# TOTAL MAXIMUM DAILY LOAD (TMDL)

## For

## Siltation and Habitat Alteration

## In The

## Lower Clinch River Watershed (HUC 06010207)

## Anderson, Campbell, Grainger, Knox, Loudon, Morgan, Roane, and Union Counties, Tennessee

**FINAL**

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| | |
|---|---|
| ARS | Agricultural Research Station |
| BMP | Best Management Practices |
| CFR | Code of Federal Regulations |
| DEM | Digital Elevation Model |
| EFO | Environmental Field Office |
| GIS | Geographic Information System |
| HUC | Hydrologic Unit Code |
| LA | Load Allocation |
| MGD | Million Gallons per Day |
| MOS | Margin of Safety |
| MRLC | Multi-Resolution Land Characteristic |
| MS4 | Municipal Separate Storm Sewer System |
| NED | National Elevation Dataset |
| NHD | National Hydrography Dataset |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | Nonpoint Source |
| NSL | National Sediment Laboratory |
| RM | River Mile |
| RMCF | Ready Mixed Concrete Facility |
| SSURGO | Soil Survey Geographic Database |
| STATSGO | State Soil and Geographic Database |
| STP | Sewer Treatment Plant |
| SWMP | Storm Water Management Program |
| SWPPP | Storm Water Pollution Prevention Plan |
| TDA | Tennessee Department of Agriculture |
| TDEC | Tennessee Department of Environment & Conservation |
| TMDL | Total Maximum Daily Load |
| TSS | Total Suspended Solids |
| USDOE | United States Department of Energy |
| USEPA | United States Environmental Protection Agency |
| USGS | United States Geological Survey |
| USLE | Universal Soil Loss Equation |
| WCS | Watershed Characterization System |
| WLA | Waste Load Allocation |
| WWTF | Wastewater Treatment Facility |

**SUMMARY SHEET**

**LOWER CLINCH RIVER WATERSHED (HUC 06010207)**

**Total Maximum Daily Load for Siltation / Habitat Alteration in Waterbodies Identified on the State of Tennessee's *2004 303(d) List***

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**Impaired Waterbody Information:**

State: Tennessee
Counties: Anderson, Campbell, Grainger, Knox, Loudon, Morgan, Roane, and Union
Watershed: Lower Clinch River Watershed (HUC 06010207)
Watershed Area: 633.7 $mi^2$
Constituent of Concern: Siltation/Habitat Alteration (excess loading of sediment produced by erosional processes – see Section 3.0)
Impaired Waterbodies: *2004 303(d) List*:

| Waterbody ID | Waterbody | RM |
|---|---|---|
| 06010207004_0100 | Grable Branch | 1.3 |
| 06010207011_0500 | Hines Branch | 3.2 |
| 06010207011_0600 | Knob Fork | 8.1 |
| 06010207011_0700 | Grassy Creek | 8.2 |
| 06010207011_0800 | Meadow Creek | 5.0 |
| 06010207011_1000 | Beaver Creek | 22.5 |
| 06010207011_2000 & 3000 | Beaver Creek | 21.2 |
| 06010207014_0100 | Williams Branch | 2.4 |
| 06010207014_0110 | Foster Branch | 1.2 |
| 06010207014_1000 | Bullrun Creek | 11.8 |
| 06010207026_0600 | Bear Creek | 5.5 |
| 06010207026_1000 | East Fork Poplar Creek | 9.7 |
| 06010207026_2000 | East Fork Poplar Creek | 11.3 |

Designated Uses: Fish & aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in watershed also classified for domestic and/or industrial water supply.

Applicable Water Quality Standard: Most stringent narrative criteria applicable to fish & aquatic life use classification:

Biological Integrity: The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.

Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion, (b) is of the appropriate stream order specified for the bioregion and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.

Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.

Habitat: The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

**TMDL Development**

General Analysis Methodology:

- Analysis performed using the Watershed Characterization System Sediment Tool (based on Universal Soil Loss Equation) applied to impaired HUC-12 subwatershed areas to calculate existing sediment loads.
- Target sediment loads (lbs/acre/year) are based on the average annual sediment loads from biologically healthy watersheds (Level IV Ecoregion reference sites).
- TMDLs are expressed as the percent reduction in average annual sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate target load.
- 5% of subwatershed target loads are reserved to account for WLAs for industrial facilities, Ready Mixed Concrete Facilities (RMCFs), and regulated mining sites. Loading from these sources is small compared to total loading.
- Since the TSS of municipal STP discharges is generally composed of primarily organic material and is considered to be different in nature than the sediments produced form erosional processes, TSS discharges from STPs were not considered in the TMDL analysis (ref.: Sections 3.0 and 6.0).

- WLAs for the USDOE Oak Ridge Y-12 National Security Complex, Municipal Separate Storm Sewer Systems (MS4s), and NPDES-regulated construction storm water discharges and LAs for nonpoint sources are expressed as the percent reduction in average annual sediment load required for a subwatershed containing impaired waterbodies relative to the appropriate reduced target load (target load minus 5% reserved WLAs for industrial facilities, mining sites, and RMCFs).

Critical Conditions: Methodology takes into account all flow conditions.

Seasonal Variation: Methodology addresses all seasons.

Margin of Safety (MOS): Implicit (conservative modeling assumptions).

**TMDL/Allocations**

TMDLs, WLA for the USDOE Oak Ridge Y-12 National Security Complex, WLAs for MS4s, WLAs for Construction Storm Water Sites, & LAs for Nonpoint Sources:

| HUC-12 Subwatershed (06010207__) | Waterbody ID | Waterbody Impaired by Siltation/ Habitat Alteration | Level IV Ecoregion | TMDL (Required Overall Load Reduction) | Required Load Reduction | |
|---|---|---|---|---|---|---|
| | | | | | WLA (MS4s and Construction SW) | LA (Nonpoint Sources) |
| | | | | [%] | [%] | [%] |
| 0104 | 06010207004_0100 | Grable Branch | 67f | 46.1 | 48.8 | 48.8 |
| 0202 | 06010207014_0100 | Williams Branch | 67i | 41.9 | 44.8 | 44.8 |
| | 06010207014_0110 | Foster Branch | | | | |
| | 06010207014_1000 | Bullrun Creek | | | | |
| 0301 | 06010207011_0500 | Hines Branch | 67f | 48.4 | 51.0 | 51.0 |
| | 06010207011_0600 | Knob Fork | | | | |
| | 06010207011_2000 | Beaver Creek | | | | |
| | 06010207011_3000 | Beaver Creek | | | | |
| 0302 | 06010207011_0700 | Grassy Creek | 67f | 42.8 | 45.7 | 45.7 |
| | 06010207011_0800 | Meadow Creek | | | | |
| | 06010207011_1000 | Beaver Creek | | | | |
| | 06010207011_2000 | Beaver Creek | | | | |
| 0503 | 06010207026_0600 | Bear Creek | 67i | 50.8 | 53.3 * | 53.3 |
| | 06010207026_1000 | East Fork Poplar Creek | | | | |
| | 06010207026_2000 | East Fork Poplar Creek | | | | |

* The WLA shown also applies to the USDOE Oak Ridge National Security Complex facility.

Note: Calculations were conducted for all HUC-12 subwatersheds containing waterbodies identified as impaired for siltation/habitat alteration. Some impaired waterbodies extend across more than one HUC-12 subwatershed.

WLAs for Mining Sites and RMCFs:

WLAs for NPDES-regulated mining sites and RMCFs located in impaired subwatersheds are equal to existing permit limits for total suspended solids (TSS).

Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds

| HUC-12 Subwatershed (06010207__) | NPDES Permit No. | Facility Name | TSS Daily Maximum Limit |
|---|---|---|---|
| | | | [mg/l] |
| 0104 | TN0026484 | Vulcan Construction Materials, LP – Dixie Lee Quarry | 40 |
| 0202 | TN0063355 | Rinker Materials – I-75 Quarry | |
| | TN0079341 | Rinker Materials – I-75 Quarry Extension | |

RMCFs Permitted to Discharge TSS and Located in Impaired Subwatersheds

| HUC-12 Subwatershed (06010207__) | NPDES Permit No. | Facility Name | TSS Daily Maximum Limit | TSS Cut-off Conc. (SW Discharge) |
|---|---|---|---|---|
| | | | [mg/l] | [mg/l] |
| 0302 | TNG110288 | Knoxville Concrete | 50 | 200 |

# TOTAL MAXIMUM DAILY LOAD (TMDL) FOR SILTATION/HABITAT ALTERATION LOWER CLINCH RIVER WATERSHED (HUC 06010207)

## 1.0 INTRODUCTION

Section 303(d) of the Clean Water Act requires each state to list those waters within its boundaries for which technology based effluent limitations are not stringent enough to protect any water quality standard applicable to such waters. Listed waters are prioritized with respect to designated use classifications and the severity of pollution. In accordance with this prioritization, states are required to develop Total Maximum Daily Loads (TMDLs) for those water bodies that are not attaining water quality standards. State water quality standards consist of designated use(s) for individual waterbodies, appropriate numeric and narrative water quality criteria protective of the designated uses and an antidegradation statement. The TMDL process establishes the maximum allowable loadings of pollutants for a waterbody that will allow the waterbody to maintain water quality standards. The TMDL may then be used to develop controls for reducing pollution from both point and nonpoint sources in order to restore and maintain the quality of water resources (USEPA, 1991).

## 2.0 WATERSHED DESCRIPTION

The Lower Clinch River Watershed, designated by the Hydrologic Unit Code (HUC) 06010207 by the USGS, is located in East Tennessee (ref.: Figure 1), in Anderson, Campbell, Grainger, Knox, Loudon, Morgan, Roane, and Union Counties. The Lower Clinch River Watershed lies within three Level III ecoregions (Ridge and Valley, Southwestern Appalachians, and Central Appalachians) and contains five Level IV subecoregions as shown in Figure 2 (USEPA, 1997):

- **Southern Limestone/Dolomite Valleys and Low Rolling Hills (67f)** form a heterogeneous region composed predominantly of limestone and cherty dolomite. Landforms are mostly low rolling ridges and valleys, and the soils vary in their productivity. Landcover includes intensive agriculture, urban and industrial uses, as well as areas of thick forest. White oak forest, bottomland oak forest, and sycamore-ash-elm riparian forests are the common forest types. Grassland barrens intermixed with cedar-pine glades also occur here.

- **Southern Dissected Ridges and Knobs (67i)** contain crenulated, broken, or hummocky ridges. The ridges on the east side of Tennessee's Ridge and Valley tend to be associated with the Ordovician Sevier shale, Athens shale, and Holston and Lenoir limestones. These can include calcareous shale, limestone, siltstone, sandstone, and conglomerate. In the central and western part the shale ridges are associated with the Cambrian-age Rome Formation: shale and siltstone with beds of sandstone. Chestnut oak forests and pine forests are typical for the higher elevations of the ridges, with white oak, mixed mesophytic forest, and tulip poplar on the lower slopes, knobs, and draws.

- **Cumberland Plateau (68a)** tablelands and open low mountains are about 1,000 feet higher than the Eastern Highland Rim (71g) to the west, and receive slightly more precipitation with cooler annual temperatures than the surrounding lower-elevation ecoregions. The plateau surface is less dissected with lower relief compared to the Cumberland Mountains (69d) or the Plateau Escarpment (68c). Elevations are generally

1,200-2,000 feet, with the Crab Orchard Mountains reaching over 3,000 feet. Pennsylvanian-age conglomerate, sandstone, siltstone, and shale is covered by well-drained, acid soils of low fertility. Bituminous coal that has been extensively surface and underground mined underlies the region. Acidification of first and second order streams is common. Stream siltation and mine spoil bedload deposits continue as long-term problems in these headwater systems. Pockets of severe acid mine drainage persist.

- **Plateau Escarpment (68c)** is characterized by steep, forested slopes and high velocity, high gradient streams. Local relief is often 1,000 feet or more. The geologic strata include Mississippian-age limestone, sandstone, shale, and siltstone, and Pennsylvanian-age shale, siltstone, sandstone, and conglomerate. Streams have cut down into the limestone, but the gorge talus slopes are composed of colluvium with huge angular, slabby blocks of sandstone. Vegetation community types in the ravines and gorges include mixed oak and chestnut oak on the upper slopes, mesic forests on the middle and lower slopes (beech-tulip poplar, sugar maple-basswood-ash-buckeye), with hemlock along rocky stream sides and river birch along floodplain terraces.

**Figure 1 Location of the Lower Clinch River Watershed**

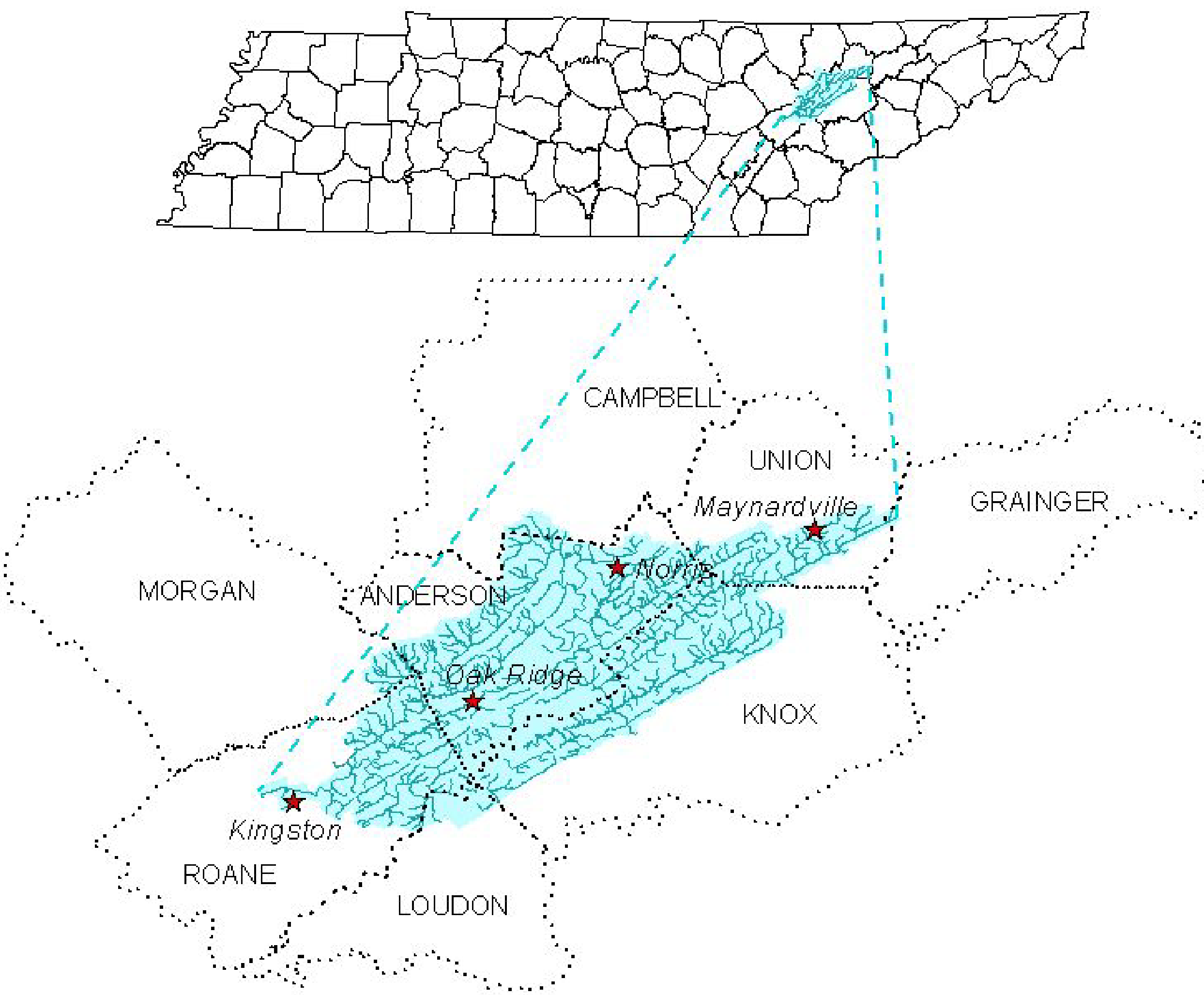
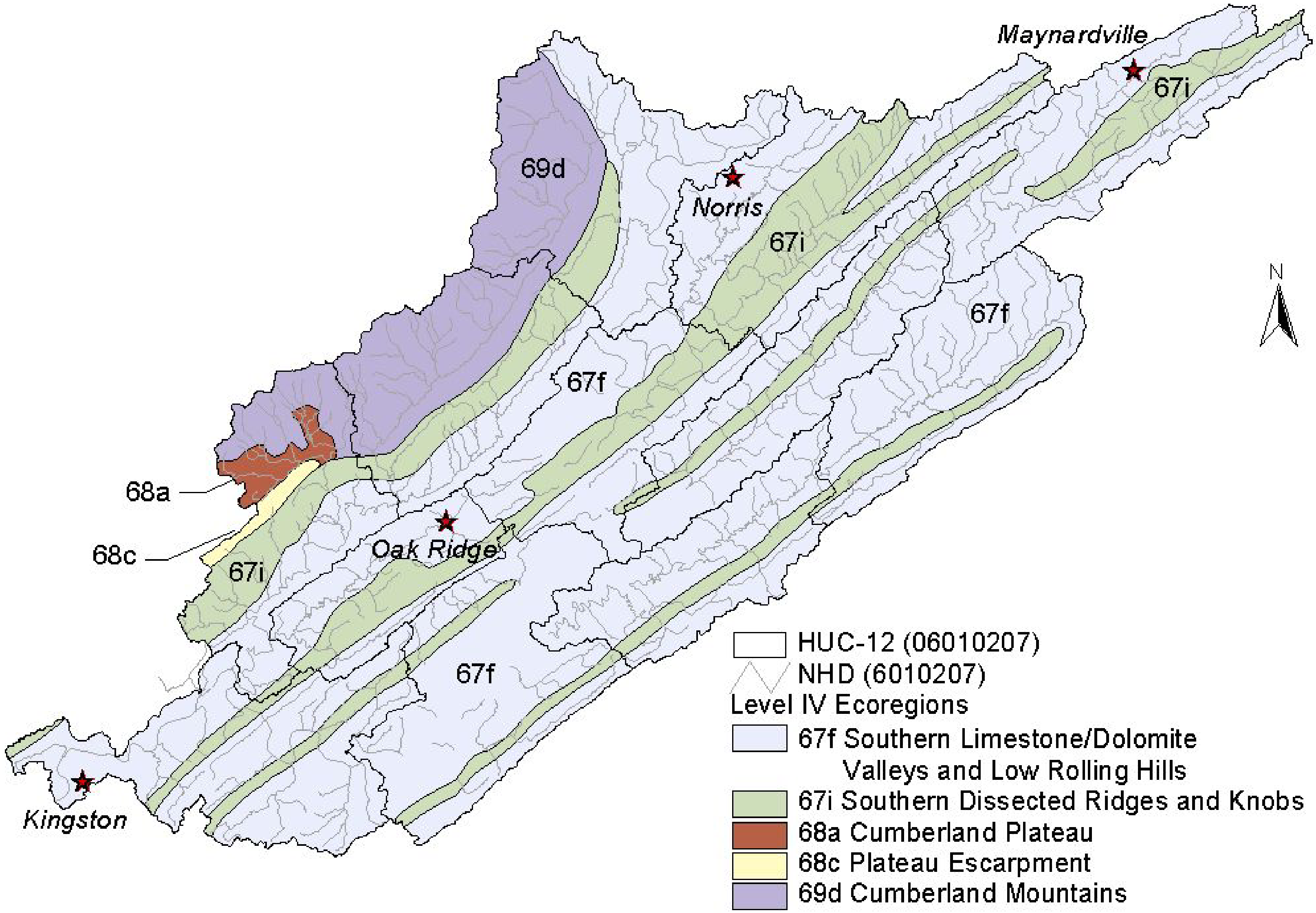


**Figure 2 Level IV Ecoregions in the Lower Clinch River Watershed**



- **Cumberland Mountains (69d)**, in contrast to the sandstone-dominated Cumberland Plateau (68a) to the west and southwest, are more highly dissected, with narrow-crested steep slopes, and younger Pennsylvanian-age shales, sandstones, siltstones, and coal. Narrow, winding valleys separate the mountain ridges, and relief is often 2,000 feet. Cross Mountain, west of Lake City, reaches 3534 feet in elevation. Soils are generally well-drained, loamy, and acidic, with low fertility. The natural vegetation is a mixed mesophytic forest, although composition and abundance vary greatly depending on aspect, slope position, and degree of shading from adjacent landmasses. Large tracts of land are owned by lumber and coal companies, and there are many areas of stripmining. Acid mine drainage is primarily limited to first and second order systems. Siltation as surface run-off remains the primary pollutant from past mining, timber harvest and unpaved roads.

