitude: <i>-86.89792° W</i>	WBID: <i>009-3000</i> Field Log #: <i>N/A</i>

Project Name: Watershed 303(d) Antideg ECO FECO Other: *VSA*

Project ID: TNPR
 Activity Type: Sample QC Sample Habitat QC habitat QC ID *VSA*

Sample Status: Collected Seasonally Dry Frequently Dry No Channel
N/A 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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<i>NO</i>	<i>VSA</i>	Periphyton	<i>NO</i>	<i>VSA</i>
SQKICK			Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other

Field Parameters: Meter(s) Used: *YSI 556 / MF Scientific DRT-151E / GW-FP111*

pH (su)	<i>8.23</i>	<i>8.24</i>	Dissolved Oxygen %	<i>111.7</i>	<i>109.9</i>
Conductivity (umhos)	<i>.534</i>	<i>.533</i>	Turbidity (NTU)	<i>15.5</i>	<i>16.0</i>
Temperature (C°)	<i>29.6</i>	<i>29.6</i>	TDS (mg/L)	<i>.319</i>	<i>.319</i>
Dissolved Oxygen (ppm = mg/L)	<i>8.42</i>	<i>8.35</i>	Flow (cfs)	<i>253</i>	<i>253</i>

Meter Problems? *112' width / 1 ft / 2.3 ft/sec*

Photos Taken? No Yes: Description: *upstream / downstream*

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) *86*

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades

Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)

Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep(>1yd)

% Canopy Cover Estimated for Reach: *51%*

% Canopy Cover Measured (mid-reach): *0* u/s + *0* d/s + *100* LDB + *98.9* RDB = Total/384*100 *51*

Channel Characteristics:

Bank Height: *5* (yd.) High Water Mark: *1* (yd.)

Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket

Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent

Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed

Foam/Surface Sheen: None Nutrient Surfactant Bacteria

Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: *N/A* *Maple & Moran Rd* Date: *6/26/18* Assessors: *MS / LM*

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|---|--|---|
| <p>Riffle</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Run</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) | <p>Pool</p> <ul style="list-style-type: none"> <input type="checkbox"/> Boulders (>10") <input checked="" type="checkbox"/> Cobble (2.5-10") <input checked="" type="checkbox"/> Gravel (0.1-2.5") <input type="checkbox"/> Bedrock <input type="checkbox"/> Sand <input type="checkbox"/> Silt (not gritty) <input type="checkbox"/> Clay (Slick) |
|---|--|---|

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|---|---|---|---|
| <input type="checkbox"/> Forest | <input checked="" type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input checked="" 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 checked="" type="checkbox"/> Hay/Fields | <input type="checkbox"/> Logging | <input checked="" type="checkbox"/> Residential | <input checked="" type="checkbox"/> Road/Hwy/RR | <input checked="" 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	
Channelization	S	Urban		Mining/ Dredging		Golf Course	M
Active Grazing	M	Commercial		Road/Hwy/RR	M	Garbage/Trash	
Row Crops	M	Residential	S	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.

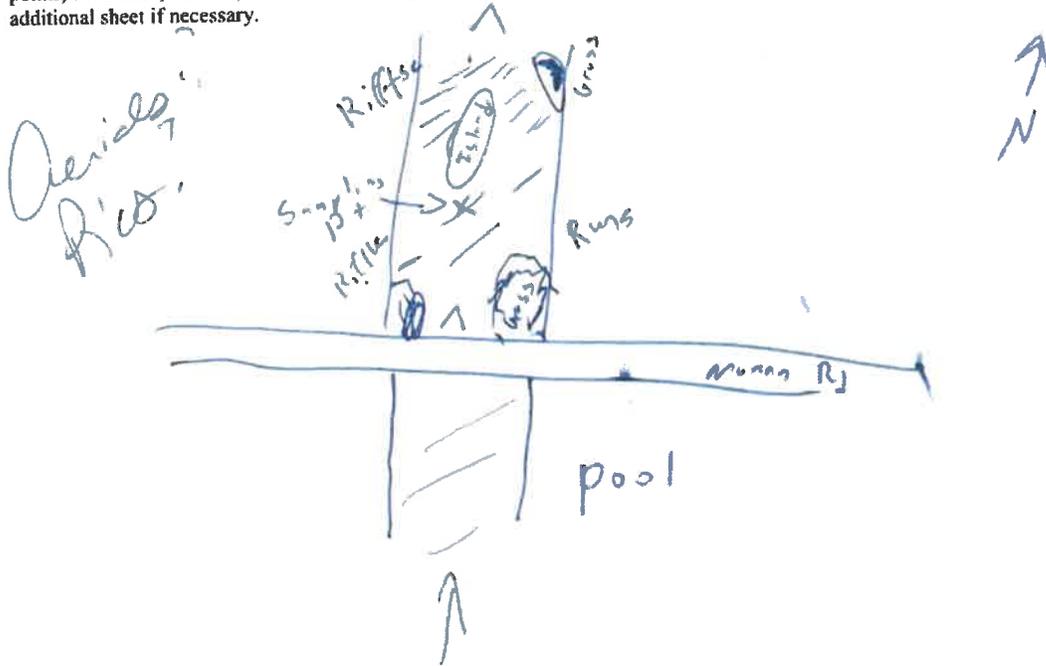


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)
 (See Protocol E for detailed descriptions and rank information)

