For Public Comment
July 2013

# Implementation Plan for Seventeen Total Maximum Daily Loads for Bacteria in the Greater Trinity River Region

## Upper Trinity River

Segment 0805

Assessment Units 0805_03 and 0805_04

## Cottonwood Branch and Grapevine Creek

Segments 0822A and 0822B

Assessment Units 0822A_02 and 0822B_01

## Lower West Fork Trinity River (Pending)

Segments 0841, 0841B, 0841C, 0841E, 0841G, 0841H, 0841J, 0841L, 0841M, 0841R, 0841T, and 0841U

Assessment Units 0841_01, 0841_02, 0841B_01, 0841C_01, 0841E_01, 0841G_01, 0841H_01, 0841J_01, 0841L_01, 0841M_01, 0841R_01, 0841T_01, and 0841U_01

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Coordination Committee of the Greater Trinity River Bacteria TMDL Implementation Project
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Onsite Sewage Facility; Parks and Recreation; Pets, Livestock, and Wildlife;
Planning and Development; Stormwater; and Wastewater.

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http://www.nctcog.org/envir/SEEclean/wq/tmdl/TMDLI-Plan.asp

## List of Acronyms and Abbreviations

| | |
|---|---|
| ALU | aquatic life use |
| ATU | aerobic treatment unit |
| AU | assessment unit |
| BMP | best management practice |
| CAFO | concentrated animal feeding operation |
| CFR | Code of Federal Regulations |
| CFU | colony-forming units |
| cfs | cubic feet per second |
| cms | cubic meters per second |
| CGP | Construction General Permit (TX) |
| C-MOM | capacity management, operation, and maintenance program |
| CRP | clean rivers program |
| DART | Dallas Area Rapid Transit |
| DFW | Dallas – Fort Worth International Airport |
| dL | deciliter |
| DMR | discharge monitoring report |
| DO | dissolved oxygen |
| *E. coli* | *Escherichia coli* |
| EPA | Environmental Protection Agency (U.S.) |
| FC | fecal coliform |
| FDC | flow duration curve |
| FWSD | fresh water supply district |
| FOG | fats, oils, and grease |
| FY | fiscal year |
| GI | Green Infrastructure |
| GIS | geographic information system |
| gpcd | gallons per capita per day |
| H-GAC | Houston-Galveston Area Council of Governments |
| IDDE | illicit discharge detection and elimination |
| I/I | inflow and infiltration |
| I-Plan | implementation plan |
| IS | implementation strategy |
| iSWM | *integrated* Stormwater Management |
| LA | load allocation |
| LID | low impact development |
| LDC | load duration curve |
| mL | milliliter |
| MGD | million gallons per day |
| MOS | margin of safety |
| MPN | most probable number |
| MS4 | municipal separate storm sewer system |
| MSGP | Multi-Sector General Permit |
| MUD | municipal utility district |
| NCTCOG | North Central Texas Council of Governments |
| NELAC | National Environmental Laboratory Accreditation Conference |

| | |
|---|---|
| NELAP | National Environmental Laboratory Accreditation Program |
| NPDES | National Pollutant Discharge Elimination System |
| NPS | nonpoint source |
| NRCS | Natural Resources Conservation Service |
| NTGAC | North Texas Grease Abatement Council |
| NTTA | North Texas Tollway Authority |
| OSSF | onsite sewage facility |
| P2 | pollution prevention |
| POTW | publicly owned treatment work |
| QAPP | quality assurance project plan |
| RSWMP | Regional Stormwater Management Program |
| RSWMCC | Regional Stormwater Management Coordinating Council |
| RWWCP | Regional Wet Weather Characterization Program |
| SEP | supplemental environmental project |
| SSO | sanitary sewer overflow |
| SSOI | sanitary sewer overflow initiative |
| SSS | sanitary sewer system |
| STATSGO | State Soil Geographic Database |
| SWCD | soil and water conservation district |
| SWMP | Stormwater Management Plan |
| SWPPP | stormwater pollution prevention plan |
| TAC | Texas Administrative Code |
| TEA | Texas Education Agency |
| TIAER | Texas Institute for Applied Environmental Research |
| TCEQ | Texas Commission on Environmental Quality |
| TMDL | total maximum daily load |
| TPDES | Texas Pollutant Discharge Elimination System |
| TPWD | Texas Parks and Wildlife Department |
| TRA | Trinity River Authority |
| TREC | Texas Real Estate Commission |
| TREES | Trinity River Environmental Education Society |
| TSSWCB | Texas State Soil and Water Conservation Board |
| TxDOT | Texas Department of Transportation |
| USACE | United States Army Corps of Engineers |
| USEPA | U.S. Environmental Protection Agency |
| USGS | United States Geological Survey |
| WBD | Watershed boundary dataset |
| WLA | wasteload allocation |
| WQMP | Water Quality Management Plan |
| WWF | wet weather facility |
| WWTF | wastewater treatment facility |
| x | occurrences — as in 5x/week (5 occurrences per week) |

## Executive Summary

In 1996 portions of the Upper Trinity River and Lower West Fork Trinity River were listed as impaired for elevated bacteria in the *Texas Water Quality Inventory and 303(d) List* (now known as *Texas Integrated Report for Clean Water Act, Section 303(d))*. In 2006, two tributaries of the Elm Fork Trinity River and multiple tributaries of the Lower West Fork Trinity were also added to the 303(d) list of impaired water bodies (TCEQ, 2010a). These bacteria-impaired segments cover the heart of the Dallas-Fort Worth metropolitan area and impact 1.33 million people. (Figure 1)

On May 11, 2011, the Texas Commission on Environmental Quality (TCEQ) adopted *Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River, Dallas, Texas (*Segment 0805, Assessment Units 0805_03 and 0805_04). The Total Maximum Daily Loads (TMDLs) were approved by the U.S. Environmental Protection Agency (EPA) on August 3, 2011. On September 21 of that same year, the TCEQ adopted *Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek* (Segments 0822A and 0822B, Assessment Units 0822A_02 and 0822B_01). The EPA approved them on May 30, 2012. The TMDLs for the Lower West Fork Trinity River, Segment 0841 and its tributaries, have not yet been adopted by TCEQ or approved by the EPA although the process is ongoing and completion is anticipated in 2013.

This implementation plan (I-Plan) describes the steps watershed stakeholders and the TCEQ will take toward achieving the pollutant reductions identified in the TMDLs and technical reports and outlines the schedule for implementation activities. The I-Plan uses an adaptive management approach where measures will be periodically assessed for efficiency and effectiveness. This iterative process of evaluation and adjustment ensures continuing progress toward achieving water quality goals, and expresses stakeholder commitment to the process. At annual meetings, the I-Plan's managing body, the Coordination Committee (Appendix A), will assess progress using the schedule of implementation, interim measurable milestones, water quality data, and the communication plans included in this document. If these assessments find that insufficient progress has been made or that implementation activities have improved water quality, the implementation strategy will be adjusted.

Many of the implementation strategies in this I-Plan are directed towards reducing bacteria loading (Appendix B) from possible point and nonpoint sources identified by the TCEQ during development of the TMDLs. The activities are intended to achieve the reductions identified in the TMDL reports necessary to comply with established water quality standards. The possible sources of bacteria identified include permitted storm sewer sources, dry weather discharges (illicit discharges), sanitary sewer overflows, and unregulated sources such as wildlife, unmanaged feral animals, and pets.

The ultimate goal of this I-Plan is to restore the primary contact recreation use in the 17 bacteria impaired segments (Appendix C) in the Project area by reducing concentrations of the indicator bacteria *Escherichia coli (E. coli)* to levels established in the TMDLs. Based on the TMDL reports and the technical support document, the following reductions are needed to meet the criteria defined in the state water quality standards:

- For the Upper Trinity TMDL bacteria loading reductions of 44 percent to 67 percent;
- For Cottonwood Creek and Grapevine Branch TMDL bacteria loading reductions of 64 percent to 84 percent; and

- For the Lower West Fork Trinity and associated impaired tributaries TMDL bacteria loading reductions of 25 percent to 98 percent.

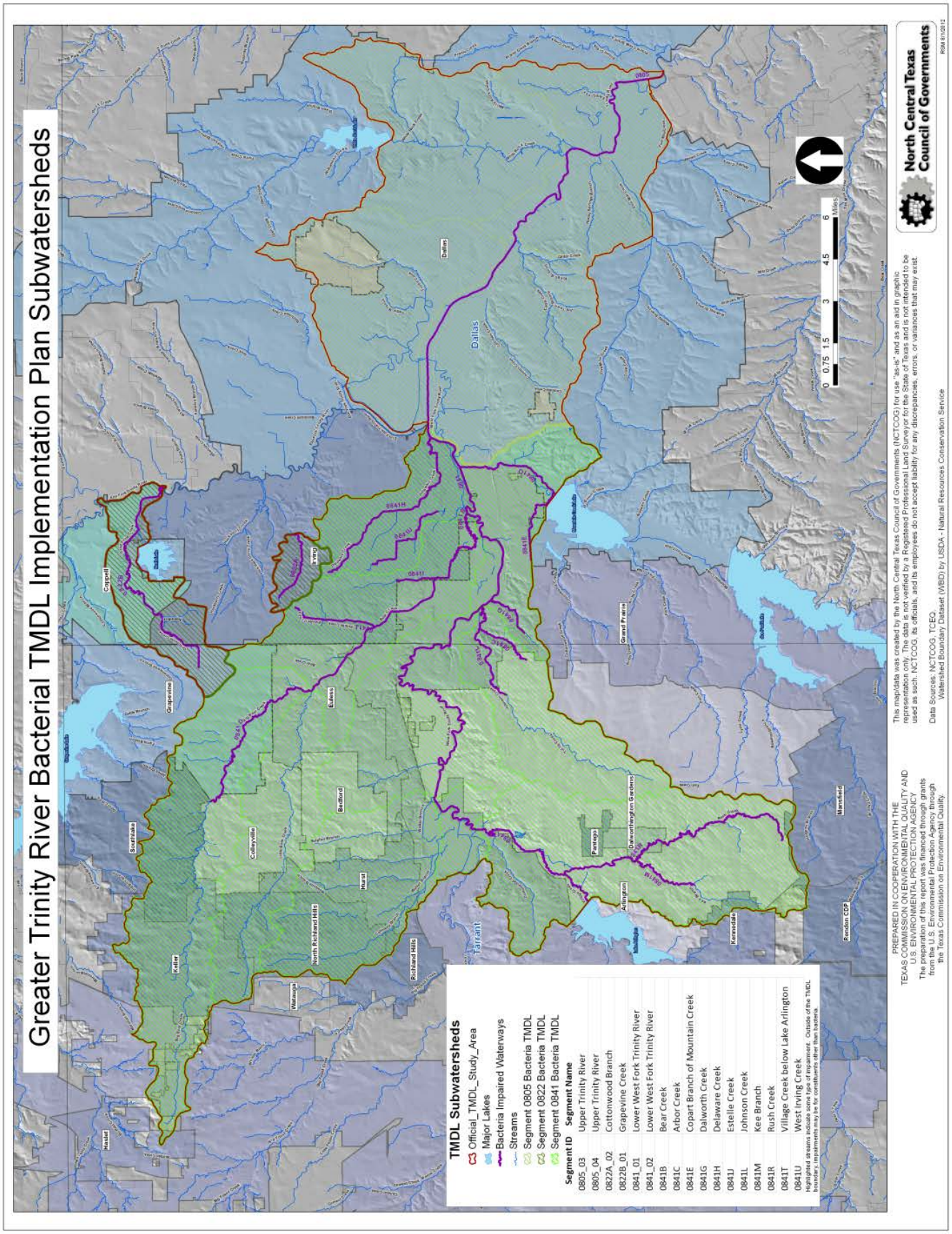
With these reductions in mind, the implementation strategies in this I-Plan are presented in sections describing the various sources of bacterial pollution identified through stakeholder and TMDL processes. These include a description of activities, identification of the parties responsible for implementing the activities, a schedule for implementation, the goals associated with the activities, and a process for tracking, evaluating, and reporting progress. A process of implementation, monitoring, analyses, adaptation, and review is also outlined so the I-Plan is intended for regular updates. The I-Plan provides a pragmatic and scientifically based approach to meet water quality goals within a reasonable timeframe. A broad summary of the implementation activities in each section can be found in Table 1.

**Table 1. Summary of Implementation Strategies**

| I-Plan Section | Activity Category | Focus of Implementation Activities* |
|---|---|---|
| Implementation Strategy 1.0 | Wastewater | SSO prevention, effluent monitoring, FOG program participation, liquid waste programs, and infrastructure funding and management. |
| Implementation Strategy 2.0 | Stormwater | BMP pilot projects and funding, regional stormwater management program participation, local SEPs, and land use and business operation risk analysis. |
| Implementation Strategy 3.0 | Planning and Development | Green infrastructure and LID standards adoption by municipalities for internal projects and ordinances, municipal ordinance evaluation, and construction site standards. |
| Implementation Strategy 4.0 | Pets, Livestock and Wildlife | Feral hog management, livestock evaluation, pet and livestock waste control measures, waterfowl management plan, and public outreach. |
| Implementation Strategy 5.0 | Onsite Sewage Facilities | OSSF education for homeowners and real estate agents, funding for and conversion from failing OSSFs, and ATU maintenance. |
| Implementation Strategy 6.0 | Monitoring Coordination | Routine sampling and data assessment for BMP efficacy, source identification, and monitoring coordination forum. |
| Implementation Strategy 7.0 | Education and Outreach | Modification of existing programs for bacteria-specific information, online BMP library, TEA curriculum, funding and partnerships, and bacteria-specific outreach. |
| Implementation Strategy 8.0 | Best Management Practices Library | Online BMP Library for stakeholders including provisions for Implementation Strategies 1.0 – 7.0. |
| Implementation Strategy 9.0 | Implementation Strategy Evaluation | Annual review by technical subcommittees of respective Implementation Strategies with recommendations to Coordination Committee for potential changes, additions, or deletions to I-Plan. |

*See pages 14-15, table of acronyms, for full acronym definitions.

**Figure 1. Greater Trinity Bacteria TMDL Project Area**



## Introduction

The Clean Water Act requires that states identify uses for the state's surface waters such as aquatic life, recreation, and sources of public water supply. The criteria or standard for evaluating support of those uses include dissolved oxygen, bacteria, and toxic substances, among others. The primary contact recreation use is designed to ensure that water is safe for swimming, waterskiing, wading by children, or other activities that involve direct contact with the water. Most water bodies in Texas and in the Dallas-Fort Worth area have a presumed primary contact recreation use. The TCEQ determines whether water quality in a water body meets the primary contact recreation use by measuring the levels of indicator bacteria. *E. coli* are the preferred indicator bacteria for assessing for recreational use in fresh water, and were used for analysis to support TMDL development on water bodies in this region. High concentrations of indicator bacteria have been associated with an increased risk of becoming ill from recreational activities.

When a waterway is determined to be impaired (Category 5a of the 303(d) List), a TMDL is developed. As defined by the EPA, a TMDL "is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards." In addition to the TMDL, an I-Plan is developed, which describes the regulatory and voluntary management measures necessary to improve water quality and restore full use of the water body to its designated use. TMDLs are developed at the assessment unit (AU) level to focus on the areas of impairment. An AU is a sub-area of a segment and is the smallest geographic area of use support reported in the Texas Integrated Report. Thus, some waterways may have more than one AU but not all may be listed as impaired.

This I-Plan is the result of work by the stakeholders convened by the North Central Texas Council of Governments (NCTCOG) for the Greater Trinity River Bacteria TMDL Implementation Project (frequently referred to in this I-Plan as 'the Project') and in particular the efforts and input of the Project Coordination Committee and the Technical Subcommittees of Education and Outreach; Monitoring Coordination; Onsite Sewage Facilities; Parks and Recreation; Pets, Livestock, and Wildlife; Planning and Development; Stormwater; and Wastewater. The Coordination Committee and subcommittee members represent city and county governments, resource agencies, business and agriculture interests, transportation interests, conservation organizations, water supply and treatment agencies, and recreational interests (see Appendix A).

Because several of the waterways within, near, or adjacent to the Greater Trinity Project Area are either listed or expected to be listed on the 303(d) list for bacteria impairments, this I-Plan has been developed with the flexibility to allow for the addition of segments and watersheds in the event that new TMDLs are adopted by the TCEQ in the future.

## Watershed Summary

The watershed(s) for the Greater Trinity River Bacteria TMDL Implementation Project encompass a total area of 411.54 square miles. The total human population is 1.33 million with a population density of approximately 3,232 people per square mile. The Project addresses watersheds covered by three separate TCEQ TMDL projects:

- Upper Trinity River Segment 0805,

- Elm Fork River Tributaries of Grapevine Creek and Cottonwood Branch, and
- Lower West Fork Trinity River Segment 0841 and 11 of its tributaries.

Appendix C details the segment descriptions and years listed for the 17 segments included in this I-Plan.

Located in central Dallas County, the Upper Trinity River (Segment 0805) flows through the center of the City of Dallas. It continues in a southeasterly direction through Ellis, Kaufman, Navarro, and Henderson Counties. Encompassing a large portion of the City of Dallas, the overall watershed drains an area of about 1,045 square miles, although the impaired portion covers only 134 square miles.