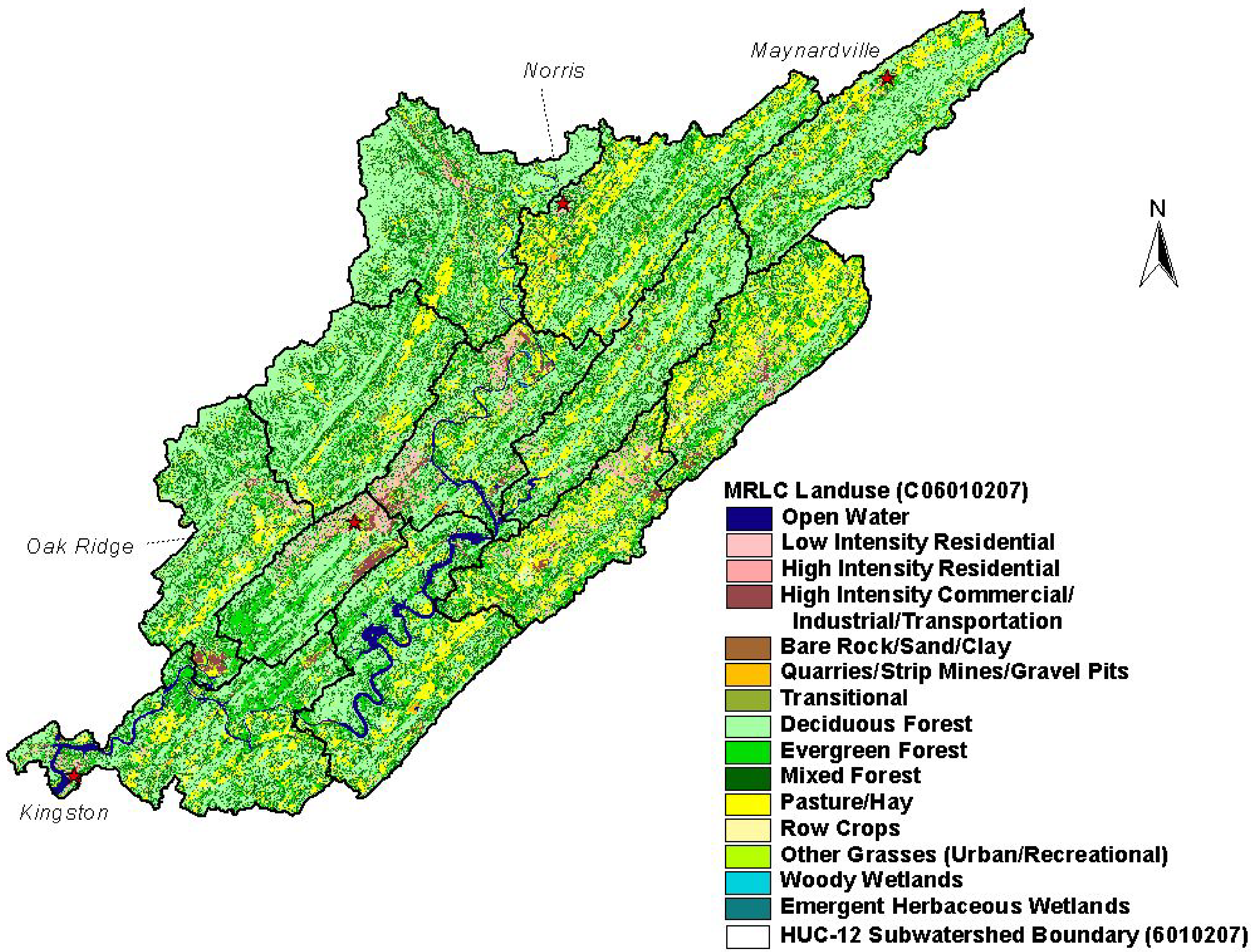
The Lower Clinch River Watershed (HUC 06010207) has approximately 6,690 lake acres and 871 miles of streams (NHD) as catalogued in the EPA/TDEC Assessment Database (ADB) and drains 633.7 square miles that empty to the Tennessee River. Watershed land use distribution is based on the 1992 Multi-Resolution Land Characteristic (MRLC) satellite imagery databases derived from Landsat Thematic Mapper digital images from the period 1990-1993. Land use for the Lower Clinch River Watershed is summarized in Table 1 and shown in Figure 3.

**Table 1 Land Use Distribution - Lower Clinch River Watershed**

| Land Use | Area | | |
|---|---|---|---|
| | [acres] | [$mi^2$] | [% of watershed] |
| Bare Rock/Sand/Clay | 1 | 0.0 | 0.0 |
| Deciduous Forest | 160,678 | 251.1 | 39.6 |
| Emergent Herbaceous Wetlands | 6 | 0.0 | 0.0 |
| Evergreen Forest | 53,596 | 83.7 | 13.2 |
| High Intensity Commercial/Industrial/Transportation | 7,083 | 11.1 | 1.7 |
| High Intensity Residential | 1,637 | 2.6 | 0.4 |
| Low Intensity Residential | 12,929 | 20.2 | 3.2 |
| Mixed Forest | 90,389 | 141.2 | 22.3 |
| Open Water | 7,175 | 11.2 | 1.8 |
| Other Grasses (Urban/Recreational) | 7,911 | 12.4 | 2.0 |
| Pasture / Hay | 54,435 | 85.1 | 13.4 |
| Quarries/Strip Mines/Gravel Pits | 378 | 0.6 | 0.1 |
| Row Crops | 8,739 | 13.7 | 2.2 |
| Transitional | 559 | 0.9 | 0.1 |
| Woody Wetlands | 37 | 0.1 | 0.0 |
| **Total** | 405,554 | 633.7 | 100.0 |

Note: A spreadsheet was used for calculations and values are approximate due to rounding.

**Figure 3 MRLC Land Use in the Lower Clinch River Watershed**



## 3.0 PROBLEM DEFINITION

The State of Tennessee's *2004 303(d) List* (TDEC, 2005) identified a number of waterbodies in the Lower Clinch River Watershed as not fully supporting designated use classifications due, in part, to siltation and/or habitat alteration associated with agriculture, urban runoff, land development, and bank modification. These waterbodies are summarized in Table 2 and shown in Figure 4. The designated use classifications for the Lower Clinch River and its tributaries include fish & aquatic life, irrigation, livestock watering & wildlife, and recreation. Some waterbodies in the watershed are also classified for industrial water supply and/or domestic water supply.

A description of the stream assessment process in Tennessee can be found in *2004 305(b) Report, The Status of Water Quality in Tennessee* (TDEC, 2004a). This document states that "biological surveys using macroinvertebrates as the indicator organisms are the preferred method for assessing support of the fish & aquatic life designated use." The waterbody segments listed in Table 2 were assessed as impaired based primarily on biological surveys. The results of these assessment surveys are summarized in Table 3. The assessment information presented is excerpted from the EPA/TDEC Assessment Database (ADB) and is referenced to the waterbody IDs in Table 2. Assessment Database information may be accessed at:

http://gwidc.memphis.edu/website/dwpc/

A typical example of a stream assessment (Hines Branch) is shown in Appendix A.

Siltation is the process by which sediments are transported by moving water and deposited on the bottom of stream, river, and lake beds. Sediment is created by the weathering of host rock and delivered to stream channels through various erosional processes, including sheetwash, gully and rill erosion, wind landslides, dry gravel, and human excavation. In addition, sediments are often produced as a result of stream channel and bank erosion and channel disturbance. Movement of eroded sediments downslope from their points of origin into stream channels and through stream systems is influenced by multiple interacting factors (USEPA, 1999).

Siltation (sedimentation) is the most frequently cited cause of waterbody impairment in Tennessee, impacting over 5,743 miles of streams and rivers (TDEC, 2004a). Unlike many chemical pollutants, sediments are typically present in waterbodies in natural or background amounts and are essential to normal ecological function. Excessive sediment loading, however, is a major ecosystem stressor that can adversely impact biota, either directly or through changes to physical habitat.

Excessive sediment loading has a number of adverse effects on fish & aquatic life in surface waters. As stated in excerpts from *Developing Water Quality Criteria for Suspended and Bedded Sediments (SABS) – Draft* (USEPA, 2003):

> In streams and rivers, fine inorganic sediments, especially silts and clays, affect the habitat for macroinvertebrates and fish spawning, as well as fish rearing and feeding behavior. Larger sands and gravels can scour diatoms and cause burying of invertebrates, whereas suspended sediment affects the light available for photosynthesis by plants and visual capacity of animals.

**Table 2** ***2004 303(d) List*** **- Stream Impairment Due to Siltation/Habitat Alteration in the Lower Clinch River Watershed**

| Waterbody Segment ID | Waterbody Segment Name | Miles/Acres Impaired | Cause (Pollutant) | Source (Pollutant) |
|---|---|---|---|---|
| 06010207004_0100 | Grable Branch | 1.3 | Oil & Grease/Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Minor Industrial Point Source/Channelization/ Industrial Permitted Runoff Discharges from MS4 area |
| 06010207011_0500 | Hines Branch | 3.2 | Habitat loss due to alteration in stream-side or littoral vegetative cover | Discharges from MS4 area |
| 06010207011_0600 | Knob Fork | 8.1 | Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Discharges from MS4 area |
| 06010207011_0700 | Grassy Creek | 8.2 | Loss of biological integrity due to siltation | Land Development |
| 06010207011_0800 | Meadow Creek | 5.0 | Loss of biological integrity due to siltation | Land Development |
| 06010207011_1000 | Beaver Creek | 22.5 | Phosphorus/Nitrate/Escherichia coli/Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Major Municipal Point Source/Pasture Grazing Land Development |
| 06010207011_2000 & 3000 | Beaver Creek | 21.2 | Escherichia coli/Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Pasture Grazing/ Land Development |
| 06010207014_0100 | Williams Branch | 2.4 | Loss of biological integrity due to siltation | Industrial Permitted Runoff |
| 06010207014_0110 | Foster Branch | 1.2 | Loss of biological integrity due to siltation | Industrial Permitted Runoff |
| 06010207014_1000 | Bullrun Creek | 11.8 | Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover/Escherichia coli | Pasture Grazing/ Channelization |

**Table 2 (Cont.) *2004 303(d) List* - Stream Impairment Due to Siltation/Habitat Alteration in the Lower Clinch River Watershed**

| Waterbody Segment ID | Waterbody Segment Name | Miles/Acres Impaired | Cause (Pollutant) | Source (Pollutant) |
|---|---|---|---|---|
| 06010207026_0600 | Bear Creek | 5.5 | Oil & Grease/Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Land Development |
| 06010207026_1000 | East Fork Poplar Creek | 9.7 | Habitat loss due to alteration in stream-side or littoral vegetative cover | Industrial Point Source/ Contaminated Sediments/ Collection System Failure/ Discharges from MS4 area |
| 06010207026_2000 | East Fork Poplar Creek | 11.3 | Loss of biological integrity due to siltation/Habitat loss due to alteration in stream-side or littoral vegetative cover | Industrial Point Source/ Contaminated Sediments/ Hydromodification Discharges from MS4 area |

**Figure 4 Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the *2004 303(d) List*)**

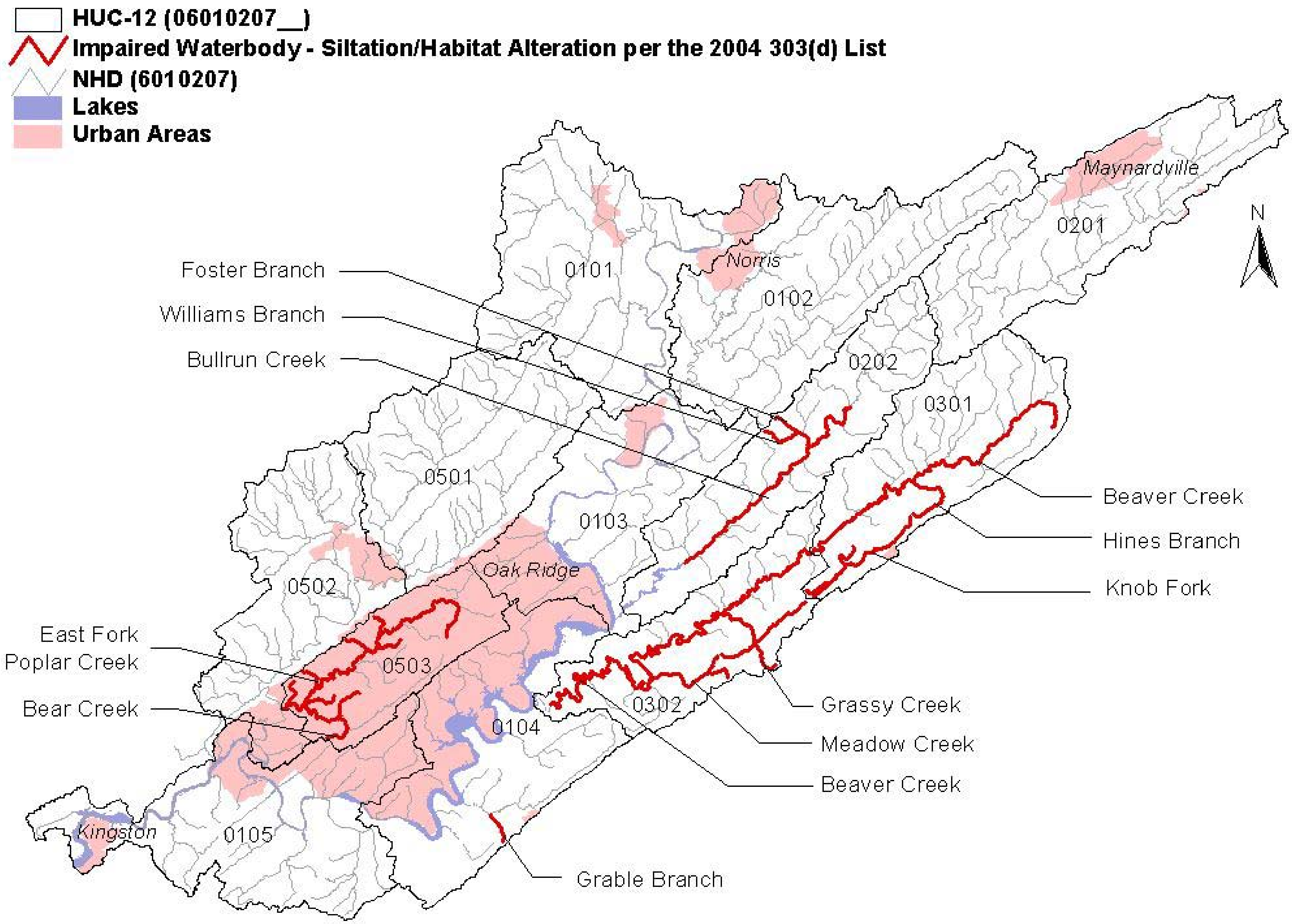


**Table 3 Water Quality Assessment of Waterbodies Impaired Due to Siltation/Habitat Alteration**

| Waterbody Segment ID | Waterbody Segment Name | Comments |
|---|---|---|
| 06010207004_0100 | Grable Branch | 1996 TVA biological survey at mile 0.4 (Watt Road). 0 EPT families, 9 total families. |
| 06010207011_0500 | Hines Branch | 1999 Ogden survey. 2 EPT genera, 34 total genera. NCBI = 5.16. Habitat score = 112. Fish IBI = 28. |
| 06010207011_0600 | Knob Fork | 1999 Ogden survey. 1 EPT genera, 16 total genera. NCBI = 7.42. Habitat score = 136. Fish IBI = 30. |
| 06010207011_0700 | Grassy Creek | 1999 Ogden survey (funded by Knox County). 1 EPT genera, 32 total genera. NCBI = 7.06. Habitat assessment = 123. Fish IBI = 40. |
| 06010207011_0800 | Meadow Creek | 1999 Ogden survey. 6 EPT genera, 38 total genera. NCBI = 7.82. Habitat score = 113. Fish IBI = 40. |
| 06010207011_1000 | Beaver Creek | 1999 TDEC chemical stations at miles 3.5, (Swafford Rd), 10.1 (Coward Mill), 12.5 (Westcott Blvd), 23.5 (d/s STP). 12 observation G.M. for E. coli = 147, 321, 258, and 295 respectively. Nitrate- nitrite average 1.8, 1.7, 1.3, 0.9. |
| 06010207011_2000 | Beaver Creek | 1999 TDEC chemical stations at miles 23.6 and 31.8. G.M. for E. coli = 431 and 312. Nitrate-nitrite levels average 0.89 and 0.82. Ogden station at mile 26.5. 2 EPT genera. Habitat score 138. Fish IBI = 28. |
| 06010207011_3000 | Beaver Creek | 1999 TDEC chemical stations at miles 36.7 (Hwy 33) and 40.2 (Stormer Road). G.M. for E. coli = 313 and 476. Nitrate-nitrite levels average 0.6 and 0.5, respectively. Ogden station at Stormer Rd. (9 EPT genera). Habitat score = 84. |
| 06010207014_0100 | Williams Branch | Enforcement against facility (I-75 American Limestone) has resulted in stream improvements. |
| 06010207014_0110 | Foster Branch | Enforcement against facility (I-75 American Limestone) resulted in stream improvement. |
| 06010207014_1000 | Bullrun Creek | 1999 TDEC station at mile 5.2 (Hwy 25). 8 EPT genera, 35 total genera at mile 5.2. NCBI = 5.43. Habitat = 105. 1996 TVA station at mile 7.2. 11 EPT families. |
| 06010207026_0600 | Bear Creek | 1999 DOE-O biological surveys at mile 6.4 and mile 7.6. 8 EPT genera, 16 total taxa at mile 6.4. 6 EPT genera, 15 total genera at mile 7.6. Not enough total taxa. |
| 06010207026_1000 | East Fork Poplar Creek | Fishing advisory due to mercury and PCBs. Pathogens from wet weather overflows from Oak Ridge STP. Mercury from historical discharges from Y-12. 1999 DOE-O biological survey at mile 3.9 & 8.6. 4 & 5 EPT genera. |
| 06010207026_2000 | East Fork Poplar Creek | Fishing advisory due to mercury and PCBs. Water contact advisory due to pathogens. Mercury and PCBs due to historical discharges from Y-12. 1999 DOE-O biological survey at mile 14.5 & 15.2. 4 & 1 EPT genera. |