DWR Station ID: <i>NA 19.027 @ Moran</i>		Habitat Assessment By: <i>ms / um</i>		
Monitoring Location Name: <i>USA Site</i>		Date: <i>6/26/14</i>	Time: <i>3:02 PM</i>	
Monitoring Location: <i>Moran Pt. @ 19.027</i>		Field Log Number:		
HUC: <i>05150209</i>	WS Group: <i>093000</i>	Ecoregion: <i>71h</i>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
	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 <i>19</i> 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <i>17</i> 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <i>19</i> 18 17 16	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <i>9</i> 8 7 6	5 4 3 2 1
Comments				
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 <i>16</i>	15 14 13 12 11	10 9 8 7 6	5 4 3 2 1
Comments				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 - DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors														
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. Instream 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 riffle 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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1
Comments																									
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1
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 (LB)	Left Bank	10	9	8	7	6	5	4	3	2	1	0	SCORE (RB)	Right Bank	10	9	8	7	6	5	4	3	2	1
Comments																									

Total Score 158 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: <u>Murray Branch</u>	Samplers: <u>M/S/W/M</u>
Monitoring Location Name: <u>VSA site 5</u>	Date: <u>6/29/18</u> Time: <u>10:00 AM</u>
Monitoring Location: <u>Mount Pier @ Murray</u>	Organization: <u>WLC</u> Drainage Area: <u>0.45 mi²</u>
County: <u>Wilkeson</u>	Ecoregion: <u>71h</u> u/s ECO: <u>N/A</u>
Latitude: <u>35.97797° N</u>	HUC: <u>05130204</u> WS Grp: <u>N/A</u>
Longitude: <u>-86.93987° W</u>	WBID: <u>009-0600</u> Field Log #: <u>N/A</u>

Project Name: Watershed 303(d) Antideg ECO FECO Other: VSA

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID VSA

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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<u>NO</u>	<u>VSA</u>	Periphyton	<u>NO</u>	<u>VSA</u>
SQKICK			Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other

Field Parameters: Meter(s) Used: VSI SSG / MF Seawater DRT-156 / 16 W FPII

pH (su)	<u>7.62</u>	<u>7.62</u>	Dissolved Oxygen %	<u>74.1</u>	<u>77.9</u>
Conductivity (umhos)	<u>.356</u>	<u>.356</u>	Turbidity (NTU)	<u>21.5</u>	<u>23.5</u>
Temperature (C°)	<u>22.2</u>	<u>22.1</u>	TDS (mg/L)	<u>245</u>	<u>245</u>
Dissolved Oxygen (ppm = mg/L)	<u>6.42</u>	<u>6.33</u>	Flow (cfs)	<u>0.91</u>	<u>0.91</u>

Meter Problems? Depth .4 0.2 ft/s w-LR 64

Photos Taken? No Yes: Description: upstream / downstream

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 79°F

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades

Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)

Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)

% Canopy Cover Estimated for Reach: 100 %

% Canopy Cover Measured (mid-reach): 100u/s + 99.96/s + 100 LDB + 100 RDB = Total/384*100 124

Channel Characteristics:

Bank Height: 2 (yd.) High Water Mark: 5 (yd.)

Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket

Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent

Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed

Foam/Surface Sheen: None Nutrient Surfactant Bacteria

Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: Murray Branch @ Mont Pitt Date: 6/26/18 Assessors: MJ / WJ

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|---|--|--|
| <p>Riffle</p> <input checked="" type="checkbox"/> Boulders (>10")
<input checked="" type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Run</p> <input checked="" type="checkbox"/> Boulders (>10")
<input checked="" type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Pool</p> <input type="checkbox"/> Boulders (>10")
<input type="checkbox"/> Cobble (2.5-10")
<input checked="" type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<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		Logging		Industry		ATV/OHV	
Channelization	M	Urban		Mining/ Dredging		Golf Course	
Active Grazing		Commercial		Road Hwy/RR		Garbage/Trash	
Row Crops		Residential	M	Construction		Landfill	
CAFO/Dairy		STP/WWTP		Impoundment		Water Withdrawal	

Other Stream Information and Stressors:

Culvert Rusted out of bottom

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.

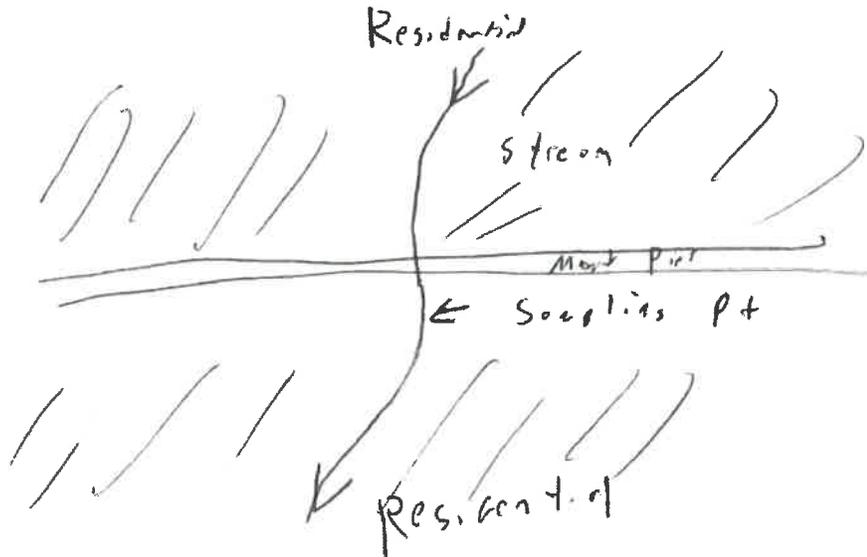


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)
 (See Protocol E for detailed descriptions and rank information)