Two of the five AUs of the Upper Trinity (Segment 0805) are addressed by a TMDL, covering the area from the confluence of the Elm Fork Trinity River and Lower West Fork Trinity River, downstream to the confluence of the Upper Trinity River with Five Mile Creek. Both impaired AUs (0805_03 and 0805_04) lie entirely within Dallas County in highly urbanized watersheds. The cities within the watershed include the cities of Dallas, Cockrell Hill, and University Park and the Town of Highland Park TCEQ, 2011a). (Figure 2)

Cottonwood Branch and Grapevine Creek (Segments 0822A and 0822B) are urban creeks located in the north central portion of the Dallas-Fort Worth Metroplex. Both are tributaries of the Elm Fork Trinity River below Lake Lewisville (Segment 0822). Grapevine Creek (0822B) is the larger of the two creeks with a drainage area of about 14 square miles, while Cottonwood Branch (0822A) has a drainage area of about five square miles. Cottonwood Branch is divided into two AUs while Grapevine Creek consists of a single AU. Only the upper AU of Cottonwood Branch (0822A_02) is impaired. The drainage area of both AUs for Cottonwood Branch and the single AU for Grapevine Creek lie within Dallas County with the exception of the upstream portion of the AU for Grapevine Creek that lies within Tarrant County. The cities within the Grapevine Creek watershed include Irving, Coppell, and Grapevine in addition to the presence of the Dallas-Fort Worth International Airport (DFW). The Cottonwood Branch watershed lies largely within the City of Irving. A small portion lies within DFW Airport property, and a portion of the unimpaired downstream AU is also within the jurisdiction of the Dallas County Utility and Reclamation District (TCEQ, 2011b). (Figure 3)

The Lower West Fork Trinity River (Segment 0841) is located in Dallas and Tarrant Counties and begins at the confluence of the Lower West Fork Trinity and Village Creek in Arlington and continues downstream to the confluence with the Elm Fork Trinity River. The Lower West Fork Trinity River is divided into two AUs (0841_01 and 0841_02). The watershed of the Lower West Fork Trinity and the 11 impaired tributaries addressed in this I-Plan — Arbor Creek, Bear Creek, Copart Branch Mountain Creek, Dalworth Creek, Delaware Creek, Estelle Creek, Johnson Creek, Kee Branch, Rush Creek, Village Creek, and West Irving Branch are located within the urbanized area of the Metroplex's mid cities and Fort Worth. Each of the impaired tributaries of the Lower West Fork Trinity River consists of a single AU.

The watershed for Segment 0841 — which includes the individual watersheds of the 11 tributaries — is the largest of the three TMDLs and encompasses parts or all of the cities of Arlington, Bedford, Colleyville, Dallas, Dalworthington Gardens, Euless, Fort Worth, Grand Prairie, Grapevine, Haslet, Hurst, Irving, Keller, Kennedale, North Richland Hills, Richland Hills, and Southlake, and Town of Pantego. The total area covered for this segment is 412 square miles (TIAER, 2012). (Figure 4)

**Figure 2. Segment 0805, Upper Trinity Area**

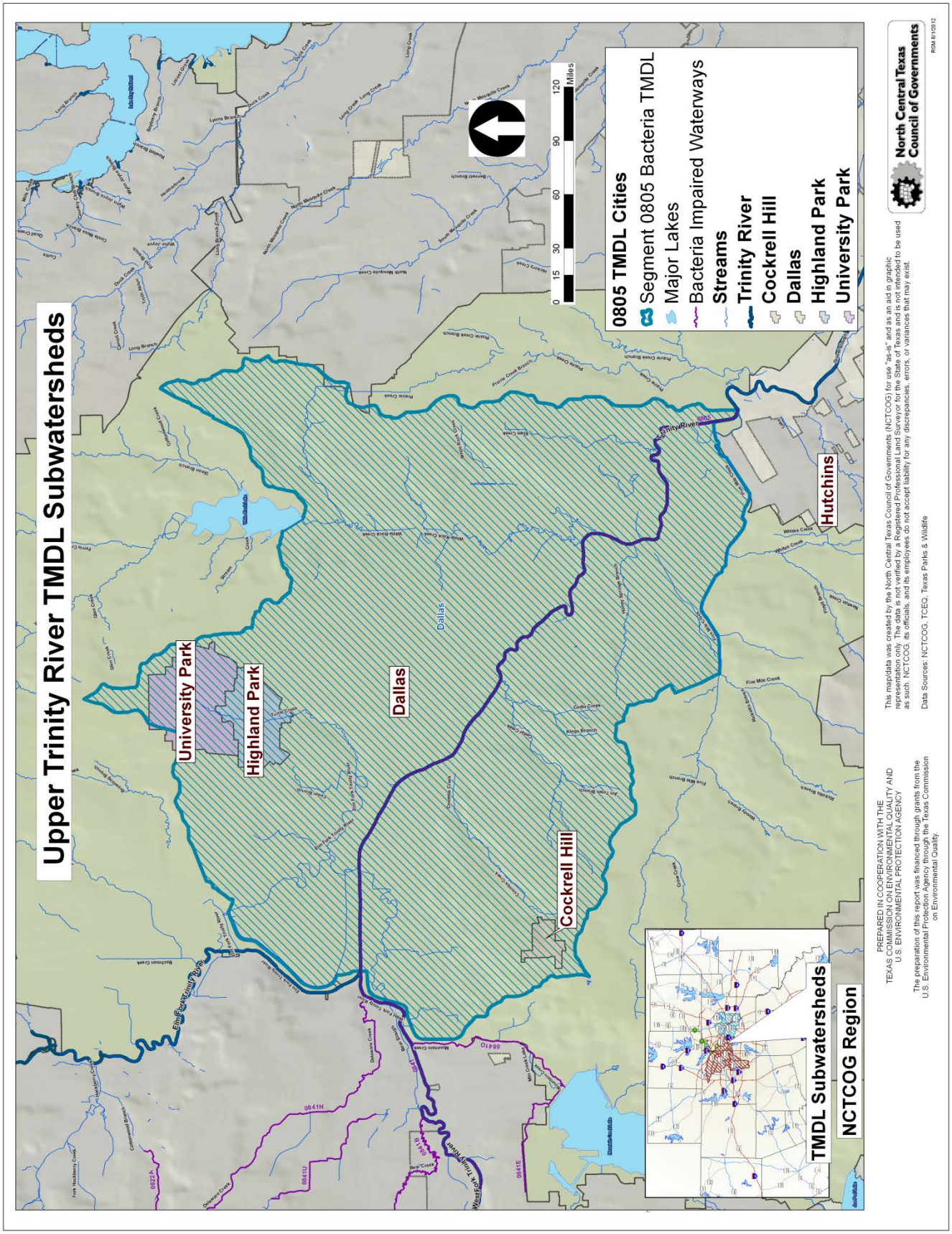


**Figure 3. 0822 Segments, Cottonwood Creek and Grapevine Branch**

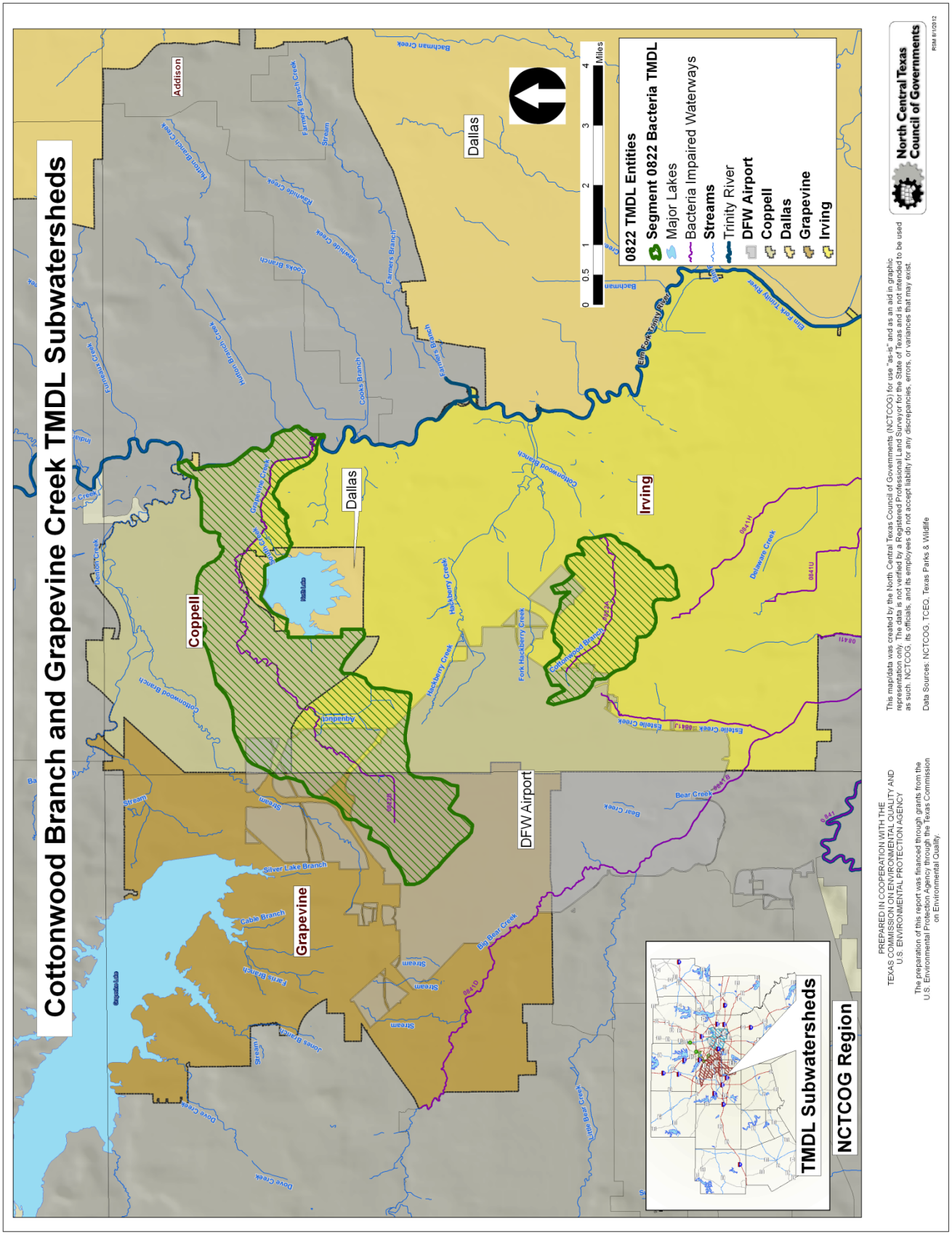
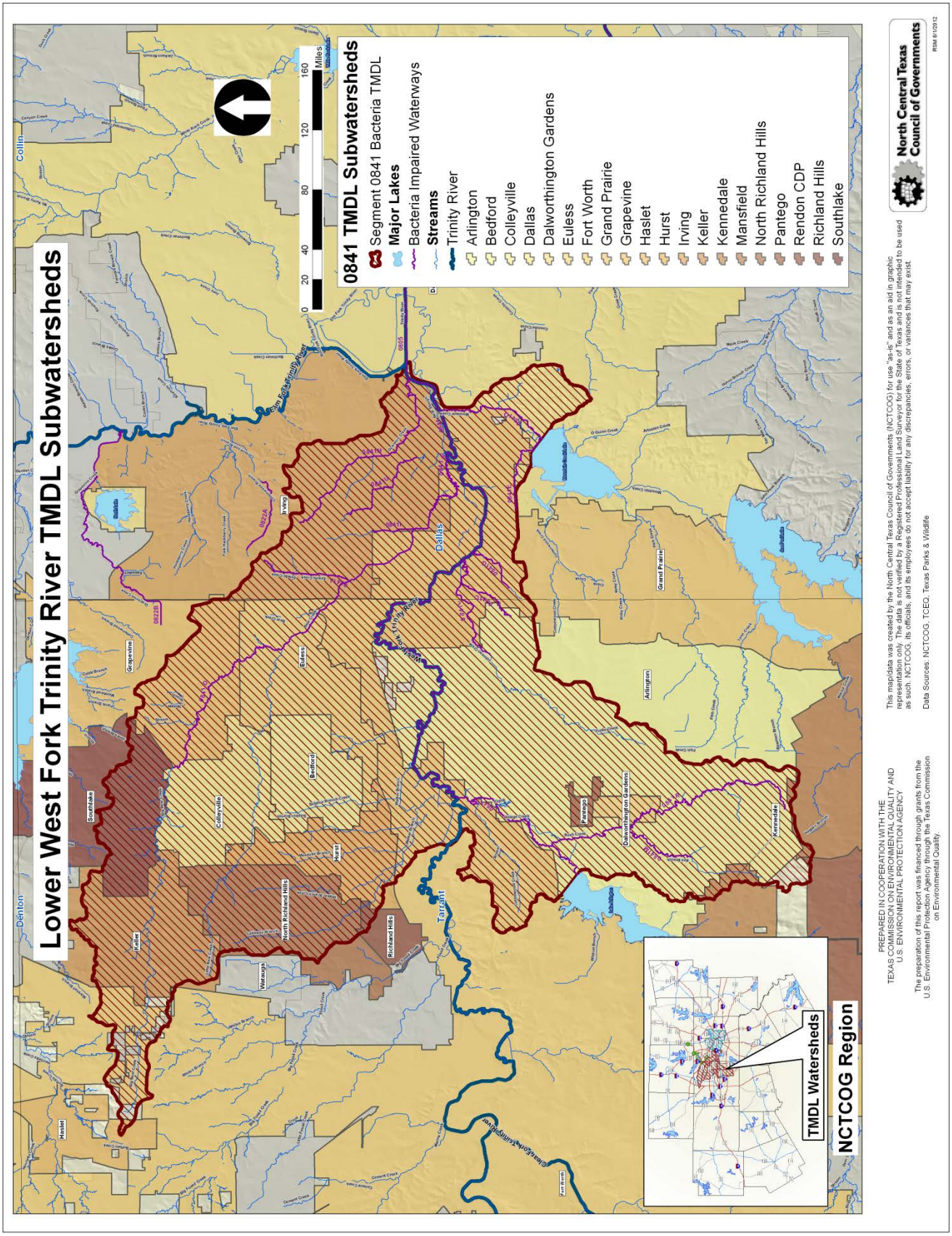


**Figure 4. 0841 Segments, Lower West Fork Trinity with Impaired Tributaries**



## Designated Uses and Water Quality Standards

The basis for assessing attainment of the primary contact recreation use is expressed as the number (or 'counts') of *E. coli* bacteria, given as the most probable number (MPN). In order to meet numeric criterion defined in the TCEQ water quality standards for support of the primary contact recreation use, the geometric mean of *E. coli* in freshwater should not exceed 126 MPN per 100 milliliters (mL).

Although this criterion represents the standards for primary contact recreation adopted by the TCEQ on June 30, 2010 (TCEQ, 2010b), other criteria may have been in place prior to that date that led to a stream initially being identified as impaired for bacteria.

### Seasonal Variation

Federal regulations (40 CFR §130.7(c)(1)) require that TMDLs account for seasonal variation in watershed conditions and pollutant loading. According to TCEQ in their adopted TMDLs for the Upper Trinity (Segment 0805) (TCEQ, 2011a) and Cottonwood Branch and Grapevine Creek (Segments 0822A and 0822B) (TCEQ, 2011b), and the technical report for the Lower West Fork Trinity (Segment 0841) and its impaired tributaries (TIAER, 2012), no statistically significant seasonal variation was found in *E. coli* data examined. Consequently, seasonal variation was not considered in the TMDL calculations or this I-Plan.

## Summary of the TMDLs

### Upper Trinity Segment 0805 TMDL

According to TCEQ's TMDL for Segment 0805, *Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River, Dallas, Texas,* adopted in 2011, impairment to the primary contact recreation use for this segment was first listed in the 1996 303(d) List. The impairments were identified more precisely as AUs 0805_03 and 0805_04 in the *2008 Texas Water Quality Integrated Report for Clean Water Sections 305(b) and 303(d).* The goal, or endpoint, for the Upper Trinity River TMDL is to maintain concentrations of *E. coli* below the geometric mean criterion of 126 MPN/100 mL.

Table 2 presents a historical summary of ambient indicator bacteria data from the TCEQ surface water database, Surface Water Quality Monitoring Information System (SWQMIS), from February 2001 through November 2008 for all AUs in Segment 0805. As indicated in Table 2, only TCEQ stations 10937 (in AU 0805_04) and 10934 (in AU 0805_03) exceeded the geometric mean criterion of 126 MPN/100 mL (TCEQ, 2011a).

**Table 2. Sampling Data Segment 0805**

| AU | Station ID | Location | No. of Samples (02/2001-11/2008) | Range of measured *E. coli* (MPN/100mL) | Geometric mean |
|---|---|---|---|---|---|
| 0805_04 | 10937 | Mockingbird Ln./ Dallas Co. | 75 | 12 – 24,200 | 224 |
| 0805_03 | 10934 | South Loop 12/ Dallas Co. | 75 | 17 – 39,700 | 384 |
| 0805_06 | 10932 | Dowdy Ferry Rd./ Dallas Co. | 13 | 11 – 980 | 85 |
| 0805_06 | 10930 | Belt Line Rd./ Dallas Co. | 60 | 3 – 1,540 | 54 |
| 0802_02 | 10925 | Downstream of SH 34/ Kaufman Co. | 82 | 2 – 4,840 | 122 |
| 0805_01 | 10924 | Near FM 85/ Henderson Co. | 6 | 8 – 770 | 56 |

**Elm Fork Tributaries Segments 0822A and 0822B TMDL**

In TCEQ's TMDL for the Elm Fork tributaries, *Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek,* impairment to the primary contact recreation use for Cottonwood Branch (Segment 0822A) and Grapevine Creek (Segment 0822B) were first identified in the 2006 *Texas Water Quality Integrated Report for Clean Water Sections 305(b) and 303(d)*. All or part of each water body was subsequently included on the 2008 and 2010 §303(d) Lists. The impaired AUs in Segments 0822A and 0822B on the 303(d) List are 0822A_02 and 0822B_01. The goal, or endpoint, for the Cottonwood Branch and Grapevine Creek TMDL is to maintain concentrations of *E. coli* below the geometric mean criterion of 126 MPN/100 mL.