> Sedimentation alters the structure of the invertebrate community by causing a shift in proportions from one functional group to another. Sedimentation can lead to embeddedness, which blocks critical macroinvertebrate habitat by filling in the interstices of the cobble and other hard substrate on the stream bottom. As deposited sediment increases, changes in invertebrate community structure and diversity occur.
>
> Invertebrate drift is directly affected by increased suspended sediment load in freshwater streams. These changes generally involve a shift in dominance from ephemeroptera, plecoptera and trichoptera (EPT) taxa to other less pollution-sensitive species that can cope with sedimentation. Increases in sediment deposition that affect the growth, abundance, or species composition of the periphytic (attached) algal community will also have an effect on the macroinvertebrate grazers that feed predominantly on periphyton. ……. Effects on aquatic individuals, populations, and communities are expressed through alterations in local food webs and habitat. When sedimentation exceeds certain thresholds, ensuing effects will likely involve decline of the existing aquatic invertebrate community and subsequent colonization by pioneer species.

Historically, waterbodies in Tennessee have been assessed as not fully supporting designated uses due to siltation when the impairment was determined to be the result of excess loading of the inorganic sediment produced by erosional processes. In cases where impairment was determined to be caused by excess loading of the primarily organic particulate material found in sewage treatment plant (STP) effluent, the cause of pollution was listed as total suspended solids (TSS) or organic enrichment. In consideration of this practice, this document presents the details of TMDL development for waterbodies in the Lower Clinch River Watershed listed as impaired due to siltation (excess inorganic sediment produced by erosional processes) and/or appropriate cases of habitat alteration. The TSS in STP effluent is considered to be a distinctly different pollutant and, therefore, is excluded in sediment loading calculations.

## 4.0 TARGET IDENTIFICATION

Several narrative criteria, applicable to siltation/habitat alteration, are established in *Rules of Tennessee Department of Environment and Conservation, Tennessee Water Quality Control Board, Division of Water Pollution Control, Chapter 1200-4-3 General Water Quality Criteria, January, 2004* (TDEC, 2004):

Applicable to all use classifications (Fish & Aquatic Life shown):

> Solids, Floating Materials, and Deposits – There shall be no distinctly visible solids, scum, foam, oily slick, or the formation of slimes, bottom deposits or sludge banks of such size and character that may be detrimental to fish & aquatic life.
>
> Other Pollutants – The waters shall not contain other pollutants that will be detrimental to fish or aquatic life.

Applicable to the Domestic Water Supply, Industrial Water Supply, Fish & Aquatic Life, and Recreation use classifications (Fish & Aquatic Life shown):

> Turbidity or Color – There shall be no turbidity or color in such amounts or of such character that will materially affect fish & aquatic life.

Applicable to the Fish & Aquatic Life use classification:

> Biological Integrity - The waters shall not be modified through the addition of pollutants or through physical alteration to the extent that the diversity and/or productivity of aquatic biota within the receiving waters are substantially decreased or adversely affected, except as allowed under 1200-4-3-.06.
>
> Interpretation of this provision for any stream which (a) has at least 80% of the upstream catchment area contained within a single bioregion, (b) is of the appropriate stream order specified for the bioregion, and (c) contains the habitat (riffle or rooted bank) specified for the bioregion, may be made using the most current revision of the Department's Quality System Standard Operating Procedure for Macroinvertebrate Stream Surveys and/or other scientifically defensible methods.
>
> Interpretation of this provision for all other streams, plus large rivers, reservoirs, and wetlands, may be made using Rapid Bioassessment Protocols for Use in Wadeable Streams and Rivers (EPA/841-B-99-002) and/or other scientifically defensible methods. Effects to biological populations will be measured by comparisons to upstream conditions or to appropriately selected reference sites in the same bioregion if upstream conditions are determined to be degraded.
>
> Habitat - The quality of instream habitat shall provide for the development of a diverse aquatic community that meets regionally based biological integrity goals. The instream habitat within each subecoregion shall be generally similar to that found at reference streams. However, streams shall not be assessed as impacted by habitat loss if it has been demonstrated that the biological integrity goal has been met.

These TMDLs are being established to attain full support of the fish & aquatic life designated use classification. TMDLs established to protect fish & aquatic life will protect all other use classifications for the identified waterbodies from adverse alteration due to sediment loading.

In order for a TMDL to be established, a numeric "target" protective of the uses of the water must be identified to serve as the basis for the TMDL. Where State regulation provides a numeric water quality criteria for the pollutant, the criteria is the basis for the TMDL. Where State regulation does not provide a numeric water quality criteria, as in the case of siltation/habitat alteration, a numeric interpretation of the narrative water quality standard must be determined. For the purpose of these TMDLs, the average annual sediment loading in lbs/acre/yr, from a biologically healthy watershed, located within the same Level IV ecoregion as the impaired watershed, is determined to be the appropriate numeric interpretation of the narrative water quality standard for protection of fish & aquatic life. Biologically healthy watersheds were identified from the State's ecoregion reference sites. These ecoregion reference sites have similar characteristics and conditions as the majority of streams within that ecoregion. Detailed information regarding Tennessee ecoregion reference sites can be found in *Tennessee Ecoregion Project, 1994-1999* (TDEC, 2000). In general, land use in ecoregion reference watersheds contain more forested areas and less pasture, cropland, and urban areas than impaired watersheds. The biologically healthy (reference) watersheds are considered the "least impacted" in an ecoregion and, as such, sediment loading from these watersheds may serve as an appropriate target for the TMDL.

Using the methodology described in Appendix B, the Watershed Characterization System (WCS) Sediment Tool was used to calculate the average annual sediment load for each of the biologically healthy (reference) watersheds in Level IV ecoregions 67f, 67i, 68a, 68c, and 69d. The geometric mean of the average annual sediment loads of the reference watersheds in each Level IV ecoregion was selected as the most appropriate target for that ecoregion. Since the impairment of biological integrity due to sediment build-up is generally a long-term process, using an average annual load is considered appropriate. The average annual sediment loads for reference sites and corresponding TMDL target values for Level IV ecoregions 67f, 67i, 68a, 68c, and 69d are summarized in Table 4. Reference site locations are shown in Figure 5.

*Note: Ecoregion reference sites are continually reviewed, with sites added or deleted as circumstances warrant. Using the methodology described in Appendix B, the WCS Sediment Tool was used to determine the average annual sediment loads, due to precipitation-based sources, for the active Level IV ecoregion reference sites as of April 30, 2005. The WCS sediment tool utilizes DEM and MRLC coverages to calculate the sediment loads. The stations listed in Table 4 and shown in Figure 5 are the ecoregion reference sites as of April 30, 2005 for which the average annual sediment loads could be calculated with current information.*

**Table 4 Average Annual Sediment Loads of Level IV Ecoregion Reference Sites**

| Level 4 Ecoregion | Reference Site | Stream | Drainage Area | Average Annual Sediment Load |
|---|---|---|---|---|
| | | | (acres) | [lbs/acre/year] |
| 67f | Eco67f06 | Clear Creek | 1,975 | 400.6 |
| | Eco67f13 | White Creek | 1,724 | 272.4 |
| | Eco67f17 | Big War Creek | 30,062 | 585.1 |
| | | **Geometric Mean (Target Load)** | | **399.8** |
| 67i | Eco67i12 | Mill Branch | 681 | **279.0** |
| 68a | Eco68a01 | Rock Creek | 3,718 | 43.0 |
| | Eco68a03 | Laurel Fork Of Station Camp Creek | 10,828 | 120.7 |
| | Eco68a08 | Clear Creek | 98,904 | 166.1 |
| | Eco68a13 | Piney Creek | 8,947 | 157.0 |
| | Eco68a20 | Mullens Creek | 7,388 | 122.1 |
| | Eco68a26 | Daddys Creek | 110,980 | 483.1 |
| | Eco68a28 | Rock Creek | 16,036 | 105.0 |
| | | **Geometric Mean (Target Load)** | | **135.5** |
| 68c | Eco68c12 | Ellis Gap Branch | 810 | 91.6 |
| | Eco68c13 | Mud Creek | 1,777 | 247.5 |
| | Eco68c15 | Crow Creek | 12,653 | 183.0 |
| | Eco68c20 | Crow Creek | 12,614 | 174.0 |
| | | **Geometric Mean (Target Load)** | | **163.9** |

**Table 4 (Cont.) Average Annual Sediment Loads of Level IV Ecoregion Reference Sites**

| Level 4 Ecoregion | Reference Site | Stream | Drainage Area (acres) | Average Annual Sediment Load [lbs/acre/year] |
|---|---|---|---|---|
| 69d | Eco69d01 | No Business Branch | 1,615 | 54.1 |
| | Eco69d03 | Flat Fork | 4,459 | 309.7 |
| | Eco69d04 | Stinking Creek | 7,924 | 1,196.8 |
| | Eco69d05 | New River | 2,125 | 167.5 |
| | Eco69d06 | Round Rock Creek | 8,936 | 772.9 |
| | | | **Geometric Mean (Target Load)** | **303.9** |

## 5.0 WATER QUALITY ASSESSMENT AND DEVIATION FROM TARGET

Using the methodology described in Appendix B, the WCS Sediment Tool was used to determine the average annual sediment load, due to precipitation based sources, for all HUC-12 subwatersheds in the Lower Clinch River Watershed (ref.: Figure 4). Existing precipitation based sediment loads for subwatersheds with waterbodies listed on the *2004 303(d) List* as impaired for siltation/habitat alteration are summarized in Table 5.

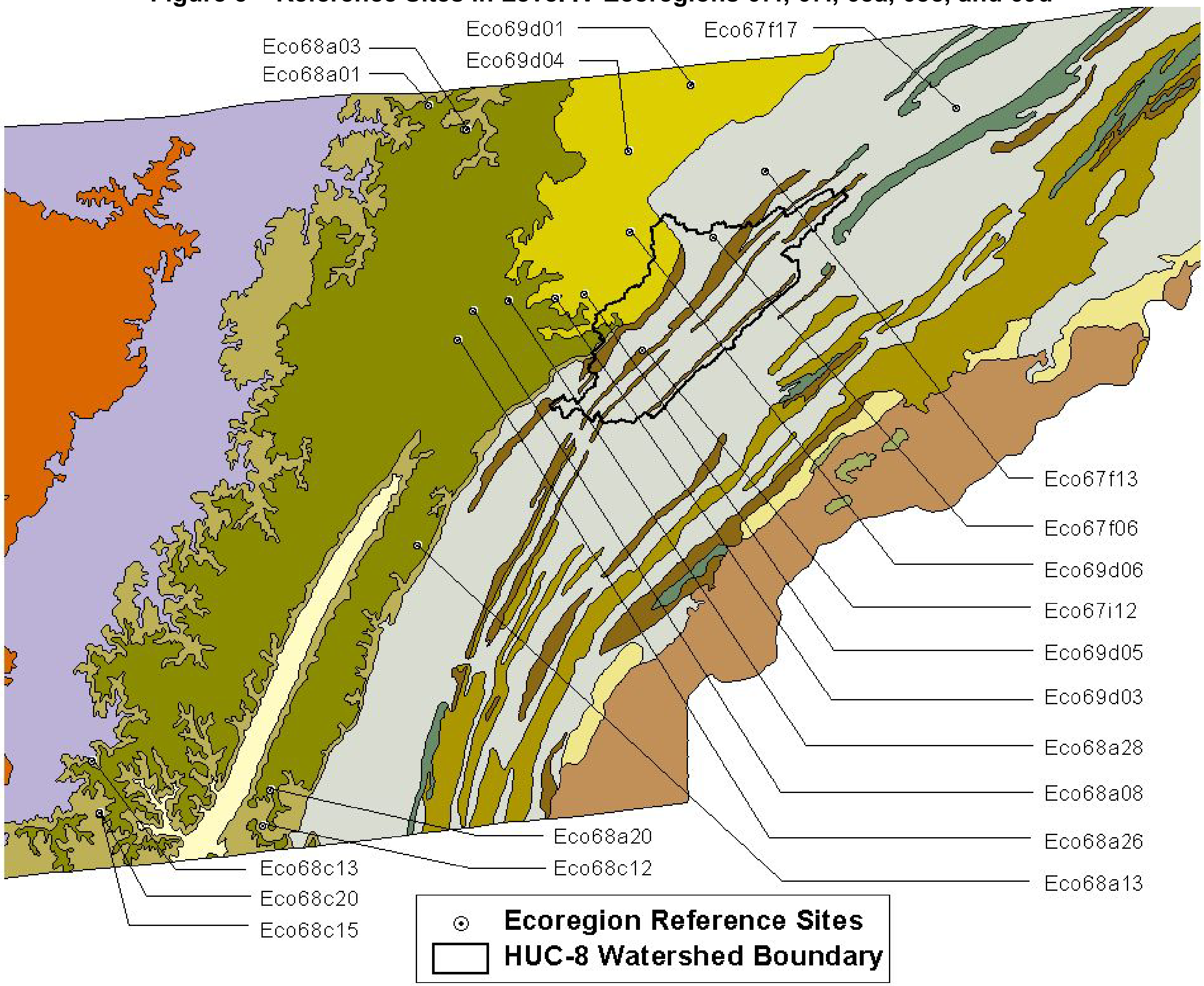
**Table 5 Existing Sediment Loads in Subwatersheds with Impaired Waterbodies**

| HUC-12 Subwatershed (06010207____) | Level IV Ecoregion | Existing Sediment Load [lbs/ac/yr] |
|---|---|---|
| 0104 | 67f | 742 |
| 0202 | 67i | 480 |
| 0301 | 67f | 775 |
| 0302 | 67f | 669 |
| 0503 | 67i | 567 |

## 6.0 SOURCE ASSESSMENT

An important part of the TMDL analysis is the identification of individual sources, source categories, or source subcategories of siltation in the watershed and the amount of pollutant loading contributed by each of these sources. Under the Clean Water Act, sources are broadly classified as either point or nonpoint sources. Under 40 CFR 122.2, a point source is defined as a discernable, confined, and discrete conveyance from which pollutants are or may be discharged to surface waters. The National Pollutant Discharge Elimination System (NPDES) program regulates point source discharges. Regulated point sources include: 1) municipal and industrial wastewater treatment facilities (WWTFs), 2) storm water discharges associated with industrial activity (which includes construction activities), and 3) certain discharges from Municipal Separate Storm Sewer Systems (MS4s). A TMDL must provide Waste Load Allocations (WLAs) for all NPDES-regulated point sources. For the purposes of these TMDLs, all sources of sediment loading not regulated by NPDES are considered nonpoint sources. The TMDL must provide a Load Allocation (LA) for these sources.

**Figure 5 Reference Sites in Level IV Ecoregions 67f, 67i, 68a, 68c, and 69d**



## 6.1 Point Sources

### 6.1.1 NPDES-Regulated Wastewater Treatment Facilities

As stated in Section 3.0, waterbodies in Tennessee have historically been assessed as not fully supporting designated uses due to siltation when the impairment was determined to be the result of the excess loading of inorganic sediment predominantly produced by erosional processes. In cases where impairment was determined to be caused by excess loading of the primarily organic particulate material found in sewage treatment plant (STP) effluent, the cause of pollution was listed as total suspended solids (TSS) or organic enrichment. In view of this practice, only the TSS loading from industrial wastewater or storm water discharges was considered in the development of TMDLs for waterbodies in the Lower Clinch River watershed listed as impaired due to siltation and/or appropriate cases of habitat alteration.

There are four industrial facilities with individual NPDES permits that require monitoring of TSS located in impaired HUC-12 subwatersheds. These facilities are tabulated in Table 6 and shown in Figure 6. Sediment Loading (as TSS) from the Flying J Travel Plaza #5034, Knoxville Travel Center, and Petro Shopping Center facilities is small with respect to total sediment loading in Subwatershed 060102070104 (see Appendix D). However, due the facility size, number of outfalls, and nature of its operations, the USDOE Oak Ridge Y-12 National Security Complex has the potential to contribute significant sediment loading to surface waters in Subwatershed 060102070503.

### 6.1.2 NPDES-Regulated Mining Sites

Discharges from regulated mining activities may also contribute sediment to surface waters as TSS (TSS discharged from mining sites is composed of primarily inorganic material and is therefore included as a source for TMDL development). Discharges from active mines may result from dewatering operations and/or in response to storm events, whereas discharges from permitted inactive mines are only in response to storm events. Inactive sites with successful surface reclamation contribute relatively little solids loading. Of the twenty-three permitted mining sites in the Lower Clinch River Watershed (as of November 1, 2005), three are located in impaired subwatersheds, as listed in Table 7 and shown in Figure 6. Sediment loads (as TSS) to waterbodies from mining site discharges are negligible in relation to total sediment loading (ref.: Appendix D).