DWR Station ID: <i>N/A Murrey Branch @ Montpelier</i>		Habitat Assessment By: <i>AS/VW</i>		
Monitoring Location Name: <i>VSA 5</i>		Date: <i>6/28/14</i>	Time: <i>10:00 AM</i>	
Monitoring Location: <i>Montpelier Rd @ Murrey</i>		Field Log Number:		
HUC: <i>05130204</i>	WS Group: <i>009.000</i>	Ecoregion: <i>71h</i>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor 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				
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				
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				
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				
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				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors										
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. Instream 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 riffle 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																					
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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0		
Comments																					
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	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.	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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
	SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0		
Comments																					

Total Score 86 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: <u>Murray @ Old Natick</u>	Samplers: <u>MS/LMM</u>
Monitoring Location Name: <u>VSA STA 6</u>	Date: <u>6/29</u> Time: <u>11:00</u>
Monitoring Location: <u>Old Natick @</u>	Organization: _____
County: <u>Wilmington</u>	Drainage Area: <u>0.79 mi²</u>
Latitude: <u>35.98020° N</u>	Ecoregion: <u>71h</u> u/s ECO: <u>NA</u>
Longitude: <u>-86.93123° W</u>	HUC: <u>05130204</u> WS Grp: <u>NA</u>
Project Name: <input type="checkbox"/> Watershed <input type="checkbox"/> 303(d) <input type="checkbox"/> Antideg <input type="checkbox"/> ECO <input type="checkbox"/> FECO Other: <u>VSA</u>	WBID: <u>009-0600</u> Field Log #: <u>N/A</u>

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID VSA

Sample Status: Collected Seasonally Dry Frequently Dry No Channel

N/A 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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<u>VSA NO</u>	<u>VSA</u>	Periphyton	<u>NO</u>	<u>VSA</u>
SQKICK			Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other

Field Parameters: Meter(s) Used: VSI 556 / MF Scientific DRT-151E / OW-1-P111

pH (su)	<u>7.71</u>	<u>7.72</u>	Dissolved Oxygen %	<u>77.3</u>	<u>75.7</u>
Conductivity (umhos)	<u>.376</u>	<u>.375</u>	Turbidity (NTU)	<u>45.9</u>	<u>46.1</u>
Temperature (C°)	<u>23.3</u>	<u>23.3</u>	TDS (mg/L)	<u>252</u>	<u>252</u>
Dissolved Oxygen (ppm = mg/L)	<u>6.52</u>	<u>6.43</u>	Flow (cfs)	<u>5</u>	<u>5</u>

Meter Problems? Depth 49 .6 ft/s Width 10 ft

Photos Taken? No Yes: Description: 4 photos / 1 macro specimen

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 79°F

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades

Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)

Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)

% Canopy Cover Estimated for Reach: 99 %

% Canopy Cover Measured (mid-reach): 48.6/s + 43.8/d/s + 98.9/LDB + 100 RDB = Total/384*100 99.3

Channel Characteristics:

Bank Height: .3 (yd.) High Water Mark: 1 (yd.)

Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket

Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent

Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed

Foam/Surface Sheen: None Nutrient Surfactant Bacteria

Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: _____ Date: _____ Assessors: _____

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|--|---|---|
| <p>Riffle</p> <input checked="" type="checkbox"/> Boulders (>10")
<input type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Run</p> <input checked="" type="checkbox"/> Boulders (>10")
<input type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Pool</p> <input type="checkbox"/> Boulders (>10")
<input type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input checked="" type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) |
|--|---|---|

Surrounding Land Uses (list additional land uses under comments)

- | | | | | |
|--|---|---|---|---------------------------------------|
| <input type="checkbox"/> Forest | <input checked="" type="checkbox"/> Grazing | <input type="checkbox"/> Stormwater | <input type="checkbox"/> STP/WWTP | <input type="checkbox"/> Construction |
| <input type="checkbox"/> Wetland | <input checked="" 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 checked="" 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	M	Logging		Industry		ATV/OHV	
Channelization	M	Urban		Mining/ Dredging		Golf Course	
Active Grazing	M	Commercial		Road/Hwy/RR	M	Garbage/Trash	
Row Crops	S	Residential	S	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.

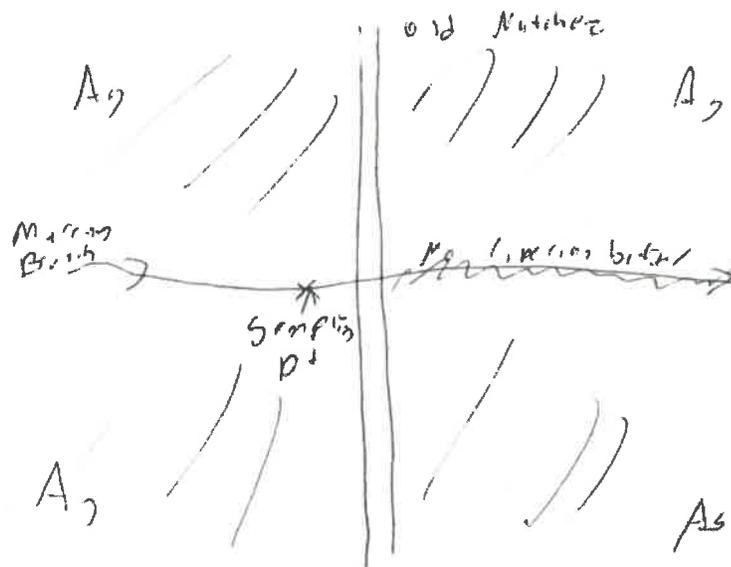


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)