Table 3 presents a historical summary of ambient indicator bacteria data from the TCEQ SWQMIS database for November 2001 through October 2004. All AUs in Segments 0822A and 0822B are included in the data summary. As indicated in Table 3, only the AUs associated with TCEQ stations 17165 and 17166 in AU 0822A_02 and stations 17531 and 17939 in AU 0822B_01 exceeded the geometric mean criterion of 126 MPN/100 mL (TCEQ, 2011b).

**Table 3. Sampling Data 0822 Segments**

| AU | Station ID | Location | No. of Samples (02/2001-11/2008) | Range of measured *E. coli* (MPN/100mL) | Station Geometric Mean (MPN/100mL) | AU Geometric Mean (MPN/100mL) |
|---|---|---|---|---|---|---|
| 0822A_01 | 18359 | 433 m upstream of N. MacArthur Blvd / Dallas Co | 76 | 2 – 2,600 | 37 | 47 |
| 0822A_01 | 17167 | N. MacArthur Blvd / Dallas Co. | 7 | 3 – >2,400 | 154 | 47 |
| 0822A_01 | 17168 | Spur 348 (Northwest Hwy) / Dallas Co. | 31 | <1 – 977 | 41 | 47 |
| 0822A_02 | 17165 | N. Beltline Rd. / Dallas Co. | 32 | 19 – >4,838 | 764 | 786 |
| 0822A_02 | 17166 | N. Story Rd. / Dallas Co. | 30 | 99 – >4,840 | 811 | 786 |
| 0822B_01 | 17531 | Airfield North upstream of bridge / Tarrant Co. | 12 | 21 – >2,419 | 121 | 411 |
| 0822B_01 | 17939 | 210 m upstream of Regent Blvd. and 535 m upstream of I-635 / Dallas Co. | 22 | 48 – 4,838 | 799 | 411 |

**Lower West Fork Trinity, Segment 0841 and Tributaries**

The bacteria impairments within the Lower West Fork Trinity River were first identified in the 1996 and each subsequent version through 2010 of the *Texas Water Quality Integrated Report for Clean Water Sections 305(b) and 303 (d).* Bacteria impairments within Bear Creek, Arbor Creek, Copart Branch Mountain Creek, Dalworth Creek, Delaware Creek, Estelle Creek, Johnson Creek, Kee Branch, Rush Creek, Village Creek, and West Irving Branch were all first identified in the 2006 303(d) List and each subsequent List through 2010 (TIAER, 2012).

Table 4, based on the 2012 report, *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in the Lower West Fork Trinity River Watershed*, by TIAER, addresses the historical data for Lower West Fork Trinity Segment 0841 and its tributaries. The goal or endpoint for the Lower West Fork Trinity TMDL is to maintain concentrations of *E. coli* below the geometric mean criterion of 126 MPN/100 mL.

**Table 4. Sampling Data 0841 Segments**

| Water Body | AU | Station | No. of Samples | Data Date Range | Station Geometric Mean (MPN/100 mL) | AU Geometric Mean (MPN/100 mL) |
|---|---|---|---|---|---|---|
| Lower West Fork Trinity | 0841_01 | 11079 | 4 | 2002 | 36 | 177 |
| Lower West Fork Trinity | 0841_01 | 11080 | 33 | 2001-2004 | 170 | 177 |
| Lower West Fork Trinity | 0841_01 | 11081 | 71 | 2001-2008 | 216 | 177 |
| Lower West Fork Trinity | 0841_01 | 11089 | 7 | 2005-2006 | 70 | 177 |
| Lower West Fork Trinity | 0841_02 | 17669 | 90 | 2001-2008 | 164 | 135 |
| Lower West Fork Trinity | 0841_02 | 11084 | 11 | 2001-2002 | 56 | 135 |
| Lower West Fork Trinity | 0841_02 | 11087 | 1 | 2002 | 97 | 135 |
| Lower West Fork Trinity | 0841_02 | 17160 | 4 | 2002 | 23 | 135 |
| Bear Creek | 0841B | 10864 | 5 | 2002 | 224 | 152 |
| Bear Creek | 0841B | 10865 | 27 | 2005-2008 | 78 | 152 |
| Bear Creek | 0841B | 10866 | 31 | 2001-2004 | 225 | 152 |
| Bear Creek | 0841B | 10867 | 81 | 2001-2008 | 209 | 152 |
| Bear Creek | 0841B | 10868 | 27 | 2001-2007 | 77 | 152 |
| Bear Creek | 0841B | 10869 | 12 | 2005-2008 | 66 | 152 |
| Bear Creek | 0841B | 17663 | 83 | 2001-2008 | 192 | 152 |
| Bear Creek | 0841B | 18313 | 25 | 2002-2004 | 136 | 152 |
| Bear Creek | 0841B | 18315 | 25 | 2002-2004 | 106 | 152 |
| Arbor Creek | 0841C | 17666 | 68 | 2001-2007 | 139 | 139 |
| Copart Branch Mountain Creek | 0841E | 17672 | 79 | 2001-2008 | 156 | 156 |
| Dalworth Creek | 0841G | 17671 | 52 | 2001-2008 | 720 | 720 |
| Delaware Creek | 0841H | 10871 | 7 | 2001-2002 | 1,055 | 383 |
| Delaware Creek | 0841H | 17175 | 31 | 2001-2004 | 1,120 | 383 |
| Delaware Creek | 0841H | 17176 | 32 | 2001-2004 | 227 | 383 |
| Delaware Creek | 0841H | 17177 | 30 | 2001-2004 | 504 | 383 |
| Delaware Creek | 0841H | 17178 | 43 | 2001-2008 | 178 | 383 |
| Delaware Creek | 0841H | 18314 | 25 | 2002-2004 | 405 | 383 |
| Estelle Creek | 0841J | 17174 | 32 | 2001-2004 | 342 | 342 |
| Johnson Creek | 0841L | 17174 | 32 | 2001-2004 | 342 | 128 |
| Johnson Creek | 0841L | 10719 | 37 | 2001-2008 | 179 | 128 |
| Johnson Creek | 0841L | 10721 | 26 | 2002-2008 | 291 | 128 |

| Water Body | AU | Station | No. of Samples | Data Date Range | Station Geometric Mean (MPN/100 mL) | AU Geometric Mean (MPN/100 mL) |
|---|---|---|---|---|---|---|
| Johnson Creek | 0841L | 17664 | 80 | 2001-2008 | 136 | 128 |
| Johnson Creek | 0841L | 17665 | 22 | 2001-2005 | 93 | 128 |
| Johnson Creek | 0841L | 18311 | 57 | 2003-2008 | 73 | 128 |
| Kee Branch | 0841M | 10792 | 26 | 2002-2008 | 188 | 196 |
| Kee Branch | 0841M | 15103 | 6 | 2007-2008 | 261 | 196 |
| Kee Branch | 0841M | 16896 | 6 | 2007-2008 | 173 | 196 |
| Rush Creek | 0841R | 10791 | 25 | 2002-2008 | 101 | 148 |
| Rush Creek | 0841R | 17190 | 25 | 2002-2008 | 207 | 148 |
| Rush Creek | 0841R | 17191 | 24 | 2002-2008 | 156 | 148 |
| Village Creek | 0841T | 10778 | 5 | 2005 | 142 | 137 |
| Village Creek | 0841T | 17189 | 27 | 2002-2008 | 136 | 137 |
| West Irving Branch | 0841U | 17179 | 35 | 2002-2008 | 357 | 357 |

## Potential Sources of Bacteria

According to the 2011 *Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River, Dallas, Texas*, the 2011 *Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek*; and 2012 *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in the Lower West Fork Trinity River Watershed*, the potential sources of *E. coli* pollution can be divided into two primary categories: regulated and unregulated. Pollution sources that are regulated have permits under the Texas Pollutant Discharge Elimination System (TPDES) and the National Pollution Discharge Elimination System (NPDES). Examples of regulated sources include:

- municipal and private domestic wastewater treatment facility (WWTF) discharges;
- industrial facilities with individual stormwater permits and/or discharging treated industrial wastewater and/or groundwater; and
- stormwater discharges from industries, construction, and municipal separate storm sewer systems (MS4s).

**Commonly used abbreviations:**

AU = assessment unit
cms = cubic meters per second
Criterion = 126 MPN/100 mL
$FDA_{SWP}$ = fractional proportion of drainage area under jurisdiction of stormwater permits
FG = future growth loads from potential permitted facilities
gpcd = gallons per capita per day
LA = allowable load from unregulated sources (predominately nonpoint sources)
$LA_{USL}$ = upstream load allocations entering the AU
$LA_{AU}$= allowable loads from unregulated sources within the AU
MGD = millions of gallons per day
MOS = margin of safety load
MPN = most probable number of bacteria forming units
$Q_{inlet}$ = median value of the high flow regime entering the AU
$Q_{Trib}$ = median value of the very high flow regime at the tributary or upstream AU outlet(s) to an impaired AU
TMDL = total maximum daily load
$WL_{ASW}$ = waste load from all permitted stormwater sources
$WLA_{WWTF}$ = waste load allocation from WWTFs

Unregulated sources of pollution are generally nonpoint. Nonpoint source pollution originates from multiple locations and is usually carried to surface waters by rainfall runoff. It is not regulated by permit under the TPDES or NPDES. Nonpoint sources include pets, livestock, and wildlife, and failing onsite sewage facilities (OSSFs).

## Methods for Estimating Bacteria Loads

Establishing the relationship between instream water quality and the source of loadings is an important component in developing a TMDL. It allows for the evaluation of management options that will achieve the desired endpoint — in this case attaining *E. coli* concentrations below 126 MPN/100 mL. The relationship may be established through a variety of techniques.

Generally, if high bacteria concentrations are measured in a water body at low to median flow in the absence of runoff events, the main contributing sources are likely to be point sources or direct deposition. During ambient flows, these constant inputs to the system will increase pollutant concentrations depending on the magnitude and concentration of the sources. As flows increase in magnitude, the effect of point sources is typically diluted, therefore making point sources a smaller part of the overall concentration.

Bacteria contributions from regulated and unregulated stormwater sources are greatest during runoff events. Rainfall runoff, depending upon the severity of the storm, has the capacity to carry indicator bacteria from the land surface into the receiving stream. Generally, this loading follows a pattern of low concentration in the water body just before the rain event, followed by a rapid increase in bacteria concentrations in the water body as the first flush of storm runoff enters the receiving stream. Over time, the concentrations diminish because the sources of indicator bacteria are attenuated as runoff washes them from the land surface and the volume of runoff decreases following the rain event (TCEQ, 2011a).

## Pollutant Sources and Loads

The TMDL represents the maximum amount of a pollutant that the stream can receive in a single day without exceeding water quality standards. Detailed load allocation analysis can be found in Appendix C.

As stated in 40 CFR, 130.2(1), TMDLs can be expressed in terms of mass per time, toxicity, or other appropriate measures. For *E. coli*, TMDLs are expressed as MPN/day, and represent the maximum one-day load the stream can assimilate while still attaining the standards for surface water quality. The TMDLs developed, as well as the one for the Lower West Fork Trinity, in the process of development, use the same methodologies.

The pollutant load allocation for the selected scenarios was calculated using the following equation:

**TMDL = ΣWLA + ΣLA + ΣFG + MOS**

Where:

**WLA**: wasteload allocation, the amount of pollutant allowed by permitted or regulated dischargers

**LA:** load allocation, the amount of pollutant allowed by unregulated sources

**FG:** loadings associated with future growth from potential permitted facilities

**MOS**: margin of safety load

- Load Duration Curves (LDCs) were developed for the outlet of each AU. The estimated maximum allowable loads of *E. coli* for each of the AUs was determined as that corresponding to the median flow within the high flow regime.

- An explicit Margin of Safety (MOS) was incorporated by setting a target for indicator bacteria loads that is 5 percent lower than the geometric mean criterion. For primary contact recreation, this equates to a geometric mean target of 120 MPN/100 mL of *E. coli*. The net effect of the TMDL with MOS is that the assimilative capacity or allowable pollutant loading of each water body is slightly reduced.

- Median flows were derived using the median flow (or 5% flow) within the very high flow regime of the LDC developed for the outlet of each AU.

### Waste Load Allocations

The WLA is the waste load allocation for regulated source contributions in the watershed. The WLA component is generally split into a $WLA_{WWTF}$ for discharges from wastewater treatment facilities (WWTFs), and a $WLA_{SW}$ for regulated stormwater.

There are 12 permitted wastewater dischargers in the Greater Trinity TMDL Project area (Table 5). Of those, only four, all domestic WWTFs, may discharge bacteria as part of normal operations (highlighted in grey in Table 5).

**Table 5. TPDES Permitted Wastewater Dischargers**

| Segment Watershed | Discharges to: | TPDES Permit No. (WQ00--) | Permittee* | Effluent Type[a] | Permitted Flow (MGD)[c] |
|---|---|---|---|---|---|
| 0822B | Grapevine Creek (0822B) | 01441-059 | Dallas/Fort Worth International Airport | SW | [b] |
| 0841 | 0841_02 | 10494-013 | City of Fort Worth Village Creek WWTP | WW | 166 |
| 0841 | 0841_01 | 03446-000 | Hanson Pipe & Precast, Inc. | IW/SW | [b] |
| 0841 | 0841_01 | 10303-001 | Trinity River Authority (TRA) Central WWTP | WW | 189 |
| 0841 | Big Bear Creek (0841D) | 11032-001 | Chester Alan Andrews – Alta Vista Mobile Home Park | WW | 0.008 |
| 0841 | Bear Creek Big Bear Creek Trigg Lake | 01441-001 -014, -019, -025, -023 | Dallas/Fort Worth International Airport | SW | [b] |
| 0841 | Mountain Creek | 01250-003 | Extex LaPorte LP – Mountain Creek Lake Steam Electric Station | SW | [b] |
| 0805 | 0805_04 | 04161-000 | Hines Reit 2200 Ross LP (Chase Tower) | GW | 0.155 |
| 0805 | 0805_04 | 04663-001 and -002 | Buckley Oil Company | SW | [b] |
| 0805 | 0805_04 | 04765-000 | 2100 Ross Realty LP (San Jacinto Tower) | GW | 0.0291 |
| 0805 | Old Channel of Elm Fork Trinity | 14699-001 | Dallas County Park Cities MUD Water Treatment Plant | FB | 0.72 |
| 0805 | 0805_03 | 10060-001 | City of Dallas Central WWTP | WW | 200 |

[a] WW = domestic wastewater treatment plant; IW = industrial wastewater; SW = stormwater; GW = groundwater; FB = filter backwash water
[b] Flow is permitted as *intermittent and variable* with a requirement to measure and report the actual amount.
[C] MGD=millions of gallons per day
*See Figure 5 for locations

**Wastewater Treatment Facilities**

TPDES-permitted WWTFs are allocated a daily wasteload ($WLA_{WWTF}$) calculated as their full permitted discharge flow rate multiplied by one-half of the instream geometric mean criterion. One-half of the water quality criterion (63 MPN/100mL) is used as the WWTF target to provide instream and downstream load capacity.

In segment 0805_03 of the Upper Trinity River, there is only one facility, Dallas Central WWTF (TPDES WQ0010060-001), and it represents the entire $WLA_{WWTF}$ allocation in that AU. AU 0805_04 of the Upper Trinity River contains no WWTFs, but does contain three permitted industrial facilities and one permitted domestic water treatment plant. Based on the effluent type of these facilities, daily waste loads were not allocated for these permits and permit limits for bacteria are not anticipated to be necessary for them (TCEQ, 2011a). The Elm Fork tributaries, Cottonwood Creek and Grapevine Branch have no WWTFs (TCEQ, 2011b).

Equation for daily wasteload allocation for TPDES wastewater treatment facilities:

**$WLA_{WWTF}$**= Criterion/2 * flow (MGD) * conversion factor

Where:

| | |
|---|---|
| **Criterion:** | 126 MPN/100 mL |
| **Flow (MGD)**: | full permitted flow |
| **Conversion factor**: | 37,854,000 100 mL /MGD |

Three facilities that treat domestic wastewater are located within the Lower West Fork Trinity River watershed. Along the mainstem of the Lower West Fork Trinity River is the City of Fort Worth Village Creek WWTF (WQ0010949-013) located within AU 0841_02, and the Trinity River Authority (TRA) Central Regional WWTF (WQ0010303-001) located within AU 0841_01. The Chester Alton Andrews Alta Vista Mobile Home Park WWTF (WQ0011032-001) is located within the watershed of non-impaired Big Bear Creek (0841D), a tributary to Bear Creek (0841B). Loadings arising from the Alta Vista Mobile Home Park WWTF are incorporated into the upstream loading entering Bear Creek rather than allocated as a separate $WLA_{WWTF}$ loading. Loadings arising from the two facilities located in AUs 0841_01 and 0841_02 represent the $WLA_{WWTF}$ allocation in the AU in which each facility is located. The remaining 10 impaired tributary AUs have no facilities regulated for discharge to include in the $WLA_{WWTF}$ term (TIAER, 2012). See Figure 5 for WWTF areas of service.

### Regulated Stormwater

Stormwater discharges from MS4, industrial, and construction areas are considered permitted point sources. Therefore, the WLA calculations must also include an allocation for permitted stormwater discharges ($WLA_{SW}$). A simplified approach for estimating the WLA for these areas was used in the development of these TMDLs due to the limited amount of data available, the complexities associated with simulating rainfall runoff, and the variability of stormwater loading. The percentage of each watershed that is under the jurisdiction of MS4 stormwater permits is used to estimate the amount of the overall runoff load that should be allocated to the $WLA_{SW}$ as the permitted stormwater contribution.