### 6.1.3 NPDES-Regulated Ready Mixed Concrete Facilities

Discharges from regulated Ready Mixed Concrete Facilities (RMCFs) may contribute sediment to surface waters as TSS (TSS discharged from RMCFs is composed of primarily inorganic material and is therefore included as a source for TMDL development). Most of these facilities obtain coverage under NPDES Permit No. TNG110000, *General NPDES Permit for Discharges of Storm Water Runoff and Process Wastewater Associated With Ready Mixed Concrete Facilities* (TDEC, 2003). This permit establishes a daily maximum TSS concentration limit of 50 mg/l on process wastewater effluent and specifies monitoring procedures for storm water discharges. Facilities are also required to develop and implement storm water pollution prevention plans (SWPPPs). Discharges from RMCFs are generally intermittent, and contribute a small portion of total sediment loading to HUC-12 subwatersheds (ref.: Appendix D). In some cases, for discharges into waterbodies impaired for siltation as indicated on the *2004 303(d) List*, sites may be required to obtain coverage under an individual NPDES permit. Of the six permitted RMCFs in the Lower

Clinch River Watershed (as of November 1, 2005), one is located in an impaired subwatershed. This facility is listed in Table 8 and shown in Figure 6.

**Table 6 Industrial Facilities Permitted to Discharge TSS in Impaired Subwatersheds**

| NPDES Permit No. | Facility | HUC-12 Subwatershed (06010207__) | Effluent Type | Outfall | Dmax Permit Limit | Flow | Facility Area |
|---|---|---|---|---|---|---|---|
| | | | | | [mg/l] | [MGD] | [acres] |
| TN0064548 | Flying J Travel Plaza #5034 | 0104 | GW | 001 | 40 | Intermittent | 6.5 |
| | | | SW, NPW | 002 | 40 | 0.096 | |
| TN0065137 | Knoxville Travel Center | 0104 | SW | 001 | 40 | Varies | 21 |
| TN0067024 | Petro Shopping Center | 0104 | SW | 001 | 40 | Varies | 17.3 |
| TN0002968 | USDOE Oak Ridge Y-12 National Security Complex | 0503 | PW, NPW, SW, GW | * | * | * | 811 |

* Facility has multiple outfalls and discharge requirements. See NPDES permit for details.

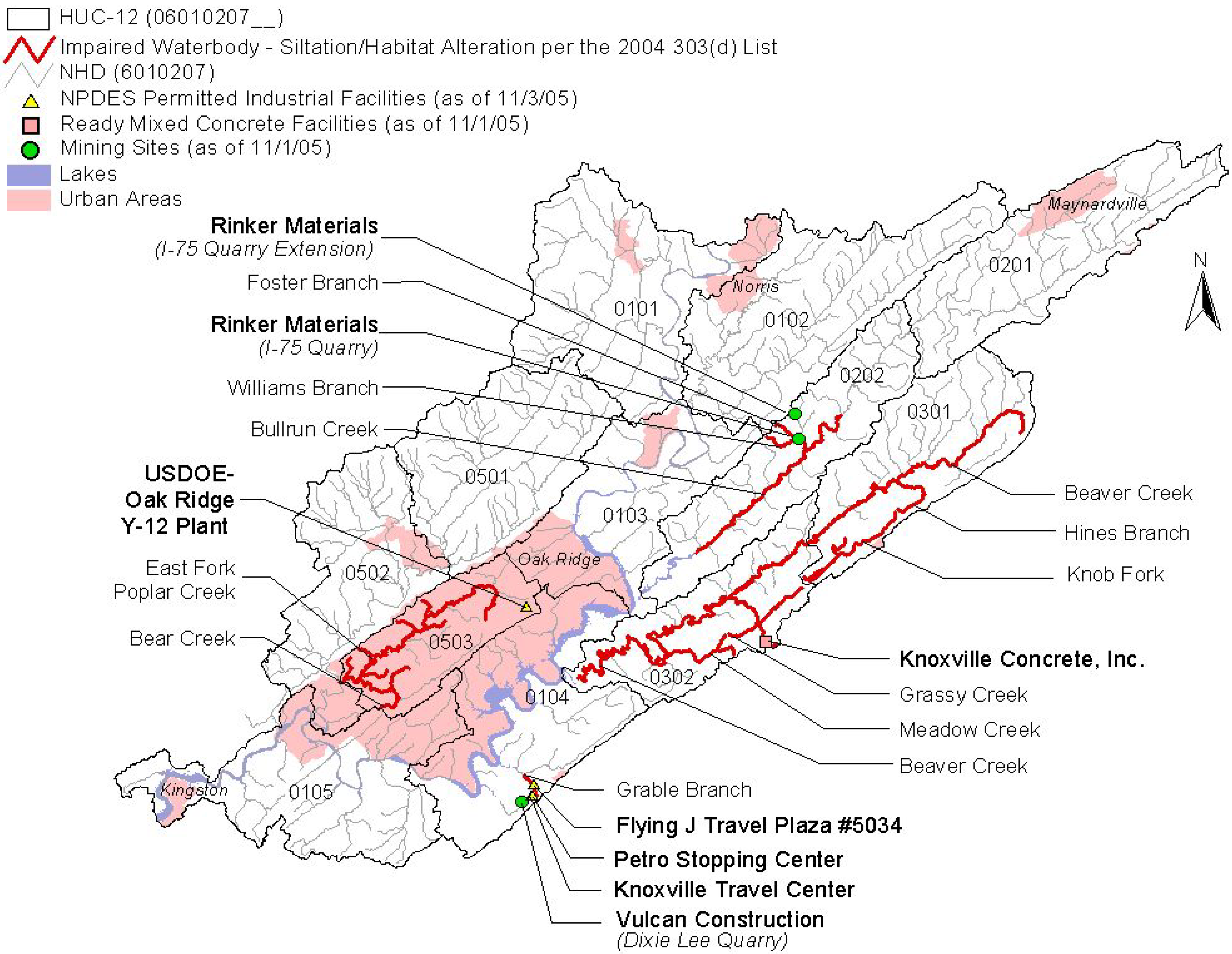
**Table 7 NPDES-Regulated Mining Sites Permitted to Discharge TSS and Located in Impaired Subwatersheds (as of November 1, 2005)**

| HUC-12 Subwatershed (06010207__) | NPDES Permit No. | Facility Name | TSS Daily Maximum Limit |
|---|---|---|---|
| | | | [mg/l] |
| 0104 | TN0026484 | Vulcan Construction Materials, LP – Dixie Lee Quarry | 40 |
| 0202 | TN0063355 | Rinker Materials – I-75 Quarry | |
| | TN0079341 | Rinker Materials – I-75 Quarry Extension | |

**Table 8 NPDES-Regulated Ready Mixed Concrete Facilities Located in Impaired Subwatersheds (as of November 1, 2005)**

| HUC-12 Subwatershed (06010207__) | NPDES Permit No. | Facility Name | TSS Daily Maximum Limit | TSS Cut-off Conc. |
|---|---|---|---|---|
| | | | [mg/l] | [mg/l] |
| 0302 | TNG110288 | Knoxville Concrete | 50 | 200 |

**Figure 6 NPDES-Regulated Mining Sites and Ready Mixed Concrete Facilities in Impaired Subwatersheds**



#### 6.1.4 NPDES-Regulated Construction Activities

Discharges from NPDES-regulated construction activities are considered point sources of sediment loading to surface waters and occur in response to storm events. Currently, discharges of storm water from construction activities disturbing an area of one acre or more must be authorized by an NPDES permit. Most of these construction sites obtain coverage under NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005a). Since construction activities at a site are of a temporary, relatively short-term nature, the number of construction sites covered by the general permit at any instant of time varies. In the Lower Clinch River Watershed, there were 119 permitted active construction sites on October 18, 2005 (ref.: Figure 7).

#### 6.1.5 NPDES-Regulated Municipal Separate Storm Sewer Systems

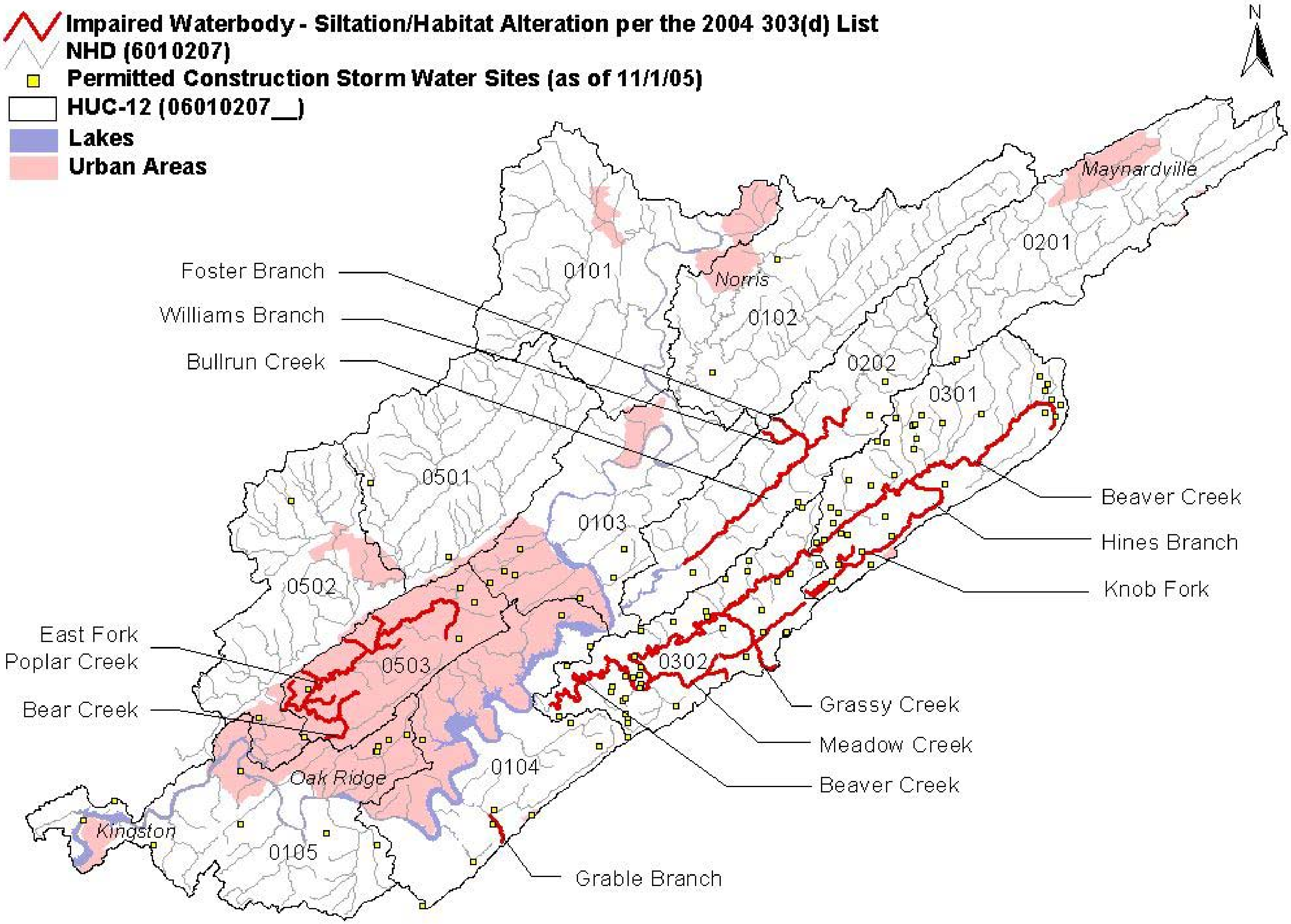
MS4s may discharge sediment to waterbodies in response to storm events through road drainage systems, curb and gutter systems, ditches, and storm drains. These systems convey urban runoff from surfaces such as bare soil and wash-off of accumulated street dust and litter from impervious surfaces during rain events. Large and medium MS4s serving populations greater than 100,000 people are required to obtain NPDES storm water permits. At present, there is only one MS4 of this size in the Lower Clinch River Watershed (City of Knoxville, TNS068055). As of March 2003, small MS4s serving urbanized areas, or having the potential to exceed instream water quality standards, are required to obtain a permit under the *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003a). An urbanized area is defined as an entity with a residential population of at least 50,000 people and an overall population density of 1,000 people per square mile. Four permittees are covered under Phase II of the NPDES Storm Water Program. The five permitted MS4s in the Lower Clinch River Watershed are as follows:

| NPDES Permit Number | Phase | Permittee Name |
|---|---|---|
| TNS068055 | I | City of Knoxville Municipal Separate Storm Drain System |
| TNS075108 | II | Anderson County |
| TNS075299 | II | Farragut |
| TNS075582 | II | Knox County |
| TNS075591 | II | Loudon County |

An NPDES Permit is pending for Pellissippi State Community College (TNS076074).

The Tennessee Department of Transportation (TDOT) is being issued an MS4 permit (TNS077585) for State roads in urban areas. Information regarding storm water permitting in Tennessee may be obtained from the TDEC website at http://www.state.tn.us/environment/wpc/stormh2o/.

**Figure 7 Location of NPDES Permitted Construction Storm Water Sites in the Lower Clinch River Watershed**



### 6.2 Nonpoint Sources

Nonpoint sources account for the vast majority of sediment loading to surface waters. These sources include:

- Natural erosion occurring from the weathering of soils, rocks, and uncultivated land; geological abrasion; and other natural phenomena.

- Erosion from agricultural activities can be a major source of sedimentation due to the large land area involved and the land-disturbing effects of cultivation. Grazing livestock can leave areas of ground with little vegetative cover. Unconfined animals with direct access to streams can cause streambank damage.

- Urban erosion from bare soil areas under construction and washoff of accumulated street dust and litter from impervious surfaces.

- Erosion from unpaved roadways can be a significant source of sediment to rivers and streams. It occurs when soil particles are loosened and carried away from the roadway, ditch, or road bank by water, wind, or traffic. The actual road construction (including erosive road-fill soil types, shape and size of coarse surface aggregate, poor subsurface and/or surface drainage, poor road bed construction, roadway shape, and inadequate runoff discharge outlets or "turn-outs" from the roadway) may aggravate roadway erosion. In addition, external factors such as roadway shading and light exposure, traffic patterns, and road maintenance may also affect roadway erosion. Exposed soils, high runoff velocities and volumes, and poor road compaction all increase the potential for erosion.

- Runoff from abandoned mines may be significant sources of solids loading. Mining activities typically involve removal of vegetation, displacement of soils and other significant land disturbing activities.

- Soil erosion from forested land that occurs during timber harvesting and reforestation activities. Timber harvesting includes the layout of access roads, log decks, and skid trails; the construction and stabilization of these areas; and the cutting of trees. Established forest areas produce very little soil erosion.

For the listed waterbodies within the Lower Clinch River Watershed, the primary sources of nonpoint sediment loads come from agriculture, roadways and urban sources. The watershed land use distribution based on the 1992 MRLC satellite imagery databases is shown in Appendix C for impaired HUC-12 subwatersheds.

## 7.0 DEVELOPMENT OF TOTAL MAXIMUM DAILY LOAD

The TMDL process quantifies the amount of a pollutant that can be assimilated in a waterbody, identifies the sources of the pollutant, and recommends regulatory or other actions to be taken to achieve compliance with applicable water quality standards based on the relationship between pollution sources and in-stream water quality conditions. A TMDL can be expressed as the sum of all point source loads (Waste Load Allocations), non-point source loads (Load Allocations), and an appropriate margin of safety (MOS) which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \Sigma \text{ WLAs} + \Sigma \text{ LAs} + \text{MOS}$$

The objective of a TMDL is to allocate loads among all of the known pollutant sources throughout a watershed so that appropriate control measures can be implemented and water quality standards achieved. 40 CFR §130.2 (i) states that TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measure.

TMDL analyses are performed on a 12-digit hydrologic unit area (HUC-12) basis for subwatersheds containing waterbodies identified as impaired due to siltation or habitat alteration on the *2004 303(d) List*. HUC-12 subwatershed boundaries are shown in Figure 4.

## 7.1 Analysis Methodology

Sediment analysis for watersheds can be conducted using methods ranging from simple, gross estimates to complex dynamic loading and receiving water models. The choice of methodology is dependent on a number of factors that include: watershed size, type of impairment, type and quantity of data available, resources available, time, and cost. In consideration of these factors, the following approach was selected as the most appropriate for first phase sediment TMDLs in the Lower Clinch River Watershed.

Sediment loading analysis for waterbodies impaired due to siltation/habitat alteration in the Lower Clinch River Watershed was accomplished using the Watershed Characterization System (WCS) Sediment Tool. This ArcView geographic information system (GIS) based model is described in Appendix B and was utilized according to the following procedure:

- The Watershed Characterization System (WCS) Sediment Tool was used to determine sediment loading to Level IV ecoregion reference site watersheds. These are considered to be biologically healthy watersheds. The average annual sediment loads in lbs/acre/yr of these reference watersheds serve as target values for the Lower Clinch River Watershed sediment TMDLs.

- The Sediment Tool was also used to determine the existing average annual sediment loads of impaired watersheds located in the Lower Clinch River Watershed. Impaired watersheds are defined as 12-digit HUCs containing one or more waterbodies identified as impaired due to siltation/habitat alteration on the State's *2004 303(d) List* (ref.: Figure 4).

- The existing average annual sediment load of each impaired HUC-12 watershed was compared to the average annual load of the appropriate reference (biologically healthy) watershed and an <u>overall</u> required percent reduction in loading calculated. For each impaired HUC-12 subwatershed, the TMDL is equal to this <u>overall</u> required reduction:

$$\text{TMDL} = \frac{(\text{Existing Load}) - (\text{Target Load})}{(\text{Existing Load})} \times 100$$

Although the Sediment Tool uses the best road, elevation, and land use GIS coverages available, the resulting average annual sediment loads should not be interpreted as an absolute value. The calculated loading reductions, however, are considered to be valid since they are based on the relative comparison of loads calculated using the same methodology.

- In each impaired subwatershed, 5% of the ecoregion-based target load was reserved to account for WLAs for NPDES permitted industrial facilities, mining sites, and RMCFs. The existing loads from these facilities (except for the USDOE Oak Ridge Y-12 National Security Complex) are less than the five percent reserved in each impaired HUC-12 subwatershed. Any difference between these existing loads and the 5% reserved load provide for future growth and additional MOS (ref.: Appendix D).