(See Protocol E for detailed descriptions and rank information)

DWR Station ID: Murray Branch @ Old Natchez		Habitat Assessment By: AS/wm		
Monitoring Location Name: VSA 6		Date: 6/22	Time: 11:00 AM	
Monitoring Location: Old Natchez / Murray		Field Log Number: N/A		
HUC: 05130204	WS Group: 09910600	Ecoregion: 71h	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor 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				
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				
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				
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				
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				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors									
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. Instream 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 riffle 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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0		
Comments																				
9. Vegetative Protective (score each bank) includes 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 bank 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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RB)	Right Bank	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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0		
SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0		
Comments																				

Total Score 73 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 10 of 15

STREAM SURVEY INFORMATION

DWR Station ID: <u>BR04W0001W1</u>	Samplers: <u>M7/WM</u>	
Monitoring Location Name: <u>VSA 7</u>	Date: <u>6/28/16</u>	Time: <u>12:00</u>
Monitoring Location: <u>Shaw Creek @ W. Hill</u>	Organization: <u>WDC</u>	Drainage Area: <u>3.29 sq mi</u>
County: <u>Williamson</u>	Ecoregion: <u>71h</u>	u/s ECO: <u>N/A</u>
Latitude: <u>35.99598</u>	HUC: <u>05130204</u>	WS Grp: <u>N/A</u>
Longitude: <u>-86.93609 W</u>	WBID: <u>009-0700</u>	Field Log #: <u>1/0</u>

Project Name: Watershed 303(d) Antideg ECO FECO Other: VSA

Project ID: TNPR

Activity Type: Sample QC Sample Habitat QC habitat QC ID VSA

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

Sample	Collected?	Comment	Sample	Collected?	Comment
Biorecon	<u>NO</u>	<u>VSA</u>	Periphyton	<u>NO</u>	<u>VSA</u>
SQKICK	<u>1</u>		Other		
SQBANK			Describe Other Sample:		

Chemicals/Bacteria: None Routine Nutrient Metals E. coli Organics Other

Field Parameters: Meter(s) Used: YSI 556 MF Scientific DRT-15CE / UW-EP11

Parameter	Value 1	Value 2	Parameter	Value 1	Value 2
pH (su)	<u>7.68</u>	<u>7.67</u>	Dissolved Oxygen %	<u>63.9</u>	<u>62.9</u>
Conductivity (umhos)	<u>.348</u>	<u>.348</u>	Turbidity (NTU)	<u>95</u>	<u>9.3</u>
Temperature (C°)	<u>23.19</u>	<u>23.19</u>	TDS (mg/L)	<u>234</u>	<u>234</u>
Dissolved Oxygen (ppm = mg/L)	<u>5.47</u>	<u>5.38</u>	Flow (cfs)	<u>3.71</u>	<u>3.71</u>

Meter Problems? 4 ft/s 6 ft depth 10 ft width

Photos Taken? No Yes: Description: upstream / downstream

Previous 48 hours precipitation: Unknown None Slight Moderate Heavy Flooding

Air Temperature (°F) 79°F

Physical Characteristics & Light Penetration:

Gradient (sample reach): Flat Low Moderate High Cascades

Average Stream Width: Very Small (<1.5yd) Small (1.5-3yd) Med. (3-10yd) Large (10-25yd) Very Large (>25yd)

Maximum Stream Depth: Shallow (<0.3yd) Medium (0.3-0.6yd) Deep (0.6 - 1yd) Very Deep (>1yd)

% Canopy Cover Estimated for Reach: 99%

% Canopy Cover Measured (mid-reach): 96.9 u/s + 91.7 d/s + 94.9 LDB + 95.8 RDB = Total/384*100 98.75

Channel Characteristics:

Bank Height: 7 (yd.) High Water Mark: 1 (yd.)

Bank Slope LDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Bank Slope RDB: Deeply incised Bluff/Wall Undercut Sloughing Steep terrain Gentle Slope

Manmade Modification: None Rip-Rap Cement Gabions Channelized Dam Dredging Bridge ATV

Stream Characteristics:

Sediment Deposits: None Slight Moderate Excessive Blanket

Sediment Type: None Sand Silt Mud Clay Sludge Mn Precipitant Orange Flocculent

Turbidity: Clear Slightly Turbid Muddy Milky Tannic Planktonic Algae Dyed

Foam/Surface Sheen: None Nutrient Surfactant Bacteria

Algae: None Slight Moderate High Choking Type: Diatoms Green Filamentous Blue-green

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6 DWR-PAS-P-01-QSSOP-081117
 Effective Date: August 11, 2017
 Appendix B: Page 11 of 15

TDEC-DWR Stream Survey Field Sheet (Back)