The allocation of permitted stormwater discharges ($WLA_{SW}$) is the sum of loads from regulated (or permitted) stormwater sources and is calculated as:

$$\mathbf{\Sigma WLA_{SW}} = (TMDL - \Sigma WLA_{WWTF} - LA_{USL} - \Sigma FG - MOS) * FDA_{SWP}$$

Where:

| | |
|---|---|
| $\mathbf{\Sigma WLA_{SW}}$: | sum of all permitted stormwater loads |
| **TMDL**: | total maximum allowable load |
| $\mathbf{\Sigma WLA_{WWTF}}$: | sum of all WWTF loads |
| $\mathbf{LA_{USL}}$: | upstream load allocations entering AU (see $LA_{USL}$ formula in text box below) |
| **ΣFG**: | sum of future growth loads from potential permitted facilities |
| **MOS**: | margin of safety load |
| $\mathbf{FDA_{SWP}}$: | fractional proportion of drainage area under jurisdiction of stormwater permits |

### Nonpoint Sources

The load allocation (LA) is the sum of loads from unregulated sources. The LA component of the TMDL corresponds to direct nonpoint runoff and is the difference between the total load from stormwater runoff and the portion allocated to $WLA_{SW}$. The LA is the sum of the upstream bacteria load ($LA_{USL}$) entering the AU and all remaining loads in the AU from unregulated sources ($LA_{AU}$):

$$\mathbf{LA = LA_{AU} + LA_{USL}}$$

Where:

**LA** = allowable load from unregulated sources (predominately nonpoint sources)

$\mathbf{LA_{AU}}$= allowable loads from unregulated sources within the AU

$\mathbf{\Sigma LA_{USL}}$ = upstream load allocations entering the AU

The $LA_{USL}$ is calculated as:
**$LA_{USL}$** = $Q_{inlet}$ * criterion

Where:
**Criterion**: 126 MPN/100 mL
**$Q_{inlet}$**: median value of the high flow regime entering the AU

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The $LA_{AU}$ is calculated as:
**$LA_{AU} = TMDL - \Sigma WLA_{WWTF} - \Sigma WLA_{SW} - LA_{USL} - \Sigma FG - MOS$**

Where:
**$LA_{AU}$**: allowable load from unregulated sources within the AU
**TMDL**: total maximum allowable load
**$\Sigma WLA_{WWTF}$**: sum of all WWTF loads
**$\Sigma WLA_{SW}$**: sum of all permitted stormwater loads
**$LA_{USL}$**: upstream load allocations entering AU
**ΣFG**: sum of future growth loads from potential permitted facilities
**MOS**: margin of safety load

The TMDL equation can thus be expanded to show the components of WLA and LA:
**$TMDL = \Sigma WLA_{WWTF} + \Sigma WLA_{SW} + LA_{AU} + LA_{USL} + \Sigma FG + MOS$**

**Allowances for Future Growth**

The Future Growth component of the TMDL equation addresses the requirement of TMDLs to account for future loadings that may occur as a result of population growth, changes in community infrastructure, and development. The assimilative capacity of streams increases as the amount of flow increases. Increases in flow allow for additional indicator bacteria loads if the concentrations are at or below the primary contact recreation standard.

Future growth was considered in the developing the TMDL for the Upper Trinity. To account for the probability that additional flows from WWTF discharges may occur in both 0805 AUs, a provision for future growth was included in the TMDL calculations based on the population increase from year 2005 estimates to year 2030 projections and an estimate of the amount of wastewater generated per person per day or gallons per capita per day (gpcd). Wastewater treatment for the City of Dallas is provided by two large facilities—the Central WWTF in AU 0805_03 and the Southside WWTF, which discharges into the Upper Trinity River downstream of the impaired AUs. The sewered collection areas of both facilities include an area greater than the 0805_04 and 0805_03 drainage areas. The collection areas also include a significant area serviced jointly by both facilities, which complicates the estimate of additional WWTF discharges due to future growth.

Using a conservative approach for the TMDL, it is assumed that all estimated future growth associated with the sewered collection area of the Dallas Central WWTF results in future growth in both AUs. The future growth computation includes: calculating the estimated increase in future capacity required for the sewered collection area of the present Dallas Central WWTF using available data; proportioning the future capacity between AUs 0805_04 and 0805_03; and the final computation to determine an *E. coli* loading for future capacity.

In the next step, the computed future capacity is apportioned to the two impaired AUs based on the fraction of the drainage area of each AU to the combined drainage area of the two AUs resulting in the estimated future growth term.

Additional stormwater dischargers represent additional flow that is not accounted for in the current allocations. Changes in MS4 jurisdiction or additional development associated with population increases in the watershed can be accommodated by shifting allotments between the WLA and the LA. This can be done without the need to reserve future-capacity WLAs for stormwater. In non-urbanized areas, growth can be accommodated by shifting loads between the LA and the WLA (for stormwater) (TCEQ, 2011b).

Currently, no permitted WWTFs discharge into Segments 0822A and 0822B. Wastewater generated within Cottonwood Branch and Grapevine Creek is transported out of both watersheds to the TRA Central Regional WWTF located on the Lower West Fork Trinity River (Segment 0841).

Since both impaired watersheds lie within the much larger wastewater collection service area for the TRA Central Regional WWTF, the approach taken was to determine the service population of the TRA WWTF and the year 2005 average daily discharge for the TRA Central Regional WWTF based on its discharge monitoring reports (DMRs). The wastewater flow per capita was then determined by dividing the TRA Central Regional WWTF 2005 annual daily discharge by its service population giving a wastewater flow of 107 gpcd.

Future capacity (FC), in MGD, is calculated as:
**$FC = Flow_{2005} * Pop_{05/30} * [DC_{permit} / (DC_{permit} + DS_{permit})] *$ conversion factor**

Where:
**$Flow_{2005}$**= gallons per capita per day based on the average combined discharges of Dallas Central and Dallas Southside WWTFs from year 2005 Discharge Monitoring Report (DMR) data divided by the year 2005 Dallas wastewater collection area population estimate
**$Pop_{05/30}$**= Dallas wastewater collection area population increase for 2005 to 2030
**$DC_{permit}$**= Full permitted discharge of Dallas Central WWTF
**$DS_{permit}$**= Full permitted discharge of Dallas Southside WWTF
**Conversion factor** = 0.000001 MGD/gpcd

The estimated future growth term is calculated:
**FG = Criterion/2 * FC (MGD) * $FDA_{AU}$* conversion factor**
Where:
**Surface water quality standard** = 126 MPN/100 mL
**FC** = future capacity calculated from preceding equation in MGD
**$FDA_{AU}$**= fraction of the each AU's drainage area to combined drainage areas
**Conversion factor** = 37,854,000 100 mL / MGD

Future growth (FG) is calculated as:
**FG** = Target * [$POP_{2010-2040}$ * Use] * Conversion Factor
Where:
**Target** = 63 MPN/100 mL
**$POP_{2010-2040}$** = estimated percent increase in population between 2010 and 2040
**Use** = average per capita water usage (101.77 gpcd)
**Conversion factor** = 37.854 100 mL / gallon

Additional stormwater dischargers represent additional flow that is not accounted for in the current allocations. Changes in MS4 jurisdiction or additional development associated with population increases in the watershed can be accommodated by shifting allotments between the WLA and the LA. This can be done without the need to reserve future-capacity WLAs for stormwater. In non-urbanized areas, growth can be accommodated by shifting loads between the LA and the WLA (for stormwater) (TCEQ, 2011b).

Within the Lower West Fork Trinity watershed, there are currently two facilities that treat domestic wastewater and discharge into impaired AUs. The City of Fort Worth Village Creek WWTF discharges into AU 0841_02, and the TRA Central Regional WWTF discharges into 0841_01. The Village Creek WWTF is built out with no capacity for expansion beyond its current size, while the Central Regional WWTF has additional capacity for expansion.

The majority of the Lower West Fork Trinity River watershed is serviced by the TRA Central Regional WWTF (Figure 5). Planned expansions of the TRA Central Regional WWTF will increase the permitted discharge from 189 MGD to 232 MGD based on long term projections to the year 2040, an increase of 43 MGD. This additional 43 MGD serves as the future growth component for those areas serviced by the TRA Central Regional WWTF and is applied to the TMDL of AU 0841_01 since the discharge occurs into that section of the Lower West Fork Trinity River. Since all wastewater collected within the watersheds of AUs 0841C, 0841E, 0841G, 0841H, 0841J, 0841L, 0841M, and 0841U are sent to the TRA Central Regional WWTF and subsequently discharged into AU0841_01, the future growth component for these eight AUs was not explicitly derived and was set to a value of zero (TIAER, 2012).

The future growth term of AU0841_01 was calculated using the identical equation applied to determine the $WLA_{WWTF}$ term.

To account for the probability that new flows from WWTF discharges may occur in areas within the TMDL watersheds that are outside of the TRA Central Regional WWTF service area, a provision for future growth was included in the TMDL calculations based on population projections and per capita wastewater use. Current population projections for areas not serviced by the TRA Central Regional Facility were obtained from the 2010 U.S. Census (USCB, 2010), and 2040 projected population increases. Per capita wastewater use was obtained from the TRA and represents population projected for the year 2040.

For the remaining four AUs in the Lower West Fork Trinity River watershed (0841_02, 0841B, 0841R, and 0841T), the future growth component for the areas within each AU that are not serviced by the TRA Central Regional WWTF were calculated based on estimated population increases from 2010 to 2040 multiplied by the per capita wastewater usage by the projected population increase. The resulting future wastewater flow was then converted into a loading.

## Implementation Strategies

This I-Plan documents nine implementations strategies to reduce bacteria loading in the Project area. The implementation strategies cover a variety of areas and include provisions for:

- wastewater,
- stormwater,
- planning and development,

- pets, livestock and wildlife,
- onsite sewage facilities,
- monitoring coordination,
- education and outreach,
- best management practices library, and
- implementation strategy evaluation.

The strategies include voluntary activities designed to improve water quality while establishing antidegradation procedures through regular evaluation of I-Plan components. Within each of the activities are:

- potential load reductions,
- technical and financial assistance needed,
- an education component,
- schedule of implementation,
- interim milestones,
- progress indicators,
- a monitoring component, and
- responsible entities.

## Wastewater Implementation Strategies

Wastewater management encompasses a broad range of efforts that promote effective and responsible water use, treatment, and disposal while encouraging the protection and restoration of the region's — and this Project's — watersheds. Properly designed, operated, and maintained sanitary sewer systems collect and transport all sewage that flows into them to a publicly owned treatment works (POTW). Wastewater treatment facility operators bear a large responsibility for converting the sewage into water that can be safely released back into the Trinity River. Table 6 lists the permitted WWTFs in the Greater Trinity Watershed. For the waste not handled as part of a sanitary sewer system, liquid waste haulers provide services to OSSFs and portable/chemical toilets. Given the bacteria-laden nature of wastewater (Lusk, 2011), broad attention in this I-Plan will be given to the wastewater system. WWTFs, sanitary sewer systems, lift stations, and liquid waste haulers all have the potential to impact bacteria loading in impaired waterways (see Implementation Strategies 5.0 – 5.5 for OSSFs).

### Implementation Strategies 1.0: Wastewater Treatment Facility Effluent Limits

In November 2009, TCEQ commissioners approved Rule Project No. 2009-005-309-PR. This rule requires the addition of bacteria limits for *E. coli* in fresh water discharges for all TPDES domestic wastewater permits during their next permit amendment or revision. This rule is defined in Title 30 Administrative Code Chapter (TAC) 309.3(h) and the frequency of testing required is defined in 30 TAC Chapter 319.5(b). Through this control action, responsible entities will continue to monitor *E. coli* concentrations in WWTF effluent as required by individual WWTF permits and any subsequent permit amendments or revisions.

Currently, four permitted WWTFs (Table 6) have direct impact in the Greater Trinity Project area watershed(s) and three of those are currently required to monitor *E. coli* levels in their effluent. The remaining plant will be required to monitor for *E. coli* upon renewal of the permit. For TCEQ bacteria TMDLs in the Dallas-Fort Worth area, TPDES-permitted WWTFs are allocated a daily waste load allocation ($WLA_{WWTF}$) calculated as their full permitted discharge flow rate multiplied by one half the instream geometric mean criterion. One-half of the water quality criterion (63 MPN/100mL) is used as the WWTF target to provide instream and downstream load capacity. Changes to effluent *E. coli* limits will occur following the approval of the TMDLs and during the next amendment or revision to an individual permit. Table 7 summarizes this implementation strategy.

**Table 6. Permitted WWTFs in the Greater Trinity Watershed**

| Facility Name | Permit Number | Permit Daily Average *E. coli*[a] | Permit Effective Date | *E. coli* Permit Monitoring Frequency |
|---|---|---|---|---|
| Dallas Central WWTF | WQ0010060-001 | 63 MPN/100 mL | 8/13/2012 | 5x/wk |
| FTW Village Creek WWTF | WQ0010949-013 | 126 MPN/100 mL[b] | 12/29/2011 | 5x/wk |
| TRA Central Regional WWTF | WQ0010303-001 | n/a[c] | 2/4/2008 | n/a[c] |
| Alta Vista WWTF | WQ0011032-001 | 126 MPN/100 mL | 9/15/2011 | 1x/quarter |

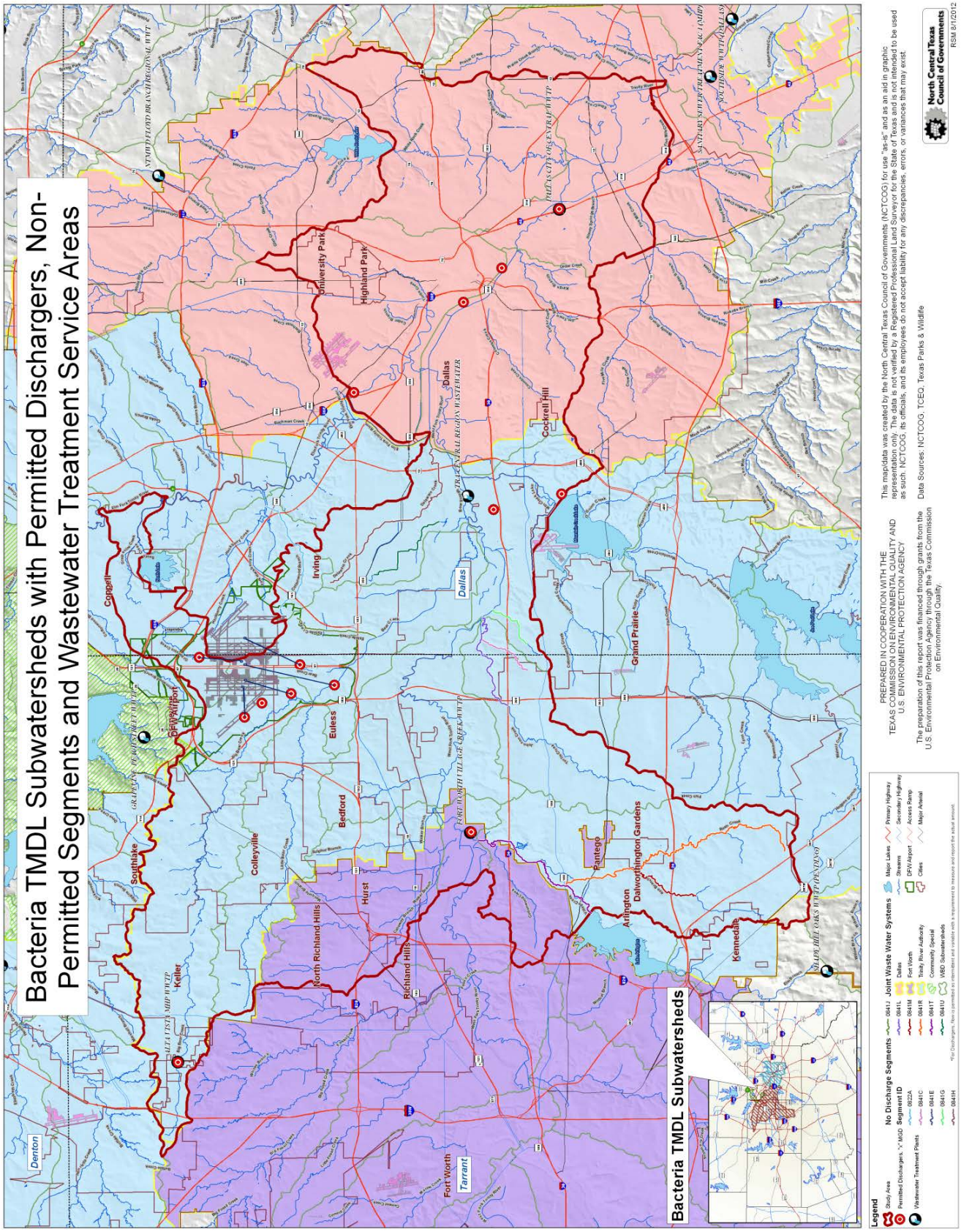
[a] There is also a daily maximum of 394 MPN/100mL.
[b] Subsequent renewals will include an E. coli limit of 63 MPN/100mL.
[c] Permit currently in renewal process. Renewed permit will include an *E. coli* limit of 126 MPN/100 mL and a monitoring frequency of 5x/week. Subsequent renewals will include an *E. coli* limit of 63 MPN/100 mL.