- For each impaired HUC-12 subwatershed, WLAs for construction storm water sites and MS4s and LAs for nonpoint sources were considered to be the percent load reduction required to decrease the existing annual average sediment load to a level equal to 95% of the target value.

$$WLA_{Const.SW} = WLA_{MS4} = LA = \frac{(\text{Existing Load}) - [(.95)\ (\text{Target Load})]}{(\text{Existing Load})} \times 100$$

*Note: For Subwatershed 060102070503, the WLA for the USDOE Oak Ridge Y-12 National Security Complex, as well as WLAs for construction storm water sites and MS4s and LAs for nonpoint sources were considered to be the percent load reduction required to decrease the existing annual average sediment load to a level equal to 95% of the target value (i.e.: $WLA_{Y\text{-}12} = WLA_{Const.SW} = WLA_{MS4} = LA$).*

- TMDLs, WLAs for the Y-12 facility, MS4s, and construction storm water sites, and LAs for nonpoint sources are expressed as a percent reduction in average annual sediment loading. WLAs for industrial facilities (except the USDOE Oak Ridge Y-12 National Security Complex*),*mining sites, and RMCFs are equal to loads authorized by their existing permits. Since sediment loading from these facilities are small with respect to storm water induced sediment loading for all subwatersheds, further reductions from these facilities was not considered warranted (ref.: Appendix D).

It is considered that the reduction of sediment loading as specified by WLAs and LAs in impaired watersheds will result in the attainment of fully supporting status for all designated use classifications, with respect to siltation/habitat alteration. According to 40 CFR §130.2 (i), TMDLs can be expressed in terms of mass per time, toxicity or other appropriate measure.

Details of the analysis methodology are more fully described in Appendix B. This approach is recognized as an acceptable alternative to a maximum allowable mass load per day in the *Protocol for Developing Sediment TMDLs* (USEPA, 1999).

## 7.2 TMDLs for Impaired Subwatersheds

Sediment TMDLs for subwatersheds containing waterbodies identified as impaired for siltation/habitat alteration are summarized in Table 9.

## 7.3 Waste Load Allocations

### 7.3.1 NPDES-Regulated Industrial Facilities

WLAs are specified for industrial facilities located in impaired subwatersheds that have individual NPDES permits authorizing the discharge of TSS. The Flying J Travel Plaza #5034, Knoxville Travel Center, and Petro Shopping Center facilities are all located in Subwatershed 060102070104. Since the sediment loading (as TSS) contributed by these facilities is small compared to the total loading in this subwatershed (ref.: Appendix D), WLAs are considered to be equal to the existing NPDES permit requirements.

Due to the number and complexity of discharges and the preponderance of precipitation-based sediment loading, for the USDOE Oak Ridge Y-12 National Security Complex the WLA is expressed as the as the required percent reduction in the estimated average annual sediment loading for Subwatershed 060102070503, relative to the estimated average annual sediment loading (minus (5%)) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion. This WLA is the overall reduction required for the Y-12 facility as a whole.

### 7.3.2 Waste Load Allocations for NPDES-Regulated Mining Activities

Of the twenty-three mining sites in the Lower Clinch River Watershed with NPDES permits (as of November 1, 2005), three are located in impaired subwatersheds (ref.: Table 7). Since sediment loading from mining sites is small (ref.: Appendix D) compared to the total loading for impaired subwatersheds, the WLAs are considered to be equal to the existing permit requirement for these sites.

### 7.3.3 Waste Load Allocations for NPDES-Regulated Ready Mixed Concrete Facilities

Of the six Ready Mixed Concrete Facilities (RMCFs) in the Lower Clinch River Watershed with NPDES permits, one is located in an impaired subwatershed (ref.: Table 8). Since sediment loading from RMCFs is small (ref.: Appendix D) compared to the total loading for impaired subwatersheds, the WLAs are considered to be equal to the existing permit requirement for these facilities.

**Table 9 Sediment TMDLs for Subwatersheds with Waterbodies Impaired for Siltation/Habitat Alteration**

| HUC-12 Subwatershed (06010207__) | Waterbody ID | Waterbody Impaired by Siltation/Habitat Alteration | Level IV Ecoregion | Existing Sediment Load | Target Load | TMDL (Required Load Reduction) |
|---|---|---|---|---|---|---|
| | | | | [lbs/ac/yr] | [lbs/ac/yr] | [%] |
| 0104 | 06010207004_0100 | Grable Branch | 67f | 742 | 399.8 | 46.1 |
| 0202 | 06010207014_0100 | Williams Branch | 67i | 480 | 279.0 | 41.9 |
| | 06010207014_0110 | Foster Branch | | | | |
| | 06010207014_1000 | Bullrun Creek | | | | |
| 0301 | 06010207011_0500 | Hines Branch | 67f | 775 | 399.8 | 48.4 |
| | 06010207011_0600 | Knob Fork | | | | |
| | 06010207011_2000 | Beaver Creek | | | | |
| | 06010207011_3000 | Beaver Creek | | | | |
| 0302 | 06010207011_0700 | Grassy Creek | 67f | 669 | 399.8 | 42.8 |
| | 06010207011_0800 | Meadow Creek | | | | |
| | 06010207011_1000 | Beaver Creek | | | | |
| | 06010207011_2000 | Beaver Creek | | | | |
| 0503 | 06010207026_0600 | Bear Creek | 67i | 567 | 279.0 | 50.8 |
| | 06010207026_1000 | East Fork Poplar Creek | | | | |
| | 06010207026_2000 | East Fork Poplar Creek | | | | |

Note: Calculations were conducted for all HUC-12 subwatersheds containing waterbodies identified as impaired for siltation/habitat alteration. Some impaired waterbodies extend across more than one HUC-12 subwatershed.

7.3.4 Waste Load Allocations for NPDES-Regulated Construction Activities

Point source discharges of storm water from construction activities (including clearing, grading, filling, excavating, or similar activities) that result in the disturbance of one acre or more of total land area must be authorized by an NPDES permit. Since these discharges have the potential to transport sediment to surface waters, WLAs are provided for this category of activities. WLAs are established for each subwatershed containing a waterbody identified on the *2004 303(d) List* as impaired due to siltation and/or habitat alteration (ref.: Table 2). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading (minus 5%) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 10). WLAs provided to NPDES-regulated construction activities will be implemented as Best Management Practices (BMPs), as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activit*y (TDEC, 2005a). WLAs should not be construed as numeric permit limits.

7.3.5 Waste Load Allocations for NPDES-Regulated Municipal Separate Storm Sewer Systems (MS4s)

Municipal separate storm sewer systems (MS4s) are regulated by the State's NPDES program (ref.: Section 6.1.5). Since MS4s have the potential to discharge TSS to surface waters, WLAs are specified for these systems. WLAs are established for each HUC-12 subwatershed containing a waterbody identified on the *2004 303(d) List* as impaired due to siltation or habitat alteration (ref.: Table 2). WLAs are expressed as the required percent reduction in the estimated average annual sediment loading for an impaired subwatershed, relative to the estimated average annual sediment loading (minus the 5% allocated to RMCFs and regulated mining sites) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 10).

WLAs provided to NPDES-regulated MS4s will be implemented as Best Management Practices (BMPs) as specified in Phase I and II MS4 permits. WLAs should not be construed as numeric permit limits.

**Table 10 Summary of WLAs for USDOE Oak Ridge Y-12 National Security Complex, MS4s, and Construction Storm Water Sites and LAs for Nonpoint Sources**

| HUC-12 Subwatershed (06010207__) | Level IV Ecoregion | Percent Reduction – Average Annual Sediment Load | |
|---|---|---|---|
| | | WLAs (MS4s and Construction SW) | LAs (Nonpoint Sources) |
| | | [%] | [%] |
| 0104 | 67f | 48.8 | 48.8 |
| 0202 | 67i | 44.8 | 44.8 |
| 0301 | 67f | 51.0 | 51.0 |
| 0302 | 67f | 45.7 | 45.7 |
| 0503 | 67i | 53.3 * | 53.3 |

* The WLA shown also applies to the USDOE Oak Ridge National Security Complex facility.

### 7.4 Load Allocations for Nonpoint Sources

All sources of sediment loading to surface waters not covered by the NPDES program are provided a Load Allocation (LA) in these TMDLs. LAs are established for each HUC-12 subwatershed containing a waterbody identified on the *2004 303(d) List* as impaired due to siltation or habitat alteration (ref.: Table 2). LAs are expressed as the required percent reduction in the estimated average annual sediment loading for the impaired subwatershed, relative to the estimated average annual sediment loading (minus 5%) of a biologically healthy (reference) subwatershed located in the same Level IV ecoregion (ref.: Table 10).

### 7.5 Margin of Safety

There are two methods for incorporating a Margin of Safety (MOS) in the analysis: a) implicitly incorporate the MOS using conservative model assumptions to develop allocations; or b) explicitly specify a portion of the TMDL as the MOS and use the remainder for allocations. In these TMDLs, an implicit MOS was incorporated through the use of conservative modeling assumptions. These include:

- Target values based on Level IV ecoregion reference sites. These sites represent the least impacted streams in the ecoregion.

- The use of the sediment delivery process that results in the most sediment transport to surface waters (Method 2 in Appendix B).

In most presently impaired subwatersheds, some amount of explicit MOS is realized due to the WLAs specified for NPDES permitted mining sites and RMCFs being less than the 5% of the target load reserved for these facilities.

### 7.6 Seasonal Variation

Sediment loading is expected to fluctuate according to the amount and distribution of rainfall. The determination of sediment loads on an average annual basis accounts for these differences through the rainfall erosivity index in the USLE (ref.: Appendix B). This is a statistic calculated from the annual summation of rainfall energy in every storm and its maximum 30-minute intensity.

## 8.0 IMPLEMENTATION PLAN

### 8.1 Point Sources

#### 8.1.1 NPDES Regulated Industrial Facilities

WLAs for regulated industrial facilities will be implemented through the provisions of their individual NPDES permits. In the case of the USDOE Oak Ridge Y-12 National Security Complex (TN0002968), the WLA is the overall load reduction required for the facility as a whole. Latitude can be given with respect to reductions for specific outfalls as long as the overall reduction for the facility achieved.

8.1.2 NPDES-Regulated Mining Sites

Of the twenty-three mining sites in the Lower Clinch River Watershed, three are located are located in impaired subwatersheds (ref.: Table 7). WLAs will be implemented through the existing permit requirements for these sites.

8.1.3 NPDES-Regulated Ready Mixed Concrete Facilities

Of the six RMCFs in the Lower Clinch River Watershed, one is located in an impaired subwatershed (ref.: Table 8). WLAs will be implemented through NPDES Permit No. TNG110000, *General NPDES Permit for Discharges of Storm Water Runoff and Process Wastewater Associated With Ready Mixed Concrete Facilities* (TDEC, 2003).

8.1.4 NPDES-Regulated Construction Storm Water

The WLAs provided to existing and future NPDES-regulated construction activities will be implemented through Best Management Practices (BMPs) as specified in NPDES Permit No. TNR10-0000, *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005a). The permit requires the development and implementation of a site-specific Storm Water Pollution Prevention Plan (SWPPP) prior to the commencement of construction activities. The SWPPP must be prepared in accordance with good engineering practices and the latest edition of the *Tennessee Erosion and Sediment Control Handbook* (TDEC, 2002) and must identify potential sources of pollution at a construction site that would affect the quality of storm water discharges and describe practices to be used to reduce pollutants in those discharges. At a minimum, the SWPPP must include the following elements:

- Site description
- Description of storm water runoff controls
- Erosion prevention and sediment controls
- Storm water management
- Description of items needing control
- Approved local government sediment and erosion control requirements
- Maintenance
- Inspections
- Pollution prevention measures for non-storm water discharges
- Documentation of permit eligibility related to TMDLs

The SWPPP must include documentation supporting a determination of permit eligibility with regard to waters that have an approved TMDL for a pollutant of concern, including:

- identification of whether the discharge is identified, either specifically or generally, in an approved TMDL and any associated allocations, requirements, and assumptions identified for the discharge;
- summaries of consultation with the division on consistency of SWPPP conditions with the

approved TMDL; and

- measures taken to ensure that the discharge of pollutants from the site is consistent with the assumptions and requirements of the approved TMDL, including any specific wasteload allocation that has been established that would apply to the discharge.

The permit does not authorize discharges that would result in a violation of a State water quality standard. In addition, a number of special requirements are specified for discharges entering high quality waters or waters identified as impaired due to siltation. These additional requirements include:

- The SWPPP must certify that erosion and sediment controls are designed to control runoff from a 5-year, 24-hour storm event.
- More frequent (twice weekly) inspections of erosion and sediment controls.
- If a discharger is complying with the SWPPP, but is contributing to the impairment of a stream, the SWPPP must be revised and implemented to eliminate further impairment to the stream. If these changes are not implemented within 7 days of receipt of notification, coverage under the general permit will be terminated and continued discharges covered under an individual permit. The construction project must be stabilized until the revised SWPPP is implemented or an individual permit issued. No earth disturbing activities, except for stabilization, are authorized until the individual permit is issued.
- For an outfall in a drainage area of a total of 5 or more acres, a temporary (or permanent) sediment basin that provides storage for a calculated volume of runoff from a 5-year, 24-hour storm and runoff from each acre drained, or equivalent control measures, shall be provided until final stabilization of the site.
- A 60-foot natural riparian buffer zone adjacent to a receiving stream designated as impaired or high quality waters must be preserved, to the maximum extent practicable, during construction activities at the site.

Strict compliance with the provisions of the *General NPDES Permit for Storm Water Discharges Associated With Construction Activity* (TDEC, 2005a) can reasonably be expected to achieve reduced sediment loads to streams. The primary challenge for the reduction of sediment loading from construction sites to meet TMDL WLAs is in the effective compliance monitoring of all requirements specified in the permit and timely enforcement against construction sites not found to be in compliance with the permit.

8.1.5 NPDES-Regulated Municipal Separate Storm Sewer Systems (MS4s)

For existing and future regulated discharges from municipal separate storm sewer systems, WLAs will be implemented through Phase I & II MS4 permits. These permits will require the development and implementation of a Storm Water Management Program (SWMP) that will reduce the discharge of pollutants to the "maximum extent practicable" and not cause or contribute to violations of State water quality standards. The *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003a) was issued on February 27, 2003 and requires SWMPs to include six minimum control measures:

- Public education and outreach on storm water impacts

- Public involvement/participation
- Illicit discharge detection and elimination
- Construction site storm water runoff control
- Post-construction storm water management in new development and re-development
- Pollution prevention/good housekeeping for municipal operations

For discharges into impaired waters, the Small MS4 General Permit (ref.: http://www.state.tn.us/environment/wpc/stormh2o/MS4II.php) requires that SWMPs include a section describing how discharges of pollutants of concern will be controlled to ensure that they do not cause or contribute to instream exceedances of water quality standards. Specific measures and BMPs to control pollutants of concern must also be identified. In addition, MS4s must implement the WLA provisions of an applicable TMDL and describe methods to evaluate whether storm water controls are adequate to meet the WLA.

In order to evaluate SWMP effectiveness and demonstrate compliance with specified WLAs, MS4s must develop and implement appropriate monitoring programs. Instream monitoring, at locations selected to best represent the effectiveness of BMPs, must include analytical monitoring of pollutants of concern as well as stream surveys to evaluate biological integrity. A detailed plan describing the monitoring program must be submitted to the appropriate Environmental Field Office (EFO) of the Division of Water Pollution Control within 12 months of the approval date of this TMDL. The appropriate EFO can be determined based on the county (ref.: http://tennessee.gov/environment/eac/index.php).

Implementation of the monitoring program must commence within 6 months of plan approval by the EFO. The monitoring program shall comply with the monitoring, record keeping, and reporting requirements of *NPDES General Permit for Discharges from Small Municipal Separate Storm Sewer Systems* (TDEC, 2003a).

## 8.2 Nonpoint Sources

The Tennessee Department of Environment & Conservation (TDEC) has no direct regulatory authority over most nonpoint source discharges. Reductions of sediment loading from nonpoint sources (NPS) will be achieved using a phased approach. Voluntary, incentive-based mechanisms will be used to implement NPS management measures in order to assure that measurable reductions in pollutant loadings can be achieved for the targeted impaired waters. Cooperation and active participation by the general public and various industry, business, and environmental groups is critical to successful implementation of TMDLs. Local citizen-led and implemented management measures offer the most efficient and comprehensive avenue for reduction of loading rates from nonpoint sources. There are links to a number of publications and information resources on EPA's Nonpoint Source Pollution website (http://www.epa.gov/owow/nps/pubs.html) relating to the implementation and evaluation of nonpoint source pollution control measures.

TMDL implementation activities will be accomplished within the framework of Tennessee's Watershed Approach (ref.: http://www.state.tn.us/environment/wpc/watershed/). The Watershed Approach is based on a five-year cycle and encompasses planning, monitoring, assessment, TMDLs, WLAs/LAs, and permit issuance. It relies on participation at the federal, state, local and nongovernmental levels to be successful.