DWR Station ID: BROWN CREEK Date: 6/24/16 Assessors: MG/WAC

Dominate Substrate: (More than 25%) Check all that apply

- | | | |
|--|---|---|
| <p>Riffle</p> <input type="checkbox"/> Boulders (>10")
<input checked="" type="checkbox"/> Cobble (2.5-10")
<input checked="" type="checkbox"/> Gravel (0.1-2.5")
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Run</p> <input type="checkbox"/> Boulders (>10")
<input checked="" type="checkbox"/> Cobble (2.5-10")
<input checked="" type="checkbox"/> Gravel (0.1-2.5")
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<input type="checkbox"/> Clay (Slick) | <p>Pool</p> <input checked="" type="checkbox"/> Boulders (>10")
<input type="checkbox"/> Cobble (2.5-10")
<input type="checkbox"/> Gravel (0.1-2.5")
<input type="checkbox"/> Bedrock
<input type="checkbox"/> Sand
<input type="checkbox"/> Silt (not gritty)
<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 checked="" 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 checked="" 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	S	Logging		Industry		ATV/OHV	
Channelization	M	Urban		Mining/ Dredging		Golf Course	
Active Grazing	M	Commercial		Road/Hwy/RR	M	Garbage/Trash	
Row Crops	M	Residential	S	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.

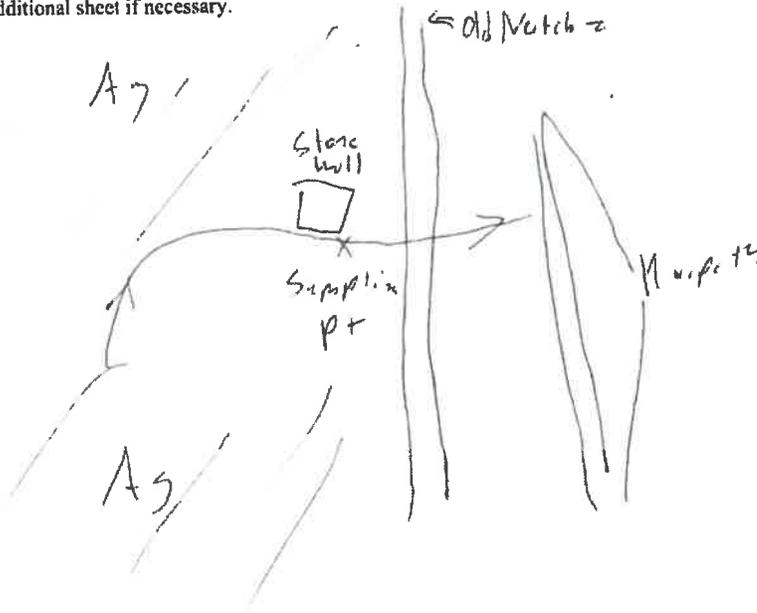


Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 5 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (FRONT)

(See Protocol E for detailed descriptions and rank information)

DWR Station ID: <u>B30W/000141</u>		Habitat Assessment By: <u>MS/MA</u>		
Monitoring Location Name: <u>USA 7</u>		Date: <u>8/28/18</u>	Time: <u>12:00 PM</u>	
Monitoring Location: <u>Old Natches / Brown</u>		Field Log Number: <u>N/A</u>		
HUC: <u>05100204</u>	WS Group: <u>009-0700</u>	Ecoregion: <u>714</u>	QC: <input type="checkbox"/> Duplicate <input type="checkbox"/> Consensus	
1. Epifaunal Substrate/ Available Cover	Optimal Over 70% of stream reach has natural stable habitat suitable for colonization by fish and/or macroinvertebrates. Four or more productive habitats are present.	Suboptimal 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.)	Marginal 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.)	Poor Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking.
	SCORE 20 19 18 17 16	15 14 13 <u>12</u> 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <u>13</u> 12 11	10 9 8 7 6	5 4 3 2 1
Comments				
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 <u>8</u> 7 6	5 4 3 2 1
Comments				
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 <u>8</u> 7 6	5 4 3 2 1
Comments				
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 <u>8</u> 7 6	5 4 3 2 1
Comments				

Figure 4: Visual Site Assessments - Continued

Division of Water Resources
 QSSOP for Macroinvertebrate Stream Surveys
 Revision 6: DWR-PAS-011-QSSOP-08117
 Effective Date: August 11, 2017
 Appendix B: Page 6 of 15

HABITAT ASSESSMENT FIELD SHEET- MODERATE TO HIGH GRADIENT STREAMS (BACK)

DWR Station ID	Date										Assessors													
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. Instream 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. <small>Use frequency of riffle or bends for category. Rank by quality.</small>	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 <small>(score each bank) Determine left or right side by facing downstream</small>	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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0					
	SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0					
Comments																								
9. Vegetative Protective <small>(score each bank) includes vegetation from top of bank to base of bank. Determine left or right side by facing downstream</small>	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 bank 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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0					
	SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0					
Comments																								
10. Riparian Vegetative Zone Width <small>(score each bank.) Zone begins at top of bank.</small>	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 (LB)	Left Bank	10	9			8	7	6			5	4	3			2	1	0					
	SCORE (RB)	Right Bank	10	9			8	7	6			5	4	3			2	1	0					
Comments																								

Total Score 100 Comparison to Ecoregion Guidelines (circle): ABOVE or BELOW
 If score is below guidelines, result of (circle): Natural Conditions or Human Disturbance
 Describe:



Williamson County Engineering Department Stormwater Management Program Enforcement Response Plan

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to develop project review, approval and enforcement procedures, which are outlined within the Enforcement Response Plan (ERP).