Each of the entities listed in Table 6 is responsible for adhering to the requirements of their specific permits only. The terms and conditions in each individual permit are agreed upon by both the TCEQ and the permittee. Each permit specifically outlines the effluent constituents that require monitoring as well as the monitoring and reporting frequency to which the permittee must adhere. The TCEQ reviews and documents compliance with individual permits. WWTF permits are issued on a five year cycle and must be renewed by the permittee. A map of WWTF coverage in the Project area can be found in Figure 5.

**Table 7. Implementation Strategy 1.0 Summary — Wastewater treatment facility effluent limits**

| | |
|---|---|
| Targeted Source(s) | WWTF effluent |
| Estimated Potential Load Reduction | Implementation Strategy (IS) 1.0 may result in a 2% reduction of calculated bacteria loading from WWTF effluent |
| Technical and Financial Assistance Needed | Technical: none — permit requirements are already being met<br>Financial: none — permit requirements are already being met |
| Education Component | None |
| Schedule of Implementation | Immediate. New requirements for WWTF permits would come from TCEQ |
| Interim, Measurable Milestone | The number of permits requiring bacteria monitoring with reduced daily average limits |
| Progress Indicators | Allowable daily average will be reduced from 126 MPN/100 mL to no more than 63 MPN/100 mL for all WWTF discharging to impaired waterways |
| Monitoring Component | An annual report to Coordination Committee from NCTCOG to include information on the progress of implementation strategies, in addition to self-reporting by WWTF to TCEQ |
| Responsible Entity | WWTFs will meet permit requirements and monitor *E. coli* as appropriate<br><br>NCTCOG will contact TCEQ to secure the necessary permit information pertaining to bacteria limits<br><br>NCTCOG will provide Coordination Committee with information on WWTF effluent limits |

**Figure 5. WWTF Location and Coverage Map with Permitted Dischargers**



## Implementation Strategy 1.1: Evaluation of non-participants in Sanitary Sewer Overflow Initiative (SSOI) and Capacity Management, Operation, and Maintenance (C-MOM) programs

Sanitary sewer systems that are properly designed, operated, and maintained will collect and transport all of the sewage and industrial wastewater that flow into them to a wastewater treatment facility for appropriate treatment. If, however, there is significant inflow/infiltration (I/I) to the collection system; the system is not properly operated and maintained; or its capacity is inadequate, then sanitary sewers can overflow (Figure 6). The goals of the TCEQ SSOI are to reduce the number of sanitary sewer overflows (SSOs) that occur each year in Texas and to address SSOs before they harm human health, safety, or the environment and before they become enforcement issues (TCEQ, 2008).

Wastewater treatment facilities with sanitary sewer systems and subscribers within collection systems are eligible to participate in the TCEQ SSOI which provides benefits in that, a participating facility will not be subject to formal enforcement for most continuing SSO violations, as long as the SSOs are addressed by the SSO plan. Participation also allows the facility to spend resources on correction as opposed to having to pay penalties associated with an enforcement order, in addition to the money required to complete corrective action; and participation ensures that SSOs addressed by the SSO plan will not affect the facility's compliance history rating.

C-MOM is a self-adopted program for owners and operators of sanitary sewer systems and involves proper management, operations, and maintenance of the collection system. Additionally, C-MOM programs ensure adequate capacity for peak flows, and take steps to prevent or mitigate SSOs.

Both SSOI and C-MOM programs have the potential to decrease bacteria loading by reducing SSOs. Table 8 lists SSOI participants and non-participants as of February 2012. As summarized in Table 9, the Coordination Committee or their appointees will evaluate the entities that do not participate in either the SSOI or C-MOM programs and as appropriate, encourage participation in one of those two programs.

**Table 8. SSOI Participants**

| Currently Participating as of 2/28/2013 | Not Currently Participating |
|---|---|
| City of Arlington | City of Cockrell Hill |
| City of Bedford | City of Colleyville |
| City of Dallas | City of Coppell |
| City of Euless | City of Dalworthington Gardens |
| City of Fort Worth | City of Haslet |
| City of Grand Prairie | City of Keller |
| City of Grapevine | City of Kennedale |
| City of Hurst | City of Mansfield |
| City of Irving | City of Richland Hills |
| City of North Richland Hills | City of Southlake |
| Trinity River Authority – Central WWTP System | City of University Park |
| | Town of Highland Park |
| | Town of Pantego |

**Table 9. Implementation Strategy 1.1 Summary — Evaluation of non-participants in SSOI and C-MOM programs**

| | |
|---|---|
| Targeted Source(s) | Sanitary sewer system (SSS) failures and SSOs |
| Estimated Potential Load Reduction | IS 1.1, over 25 years, may result in a 35% reduction of calculated bacteria loading from SSSs and SSOs |
| Technical and Financial Assistance Needed | Technical: non-participants may need some level of technical assistance to begin SSOI and/or C-MOM participation<br><br>Financial: grant funding, loans, and existing local funding as appropriate |
| Education Component | Outreach to SSS operators that are non-SSOI/non-C-MOM participants |
| Schedule of Implementation | By 2018, all non-participating MS4s will have been contacted by Coordination Committee members, either as a whole or individually<br><br>By 2028, SSOI/C-MOM participation will increase by 15% |
| Interim, Measurable Milestone | By 2018, 100% contact of non-participants |
| Progress Indicators | The number of participants in SSOI and/or C-MOM |
| Monitoring Component | An annual report to Coordination Committee from NCTCOG to include information on the progress of implementation strategies |
| Responsible Entity | NCTCOG will gather and distribute information about SSOI and C-MOM participation and use to the Coordination Committee<br><br>Wastewater Subcommittee and Coordination Committee will conduct outreach to non-participants<br><br>NCTCOG will contact TCEQ Office of Compliance and Enforcement Program Support Section annually to obtain a current list of SSOI participants for use in education and outreach efforts |

## Implementation Strategy 1.2: Lift station evaluation

For a variety of reasons, lift stations may occasionally cease functioning and may discharge sewage into waterways. One example is lift stations ceasing to function during extensive power outages following severe weather. Lift stations may also fail to function during circumstances other than power outages, such as due to mechanical failure or during repair. However, unlike many SSOs, lift station failures can result in the discharge of large volumes of untreated wastewater into waterways.

The stakeholders encourage entities with lift stations to survey and evaluate existing stations by 2018 to determine the appropriateness of implementing BMPs to prevent SSOs caused by lift stations. Using this information, the Coordination Committee will re-evaluate the need for identifying or developing lift station BMPs for the BMP Library (see Implementation Strategy 8.0). Table 10 provides a summary of components necessary for lift station evaluation.

**Table 10. Implementation Strategy 1.2 Summary—Lift station evaluation**

| | |
|---|---|
| Targeted Source(s) | SSS failures and SSOs from lift station failures |
| Estimated Potential Load Reduction | IS 1.2 may result in a 2% reduction in bacteria loading |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary for lift station assessment and any potential repairs or alternations<br><br>Financial: if technical assistance is not available internally to lift station owners and/or operators, then grant, loans, or local funding may be necessary for both evaluation and any potential repairs or alternations |
| Education Component | Outreach to SSS lift station operators |
| Schedule of Implementation | By 2018, all entities with lift stations will have evaluated the need for maintenance programs to reduce SSOs caused by non or malfunctioning lift stations |
| Interim, Measurable Milestone | None |
| Progress Indicators | Number of lift stations being evaluated by station owners and/or operators |
| Monitoring Component | Reports containing lift station owners and/or operators and their progress on evaluation will be made available to Wastewater technical subcommittee and Coordination Committee annually |
| Responsible Entity | Lift station owners and/or operators will evaluate lift stations and report progress to NCTCOG<br><br>NCTCOG will report on progress indicator to the Wastewater technical subcommittee and Coordination Committee |

## Implementation Strategy 1.3: Regional participation in Fats, Oils, and Grease program

Fats, oils, and grease (FOG) are considered to be the leading cause of blockages in sanitary sewers, and the EPA estimates that blockages account for nearly 50 percent of all SSOs (USEPA, 2007). The North Texas Grease Abatement Council (NTGAC) and NCTCOG have partnered to provide the cities and other agencies with public education materials related to FOG. Many organizations within the bacteria TMDL watersheds, such as Arlington, Bedford, Dallas, Fort Worth, Grand Prairie, Irving, North Richland Hills, Southlake, and the TRA already use these materials to reduce FOG in the SSS and with it, SSOs. As summarized in Table 11, the stakeholders encourage organizations and wastewater plant operators to continue participation in the regional FOG education program. As resources are available, NTGAC is encouraged to expand educational materials to include the impact of FOG and SSOs on bacteria levels.

**Table 11. Implementation Strategy 1.3 Summary — Regional participation in Fats, Oils, and Grease program**

| | |
|---|---|
| Targeted Source(s) | SSO and SSS failures |
| Estimated Potential Load Reduction | IS 1.3 may result in a 20% reduction in bacteria loading from SSOs and SSS failures |
| Technical and Financial Assistance Needed | Technical: technical assistance with FOG is available through existing programs<br><br>Financial: participation in some FOG programs may require cost sharing, in addition to costs associated with educational materials; training for grease trap operators may also be necessary through grant funding, loans, and existing local funding as appropriate |
| Education Component | Outreach to RSWMP participants to ensure participation and outreach to non-RSWMP participants to encourage participation in regional FOG program(s)<br><br>Public education is a primary component in FOG programs and an existing program is already in place<br><br>Separate education programs may be necessary for grease trap operators |
| Schedule of Implementation | Existing FOG public education participants will begin immediately and continue their programs as feasible. By 2018, outreach will be conducted to all MS4s with SSSs not participating in the regional FOG program |
| Interim, Measurable Milestone | Over 25 years, all SSS owners and/or operators will actively participate in FOG programs |
| Progress Indicators | Number of FOG program participants |
| Monitoring Component | NCTCOG will collect FOG participant information and report to Wastewater Technical subcommittee and Coordination Committee |
| Responsible Entity | NCTCOG will gather and distribute information of FOG program participation and report results to the Coordination Committee and Wastewater technical |

| | |
|---|---|
| | subcommittee<br><br>Wastewater technical subcommittee and Coordination Committee will conduct outreach to non-participants |

## Implementation Strategy 1.4: Sanitary sewer overflow reporting

State law and TCEQ regulations specify reporting requirements for SSOs in Texas Water Code Chapter 26.039 and 30 TAC 305.125(9). Without accurate and available information on SSOs, gauging the effectiveness of SSO BMPs becomes difficult. Figure 6 provides a four-year representation of SSOs in the Project area categorized by the amount of released sewage. Table 12 summarizes the implementation strategies for SSOs.

### 1.4.1: Wastewater and wastewater collection licensing

The Coordination Committee recommends TCEQ increase understanding of reporting requirements for SSOs and SSO mitigation by ensuring such information is included in wastewater licensing classes, including those for wastewater collection.

### 1.4.2: Electronic reporting

The Coordination Committee encourages TCEQ to adopt electronic SSO reporting in addition to maintaining current methods. The TCEQ should further develop its system to allow electronic collection, analysis, and dissemination of this information. This action is not intended to increase the data-entry requirements for TCEQ staff; instead, it is intended to streamline reporting and analysis. Given technological disparities, however, the Committee encourages TCEQ to maintain the existing faxed SSO report for some time while electronic reporting is instituted.

### 1.4.3: Reporting form changes

Current "source" descriptions on TCEQ's reporting form are subject to interpretation. More accurate source descriptions would provide necessary information in future prevention of SSOs. TCEQ is encouraged to change the reporting form to better reflect actual cause of SSOs, for example specifying cause of blockage, and provide some type of education for those entities reporting.

**Table 12. Implementation Strategy 1.4 Summary — Sanitary sewer overflow reporting**

| | |
|---|---|
| Targeted Source(s) | SSOs |
| Estimated Potential Load Reduction | IS 1.4. – 1.4.3 will contribute to the improved handling of SSOs and may result in a 2% reduction in calculated bacteria loading from SSOs over 25 years |
| Technical and Financial Assistance Needed | Technical: TCEQ may require technical assistance to develop appropriate database and reporting technologies as well as for wastewater licensing course materials<br><br>SSS owners and/or operators may need high speed internet access or equivalent<br><br>Financial: Existing and grant funding and loans as available |

| | |
|---|---|
| Education Component | TCEQ will provide appropriate instructions to SSS operators for using statewide SSO database.<br><br>TCEQ will provide appropriate educational materials for wastewater licensing course participants |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Deployment of an appropriate database for tracking SSOs<br><br>Wastewater licensing classes emphasizing accurate SSO reporting<br><br>Reporting form changed for more accurate SSO cause description |
| Progress Indicators | Creation of a database<br><br>Wastewater licensing course materials emphasizing SSO reporting<br><br>Changed reporting form |
| Monitoring Component | NCTCOG will collect information from TCEQ regarding any updates to educational materials for wastewater licensing course participants, as well as any progress on database improvements |
| Responsible Entity | NCTCOG will coordinate with TCEQ on exploration of options for developing appropriate materials for use in wastewater licensing courses conducted through the TCEQ. NCTCOG will also coordinate with TCEQ to identify desired modifications to the SSO reporting form that would result in more effective SSO cause identification.<br><br>SSS owners and/or operators will report SSOs as appropriate and ensure employee SSO reporting training<br><br>NCTCOG will collect and share information with the Wastewater technical subcommittee and Coordination Committee |

## Implementation Strategy 1.5: Funding opportunities for repair/replacement of sanitary sewer lines

Summarized below in Table 13, NCTCOG and stakeholders will pursue funding opportunities for rehabilitation or replacement of sanitary sewer lines, including Texas Water Development Board funding and regional supplemental environmental projects (SEPs) to repair, maintain, or extend wastewater infrastructure. NCTCOG will share information on funding opportunities to interested parties by web posting to a new or existing web page.

**Table 13. Implementation Strategy 1.5 Summary — Funding opportunities for repair/replacement of sanitary sewer lines**

| | |
|---|---|
| Targeted Source(s) | SSO and SSS failures |
| Estimated Potential Load Reduction | IS 1.5 may result in a 5% reduction in calculated bacteria loading over 25 years by reducing the portion of the wasteload contributed by leaking or broken sewer lines |
| Technical and Financial Assistance Needed | Technical: engineering and technical expertise may be necessary<br><br>Financial: existing or new grants, SEPs, or other funding mechanisms available at the local, state, or federal level |
| Education Component | NCTCOG will make new funding opportunities known to SSS owners and operators via web postings |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Available funding opportunities identified on a NCTCOG web page |
| Progress Indicators | Creation of a new or modification of an existing web page for funding opportunities and the number of successful grant or funding applications for wastewater infrastructure received in the Project Area |
| Monitoring Component | Web page use reports for Coordination Committee and annual Water Quality Management Plan Update, which details some wastewater funding in the Project area |
| Responsible Entity | NCTCOG will create or modify existing web page and maintain current information<br><br>SSS stakeholders will utilize information and seek funding opportunities to upgrade wastewater infrastructure |

## Implementation Strategy 1.6: Relocation of sewer mains from waterways

Although waterways are convenient locations for sewer mains in terms of access rights and elevation, failures in the system in such locations have a direct impact on water quality and bacteria levels. The Coordination Committee encourages MS4s to relocate sewer mains out of waterways as practicable, as part of infrastructure replacement programs. Table 14 outlines the details of this implementation strategy.

**Table 14. Implementation Strategy 1.6 Summary — Relocation of sewer mains from waterways**

| | |
|---|---|
| Targeted Source(s) | SSO and SSS failures |
| Estimated Potential Load Reduction | IS 1.6 may result in a 4% reduction over 25 years of calculated bacteria loading by reducing the potential for additional loading from leaking or collapsed sewer lines |
| Technical and Financial Assistance Needed | Technical: engineering and other technical expertise will be necessary in order to relocate wastewater lines from waterways<br><br>Financial: grant funding, loans, and existing local funding as available |
| Education Component | Public education regarding relocation benefits may be needed Additionally, education for decision-makers, such as city councils, may also be necessary |
| Schedule of Implementation | Beginning immediately as appropriate, SSS owners and/or operators will consider relocation of sewer lines out of waterways as part of infrastructure repair and replacement |
| Interim, Measurable Milestone | Over 25 years, as many sewer lines as practicable will be relocated from waterways |
| Progress Indicators | Number of sewer lines relocated |
| Monitoring Component | Voluntary reports from SSS owners and/or operators to NCTCOG on relocations |
| Responsible Entity | SSS owners and/or operators will relocate sewer mains from waterways as feasible |

## Implementation Strategy 1.7: Liquid waste management and liquid waste hauler program expansion

Waste haulers routinely transport bacteria-laden materials, including septic, grease trap, and grit trap wastes. When this highly concentrated, untreated waste is discharged into waterways instead of being properly disposed of or treated, it may represent a significant local increase in bacterial loading.

NCTCOG and the Coordination Committee encourage MS4 permittees to maintain existing liquid waste hauler permit and inspection programs and expand them if necessary. Because liquid waste hauler regulation also takes place at the state level, the stakeholders request that TCEQ increase educational efforts to haulers, modify the registration form, and change regulations to include local notification. Table 15 summarizes the implementation strategies for liquid waste.

#### 1.7.1: Liquid waste hauler inspection program

Using sample ordinances available through the online BMP Library (see Implementation Strategy 8.0), municipal MS4s are encouraged to evaluate liquid waste hauler operations within their jurisdictions and create or expand inspection programs to include permitting, inspections, and tracking of liquid waste haulers; with a goal of having inspection programs in 100 percent of large MS4s by 2028 and 25 percent of small MS4s by 2033.

#### 1.7.2: TCEQ and liquid waste haulers

The Coordination Committee encourages TCEQ to increase its educational efforts toward liquid waste haulers, especially in regards to operations in areas with bacteria impaired waterways, illegal discharge penalties, and mitigation procedures.