The actions of local government agencies and watershed stakeholders should be directed to accomplish the goal of a reduction of sediment loading in the watershed. There are a number of measures that are particularly well-suited to action by local stakeholder groups. These measures include, but are not limited to:

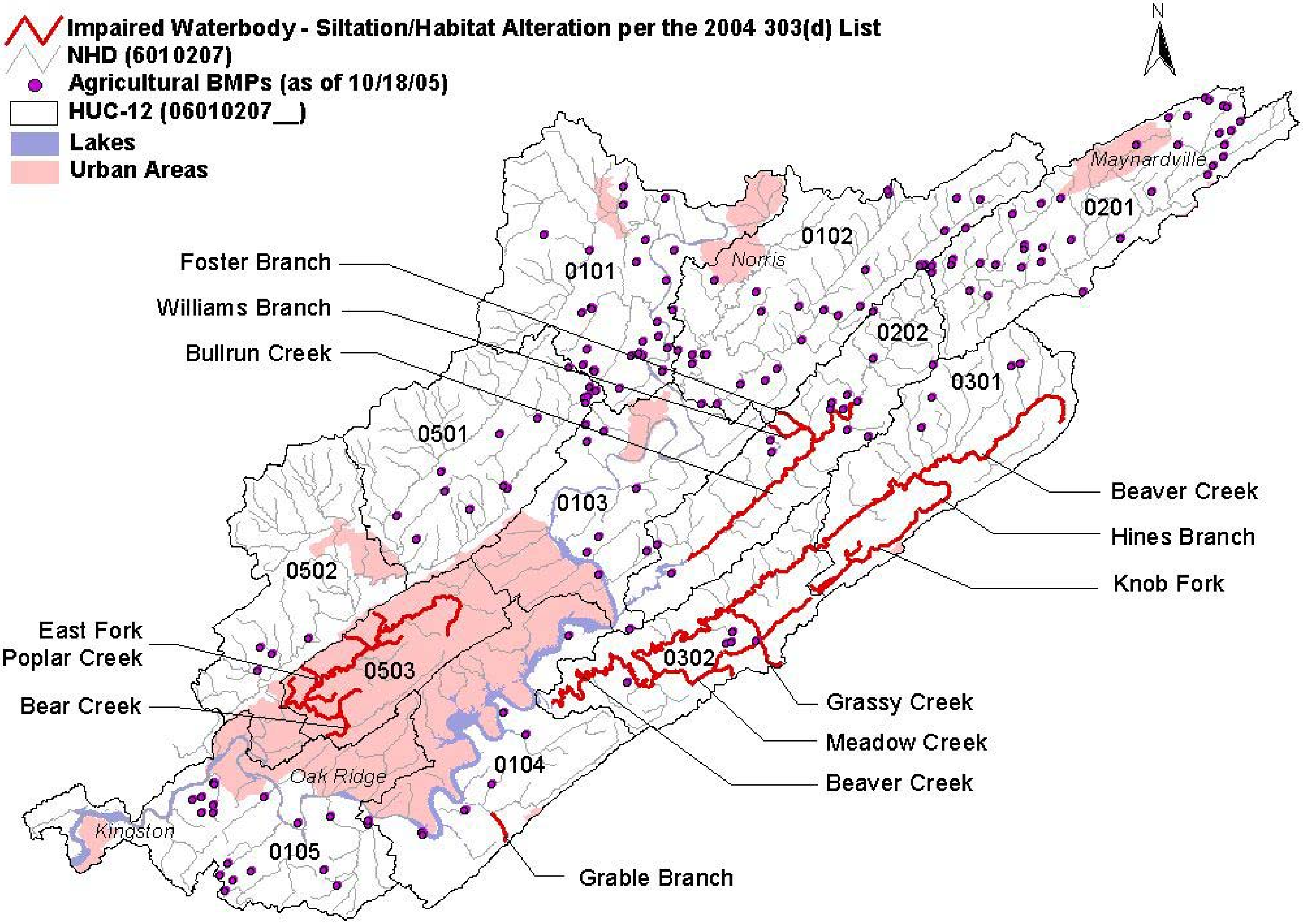
- Detailed surveys of impaired subwatersheds to identify additional sources of sediment loading.
- Advocacy of local area ordinances and zoning that will minimize sediment loading to waterbodies, including establishment of buffer strips along streambanks, reduction of activities within riparian areas, and minimization of road and bridge construction impacts.
- Educating the public as to the detrimental effects of sediment loading to waterbodies and measures to minimize this loading.
- Advocacy of agricultural BMPs (e.g., riparian buffer, animal waste management systems, waste utilization, stream stabilization, fencing, heavy use area treatment protection, livestock exclusion, etc.) and practices to minimize erosion and sediment transport to streams. The Tennessee Department of Agriculture (TDA) keeps a database of BMPs implemented in Tennessee. Of the 232 BMPs in the Lower Clinch River Watershed as of October 18, 2005, 44 are in sediment-impaired subwatersheds (see Figure 8).

An excellent example of stakeholder involvement and action for the development of TMDLs is described in *Beaver Creek Watershed Assessment* (Knox County Engineering and Public Works, 2003). Knox County Engineering and Public Works and Knox County Parks and Recreation partnered with the Knox Land and Water Conservancy (KLWC) and other interested organizations to conduct an assessment of the Beaver Creek watershed. As part of this study, sample data were collected in the Beaver Creek watershed for water quality parameters necessary to generate TMDLs for nutrients and pathogens. The results of the study will help Knox County plan more effectively for flood control, water quality, and allocation of land for open space, recreation and trails. Copies of the report are available at various branches of the Knox County Public Library.

## 8.3 Evaluation of TMDL Effectiveness

The effectiveness of the TMDL will be assessed within the context of the State's rotating watershed management approach. Watershed monitoring and assessment activities will provide information by which the effectiveness of sediment loading reduction measures can be evaluated. Monitoring data, ground-truthing, and source identification actions will enable implementation of particular types of BMPs to be directed to specific areas in the subwatersheds. These TMDLs will be reevaluated during subsequent watershed cycles and revised as required to assure attainment of applicable water quality standards.

**Figure 8 Location of Agricultural Best Management Plans in the Lower Clinch River Watershed**



## 9.0 PUBLIC PARTICIPATION

In accordance with 40 CFR §130.7, the proposed sediment TMDLs for the Lower Clinch River Watershed was placed on Public Notice for a 35-day period and comments were solicited. Steps that were taken in this regard included:

1) Notice of the proposed TMDLs was posted on the Tennessee Department of Environment and Conservation website. The notice invited public and stakeholder comments and provided a link to a downloadable version of the TMDL document.

2) Notice of the availability of the proposed TMDLs (similar to the website announcement) was included in the January 9, 2006 NPDES permit Public Notice mailings, which is sent to approximately 90 interested persons or groups who have requested this information.

3) A letter was sent to point source facilities in the Lower Clinch River Watershed that are permitted to discharge treated total suspended solids (TSS) and are located in impaired subwatersheds advising them of the proposed sediment TMDLs and their availability on the TDEC website. The letter also stated that a written copy of the draft TMDL document would be provided on request. Letters were sent to the following facilities:

| | |
|---|---|
| TN0002968 | USDOE Oak Ridge Y-12 National Security Complex |
| TN0026484 | Vulcan Construction Materials, LP – Dixie Lee Quarry |
| TN0063355 | Rinker Materials – I-75 Quarry |
| TN0064548 | Flying J Travel Plaza #5034 |
| TN0065137 | Knoxville Travel Center |
| TN0067024 | Petro Shopping Center |
| TN0079341 | Rinker Materials – I-75 Quarry Extension |
| TNG110288 | Knoxville Concrete |

4) A letter was sent to local interagency and stakeholder groups in the Lower Clinch River Watershed advising them of the proposed sediment TMDLs and their availability on the TDEC website. The letter also stated that a written copy of the draft TMDL document will be provided upon request. A letter was sent to the following interagency and local stakeholder groups (list continued on next page):

   Natural Resources Conservation Service
   USGS Water Resource Programs
   USDA – Forest Service
   Tennessee Valley Authority
   Tennessee Department of Agriculture
   Tennessee Wildlife Resources Agency
   Clinch River Chapter of Trout Unlimited
   Beaver Creek Watershed Association

Beaver Creek Task Force
Bullrun Creek Watershed Association
Bullrun Creek Restoration Initiative
Coal Creek Watershed Foundation
Hinds Creek Watershed Partnership
Oak Ridge Reservation Local Oversight Committee
Tennessee Citizens for Wilderness Planning

5) A draft copy of the proposed sediment TMDLs was sent to the following MS4s:

| | |
|---|---|
| TNS068055 | City of Knoxville Municipal Separate Storm Drain System |
| TNS075108 | Anderson County |
| TNS075299 | Farragut |
| TNS075582 | Knox County |
| TNS075591 | Loudon County |
| TNS077585 | Tennessee Department of Transportation (TDOT) |
| TNS076074 | Pellissippi State Community College |

## 10.0 FURTHER INFORMATION

Further information concerning Tennessee's TMDL program can be found on the Internet at the Tennessee Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/

Technical questions regarding these TMDLs should be directed to the following members of the Division of Water Pollution Control staff:

Mary L. Wyatt, Watershed Management Section
e-mail: Mary.Wyatt@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
e-mail: Sherry.Wang@state.tn.us

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# APPENDIX A

## Example of Stream Assessment (Hines Branch)

**Figure A-1 Hines Branch Stream Survey, page 1 – July 15, 2003**

#4

## STREAM SURVEY FORM

**STREAM SURVEY INFORMATION** Fill out all header information for new stations and shaded fields for existing stations.

| | | | |
|---|---|---|---|
| STATION NUMBER: | HINES000.2AN KN | ASSESSORS: | CAP/CLH |
| STREAM NAME: | Hines Branch | DATE: | 7/15/03 |
| STATION LOCATION: | US W3 Cunningham Rd | TIME: | 1330 |
| COUNTY CODE:(FIPS) | 001 (STATE CODE) 01 | STREAM MILE: | 0.2 |
| WBID#/HUC: | TN06010207 | STREAM ORDER: | |
| HUC NAME: | Lower Clinch | ADB SEGMENT | |
| LAT/LONG DEC: | N36.06849 W83.94244 USD | 3Q20: | |
| ECOLOGICAL SUBREGION: | 67f | ELEVATION (ft): | 1094 |
| USGS QUAD: | 146 SW | GAZETTEER PAGE | 59 |
| PROJECT/PURPOSE: | Lower Clinch | | |

**SAMPLES COLLECTED**

Aquatic Life Assessed: (Macroinvertebrates) Fish Algae Other:

Type of benthic sample: (BIORECON) (SQ KICK) SQ BANK DENDY SURBER OTHER

CHEMICALS Y or (N)

**FIELD MEASUREMENTS**

METERS USED: Scout 13

| | | | | |
|---|---|---|---|---|
| pH | 7.71 SU | DO% | | 79.4 |
| CONDUCTIVITY | 427 UMHOS | DISSOLVED OXYGEN | | 7.25 PPM |
| TEMPERATURE | 19.58 °C | TIME | | 1534 |
| | | OTHERS | | 13.5 |

Previous 48 hours Precip: UNKNOWN (NONE) LITTLE MODERATE HEAVY FLOODING

Ambient Weather: SUNNY mostly (CLOUDY) (BREEZY) RAIN SNOW AIR TEMP: 75°

**WATERSHED CHARACTERISTICS** App. % of watershed observed:

UPSTREAM SURROUNDING LAND USE: (estimated %)

| | | | | | |
|---|---|---|---|---|---|
| PASTURE | | URBAN | | RESID | 80 |
| CROPS | | INDUSTRY | | OTHER | |
| FOREST | 20 | MINING | | | |

IMPACTS: rated S(light), M(oderate), H(igh) magnitude. Blank = not observed

| CAUSES | | SOURCES | |
|---|---|---|---|
| Pesticides (0200) | Flow Alter. (1500) | Point Source: Indust (0100) | Unknown (9000) |
| Metals (0500) | Habitat Alt. (1600) | Logging (2000) | Municipal (2000) |
| Ammonia (0600) | Thermal Alt. (1400) | Construction;Land Devel (3200) | Mining (5000) |
| Chlorine (0700) | Pathogens (1700) | U/S Dam (8800) | Road /bridge (3100) |
| Nutrients (0900) | Oil & grease (1900) | Riparian loss (7600) | Urban Runoff (4000) |
| pH (1000) | Unknown (0000) | Agriculture: Row crop (1000) | Bank destabilization (7700) |
| Organic Enrichment / Low D.O. (1200) | Siltation (1100) M | Livestock grazing-riparian (1410) | Intensive Feedlot (1600) |
| Other: | | Other: | Dredging (7200) |

**PHYSICAL STREAM CHARACTERISTICS** **LENGTH OF STREAM AREA ASSESSED (m):**

SURROUNDING LAND USE :

| ESTIMATE % | RDB | LDB | | RDB | LDB | | RDB | LDB |
|---|---|---|---|---|---|---|---|---|
| PASTURE | | | URBAN | | | RESID. | 90 | 80 |
| CROPS | | | INDUSTRY | | | OTHER | | |
| FOREST | 10 | 20 | MINING | | | | | |

% CANOPY COVER: Estimated: Closed Measured: 91.6 Open(0-10) U/S 60 (Partly Shaded(11-45)) D/S 40 Mostly Shaded(46-80) LB 20 Shaded(>80) RB 40

BANK HEIGHT (m): 1/2 m HIGH WATER MARK (m): 1 1/2

SEDIMENT DEPOSITS: NONE SLIGHT (MODERATE) EXCESSIVE BLANKET

TYPE: SLUDGE (MUD) (SAND) (SILT) NONE OTHER Contaminated Y or N

TURBIDITY CLEAR SLIGHT MODERATE HIGH OPAQUE

ALGAE PRESENT? (NONE) SLIGHT MODERATE CHOKING TYPE

AQUATIC VEGET. ROOTED FLOATING TYPE

ADDITIONAL COMMENTS:(oil sheen, odor, colors) steep bank (high web) some sloughing, creek runs through a residential area b/n house & apartment complex (grass is mowed to creek) d/s of Cunningham is forest on LDB u/s 6 forest half

State of TN Page 1 3/12/02

**Figure A-2 Hines Branch Stream Survey, page 2 – July 15, 2003**

**STREAM SURVEY FORM**

**PHYSICAL STREAM CHARACTERISTICS (cont.)**

| | RIFFLE | RUN | POOL |
|---|---|---|---|
| DEPTH (m) | 8 in | 1/2 ft | |
| WIDTH (m) | 1½ m | 1½ m | |
| REACH LENGTH (m) | 2 m | 10 m | |

Staff Gauge/Bench Ht:
VELOCITY (FS)
FLOW (CFS)
HABITAT ASSESSMENT SCORE #:
RR # GP #

**Gradient (sample reach):** Flat Low (Mode) High Cascade

**Size (stream width):** ✓ V. Small (<1.5m) Small (1.5-3m) Med (3-10m) Large (10-25m) Very Lrg (>25m)

**SUBSTRATE (Complete either particle count or estimate substate (%)**

**Particle Count - 100 measured particles (mm).** Circle one: RIFFLE RUN

| size (mm) | description | abbreviation |
|---|---|---|
| <0.062 | silt/clay | cl |
| 0.062-0.125 | very fine sand | vfs |
| 0.125-.250 | fine sand | fs |
| 0.25-0.50 | med sand | ms |
| 0.5-1.0 | coarse sand | cs |
| 1.0-2.0 | very coarse sand | (use actual size) |
| 2.0-64.0 | gravel | (use actual size) |
| 64-256 | cobble | (use actual size) |
| 256-4096 | boulder | (use actual size) |
| --- | bedrock | bdrx |
| --- | woody debris | wood |

Record measured particle size. Use abbrev. below for smaller sizes.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1-10 | | | | | | | | | |
| 11-20 | | | | | | | | | |
| 21-30 | | | | | | | | | |
| 31-40 | | | | | | | | | |
| 41-50 | | | | | | | | | |
| 51-60 | | | | | | | | | |
| 61-70 | | | | | | | | | |
| 71-80 | | | | | | | | | |
| 81-90 | | | | | | | | | |
| 91-100 | | | | | | | | | |

**SUBSTRATE (%)** **(Visual estimates)**

| | RIFFLE | RUN | POOL |
|---|---|---|---|
| BOULDER (> 10") | 10 % | % | % |
| COBBLE (2.5-10") | 10 % | 5 % | % |
| GRAVEL (0.1-2.5") | 40 % | 50/45 % | % |
| BEDROCK | % | % | % |
| SAND (gritty) | 25 % | 25 % | % |

| | RIFFLE | RUN | POOL |
|---|---|---|---|
| CLAY (slick) | % | % | % |
| SILT | 5 % | 20 % | % |
| DETRITUS (CPOM) | % | % | % |
| MUCK-MUD (FPOM) | 5 % | 15 % | % |
| MARL (shell frags.) | % | % | % |

**STREAM USE SUPPORT:** WATER WITHDRAWL NOTED

**CLASSIFIED FOR:**
Dom. H2O Supply Ind. H2O Supply
TIER II/TIER III Navigation
Trout >> Nat. Repr?

**POSTED FOR:**
Bacteriological Advis.
Do Not Consume
Precautionary
Fish Tissue Advis.:

**SUPPORT STATUS:**
FULLY SUPPORTING (FS) PARTIALLY SUPPORTING (PS) SUPPORTING, BUT THREATENED (TH) NONSUPPORTING (NS)

**Photos ? Y or N** **Roll/Disc #** 2 **Photo #ID** 5 #/ID
#/ID #/ID

**STREAM SKETCH** (include flow direction, reach distance, distance from bridge, sampling points, tribs, outfalls, livestock access, riparian area etc.)

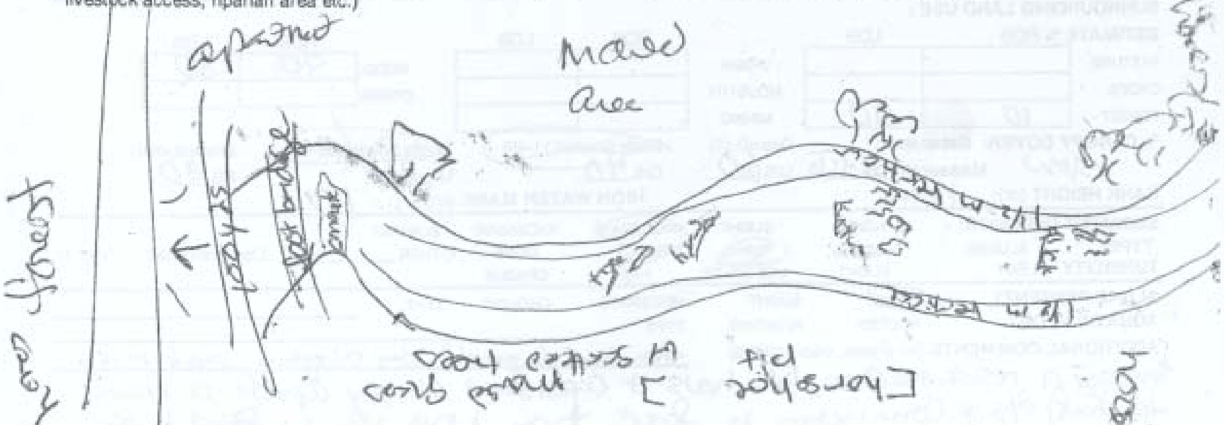

**Figure A-3 Hines Branch Habitat Assessment Field Data Sheet, front – July 15, 2003**

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HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (FRONT)

| | |
|---|---|
| STREAM NAME Hines Branch | LOCATION |
| STATION # ______ RIVER MILE 0.2 | STREAM CLASS |
| LAT ______ LONG ______ | RIVER BASIN Lower Clinch |
| STORET# HINES000.2AN KN | AGENCY KDOS for KEAC |
| INVESTIGATORS CAP, GRH | |
| FORM COMPLETED BY CAP | DATE 7/15/03 TIME 1500 AM PM / REASON FOR SURVEY |

| Habitat Parameter | Condition Category: Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|---|
| 1. Epifaunal Substrate/Available Cover (20 feet) | Greater than 70% of substrate favorable for epifaunal colonization and fish cover; mix of snags, submerged logs undercut banks, cobble or other stable habitat and at stage to allow full colonization potential (i.e., logs/snags that are not new fall and not transient) | 40-70% mix of stable habitat; well-suited for full colonization potential; adequate habitat for maintenance of populations; presence of additional substrate in the from of newfall, but not yet prepared for colonization (may rate at high end of scale). | 20-40% mix of stable habitat; availability less than desirable; substrate frequently disturbed or removed | Less than 20% stable habitat; lack of habitat is obvious; substrate unstable or lacking |
| SCORE 6 | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 (6) | 5 4 3 2 1 |
| 2. Embeddedness | Gravel, cobble, and boulder particles are 0-25% surrounded by fine sediment. Layering of cobble provides diversity of niche space. | Gravel, cobble and boulder particles are 25-50% surrounded by fine sediment. | Gravel, cobble, and boulder particles are 50-75% surrounded by fine sediment. | Gravel, cobble, and boulder particles are more than 76% surrounded by fine sediment. |
| SCORE 11 | 20 19 18 17 16 | 15 14 13 12 (11) | 10 9 8 7 6 | 5 4 3 2 1 |
| 3. Velocity/Depth Regime | All four velocity/depth regimes present (slow-deep, slow-shallow, fast-deep, fast-shallow) (Slow is<0.3m/s deep is >0.5m) | Only 3 of the 4 regimes present (if fast-shallow is missing score lower than regimes). | Only 2 of the 4 habitat regimes present (if fast-shallow or slow-shallow are missing, score low) | Dominated by 1 velocity/depth regime (usually slow-deep) |
| SCORE 8 | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 (8) 7 6 | 5 4 3 2 1 |
| 4. Sediment Deposition | Little or no enlargement of islands or point bars and less than 5% (<20% for low – gradient streams) of the bottom affected by sediment deposition | Some new increase in bar formation, mostly from gravel, sand or fine sediment; 5-30% (20-50% for low-gradient) of the bottom affected; slight deposition in pools | Moderate deposition of new gravel, sand or fine sediment on old and new bars; 30-50% (50-80% for low-gradient) of the bottom affected; sediment deposits at obstructions, constrictions, and bends; moderate deposition of pools prevalent. | Heavy deposits of fine material, increased far development; more than 50% (80% for low-gradient) of the bottom changing frequently; pools almost absent due to substantial sediment deposition |
| SCORE 6 | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 (6) | 5 4 3 2 1 |
| 5. Channel Flow Status | Water reaches base of both lower banks, and minimal amount of channel substrate is exposed. | Water fills> 75% of the available channel; or 25 % of channel substrate is exposed. | Waters fills 25-75 % of the available channel, and/or riffle substrates are mostly exposed. | Very little water in channel and mostly present as standing pools. |
| SCORE 11 | 20 19 18 17 16 | 15 14 13 12 (11) | 10 9 8 7 6 | 5 4 3 2 1 |