A. Site Plan Review and Approval

1. Development and Non-residential

- a. Applicant will be required to apply for Land Disturbance Permit as outlined in Sec. 6 of the Storm Water Regulations.
- b. Prior to issuance of Land Disturbance Permit, a pre-construction meeting will be held by staff with the owner/operator.
- c. The construction plans will be reviewed for adequate pre, during and post control BMPs.

2. Residential Lots

- a. Applicants will be required to apply for Land Disturbance Permit as outlined in Sec. 6 of the Storm Water Regulations.
- b. A site specific erosion control plan will be reviewed for adequate construction site BMPs.

3. Any changes to the plans will require re-submittal to the Engineering Department for review. Upon expiration of the Land Disturbance Permit, the owner/operator must submit plans for a new permit. If the plans have been amended, then a Land Disturbance Permit application fee will be required.

B. Performance Standards and BMP Maintenance

1. Runoff Reduction

- a. Implemented July 1, 2013 as specified within Sec. 2 of the Storm Water Regulations.
- b. Proposed BMPs will be reviewed by staff prior to issuance of Land Disturbance Permit.

2. Pollutant Removal

- a. Applicants subject to standards specified within Sec. 2 of the Storm Water Regulations.
- b. Proposed BMPs will be reviewed by staff prior to issuance of Land Disturbance Permit.
- c. Reference material is provided to assist the BMP designer to meet the required standards.

3. BMP maintenance

Storm Water Long-Term Operation and Maintenance requirements will be implemented as described in Section 5 of the Storm Water Regulations.

C. Permanent Stormwater BMP installation

1. Final storm water management BMPs must be inspected and certified that the BMPs are in accordance with the approved plans.
2. BMP inspections as described in Sec. 5 of the Storm Water Regulations are required to be submitted to Williamson County.

Enforcement

A violation of the Storm Water Regulations shall result from:

- A. Illicit discharge into any watercourse under County jurisdiction;
- B. Illicit discharge from any site required to have a Land Disturbance Permit;
- C. Failure to obtain a Land Disturbance Permit;
- D. Failure to install or maintain erosion prevention and sediment controls; OR
- E. Unapproved or unpermitted encroachment into the Waterway Natural Area (WNA).

Williamson County shall have the authority to issue Notices of Violation and citations, to impose the civil penalties, and to institute appropriate actions or proceedings at law or equity for the enforcement of the Storm Water Regulations.

For potential enforcement actions and descriptions, see Table 3.

Table 3: Potential Enforcement Actions

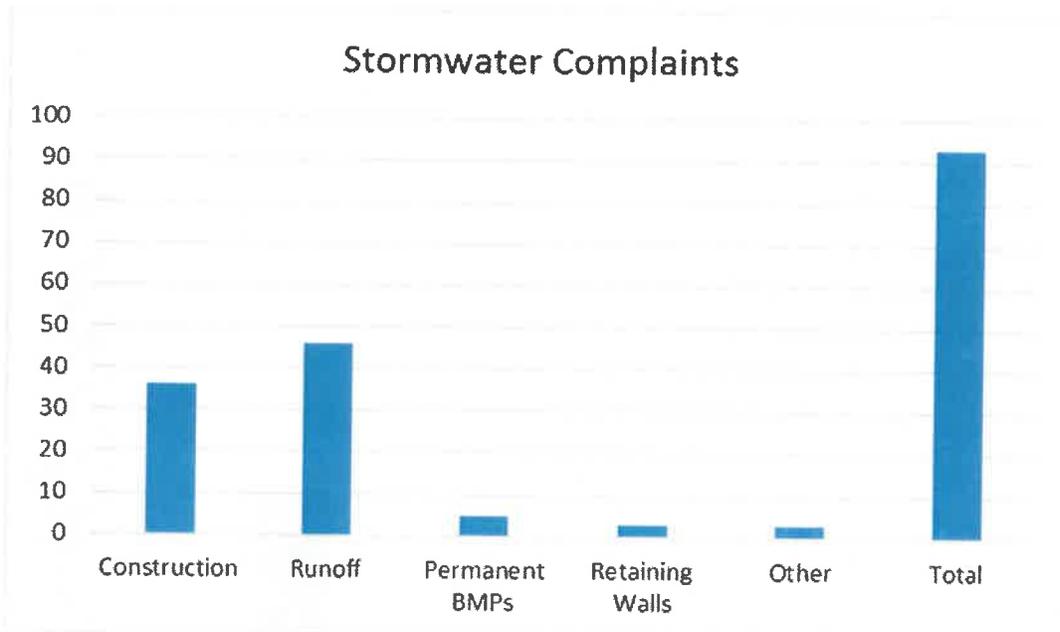
Williamson County Engineering Department Storm Water Management Program Enforcement Response Plan (ERP)	
Enforcement	Description
a. Verbal Warnings	Verbal Warnings may be used in combination with other enforcement actions or as an initial notice to the owner/operator, depending on the severity of the violation(s) or other relevant factors.
b. Notification of Violations	Notice of Violation (NOV) Consent Orders Cease and Desist Orders
c. Civil Penalties	<p>1) Residential</p> <ul style="list-style-type: none"> A. Failure to install or maintain erosion controls - \$250.00 per occurrence B. Illicit Discharge - \$500.00 per occurrence C. Failure to Obtain a Land Disturbance Permit - \$1,000.00 per occurrence <p>2) Development and Non-residential</p> <ul style="list-style-type: none"> A. Failure to install or maintain erosion controls - \$500.00 per occurrence B. Illicit Discharge - \$1,000.00 per occurrence C. Failure to Obtain a Land Disturbance Permit - \$5,000.00 per occurrence <p>Unapproved or unpermitted encroachment into the Waterway Natural Area (WNA) -\$1,000.00</p> <p>Additionally, the following may be considered when assessing Civil Penalties:</p> <ul style="list-style-type: none"> 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 violations; and G. Any equities of the situation which outweigh the benefit of imposing any penalty or damage assessment.
d. Cease and Desist Order	<p>Residential - Halt all grading and land disturbance activities on the lot until remedial or preventive action is taken.</p> <p>Development and non-residential - Halt all construction operations on development infrastructure within that Section of the development, except where necessary to take remedial or preventive action.</p>
e. Withholding of Plan Approvals or Other Authorizations	<p>Residential - Advise the Building Codes Director to not conduct any future inspections and withhold issuance of any Certificates of Occupancy until remedial action has been completed.</p> <p>Development and non-residential</p> <ul style="list-style-type: none"> A. Advise the Building Codes Director to withhold issuance of any new building permits within that section of the development until remedial or preventive action has been completed. B. Advise the Planning Director to withhold placing future submittals within the same development on the agenda of the Planning Commission until remedial or preventive action has been completed. C. Withhold issuance of any future land disturbance permits within the same development until a revised SWPPP has been submitted to the County Engineer.
f. Additional Measures	Williamson County may recover all damages proximately caused by the violator to Williamson County, which may include any reasonable expenses incurred in investigating violations of, and enforcing compliance with the Storm Water Regulations, or any other actual damages caused by the violation. Williamson County may recover costs for maintenance of storm water facilities when the user of such facilities fails to maintain them as required.