##### *1.7.2.1: Liquid waste hauler registration form addition*

The Coordination Committee also requests TCEQ add a check box on liquid waste hauler registration forms for the operator to acknowledge that they know they are operating within an area with bacteria TMDL-listed waterways.

##### *1.7.2.2: Requested change to liquid waste hauler regulations to include municipal notification*

Request TCEQ amend regulatory guidance document to have waste haulers notify any municipalities, counties, and other jurisdictions that they are transporting through or where they are serving.

#### 1.7.3: Implementation of standards for portable/chemical toilets

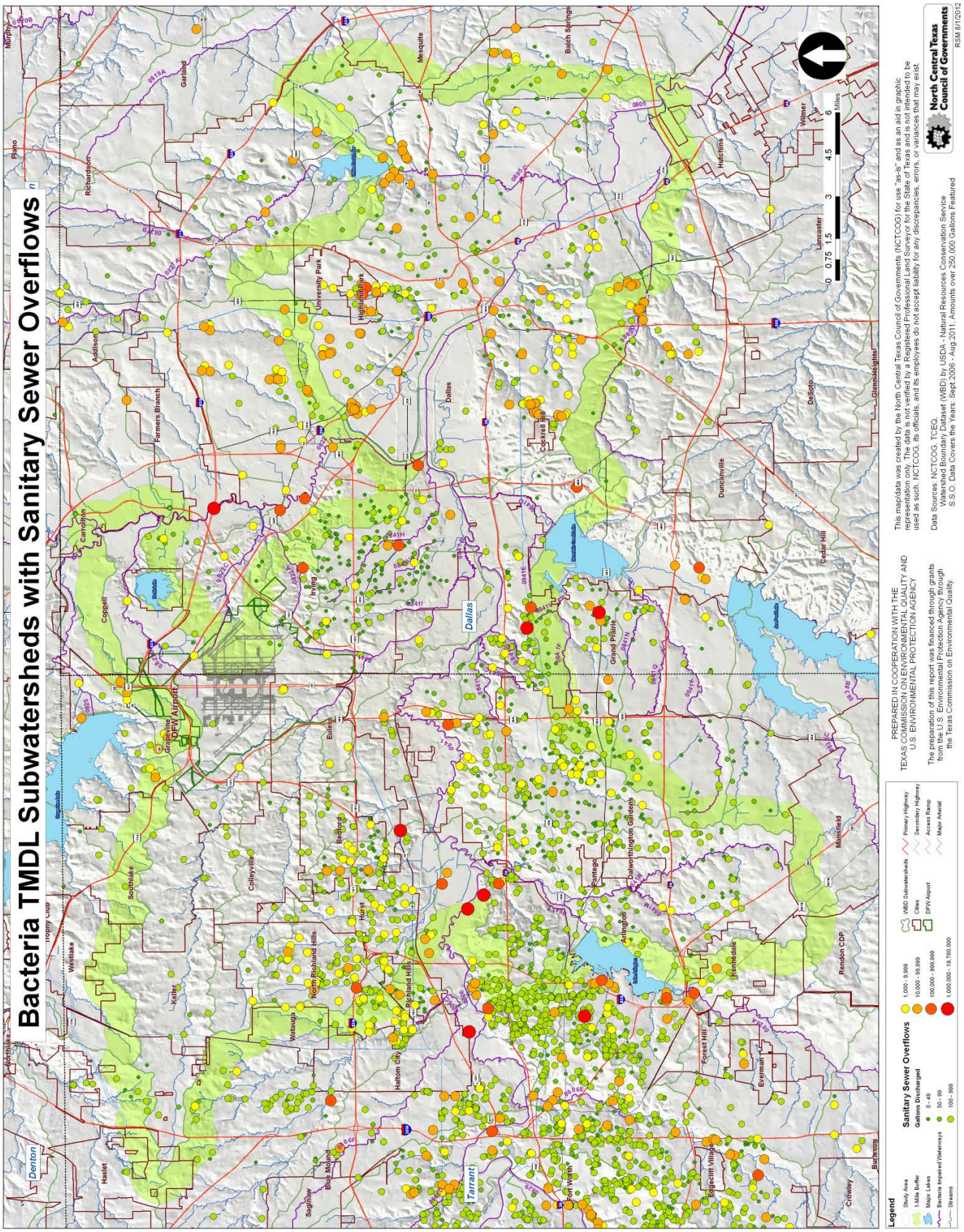
MS4s are encouraged to implement standards concerning waste management on all sites requiring use of portable/chemical toilets to ensure placement as far from stormwater inlets, gutter lines, and water bodies as feasible and to ensure regular service scheduling of onsite waste facilities.

**Table 15. Implementation Strategy 1.7 Summary — Liquid waste management and liquid waste hauler program expansion**

| | |
|---|---|
| Targeted Source(s) | Improperly disposed waste from liquid waste haulers |
| Estimated Potential Load Reduction | IS 1.7 – 1.7.2 may result in a 5% reduction of calculated bacteria loading over 25 years by reducing the portion of the waste load contributed by improper handling, transportation, and disposal of liquid wastes |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary for MS4s without liquid waste hauler inspection and tracking programs to implement standards for portable and/or chemical toilets |

| | |
|---|---|
| | Financial: grants and/or existing funding and loans as available |
| Education Component | Outreach to MS4s without inspection and tracking programs may be necessary<br><br>Educational efforts by TCEQ for liquid waste haulers regarding operations and any changes to registration form |
| Schedule of Implementation | 100% of large MS4s will have inspection and tracking programs in place by 2028<br><br>25% of small MS4s will have inspection and tracking programs in place by 2033<br><br>Beginning immediately as feasible, TCEQ will consider changes to liquid waste hauler registration forms and changes to notification requirements |
| Interim, Measurable Milestone | By 2028, 100% of large MS4s will have liquid waste hauler inspection and tracking programs in place<br><br>by 2033, 25% of small MS4s will have liquid waste hauler inspection and tracking programs in place |
| Progress Indicators | Number of MS4s with inspection and tracking programs<br><br>Number of MS4s with standards for portable and/or chemical toilets<br><br>Changes to liquid waste hauler registration form(s) |
| Monitoring Component | Reports to Coordination Committee and Stormwater Technical subcommittee regarding MS4 programs and TCEQ program/form changes for liquid waste haulers |
| Responsible Entity | MS4s will adopt liquid waste hauler inspection and tracking programs<br><br>NCTCOG will coordinate with stakeholders and TCEQ staff to identify potential changes to the liquid waste hauler registration forms that will enhance their effectiveness.<br><br>NCTCOG will compile information on programs and forms for annual report to Coordination Committee and Stormwater technical subcommittee |

**Figure 6. Map — SSOs Occurring between September 2006 – August 2011**



## Stormwater Implementation Strategies

In the watershed areas covered by the Greater Trinity River Bacteria TMDL I-Plan Project, as in most urban areas, stormwater runoff is a major cause of water pollution. When rain falls on less developed areas, the water is absorbed and filtered by soil and plants. When rain falls on the roofs, streets, and parking lots of the Dallas-Fort Worth metropolitan area, however, the water cannot soak into the ground. Here, like most urban areas, stormwater is drained through engineered collection systems and discharged into nearby lakes and streams. The stormwater carries trash, heavy metals, other pollutants, and notably for this project, bacteria, from the urban landscape, degrading the quality of the receiving waters. Higher flows can also cause erosion and flooding in urban streams, damaging habitat, property, and infrastructure.

Bacteria sources, such as wastes from pets, wildlife, and even humans, can be washed into storm drains and then discharged into local waterways. Because stormwater systems are designed to quickly and efficiently remove stormwater from developments, stormwater often bypasses the natural vegetative barriers that filter sheet flow over the land, thus, exacerbating bacteria loading. Infrastructure, such as pipes, inlets, culverts, interceptors, basins, reservoirs, outfalls, and channelized waterways, can also increase direct bacterial loading. The TMDLs for the project area indicate that stormwater from permitted MS4s is thought to be a significant source of bacteria loading (TCEQ 2011a and 2011b).

Effective stormwater management is often achieved from a management systems approach, as opposed to one that focuses on individual practices. That is, the pollutant control achievable from any given management system is viewed as the sum of the parts, taking into account the range of effectiveness associated with each single practice, the costs of each practice, and the resulting overall cost and effectiveness. Some individual practices may not be very effective alone but, in combination with others, may provide a key function in highly effective systems and, in the case of the Dallas-Fort Worth metropolitan area, reduce bacteria levels in area waterways.

**About the Regional Stormwater Management Program**

NCTCOG works with local governments and other stakeholders to develop and implement a regional strategy to address stormwater quality issues impacting the region. Created in 1999 by the Regional Stormwater Management Coordinating Committee (RSWMCC), the *Regional Policy Position on Managing Urban Stormwater Quality* provides guidance for the regional strategy, setting out the key elements for a cooperative and comprehensive regional approach to stormwater management. Among the goals of the Regional Program are to:

- Protect the health and welfare of citizens and the environment;
- Effectively address state and federal regulations;
- Share professional knowledge and experience; and
- Provide training to governmental staff and the development community.

The program is built upon a series of cooperative initiatives in the following areas:

- Public education;
- Control of construction site stormwater runoff;
- Management of stormwater impacts associated with post-construction;
- Illicit discharge detection and elimination; and
- Municipal pollution prevention.

Once high levels of bacteria are present in a water body, it is more difficult and expensive to restore it to a less impacted condition. The widespread use of BMPs for pollution prevention, illicit discharge detections, and elimination (IDDE), erosion and sediment control, and outreach and education are critical in meeting water quality goals for the Trinity River and its tributaries.

Existing requirements of MS4 permits address some important elements of bacteria loading in stormwater, offering an adaptive rather than prescriptive approach to bacteria reduction. Structural BMPs, such as modifications to stormwater outfalls that may reduce bacteria through aeration, treatment by sunlight, or physical removal of contaminants, have the potential to reduce bacteria loading into waterways. Because there is limited data regarding how well such BMPs might reduce bacteria loading, the Coordination Committee has identified the evaluation of the effectiveness of stormwater implementation activities as one of the top research priorities. Any research, particularly research relevant to the Greater Trinity area, should be reported and shared with Project stakeholders, so that stakeholders can devise appropriate strategies for integrating structural stormwater BMPs into their activities (see Implementation Strategy 8.0).

A map of MS4s in the project area is shown in Figure 7. A list of stormwater permits in the project area is provided in tables 19 and 20.

## Implementation Strategy 2.0: MS4 participation in Regional Stormwater Management Program

Local and state governments along with transportation entities with MS4 permits currently employ extensive and innovative stormwater programs, and many participate in the Regional Stormwater Management Program (RSWMP). The RSWMP already includes several programs relevant to bacteria loading and this I-Plan. The programs include Construction, Illicit Discharge, Monitoring, Pollution Prevention, and Public Education. Additionally, regionally developed initiatives and cooperative purchases are also part of the program. Because of the extensive involvement of the RSWMP in existing stormwater efforts, as well as its regional scope and contacts, partnering with the program and supporting the inclusion of bacteria-specific elements is the logical choice and takes advantage of existing knowledge and infrastructure. A list of RSWMP participants can be found in Table 21, while a summary of this implementation strategy can be found in Table 16.

### 2.0.1: Request Regional Stormwater Management Coordinating Council include bacteria in RSWMP program efforts and materials

Given the broad scope of RSWMP programs and tools, the Coordination Committee requests the Regional Stormwater Management Coordinating Council (RSWMCC) direct their committees to review each program's materials for inclusion of relevant information on bacteria load reduction.

#### *2.0.1.1: IDDE program participation*

An illicit discharge is defined as any discharge to the MS4 that is not composed entirely of stormwater (except for discharges allowed under a TPDES permit). Non-stormwater discharges can originate from direct connections to the storm drain system, from business or commercial establishments (illicit connections), or indirectly as improper surface discharges to the storm drain system.

Illicit plumbing connections may be intentional or may be unknown to a property owner and often are due to the connection of floor drains to the storm sewer system. As a result of these illicit connections, wastewater that should receive treatment from a WWTF directly enters storm drains and local surface waters and subsequently negatively impacts bacteria loading.

Additional sources of illicit discharges may come from failing septic systems, illegal dumping practices, and the improper disposal of sewage from recreational practices such as boating or camping.

NCTCOG and the Coordination Committee encourage all MS4s within the Project area to participate in the RSWMP and continue and expand where necessary, their programs for IDDE through participation in existing training and educational initiatives. Stakeholders also encourage the RSWMP's IDDE Task Force to introduce or add bacteria-enhancing pollutant detection training and materials with examples from slaughter facilities, pet training/housing, farmers markets, sewage processors, zoos, etc.

#### *2.0.1.2: Inclusion of bacteria load reduction in Pollution Prevention Peer-to-Peer program and evaluation of modified Peer-to-Peer program for five years*

Peer-to-Peer is a program of the RSWMP's Pollution Prevention (P2) Task Force. The program provides site visits to assess good housekeeping procedures in MS4s which can result in cost savings in production, materials, and disposal; increase public awareness of local water quality issues; and provides safer working conditions for city/county staff.

The Coordination Committee requests the RSWMCC direct the P2 Task Force to expand the existing Peer-to-Peer review program to include awareness about good housekeeping procedures that may help reduce bacteria loading. Additionally, the Committee requests the P2 Task Force continue the modified Peer-to-Peer program over a five-year permit term allowing for reevaluation of program effectiveness.

**Table 16. Implementation Strategy 2.0 Summary — MS4 participation in Regional Stormwater Management Program**

| | |
|---|---|
| Targeted Source(s) | Stormwater |
| Estimated Potential Load Reduction | IS 2.0 – 2.0.1.2 may result in a 10% reduction over 25 years by contributing to the reduction of the stormwater bacteria load through education and cooperative efforts among various stakeholders |
| Technical and Financial Assistance Needed | Technical: participation in the RSWMP provides technical assistance for MS4s under several areas including construction, illicit discharge, monitoring, pollution prevention, and public education; some technical assistance may be necessary for the RSWMP to incorporate bacteria in their programs<br><br>Financial: participation in the RSWMP is based on cost share and varies depending on MS4 size; inclusion of bacteria information is unlikely to exceed existing funding sources |
| Education Component | Outreach to non-participating MS4s regarding benefits of participation in the RSWMP<br><br>Outreach to RSWMP's RSWMCC for inclusion of bacteria in their existing |

| | |
|---|---|
| | programs |
| Schedule of Implementation | Beginning immediately as appropriate Coordination Committee members, technical subcommittee members, and NCTCOG will conduct outreach to non-participants regarding benefits of RSWMP<br><br>Beginning immediately as appropriate Coordination Committee and technical subcommittee members already involved in RSWMP and/or the RSWMCC will approach the RSWMCC regarding inclusion of bacteria in existing programs and materials |
| Interim, Measurable Milestone | Non-RSWMP MS4s approached<br><br>RSWMCC approached for inclusion of bacteria in materials and programs |
| Progress Indicators | Number of RSWMP participants increases<br><br>Bacteria-specific information included in RSWMP programs and materials |
| Monitoring Component | NCTCOG will collect data on RSWMP participation and programs and materials |
| Responsible Entity | Coordination Committee and technical subcommittee members with ties to RSWMP and/or RSWMCC will conduct outreach to non-participating MS4s and RSWMCC<br><br>RSWMCC will consider inclusion of bacteria-specific information in RSWMP outreach materials and programs<br><br>NCTCOG will assist the Coordination Committee and Stormwater technical subcommittee with outreach and will present participation data and material and program updates annually to the Coordination Committee and Stormwater technical subcommittee |

## Implementation Strategy 2.1: Local Supplemental Environmental Projects

At the state level, the TCEQ defines supplemental environmental projects (SEPs) as, "[A] project that prevents pollution, reduces the amount of pollution reaching the environment, enhances the quality of the environment, or contributes to public awareness of environmental matters. A respondent in an enforcement action may negotiate an agreement to perform a SEP in return for an offset of the administrative penalty. The proposal to include a particular SEP in an agreed order will be presented to the Commission or Executive Director for consideration and final approval. Potential SEPs include such diverse projects as cleanups of abandoned tire sites or illegal dump sites, community collections of household hazardous waste, and pollution prevention projects that exceed regulatory requirements. SEPs that have a direct benefit allow a respondent to offset one dollar of its penalty for every dollar spent on the SEP (TCEQ, 2012a)."

Detailed in Table 17, the purpose of Implementation Strategy 2.1 is to bring the idea of SEPs to the local level — outside of the scope of the state and solely the purview of the individual local jurisdiction. Local

SEPs are intended for watershed improvements and other environmentally beneficial projects that a respondent agrees to undertake in settlement of an enforcement action, but which the respondent is not otherwise legally required to perform, and for which he/she does not receive any other benefit. The local SEPs can be negotiated through the regulatory enforcement process with the city or other regulated MS4s with enforcement capabilities.

The Coordination Committee encourages local municipalities to adopt or continue using local SEPs — separate, but not to the exclusion of the state SEP program — in addition to fines, as part of escalating enforcement programs for unfunded local stormwater projects to reduce bacteria loading. As such, a goal of 75 percent of large municipal MS4s within bacteria-impaired watersheds will have local SEPs as part of stormwater enforcement by 2028 and 25 percent of small municipal MS4s will have such a program by 2033.