**Figure A-4 Hines Branch Habitat Assessment Field Data Sheet, back – July 15, 2003**

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HABITAT ASSESSMENT DATA SHEET- HIGH GRADIENT STREAMS (BACK)

| Habitat Parameter | Condition Category: Optimal | Suboptimal | Marginal | Poor |
|---|---|---|---|---|
| 6. Channel Alteration<br>bridge<br>past bridge | Channelization or dredging absent or minimal; stream with normal pattern. | Some channelization present, usually in areas of bridge abutments; evidence of past channelization, i.e., dredging, (greater than past 20 yr) may be present, but recent channelization is not present | Channelization may be extensive; embankments or shoring structures, present on both banks; and 40 to 80% of stream reach channelized and disrupted. | Banks shored with gabion or cement; over 80% of the stream reach channelized and disrupted. Instream habitat greatly altered or removed entirely. |
| SCORE 16 | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 |
| 7. Frequency of Riffles (or bends) | Occurrence of riffles relatively frequent; ratio of distance between riffles divided by width of the stream <7:1 (generally 5-7); variety of habitat is key. In streams where riffles are continuous, placement of boulders or other large, natural obstruction is important. | Occurrence of riffles infrequent; distance between riffles divided by the width of the stream is between 7 to 15. | Occasional riffle or bend; bottom contours provide some habitat; distance between riffles divided by the width of the stream is between 15 to 25. | Generally all flat water or shallow riffles; poor habitat; distance between riffles divided by the width of the stream is a ratio of >25. |
| SCORE 16 | 20 19 18 17 16 | 15 14 13 12 11 | 10 9 8 7 6 | 5 4 3 2 1 |
| 8. Bank Stability (score each bank)<br>Note: 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. | Moderately unstable; 30-60 % of bank in reach has areas of erosion; high erosion potential during floods | Unstable, many eroded area, "raw" areas frequent along straight sections and bends; obvious bank sloughing, 60-100% of bank has erosional scars |
| SCORE 3 (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE 4 (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 9. Vegetative Protective (score each bank)<br>Note: determine left or right side by facing downstream | More than 90% of the streambank surfaces and immediate riparian zone covered by native vegetation, including trees, understory shrubs, or nonwoody macrophytes; vegetative disruption through grazing or mowing minimal or not evident; almost all plants allowed to grow naturally. | 70-90% of the streambank surfaces covered by native vegetation, but one class of plants is not well-represented; disruption evident but not affecting full plant growth potential to any great extent; more than one-half of the potential plant stubble height remaining | 50-70% of the streambank surfaces covered by vegetation; disruption obvious; patches of bare soil or closely cropped vegetation common; less than one-half of the potential plant stubble height remaining | Less than 50% of the streambank surfaces covered by vegetation; disruption of streambank vegetation is very high; vegetation has been removed to 5 centimeters or less in average stubble height |
| SCORE 2 (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE 3 (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| 10. Riparian Vegetative Zone Width (score each bank riparian zone) | Width of riparian zone > 18 meters; human activities (i.e. parking lots, roadbeds, clear-cuts, lawns or crops) have not impacted zone | Width of riparian zone 12-18 meters; human activities have impacted zone only minimally | Width of riparian zone 6-12 meters; human activities have impacted zone a great deal. | Width of riparian zone <6 meters: little or no riparian vegetation due to human activities. |
| SCORE 2 (LB) | Left Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |
| SCORE 2 (RB) | Right Bank 10 9 | 8 7 6 | 5 4 3 | 2 1 0 |

TOTAL SCORE 90

# APPENDIX B

## Watershed Sediment Loading Model

## WATERSHED SEDIMENT LOADING MODEL

Determination of target average annual sediment loading values for reference watersheds and the sediment loading analysis of waterbodies impaired for siltation/habitat alteration was accomplished utilizing the Watershed Characterization System (WCS) Sediment Tool (v.2.6). WCS is an ArcView geographic information system (GIS) based program developed by USEPA Region IV to facilitate watershed characterization and TMDL development. WCS consists of an initial set of spatial and tabular watershed data, stored in a database, and allows the incorporation of additional data when available. It provides a number of reporting tools and data management utilities to allow users to analyze and summarize data. Program extensions, such as the sediment tool, expand the functionality of WCS to include modeling and other more rigorous forms of data analysis (USEPA, 2001).

### Sediment Analysis

The Sediment Tool is an extension of WCS that utilizes available GIS coverages (land use, soils, elevations, roads, etc), the Universal Soil Loss Equation (USLE) to calculate potential erosion, and sediment delivery equations to calculate sediment delivery to the stream network. The following tasks can be performed:

- Estimate extent and distribution of potential soil erosion in the watershed.
- Estimate potential sediment delivery to receiving waterbodies.
- Evaluate effects of land use, BMPs, and road network on erosion and sediment delivery.

The Sediment Tool can also be used to evaluate different scenarios, such as the effects of changing land uses and implementation of BMPs, by the adjustment of certain input parameters. Parameters that may be adjusted include:

- Conservation management and erosion control practices
- Changes in land use
- Implementation of Best Management Practices (BMPs)
- Addition/Deletion of roads

Sediment analyses can be performed for single or multiple watersheds.

### Universal Soil Loss Equation

Erosion potential is based on the Universal Soil Loss Equation (USLE), developed by Agriculture Research Station (ARS) scientists W. Wischmeier and D. Smith. It has been the most widely accepted and utilized soil loss equation for over 30 years. The USLE is a method to predict the average annual soil loss on a field slope based on rainfall pattern, soil type, topography, crop system and management practices. The USLE only predicts the amount of soil loss resulting from sheet or rill erosion on a single slope and does not account for soil losses that might occur from gully, wind, or tillage erosion. Designed as a model for use with certain cropping and management systems, it is also applicable to non-agricultural situations (OMAFRA, 2000). While the USLE can be used to estimate long-term average annual soil loss, it cannot be applied to a specific year or a specific storm. Based on its long history of use and wide acceptance by the forestry and agricultural communities, the USLE was considered to be an adequate tool for estimating the relative long-term average annual soil erosion of watersheds and evaluating the effects of land use changes and implementation of BMP measures.

Soil loss from sheet and rill erosion is primarily due to detachment of soil particles during rain events. It is the cause of the majority of soil loss for lands associated with crop production, grazing areas, construction sites, mine sites, logging areas, and unpaved roads. In the USLE, five major factors are used to calculate the soil loss for a given area. Each factor is the numerical estimate of a specific condition that affects the severity of soil erosion in that area. The USLE for estimating average annual soil erosion is expressed as:

$$A = R \times K \times LS \times C \times P$$

where:

A = average annual soil loss in tons per acre
R = rainfall erosivity index
K = soil erodibility factor
LS = topographic factor - L is for slope length and S is for slope
C = crop/vegetation & management factor
P = conservation practice factor

Evaluating the factors in USLE:

<u>R - Rainfall Erosivity Index</u>

The rainfall erosivity index describes the kinetic energy generated by the frequency and intensity of the rainfall. It is statistically calculated from the annual summation of rainfall energy in every storm, which correlates to the raindrop size, times its maximum 30-minute intensity. This index varies with geography.

<u>K - Soil Erodibility Factor</u>

This factor quantifies the cohesive or bonding character of the soil and its ability to resist detachment and transport during a rainfall event. The soil erodibility factor is a function of soil type.

<u>LS - Topographic Factor</u>

The topographic factor represents the effect of slope length and slope steepness on erosion. Steeper slopes produce higher overland flow velocities. Longer slopes accumulate runoff from larger areas and also result in higher flow velocities. For convenience L and S are frequently lumped into a single term.

<u>C – Crop/Vegetation & Management Factor</u>

The crop/vegetation and management factor represents the effect that ground cover conditions, soil conditions and general management practices have on soil erosion. It is the most computationally complicated of USLE factors and incorporates the effects of: tillage management, crop type, cropping history (rotation), and crop yield.

P - Conservation Practice Factor

The conservation practice factor represents the effects on erosion of Best Management Practices (BMPs) such as contour farming, strip cropping and terracing.

Estimates of the USLE parameters, and thus the soil erosion as computed from the USLE, are provided by the Natural Resources Conservation Service's (NRCS) National Resources Inventory (NRI) 1994. The NRI database contains information of the status, condition, and trend of soil, water, and related resources collected from approximately 800,000 sampling points across the country.
The soil losses from the erosion processes described above are localized losses and not the total amount of sediment that reaches the stream. The fraction of the soil lost in the field that is eventually delivered to the stream depends on several factors. These include, the distance of the source area from the stream, the size of the drainage area, and the intensity and frequency of rainfall. Soil losses along the riparian areas will be delivered into the stream with runoff-producing rainfall.

**Sediment Modeling Methodology**

Using WCS and the Sediment Tool, average annual sediment loading to surface waters was modeled according to the following procedures:

1. A WCS project was setup for the watershed that is the subject of these TMDLs. Additional data layers required for sediment analysis were generated or imported into the project. These included:

   DEM (grid) – The Digital Elevation Model (DEM) layers that come with the basic WCS distribution system are shapefiles of coarse resolution (300x300m). A higher resolution DEM grid layer (30x30m) is required. The National Elevation Dataset (NED) is available from the USGS website and the coverage for the watershed (8-digit HUC) was imported into the project.

   Road – A road layer is needed as a shape file and requires additional attributes such as road type, road practice, and presence of side ditches. If these attributes are not provided, the Sediment Tool automatically assigns default values: road type - secondary paved roads, side ditches present and no road practices. This data layer was obtained from ESRI for areas in the watershed.

   Soil – The SSURGO (1:24k) soil data may be imported into the WCS project if higher-resolution soil data is required for the estimation of potential erosion. If the SSURGO soil database is not available, the system uses the STATSGO Soil data (1:250k) by default.

   MRLC Land Use – The Multi-Resolution Land Characteristic (MRLC) data set for the watershed is provided with the WCS package, but must be imported into the project.

2. Using WCS, the entire watershed was delineated into subwatersheds corresponding to USGS 12-digit Hydrologic Unit Codes (HUCs). These delineations are shown in Figure 4. Land use distribution for the impaired subwatersheds is summarized in Appendix C. All of the sediment analyses were performed on the basis of these drainage areas.

*The following steps are accomplished using the WCS Sediment Tool:*

3. For a selected watershed or subwatershed, a sediment project is set up in a new view that contains the data layers that will be subsequently used to calculate erosion and sediment delivery.

4. A stream grid for each delineated subwatershed was created by etching a stream coverage, based on National Hydrography Dataset (NHD), to the DEM grid.

5. For each 30 by 30 meter grid cell within the subwatershed, the Sediment Tool calculates the potential erosion using the USLE based on the specific cell characteristics. The model then calculates the potential sediment delivery to the stream grid network. Sediment delivery can be calculated using one of the four available sediment delivery equations:

   - Distance-based equation (Sun and McNulty 1998)
     Mad = M * (1-0.97 * D/L)
     where: Mad = mass moved (tons/acre/yr)
     M = sediment mass eroded (ton)
     D = least cost distance from a cell to the nearest stream grid (ft)
     L = maximum distance the sediment may travel (ft)

   - Distance Slope-based equation (Yagow et al. 1998)
     DR = exp(-0.4233 * L * So)
     So = exp (-16.1 * r/L+ 0.057)) - 0.6
     where: DR = sediment delivery ratio
     L = distance to the stream (m)
     r = relief to the stream (m)

   - Area-based equation (USDASCS 1983)
     $DR = 0.417762 * A^{(-0.134958)} - 1.27097$, DR <= 1.0
     where: DR = sediment delivery ratio
     A = area (sq miles)

   - WEEP-based regression equation (Swift 2000)
     $Z = 0.9004 - 0.1341 * X^2 + X^3 - 0.0399 * Y + 0.0144 * Y^2 + 0.00308 * Y^3$
     where: Z = percent of source sediment passing to the next grid cell
     X = cumulative distance down slope (X > 0)
     Y = percent slope in the grid cell (Y > 0)

   The distance slope based equation (Yagow et al. 1998) was selected to simulate sediment delivery in the Lower Clinch River Watershed.

6. The total sediment delivered upstream of each subwatershed "pour point" is calculated. The sediment analysis provides the calculations for six new parameters:

   - Source Erosion – estimated erosion from each grid cell due to the land cover
   - Road Erosion – estimated erosion from each grid cell representing a road
   - Composite Erosion – composite of the source and road erosion layers

- Source Sediment – estimated fraction of the soil erosion from each grid cell that reaches the stream (sediment delivery)
- Road Sediment – estimated fraction of the road erosion from each grid cell that reaches the stream
- Composite Sediment – composite of the source and erosion sediment layers

The sediment delivery can be calculated based on the composite sediment, road sediment, or source sediment layer. The sources of sediment by each land use type is determined showing the types of land use, the acres of each type of land use, and the tons of sediment estimated to be generated from each land use.

7. For each subwatershed of interest, the resultant sediment load calculation is expressed as a long-term average annual soil loss expressed in pounds per year calculated for the rainfall erosivity index (R). This statistic is calculated from the annual summation of rainfall energy in every storm (correlates with raindrop size) times its maximum 30-minute intensity.

   Calculated erosion, sediment loads delivered to surface waters and unit loads (per unit area) for subwatersheds that contain waters on the proposed *2004 303(d) List* as impaired for siltation and/or habitat alteration are summarized in Tables B-1, B-2 and B-3, respectively.

**Table B-1 Calculated Erosion - Subwatersheds With Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the *2004 303(d) List*)**

| HUC-12 Subwatershed (06010207__) | ***EROSION*** | | | | |
|---|---|---|---|---|---|
| | **Road [tons/yr]** | **Source [tons/yr]** | **Total [tons/yr]** | **%Road** | **%Source** |
| 0104 | 11,890 | 21,437 | 33,327 | 35.7 | 64.3 |
| 0202 | 12,140 | 3,838 | 15,978 | 76.0 | 24.0 |
| 0301 | 15,049 | 11,142 | 26,191 | 57.5 | 42.5 |
| 0302 | 11,219 | 8,590 | 19,809 | 56.6 | 43.4 |
| 0503 | 10,344 | 3,162 | 13,506 | 76.6 | 23.4 |

**Table B-2 Calculated Sediment Delivery to Surface Waters - Subwatersheds with Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the *2004 303(d) List*)**

| HUC-12 Subwatershed (06010207__) | ***SEDIMENT*** | | | | |
|---|---|---|---|---|---|
| | **Road [tons/yr]** | **Source [tons/yr]** | **Total [tons/yr]** | **%Road** | **%Source** |
| 0104 | 4,773 | 9,615 | 14,388 | 33.2 | 66.8 |
| 0202 | 6,066 | 1,421 | 7,487 | 81.0 | 19.0 |
| 0301 | 7,502 | 4,695 | 12,197 | 61.5 | 38.5 |
| 0302 | 5,196 | 3,551 | 8,747 | 59.4 | 40.6 |
| 0503 | 4,316 | 1,068 | 5,383 | 80.2 | 19.8 |

**Table B-3 Unit Loads - Subwatersheds With Waterbodies Impaired Due to Siltation/Habitat Alteration (Documented on the *2004 303(d) List*)**

| HUC-12 Subwatershed (06010207__) | *UNIT LOADS* | | | |
|---|---|---|---|---|
| | Erosion | | Sediment | |
| | [tons/ac/yr] | [lbs/ac/yr] | [tons/ac/yr] | [lbs/ac/yr] |
| 0104 | 0.859 | 1,718 | 0.371 | 742 |
| 0202 | 0.512 | 1,024 | 0.240 | 480 |
| 0301 | 0.832 | 1,664 | 0.387 | 775 |
| 0302 | 0.758 | 1,516 | 0.335 | 669 |
| 0503 | 0.711 | 1,422 | 0.283 | 567 |