Stormwater Complaints

Williamson County received 93 stormwater related complaints (Figure 5):

Construction	36
Runoff	46
Permanent BMPs	5
Retaining Walls	3
Other	3
Total	93

Figure 5: Stormwater Complaints

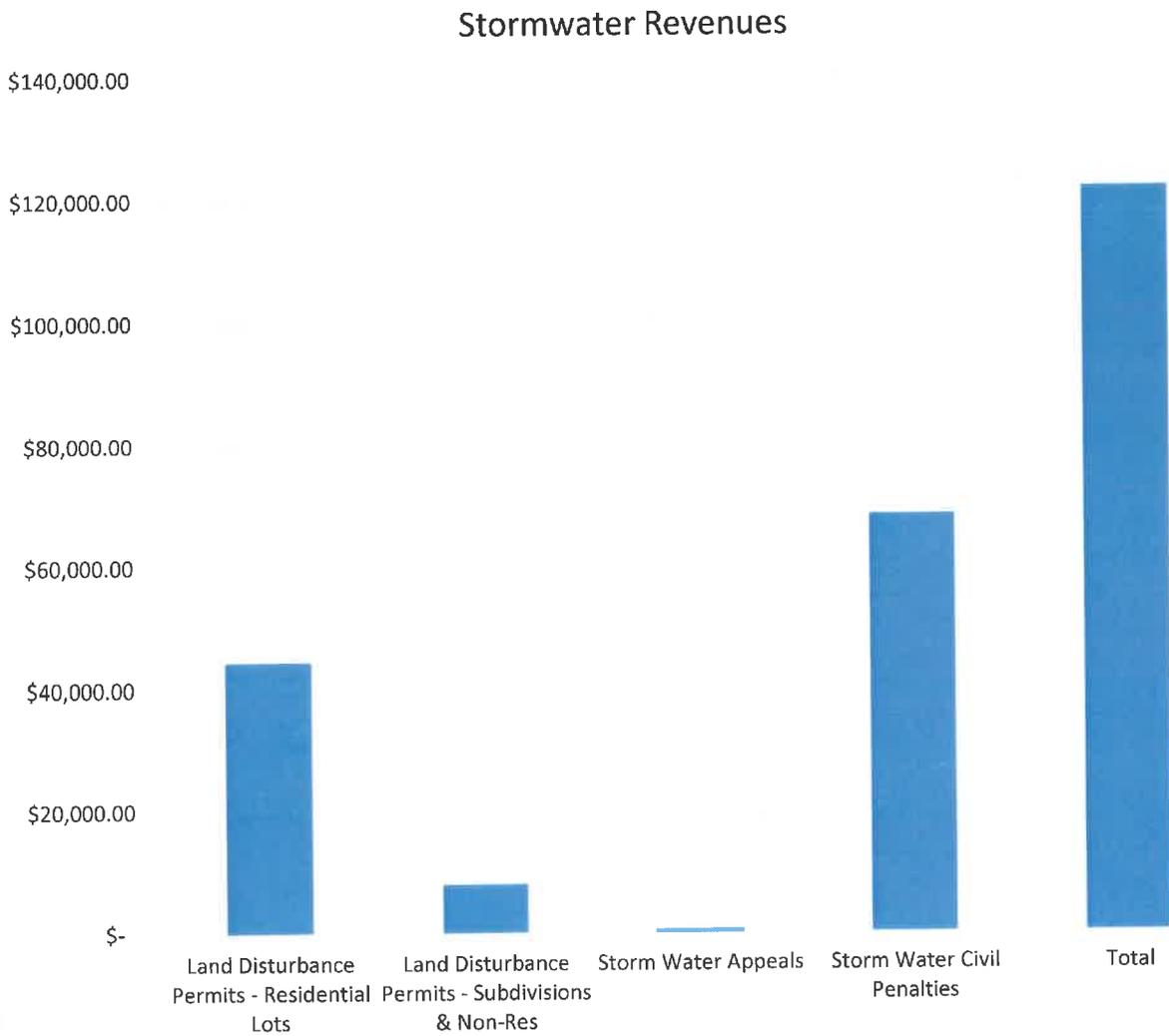


Stormwater Revenues

Williamson County had \$121,850.00 in stormwater related revenue (see Figure 6):