**Table 17. Implementation Strategy 2.1 Summary — Local Supplemental Environmental Projects**

| | |
|---|---|
| Targeted Source(s) | Stormwater |
| Estimated Potential Load Reduction | IS 2.1 may result in a 4% reduction over 25 years by providing an additional source of funds that can be used for projects that will reduce bacterial loads. Use of local SEPs may also better engage violators in the process of improving water quality locally |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary for entities to implement their own local SEP program<br><br>Financial: existing funding as appropriate |
| Education Component | Information will be made available for local SEP implementation |
| Schedule of Implementation | 75% of large municipal MS4s will have local SEP programs in place by 2028<br><br>25% of small municipal MS4s will have local SEP programs in place by 2033 |
| Interim, Measurable Milestone | By 2023, 50% of large municipal MS4s will have local SEP programs in place<br><br>By 2028, 15% of small municipal MS4s will have local SEP programs in place |
| Progress Indicators | Number of municipal MS4s with local SEP programs |
| Monitoring Component | NCTCOG will collect data on municipal MS4 local SEP programs |
| Responsible Entity | Municipal MS4s will adopt local SEP programs as feasible<br><br>NCTCOG will compile information on SEP programs for an annual report to Coordination Committee and Stormwater technical subcommittee |

## Implementation Strategy 2.2: Land use and business evaluation

Analyses by the Project's technical review subcommittee members revealed a potential gap in many existing stormwater codes and regulations with respect to addressing discharges with the potential to carry bacteria. As currently written, many rules, including the base stormwater discharge permits, focus on chemical or physical constituents, such as toxic chemicals or sediment, but may not completely address bacterial sources or discharges. Examples of facilities that may pose a risk for bacterial discharge include, but are not limited to: slaughter houses and meat-processing facilities, stables and pet-boarding facilities, sewage processors, produce packing facilities, and farmer's markets. Implementation strategies for land use and business evaluation are summarized in Table 18.

### 2.2.1: Business risk evaluation and enforcement

Municipalities will review their respective codes and ordinances and, as feasible, revise as necessary to address the discharge of bacteria, nutrients, and other substances that could contribute to bacterial growth in the environment.

### 2.2.2: Request to TCEQ for Industrial Stormwater Multi-Sector General Permit classification review and benchmark bacteria monitoring

TCEQ is encouraged to review, and as necessary amend the TPDES No. TXR050000, Multi-Sector General Permit (MSGP) to require facilities located in bacteria-impaired watersheds with operations having the potential to discharge bacteria, (such as the current Sector U, Food and Kindred Products Facilities), to perform benchmark sampling for bacteria.

**Table 18. Implementation Strategy 2.2 Summary — Land use and business evaluation**

| | |
|---|---|
| Targeted Source(s) | Businesses/facilities at risk for bacterial discharge |
| Estimated Potential Load Reduction | IS 2.2 – 2.2.2 may result in a 2% reduction in bacteria loading as problems are identified and corrected over 25 years |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary for MS4s to develop and study their own land use and evaluate businesses with potential to discharge bacteria<br><br>Financial: loans, grant funding and existing funding as appropriate |
| Education Component | Outreach to MS4s concerning land use and business evaluation may be necessary<br><br>Educational efforts by MS4s regarding operations and land use to businesses with potential to discharge bacteria<br><br>Outreach to impacted businesses should TCEQ amend MSGP requirements |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |

| | |
|---|---|
| Interim, Measurable Milestone | Number of local evaluations completed<br><br>Number of site visits to businesses with potential to discharge bacteria |
| Progress Indicators | Number of reported program expansion and/or modifications to address high risk businesses<br><br>Changes to MSGP requirements |
| Monitoring Component | NCTCOG will collect data on local efforts and any changes to the TCEQ MSGP |
| Responsible Entity | MS4s will evaluate local land use and businesses for potential for bacteria discharges<br><br>NCTCOG will coordinate dialogue between MS4s, stakeholders and TCEQ to identify potential modifications to the MSGP that will aid in addressing bacteria as a pollutant and benchmark bacteria monitoring<br><br>NCTCOG will compile data collected on local efforts and any changes to the TCEQ MSGP and present it annually to Coordination Committee and Stormwater technical subcommittee |

**Table 19. MS4 Permittees by AU for 0805 and 0822 Segments**

| AU | MS4 Permittees | TPDES Permit Number |
|---|---|---|
| 0805_03 | City of Dallas | WQ0004396 |
| 0805_03 | TxDOT – Dallas | WQ0004521 |
| 0805_03 | North Texas Tollway Authority | WQ0004400 |
| 0805_03 | Dallas Area Rapid Transit | TXR040000 |
| | | |
| 0805_04 | City of Dallas | WQ0004396 |
| 0805_04 | City of Irving and co-permittees: Dallas Co. Flood Control District #1, Dallas County Utility & Reclamation District, Irving Flood Control District Sections I & III | WQ0004691 |
| 0805_04 | TxDOT – Dallas | WQ0004521 |
| 0805_04 | North Texas Tollway Authority | WQ0004400 |
| 0805_04 | City of University Park | TXR040000 |
| 0805_04 | Town of Highland Park | TXR040000 |
| 0805_04 | City of Cockrell Hill | TXR040000 |
| 0805_04 | Dallas Area Rapid Transit | TXR040000 |
| 0805_04 | Buckley Oil Company [b] | WQ0004663 |
| | | |
| 0822A | City of Irving and co-permittees: Dallas Co. Flood Control District #1, Dallas County Utility & Reclamation District, Irving Flood Control District Sections I & III | WQ0004691 |
| 0822A | North Texas Tollway Authority | WQ0004400 |
| 0822A | DFW International Airport [a] | TXR040000 |
| | | |
| 0822B | City of Irving and co-permittees: Dallas Co. Flood Control District #1, Dallas County Utility & Reclamation District, Irving Flood Control District Sections I & III | WQ0004691 |
| 0822B | City of Dallas | WQ0004396 |
| 0822B | TxDOT– Dallas | WQ0004521 |
| 0822B | City of Coppell | TXR040000 |
| 0822B | DFW International Airport [a] | TXR040000 |

[a] Includes five outfalls covered under an individual industrial stormwater permit (WQ0001441).
[b] Individual industrial stormwater permit included as part of the MS4 allocation.

**Table 20. MS4 Permittees by AU for 0841 Segments**

| AU | MS4 Permittees | TPDES Permit Number |
|---|---|---|
| 0841_01 | City of Irving and co-permittees: Dallas Co. Flood Control District #1, Dallas County Utility & Reclamation District, Irving Flood Control District Sections I & III | WQ0004691 |
| 0841_01 | City of Arlington and co-permittees: University of Texas at Arlington and TxDOT-Fort Worth | WQ0004635 |
| 0841_01 | City of Dallas | WQ0004396 |
| 0841_01 | City of Fort Worth and co-permittees: Tarrant Regional Water District, and TxDOT-Fort Worth | WQ0004350 |
| 0841_01 | North Texas Tollway Authority | WQ0004400 |
| 0841_01 | TxDOT – Dallas | WQ0004521 |
| 0841_01 | City of Grand Prairie | TXR040000 |
| 0841_01 | City of Keller | TXR040000 |
| 0841_01 | City of Colleyville | TXR040000 |
| 0841_01 | City of Southlake | TXR040000 |
| 0841_01 | City of Grapevine | TXR040000 |
| 0841_01 | City of Euless | TXR040000 |
| 0841_01 | City of North Richland Hills | TXR040000 |
| 0841_01 | City of Bedford | TXR040000 |
| 0841_01 | City of Hurst | TXR040000 |
| 0841_01 | Tarrant County | TXR040000 |
| 0841_01 | Dallas County | TXR040000 |
| 0841_01 | TxDOT – Fort Worth | TXR040000 |
| 0841_01 | DFW International Airport [a] | TXR040000 |
| 0841_01 | Dallas Area Rapid Transit | TXR040000 |
| 0841_01 | North Texas Tollway Authority | TXR040000 |
| 0841_01 | Dallas Co. Flood Control Dist. No. 1 | TXR040000 |
| 0841_01 | Extex LaPorte LP [b] | WQ0001250 |

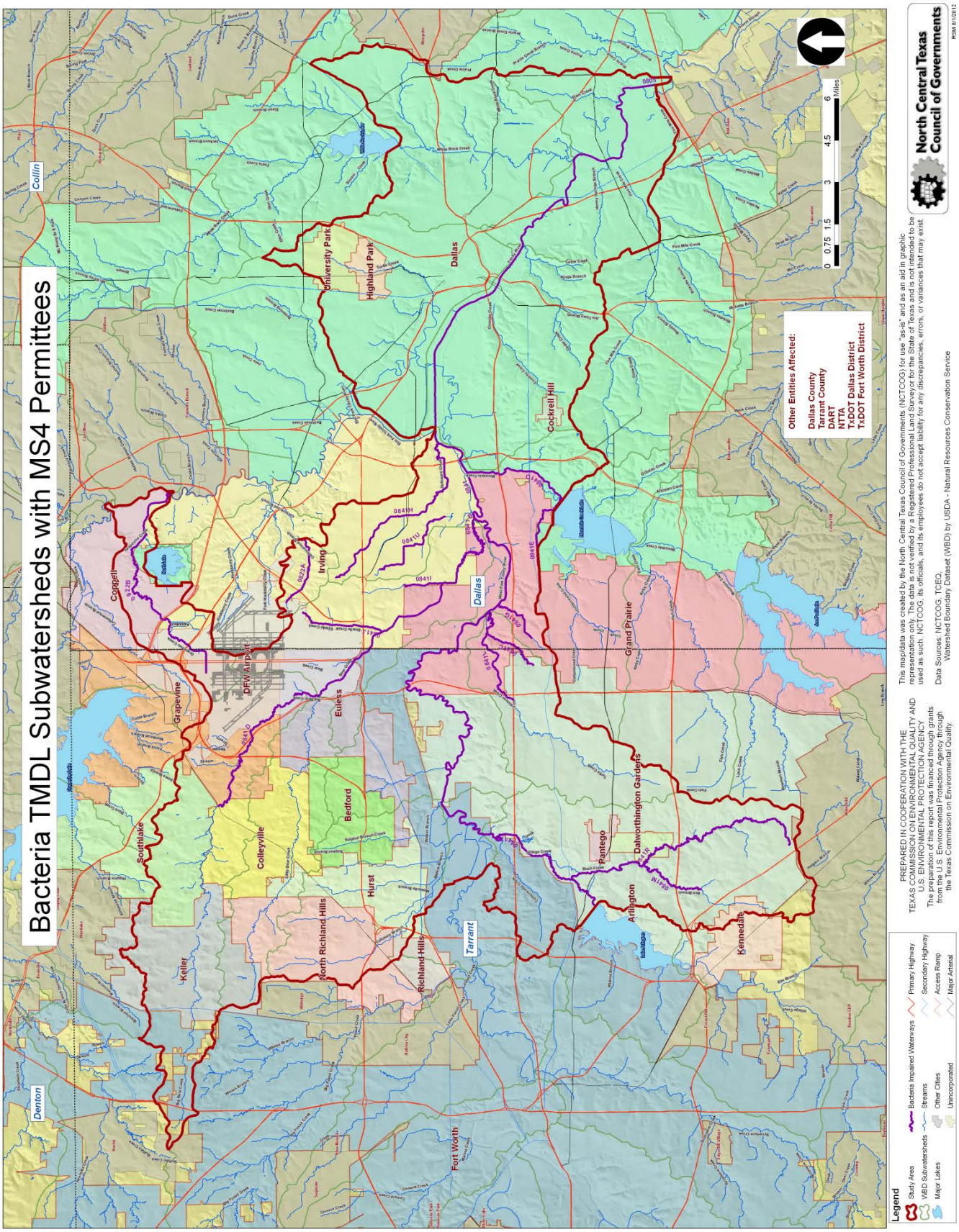
[a] Includes five outfalls covered under an individual industrial stormwater permit (WQ0001441).
[b] Individual industrial stormwater permit included as part of the MS4 allocation.

| AU | MS4 Permittees | TPDES Permit Number |
|---|---|---|
| 0841_02 | City of Arlington and co-permittees: University of Texas at Arlington and TxDOT-Fort Worth | WQ0004635 |
| 0841_02 | City of Fort Worth and co-permittees: Tarrant Regional Water District, and TxDOT-Fort Worth | WQ0004350 |
| 0841_02 | TxDOT – Dallas | WQ0004521 |
| 0841_02 | City of North Richland Hills | TXR040000 |
| 0841_02 | City of Hurst | TXR040000 |
| 0841_02 | City of Bedford | TXR040000 |
| 0841_02 | City of Grand Prairie | TXR040000 |
| 0841_02 | City of Euless | TXR040000 |
| 0841_02 | City of Dalworthington Gardens | TXR040000 |
| 0841_02 | Town of Pantego | TXR040000 |
| 0841_02 | City of Kennedale | TXR040000 |
| 0841_02 | City of Colleyville | TXR040000 |
| 0841_02 | Tarrant County | TXR040000 |
| 0841_02 | Tarrant County College NE | TXR040000 |
| 0841_02 | TxDOT-Fort Worth | TXR040000 |
| 0841_02 | Dallas Area Rapid Transit | TXR040000 |

**Table 21. RSWMP Participation in Project Area as of FY2012**

| Participants in RSWMP | Non-Participants |
|---|---|
| City of Arlington | City of Cockrell Hill |
| City of Bedford | City of Dalworthington Gardens |
| City of Colleyville | City of Haslet |
| City of Coppell | DFW Airport |
| City of Dallas | Town of Pantego |
| City of Euless | |
| City of Fort Worth | |
| City of Grand Prairie | |
| City of Grapevine | |
| City of Hurst | |
| City of Irving | |
| City of Keller | |
| City of Kennedale | |
| City of North Richland Hills | |
| City of Southlake | |
| City of University Park | |
| Dallas Area Rapid Transit | |
| Dallas County | |
| North Texas Tollway Authority | |
| Tarrant County | |
| TxDOT Dallas District | |
| TxDOT Fort Worth District | |
| Town of Highland Park | |

**Figure 7. MS4s in Project Area**



## Planning and Development Implementation Strategies

The Greater Trinity River Bacteria TMDL I-Plan Project area has experienced rapid population growth resulting in increased land development, which in turn has led to challenges in maintaining waterways as areas for recreation. According to the 2010 US Census, the project area is home to 1.33 million people and given its mostly urban, suburban, and industrial land uses, the aggregate impact of so many people and impervious surfaces has the ability to impact bacteria levels in the waterways. Figure 8 shows land use in the Project area based on 2005 data, while Figure 9 shows population density based on 2010 US Census information (NCTCOG, 2012a).

Concerns about population growth, the associated stormwater from development, and the impact on stormwater quality must be addressed as part of reducing bacteria levels. Green Infrastructure (GI) uses vegetation, soils, and natural processes to manage water and create healthier urban environments. At the scale of a city or county, GI refers to the patchwork of natural areas that provides habitat, flood protection, lowered bacteria loading, and cleaner water. Brought to the scale of a neighborhood or site, GI refers to stormwater management systems that mimic nature by soaking up and storing water (USEPA, 2012a).

Similar, although not identical to GI, is Low Impact Development (LID). LID is an approach to land development (or redevelopment) that works with nature to manage stormwater as close to its source as possible. LID employs principles, such as preserving and recreating natural landscape features, and minimizing effective imperviousness to create functional and appealing site drainage that treats stormwater as a resource rather than a waste product. There are many practices that have been used to adhere to these principles such as bioretention facilities, rain gardens, vegetated rooftops, rain barrels, and permeable pavements. By implementing LID principles and practices, water can be managed in a way that reduces the impact of built areas and promotes the natural movement of water within an ecosystem or watershed. Applied on a broad scale, LID can maintain or restore a watershed's hydrologic and ecological functions. LID has been characterized as a sustainable stormwater practice by the Water Environment Research Foundation and others (USEPA, 2012b).

Another tool for reducing stormwater impact is the *integrated* Stormwater Management (iSWM) Program for Construction and Development, a cooperative initiative through NCTCOG that assists cities and counties to achieve their goals of water quality protection, streambank protection, and flood mitigation, while also helping communities meet their construction and post-construction obligations under state stormwater permits.

iSWM considers that development and redevelopment by their nature increase the amount of imperviousness in the surrounding environment. This increased imperviousness translates into loss of natural areas, more sources for pollution, such as bacteria, in runoff, and heightened flooding risks. To help mitigate these impacts, more than 60 local governments in the NCTCOG region are cooperating to proactively create sound stormwater management guidance for the region through the iSWM Program (NCTCOG, 2012b).