# APPENDIX C

## MRLC Land Use of Impaired Subwatersheds and Ecoregion Reference Site Drainage Areas

**Table C-1 Lower Clinch River Watershed – Impaired Subwatershed Land Use Distribution**

| Land Use | Subwatershed (06010207___) | | | | | |
|---|---|---|---|---|---|---|
| | 0104 | | 0202 | | 0301 | |
| | [acres] | [%] | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand/Clay | 1 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Deciduous Forest | 14,658 | 37.8 | 14,675 | 47.0 | 5,555 | 17.6 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Evergreen Forest | 5,553 | 14.3 | 3,501 | 11.2 | 4,783 | 15.2 |
| High Intensity Commercial/Industrial/Transportation | 394 | 1.0 | 325 | 1.0 | 684 | 2.2 |
| High Intensity Residential | 7 | 0.0 | 33 | 0.1 | 174 | 0.6 |
| Low Intensity Residential | 281 | 0.7 | 691 | 2.2 | 1,824 | 5.8 |
| Mixed Forest | 8,381 | 21.6 | 7,340 | 23.5 | 6,849 | 21.8 |
| Open Water | 3,203 | 8.3 | 256 | 0.8 | 15 | 0.0 |
| Other Grasses (Urban/Recreational) | 280 | 0.7 | 473 | 1.5 | 1,040 | 3.3 |
| Pasture/Hay | 5,054 | 13.0 | 3,710 | 11.9 | 9,177 | 29.2 |
| Quarries/Strip Mines/Gravel Pits | 85 | 0.2 | 0 | 0.0 | 14 | 0.0 |
| Row Crops | 851 | 2.2 | 187 | 0.6 | 1,350 | 4.3 |
| Transitional | 46 | 0.1 | 14 | 0.0 | 11 | 0.0 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **38,796** | **100.0** | **31,204** | **100.0** | **31,477** | **100.0** |

**Table C-1 (Cont.) Lower Clinch River Watershed – Impaired Subwatershed Land Use Distribution**

| Land Use | Subwatershed (06010207___) | | | |
|---|---|---|---|---|
| | 0302 | | 0503 | |
| | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand/Clay | 0 | 0.0 | 0 | 0.0 |
| Deciduous Forest | 4,516 | 17.3 | 7,576 | 39.9 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 |
| Evergreen Forest | 4,117 | 15.8 | 3,508 | 18.5 |
| High Intensity Commercial/Industrial/Transportation | 733 | 2.8 | 1,087 | 5.7 |
| High Intensity Residential | 265 | 1.0 | 258 | 1.4 |
| Low Intensity Residential | 2,226 | 8.5 | 1,677 | 8.8 |
| Mixed Forest | 5,680 | 21.7 | 3,584 | 18.9 |
| Open Water | 44 | 0.2 | 15 | 0.1 |
| Other Grasses (Urban/Recreational) | 1,722 | 6.6 | 485 | 2.6 |
| Pasture/Hay | 5,487 | 21.0 | 463 | 2.4 |
| Quarries/Strip Mines/Gravel Pits | 60 | 0.0 | 0 | 0.0 |
| Row Crops | 1,327 | 5.1 | 304 | 1.6 |
| Transitional | 12 | 0.0 | 34 | 0.2 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 |
| **Total** | **26,135** | **100.0** | **18,991** | **100.0** |

**Table C-2 Level IV Ecoregion Reference Site Drainage Area Land Use Distribution**

| Land Use | Ecosite Subwatershed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Eco67f06 | | Eco67f13 | | Eco67f17 | | 67i12 | | 68a01 | |
| | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1,427 | 38.4 |
| Deciduous Forest | 1,686 | 85.4 | 1,640 | 87.6 | 17,329 | 57.6 | 479 | 71.3 | 0 | 0.0 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Evergreen Forest | 44 | 2.2 | 77 | 4.1 | 2,869 | 9.5 | 73 | 10.8 | 921 | 24.8 |
| High Intensity Commercial/Industrial/Transportation | 1 | 0.0 | 0 | 0.0 | 22 | 0.1 | 1 | 0.1 | 0 | 0.0 |
| High Intensity Residential | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Low Intensity Residential | 2 | 0.1 | 0 | 0.0 | 16 | 0.1 | 3 | 0.5 | 0 | 0.0 |
| Mixed Forest | 236 | 12.0 | 143 | 7.6 | 4,178 | 13.9 | 105 | 15.7 | 1,369 | 36.8 |
| Open Water | 0 | 0.0 | 0 | 0.0 | 4 | 0.0 | 0 | 0.1 | 0 | 0.0 |
| Other Grasses (Urban/Recreational) | 0 | 0.0 | 0 | 0.0 | 10 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Pasture/Hay | 6 | 0.3 | 10 | 0.5 | 5,296 | 17.6 | 9 | 1.3 | 0 | 0.0 |
| Quarries/Strip Mines/Gravel Pits | 0 | 0.0 | 1 | 0.0 | 77 | 0.3 | 0 | 0.0 | 0 | 0.0 |
| Row Crops | 0 | 0.0 | 0 | 0.0 | 258 | 0.9 | 2 | 0.4 | 0 | 0.0 |
| Transitional | 0 | 0.0 | 0 | 0.0 | 4 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **1,975** | **100.1** | **1,870** | **99.9** | **30,062** | **100.0** | **672** | **100.2** | **3,718** | **100.0** |

**Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution**

| Land Use | Ecosite Subwatershed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 68a03 | | 68a08 | | 68a13 | | 68a20 | | 68a26 | |
| | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 1 | 0.0 |
| Deciduous Forest | 3,536 | 32.7 | 46,284 | 46.8 | 4,070 | 45.5 | 4,550 | 61.6 | 58,385 | 52.7 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 | 1 | 0.0 | 0 | 0.0 | 8 | 0.0 |
| Evergreen Forest | 3,011 | 27.8 | 15,790 | 16.0 | 2,365 | 26.4 | 519 | 7.0 | 11,272 | 10.2 |
| High Intensity Commercial/Industrial/Transportation | 2 | 0.0 | 176 | 0.2 | 0 | 0.0 | 3 | 0.0 | 553 | 0.5 |
| High Intensity Residential | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 33 | 0.0 |
| Low Intensity Residential | 11 | 0.1 | 258 | 0.3 | 1 | 0.0 | 25 | 0.3 | 784 | 0.7 |
| Mixed Forest | 3,977 | 36.7 | 24,815 | 25.1 | 942 | 10.5 | 2,217 | 30.0 | 21,382 | 19.3 |
| Open Water | 0 | 0.0 | 73 | 0.1 | 9 | 0.1 | 0 | 0.0 | 940 | 0.8 |
| Other Grasses (Urban/Recreational) | 3 | 0.0 | 236 | 0.2 | 0 | 0.0 | 10 | 0.1 | 716 | 0.6 |
| Pasture/Hay | 259 | 2.4 | 9,207 | 9.3 | 501 | 5.6 | 9 | 0.1 | 13,864 | 12.5 |
| Quarries/Strip Mines/Gravel Pits | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 312 | 0.3 |
| Row Crops | 28 | 0.3 | 1,564 | 1.6 | 40 | 0.5 | 7 | 0.1 | 1,398 | 1.3 |
| Transitional | 0 | 0.0 | 501 | 0.5 | 725 | 8.1 | 48 | 0.6 | 456 | 0.4 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 | 292 | 3.3 | 0 | 0.0 | 788 | 0.7 |
| **Total** | **10,828** | **100.0** | **98,904** | **100.0** | **8,947** | **100.0** | **7,388** | **100.0** | **110,890** | **100.0** |

**Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution**

| Land Use | Ecosite Subwatershed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 68a28 | | 68c12 | | 68c13 | | 68c15 | | 68c20 | |
| | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Deciduous Forest | 10,209 | 63.7 | 518 | 63.9 | 1,280 | 72.0 | 9,965 | 78.7 | 9,928 | 78.7 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Evergreen Forest | 1,487 | 9.3 | 48 | 6.0 | 68 | 3.8 | 871 | 6.9 | 871 | 6.9 |
| High Intensity Commercial/Industrial/Transportation | 21 | 0.1 | 0 | 0.0 | 8 | 0.4 | 48 | 0.4 | 48 | 0.4 |
| High Intensity Residential | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 11 | 0.1 | 11 | 0.1 |
| Low Intensity Residential | 89 | 0.6 | 0 | 0.0 | 22 | 1.3 | 111 | 0.9 | 111 | 0.9 |
| Mixed Forest | 3,574 | 22.3 | 244 | 30.1 | 254 | 14.3 | 1,234 | 9.8 | 1,232 | 9.8 |
| Open Water | 1 | 0.0 | 0 | 0.0 | 2 | 0.1 | 37 | 0.3 | 37 | 0.3 |
| Other Grasses (Urban/Recreational) | 44 | 0.3 | 0 | 0.0 | 12 | 0.7 | 40 | 0.3 | 40 | 0.3 |
| Pasture/Hay | 469 | 2.9 | 0 | 0.0 | 93 | 5.2 | 181 | 1.4 | 181 | 1.4 |
| Quarries/Strip Mines/Gravel Pits | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Row Crops | 139 | 0.9 | 0 | 0.0 | 36 | 2.1 | 38 | 0.3 | 38 | 0.3 |
| Transitional | 3 | 0.0 | 0 | 0.0 | 2 | 0.1 | 116 | 0.9 | 116 | 0.9 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **16,036** | **100.0** | **810** | **99.9** | **1,777** | **100.0** | **12,653** | **100.0** | **12,614** | **100.0** |

**Table C-2 (Cont.) Level IV Ecoregion Reference Site Drainage Area Land Use Distribution**

| Land Use | Ecosite Subwatershed | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | 68d01 | | 68d03 | | 68d04 | | 68d05 | | 68d06 | |
| | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] | [acres] | [%] |
| Bare Rock/Sand | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Deciduous Forest | 1,162 | 71.8 | 4,161 | 93.3 | 7,294 | 92.1 | 1,979 | 93.2 | 8,060 | 90.2 |
| Emergent Herbaceous Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Evergreen Forest | 84 | 5.2 | 43 | 1.0 | 81 | 1.0 | 31 | 1.4 | 149 | 1.7 |
| High Intensity Commercial/Industrial/Transportation | 0 | 0.0 | 0 | 0.0 | 3 | 0.0 | 0 | 0.0 | 7 | 0.1 |
| High Intensity Residential | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Low Intensity Residential | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Mixed Forest | 369 | 22.8 | 225 | 5.0 | 437 | 5.5 | 100 | 4.7 | 569 | 6.4 |
| Open Water | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 2 | 0.0 |
| Other Grasses (Urban/Recreational) | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Pasture/Hay | 1 | 0.0 | 15 | 0.3 | 8 | 0.1 | 3 | 0.1 | 28 | 0.3 |
| Quarries/Strip Mines/Gravel Pits | 0 | 0.0 | 0 | 0.0 | 65 | 0.8 | 0 | 0.0 | 71 | 0.8 |
| Row Crops | 0 | 0.0 | 1 | 0.0 | 1 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| Transitional | 0 | 0.0 | 15 | 0.3 | 36 | 0.5 | 12 | 0.6 | 51 | 0.6 |
| Woody Wetlands | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 |
| **Total** | **1,615** | **99.8** | **4,459** | **99.9** | **7,924** | **100.0** | **2,125** | **100.0** | **8,936** | **99.9** |

# APPENDIX D

## Estimate of Existing Point Source Loads for NPDES Permitted Mining Sites and Ready Mixed Concrete Facilities

**Determination of Existing Point Source Sediment Loads**

Existing point source sediment loads for industrial facilities (except the USDOE Oak Ridge National Security Complex), mining sites, and RMCFs located in impaired HUC-12 subwatersheds were estimated using the methodologies described below.

Mining Sites

Existing loads for permitted mining sites are based on an assumed runoff from the site drainage area, the daily maximum permit limit for TSS, and the area of the HUC-12 subwatershed in which the mining sites are located (ref.: Table D-1). Site runoff was estimated by assuming that one half of the annual precipitation falling on the site area results in runoff. Annual precipitation for the Lower Clinch River Watershed is approximately 48 in/yr (Midwest Plan Service, 1985).

$$AAL_{Mining} = \frac{(A_d)\ (DMax)\ (Precip)\ (0.2266\ \text{lb-l/ac-in-mg})\ (0.5)}{(A_{HUC\text{-}12})}$$

where: $AAL_{Mining}$ = Average annual load [lb/yr]
$A_d$ = Facility (site) drainage area [acres]
DMax = Daily maximum concentration limit for TSS [mg/l]
Precip = Average annual precipitation for watershed [in/yr]
$A_{HUC\text{-}12}$ = Area of impaired HUC-12 subwatershed [acres]

Industrial Facilities & Ready Mixed Concrete Facilities (RMCFs)

Total loading from industrial facilities and RMCFs is the sum of loading from process/nonprocess wastewater discharges and storm water runoff. Estimates of loading (ref.: Table D-2) from these sources were determined based on facility estimated flow and the daily maximum permit limit for TSS for process/nonprocess wastewater discharges and based on methods similar to those used to determine mining site loads for storm water runoff along with the area of the HUC-12 subwatershed in which the facility is located. Loads are expressed as average annual loads per unit area and are summarized in Table D-2.

*Note: Estimated storm water loads for industrial facilities utilized the fraction of total area identified as impervious instead of the assumption that one half of the precipitation falling on the facility site area results in runoff. For the Knoxville Travel Center (TN0065137), 10 of 21 acres were identified as impervious and for the Petro Shopping Center (TN0067024), 16.2 of 17.3 acres were identified as impervious.*

Total Existing Point Source Loads for Impaired HUC-12 Subwatersheds

Estimated point source loads were summed for each impaired HUC-12 subwatershed and then compared to both existing and target subwatershed sediment loads (ref.: Table D-3).

**Table D-1 Estimate of Existing Load – NPDES Permitted Mining Sites**

| HUC-12 Subwatershed (06010207___) | Subwatershed Area [acres] | NPDES Permit No. | Site Drainage Area [acres] | Daily Maximum TSS Limit [mg/l] | Annual Average Load [lb/ac/yr] |
|---|---|---|---|---|---|
| 0104 | 38,796 | TN0026484 | 390 | 40 | 2.187 |
| 0202 | 31,204 | TN0063355 | 43 | 40 | 0.300 |
| | | TN0079341 | 219 | 40 | 1.527 |

**Table D-2 Estimate of Existing Loads – NPDES Permitted Industrial & Ready Mixed Concrete Facilities**

| HUC-12 Subwatershed | Subwatershed Area | NPDES Permit No. | Process Wastewater | | | Storm Water Runoff | | | Total Annual Ave Load |
|---|---|---|---|---|---|---|---|---|---|
| | | | Est. Flow | Daily Max TSS Limit | Annual Ave Load | Site Drain Area | Daily Max TSS Limit | Annual Ave Load | |
| | [acres] | | [MGD] | [mg/l] | [lb/ac/yr] | [acres] | [mg/l] | [lb/ac/yr] | [lb/ac/yr] |
| 0104 | 38,796 | TN0064548 | 0.096 | 40 | 0.301 | 6.5 | — | — | 0.301 |
| | | TN0065137 | — | — | — | 21 | 40 | 0.112 | 0.112 |
| | | TN0067024 | — | — | — | 17.3 | 40 | 0.182 | 0.182 |
| 0302 | 26,135 | TNG110288 | 0.0001 | 50 | 0.0006 | 2 | 200 | 0.0832 | 0.084 |

**Table D-3 Estimate of Existing Point Source Loads in Impaired HUC-12 Subwatersheds**

| HUC-12 Subwatershed (06010207__) | NPDES Permit No. | Facility Type | Average Annual Point Source Load [lb/ac/yr] | Existing Subwatershed Load [lb/ac/yr] | Point Source Percentage of Existing Load [%] | Subwatershed Target Load [lb/ac/yr] | Point Source Percentage of Target Load [%] |
|---|---|---|---|---|---|---|---|
| **0104** | TN0026484 | Mining | 2.2 | 742 | **0.38** | 429.4 | **0.70** |
| | TN0064548 | Industrial | 0.3 | | | | |
| | TN0065137 | Industrial | 0.1 | | | | |
| | TN0067137 | Industrial | 0.2 | | | | |
| | **Subwatershed 0104 Total** | | **2.8** | | | | |
| **0202** | TN0063355 | Mining | 0.3 | 480 | **0.38** | 341.3 | **0.66** |
| | TN0079341 | Mining | 1.5 | | | | |
| | **Subwatershed 0202 Total** | | **1.8** | | | | |
| **0302** | TNG110288 | RMCF | **0.1** | 669 | **0.01** | 429.4 | **0.02** |

Note: A spreadsheet was used for this calculation and values are approximate due to rounding.

# APPENDIX E

## Public Notice Announcement

# STATE OF TENNESSEE
# DEPARTMENT OF ENVIRONMENT AND CONSERVATION
# DIVISION OF WATER POLLUTION CONTROL

## PUBLIC NOTICE OF AVAILABILITY OF PROPOSED TOTAL MAXIMUM DAILY LOADS (TMDLs) FOR SILTATION & HABITAT ALTERATION IN THE LOWER CLINCH RIVER WATERSHED (HUC 06010207), TENNESSEE

Announcement is hereby given of the availability of Tennessee's proposed Total Maximum Daily Loads (TMDLs) for siltation and habitat alteration in the Lower Clinch River Watershed located in east Tennessee. Section 303(d) of the Clean Water Act requires states to develop TMDLs for waters on their impaired waters list. TMDLs must determine the allowable pollutant load that the water can assimilate, allocate that load among the various point and nonpoint sources, include a margin of safety, and address seasonality.

A number of waterbodies in the Lower Clinch River watershed are listed on Tennessee's final *2004 303(d) List* as not supporting designated use classifications due, in part, to siltation and habitat alteration associated with land development, urban runoff, and agricultural sources. The TMDLs utilize Tennessee's general water quality criteria, ecoregion reference site data, land use data, digital elevation data, a sediment loading and delivery model, and an appropriate Margin of Safety (MOS) to establish reductions in sediment loading which will result in reduced in-stream concentrations and the attainment of water quality standards. The TMDLs require reductions in sediment loading of approximately 42% to 51% in the listed waterbodies.

The proposed siltation/habitat alteration TMDLs may be downloaded from the Department of Environment and Conservation website:

http://www.state.tn.us/environment/wpc/tmdl/proposed.php

Technical questions regarding this TMDL should be directed to the following members of the Division of Water Pollution Control staff:

Mary Wyatt, Watershed Management Section
Telephone: 615-532-0714
e-mail: Mary.Wyatt@state.tn.us

Sherry H. Wang, Ph.D., Watershed Management Section
Telephone: 615-532-0656
e-mail: Sherry.Wang@state.tn.us

Persons wishing to comment on the TMDLs are invited to submit their comments in writing no later than February 13th, 2006 to:

Division of Water Pollution Control
Watershed Management Section
6th Floor, L & C Annex
401 Church Street
Nashville, TN 37243-1534

All comments received prior to that date will be considered when revising the TMDL for final submittal to the U.S. Environmental Protection Agency.

The TMDL and supporting information are on file at the Division of Water Pollution Control, 6th Floor, L & C Annex, 401 Church Street, Nashville, Tennessee. They may be inspected during normal office hours. Copies of the information on file are available on request.