Land Disturbance Permits - Residential Lots	\$44,550.00
Land Disturbance Permits - Subdivisions & Non-Res	\$8,100.00
Storm Water Appeals	\$700.00
Storm Water Civil Penalties	\$68,500.00
Total	\$121,850.00

Figure 6: Stormwater Revenues





Williamson County Engineering Department Stormwater Management Program Operation and Maintenance Program

National Pollution Discharge Elimination System Permit Number TNS000000 authorizes Williamson County to discharge stormwater runoff into Waters of the State of Tennessee in accordance with certain water quality management programs and provisions established within the permit. Williamson County is required to develop and implement an operation and maintenance program that has the ultimate goal of preventing or reducing pollutant runoff from municipal operations.

On an annual basis, Williamson County will perform pollution prevention and good housekeeping inspections at the following County operated facilities:

- Highway Department Garage
- Convenience Centers
- Transportation Garage
- Administrative Complex Garage
- AgExpo Park
- Parks and Rec Maintenance Center
- Emergency Management Services Center

Inspections will document the following concerns:

- Erosion Prevention and Sediment Control Site Conditions
- Material Handling
- Spill Prevention and Control
- Waste Management
- Vehicle and Equipment Cleaning, Fueling and Maintenance

Pollutant potentials that are observed at the facility during the inspection will be discussed in detail and the facility director will be advised to make necessary corrections. Training videos will be available, and the facility director will be encouraged or directed to view them, along with all other staff that may benefit. Additionally, educational material such as best management practices guidance may be distributed to the facility director for their review and implementation.

See Figure 7 for the Inspection Report Form that is completed annually at County facilities.

Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Convenience Centers

Inspection Date: May 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Stormwater training program has been developed and will be provided.

Comments: Convenience Centers were in excellent condition with no storm water violations noted.

Inspector:



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Parks and Rec Maintenance Facility

Inspection Date: May 16, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Stormwater training program has been developed and was provided at the time of inspection.

Comments: Facility was in excellent condition with no storm water violations noted.

Inspector: 



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Highway Department

Inspection Date: May 16, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Stormwater training program has been developed and was provided at the time of inspection.

Comments: Facility was in excellent condition with no storm water violations noted.

Inspector: 



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Public Safety / Emergency Management Facility

Inspection Date: May 17, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Stormwater training program has been developed and was provided at the time of inspection.

Comments: Facility was in very good condition with no stormwater violations noted.

Inspector: 



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Ag Expo Park

Inspection Date: June 5, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Training Program has been developed and was provided at the time of inspection.

Comments: Facility was in excellent condition. No storm water violations noted.

Inspector: 



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Transportation Garage

Inspection Date: June 11, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Detention pond area needs to be mowed; bio-retention area needs to be cleaned and inlet uncovered.

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Make sure that drums which are stored outside are properly sealed/covered.

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Training Program has been developed and was provided at the time of inspection.

Comments: *Facility was in good condition, however, the detention and bio-retention areas need maintenance.*

Inspector: 



Figure 7: County Facilities Inspection Reports



Detention area needs mowing



Bio-retention area needs sediment removal



Figure 7: County Facilities Inspection Reports

Rogers C. Anderson
Williamson County Mayor



Engineering
Floyd Heflin
Director

Stormwater Pollution Prevention and Good Housekeeping Inspection Report

Facility Information

Facility: Administrative Complex Garage

Inspection Date: June 22, 2018

Erosion Prevention and Sediment Control Site Conditions:

Is the site stabilized, structures functional, and no evidence of pollutants leaving site? Yes No N/A

Material Handling:

Are materials such as soil; pesticides and herbicides; fertilizers; detergents; petroleum products such as fuel, oil, and grease; and other hazardous chemical such as acids, lime, glues, paints, and solvents delivered, stored, and used properly? Yes No N/A

Spill Prevention and Control:

Are there adequate measures in place for spill prevention and control of chemicals and hazardous substances such as pesticides, herbicides, fertilizers, fuels, lubricants, and other petroleum distillates? Yes No N/A

The spill kit was empty.

Waste Management:

Are all wastes, including solid waste, hazardous waste, contaminated soil waste, construction waste, and sanitary/septic waste managed and disposed of properly? Yes No N/A

Vehicle and Equipment Cleaning, Fueling and Maintenance:

Are best management practices being followed to reduce the potential of contamination from activities associated with vehicle and equipment cleaning, fueling, and maintenance? Yes No N/A

Training:

Have all employees who are responsible for handling potential pollutants of concern had stormwater pollution prevention and good housekeeping training? Yes No N/A

Training Program has been developed and was provided at the time of inspection.

Comments: Facility was in good condition, however, the spill kit needs to be restocked.

Inspector: 