**Figure 8. Land Use in Project Area**

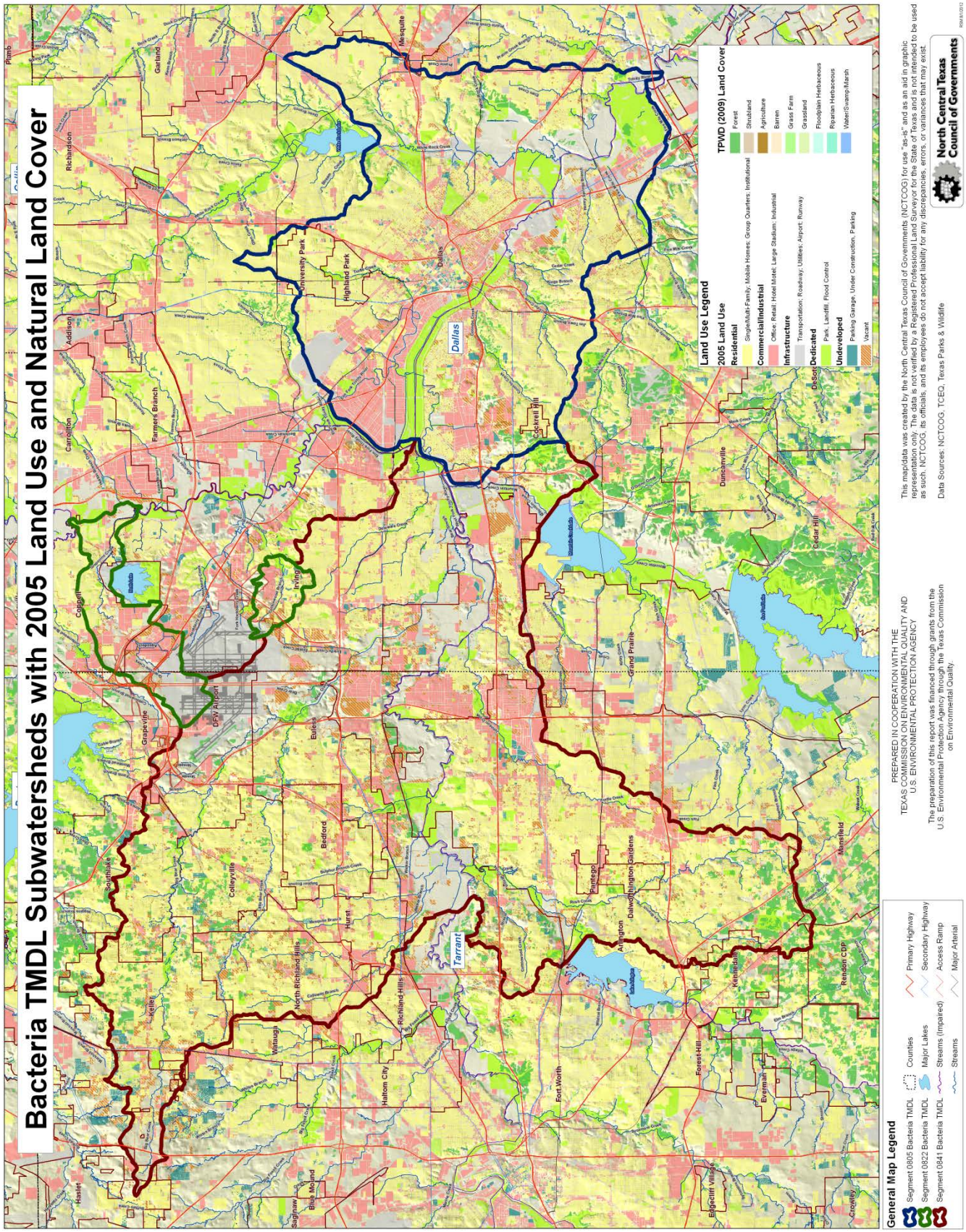
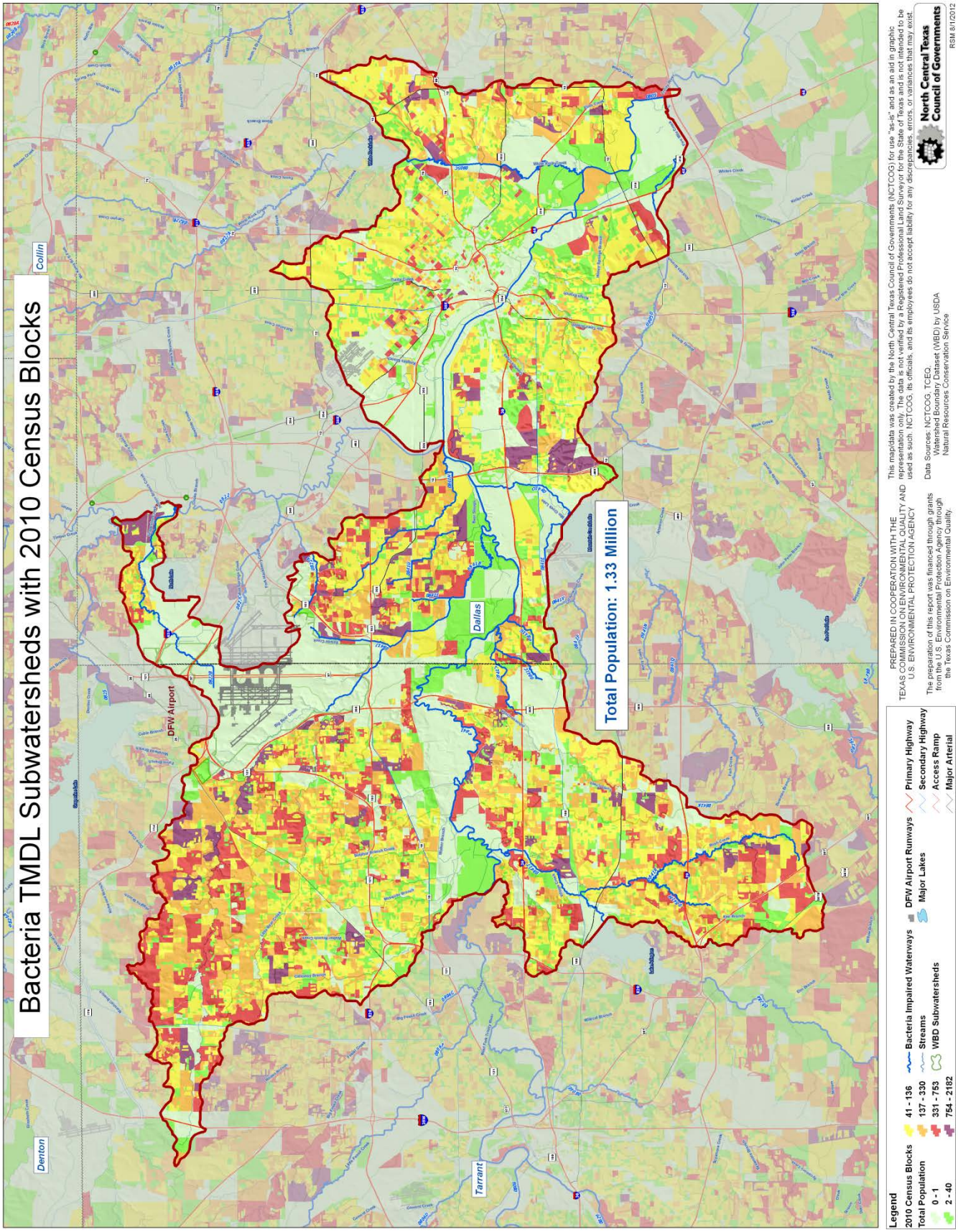

Bacteria TMDL Subwatersheds with 2005 Land Use and Natural Land Cover
Land Use Legend
2005 Land Use
Residential
Single/Multi-Family; Mobile Homes; Group Quarters; Institutional
Commercial/Industrial
Office; Retail; Hotel Motel; Large Stadium; Industrial
Infrastructure
Transportation; Roadway; Utilities; Airport; Runway
Dedicated
Park, Landfill, Flood Control
Undeveloped
Parking Garage, Under Construction, Parking
Vacant
TPWD (2009) Land Cover
Forest
Shrubland
Agriculture
Barren
Grass Farm
Grassland
Floodplain Herbaceous
Riparian Herbaceous
Water/Swamp/Marsh
General Map Legend
Segment 0805 Bacteria TMDL
Segment 0822 Bacteria TMDL
Segment 0841 Bacteria TMDL
Counties
Major Lakes
Streams (Impaired)
Streams
Primary Highway
Secondary Highway
Access Ramp
Major Arterial
PREPARED IN COOPERATION WITH THE
TEXAS COMMISSION ON ENVIRONMENTAL QUALITY AND
U.S. ENVIRONMENTAL PROTECTION AGENCY
The preparation of this report was financed through grants from the
U.S. Environmental Protection Agency through the Texas Commission
on Environmental Quality.
This map/data was created by the North Central Texas Council of Governments (NCTCOG) for use "as-is" and as an aid in graphic representation only. The data is not verified by a Registered Professional Land Surveyor for the State of Texas and is not intended to be used as such. NCTCOG, its officials, and its employees do not accept liability for any discrepancies, errors, or variances that may exist.
Data Sources: NCTCOG, TCEQ, Texas Parks & Wildlife
North Central Texas
Council of Governments
Dallas
Tarrant
Richardson
Garland
Mesquite
Addison
Carrollton
Farmers Branch
University Park
Highland Park
Coppell
Irving
Grapevine
DFW Airport
Euless
Bedford
Colleyville
Southlake
Keller
Watauga
North Richland Hills
Hurst
Richland Hills
Haltom City
Fort Worth
Grand Prairie
Pantego
Arlington
Dalworthington Gardens
Kennedale
Forest Hill
Everman
Mansfield
Rendon CDP
Cockrell Hill
Duncanville
Cedar Hill
DeSoto
Eagle Mountain Lake
Lake Ray Hubbard
Lake Lewisville
Lake Grapevine
Lake Arlington
Joe Pool Lake
Lake Ellis
Lake Waxahachie
Lake Bardwell
Lake Ennis
Lake Navarro Mills
Lake Corsicana
Lake Halbert
Lake Weatherford
Lake Benbrook
Lake Worth
Lake Cleburne
Lake Granbury
Lake Whitney
Lake Aquilla
Lake Waco
Lake Ft. Phantom Hill
Lake Sweetwater
Lake Ft. Worth
Lake Ft. Worth
Lake Ft. Worth

**Figure 9 - Population Density from 2010 US Census Data**



## Implementation Strategy 3.0: Adoption of Green Infrastructure and Low Impact Development Standards by Municipalities

Stakeholders are committed to expanding the use of GI, LID, and iSWM throughout the Project area. Although none of these practices focuses specifically on bacteria, measures slowing stormwater flow and increasing filtration will reduce bacteria carried by sheet flow into storm drains, creeks, and lakes thereby helping to reduce bacteria loading in the watersheds of the Project area. The Coordination Committee encourages 25 percent of municipalities within bacteria-impaired watersheds to adopt GI and/or LID standards for all sizes of development in their comprehensive plans by 2023 and 50 percent of cities do so by 2038. Implementation strategies for Green Infrastructure and LID are summarized in Table 22.

### 3.0.1: Reevaluation of development standards based on monitoring data

The lack of applicable data makes it difficult to assess the impact of implementation of practices like LID and GI and programs like iSWM. The current lack of information makes it even more important for stakeholders to do their own internal study of the effectiveness of development standards using stream monitoring data. Municipal stakeholders are encouraged to reevaluate development standards based on monitoring data no less than every five years in conjunction with the MS4 permit cycle.

### 3.0.2: Municipal ordinance evaluation for water quality impediments

By 2017, 25 percent of municipal stakeholders will evaluate their ordinances for impediments that discourage homeowners and businesses from actions or practices that may improve water quality. Fifty percent of municipalities will do so by 2023. Examples of impediments may include prohibitions on cisterns, rain barrels, or permeable pavement.

### 3.0.3: Internal policy and procedure integration and improved communication for municipalities

Municipal stakeholders are encouraged to evaluate city departmental structure and internal operations to better integrate policies and practices and improve communication between related departments. Additionally, municipalities are encouraged to evaluate internal practices and procedures for impediments to cooperation among stormwater-related divisions and departments with related goals, such as parks and recreation, public works, planning and development, and environmental management.

**Table 22. Implementation Strategy 3.0 Summary — Adoption of Green Infrastructure and Low Impact Development Standards by municipalities**

| | |
|---|---|
| Targeted Source(s) | Construction, development, and redevelopment |
| Estimated Potential Load Reduction | IS 3.0 – 3.0.3 may result in a 40% reduction in bacteria loading if GI and LID are implemented to the fullest extent possible over the next 25 years |
| Technical and Financial Assistance Needed | Technical: engineering and/or technical assistance may be necessary to implement changes including the adoption of LID/GI standards, reevaluating development standards based on monitoring data, inclusion of construction BMPs, post construction review, and demonstration projects |

| | |
|---|---|
| | Financial: loans, grants, local SEPs, and existing funding as appropriate |
| Education Component | Sample ordinances will be developed as resources are available<br><br>Outreach to local entities as to the importance of measuring BMP results<br><br>Sample SOPs for evaluating internal procedures will be developed as resources are available<br><br>Online resources will include pertinent materials |
| Schedule of Implementation | 25% of municipalities will evaluate their ordinances for impediments that discourage actions or practices that may improve water quality with 50% doing so by 2023<br><br>25% of municipalities encouraged to adopt LID/GI standards by 2023 with 50% adopting such standards by 2038<br><br>Other provisions for sample ordinances, sample SOPs, and online resources to be implemented immediately as resources are available |
| Interim, Measurable Milestone | Municipalities evaluating their ordinances<br><br>Municipalities with LID/GI requirements in their ordinances<br><br>Municipalities measuring BMP results<br><br>Municipalities using LID/GI in demonstration projects |
| Progress Indicators | Number of ordinances evaluated<br><br>Number of ordinances containing LID/GI requirements<br><br>Results from BMP monitoring available in BMP Library (see IS 8.0)<br><br>Number of pilot project results available in the BMP Library |
| Monitoring Component | NCTCOG and the Planning and Development technical subcommittee will collect information regarding ordinances and projects |
| Responsible Entity | Municipalities will evaluate their respective ordinances, adopt LID/GI as feasible, measure BMP results, and make those results available for inclusion in BMP Library<br><br>Municipalities will adopt LID/GI as feasible, measure BMP results, and make those results available for inclusion in BMP Library<br><br>NCTCOG and Planning and Development technical subcommittee will collect information on ordinances and projects for inclusion in an annual report to Coordination Committee |

## Implementation Strategy 3.1: Recognition program participation

Recognition programs that provide awards for GI and LID development increase awareness of the benefits of these practices and help promote adoption throughout the Project area. Stakeholders and NCTCOG encourage voluntary participation in existing recognition programs. Several voluntary programs that promote land development and stormwater have been developed or are being developed, including, but not limited to: Celebrating Leadership in Development Excellence, Leadership for Energy & Environmental Design for Neighborhood Development Rating System; International Green Construction Code; and National Green Building Standard. Although these programs do not focus specifically on bacteria reduction, they do contain elements that promote uses of GI and LID that may help reduce bacteria loading. As summarized in Table 23, the Coordination Committee encourages local governments and land developers to promote these programs and similar programs as appropriate.

### 3.1.1: Local policy and regulation evaluation for impediments for participation

Local governments should analyze their own regulations and programs in an effort to eliminate hurdles to the attainment of the requirements in these programs. For example, zoning density standards, storm sewer connection requirements, and minimum parking and road widths, can limit opportunities for GI.

### 3.1.2: Promotional efforts for recognition programs

NCTCOG and stakeholders will make an effort to publicize programs and winning projects in order to further educate the general public, elected officials, and private sector businesses about the benefits of LID and GI.

**Table 23. Implementation Strategy 3.1 Summary — Recognition program participation**

| | |
|---|---|
| Targeted Source(s) | Construction, development, and redevelopment |
| Estimated Potential Load Reduction | IS 3.1 – 3.1.2 may result in a 4% reduction over 25 years and is intended to encourage greater use of GI and LID, which should assist in reducing stormwater bacteria loads |
| Technical and Financial Assistance Needed | Technical: no technical assistance is necessary for this activity<br><br>Financial: financial assistance through loans, grant and local funding and SEPs |
| Education Component | NCTCOG and participating stakeholders will promote and encourage participation in voluntary recognition programs that encourage GI/LID<br><br>Stakeholders will evaluate ordinances, policies, and procedures for impediments for participation in such programs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Increased local participation in LID/GI building contests and programs |

| | |
|---|---|
| Progress Indicators | Number of participants<br><br>Fewer impediments to participation |
| Monitoring Component | Number of participants and number of programs identified |
| Responsible Entity | Participating stakeholders and NCTCOG will work to promote participation in voluntary recognition programs for GI/LID as feasible |

## Implementation Strategy 3.2: Construction sites

Continued population growth in the Greater Trinity River Bacteria TMDL I-Plan Project area creates a demand for new structures and expanded infrastructure. Construction sites for residential, commercial, and linear projects are common throughout the region. Although construction sites are not generally viewed as significant sources of bacteria, they can contribute sediment and nutrients through runoff and erosion and poorly managed portable toilet facilities (as detailed in Implementation Strategy 1.7.2). Bacteria may be found at construction sites in products used for fertilization and landscaping and from improper disposal of on-site sanitary wastes. Bacteria may also attach to sediment. Runoff from construction sites may contain constituents, such as nutrients, solids, fine particles, and other solid material, which could potentially influence bacteria levels in waterways.

When a construction site complies with the TCEQ Construction General Permit (CGP), TXR150000, as well as local stormwater management regulations, sediment and bacteria in runoff can be minimized. Problems arise when construction sites do not have adequate erosion and sediment controls. The Coordination Committee believes construction site regulations are adequate, in that they require sediment be retained on-site to the extent practicable. It is the small number of state or local enforcement staff, faced with an overwhelming number of construction sites at any given time, which accounts for the inadequate enforcement of and, subsequently, limited compliance with the CGP in some areas. Table 24 summarizes the implementation strategies for construction sites.

### 3.2.1: Construction site inspection programs

As applicable, enforcement at construction sites should be intensified by increasing the percentage of sites inspected. TCEQ through implementation of Minimum Control Measure (MCM) 4, local governments or other MS4 operators will evaluate the need for staffing an appropriate construction inspection program. Additional inspectors will be obtained if needed and as resources are available.

### 3.2.2: Educational materials for contractors, site owners, developers, and MS4 operators

As resources are available, NCTCOG and stakeholders will develop and distribute to MS4s educational material to inform contractors, construction site owners, developers, and MS4 operators of proper construction site practices. These educational materials are intended to encourage conformance with requirements by regulated entities. Educational materials will also have specific components to address contractors, construction site owners, and MS4 operator education. The material will discuss why it is important to prevent sediment from leaving construction sites, outline general regulations to which a construction site must adhere, and provide contact information for reporting suspected violations. Examples of publications that might be used

as models are those in the integrated Stormwater Management (iSWM) Program: iSWM Criteria Manual, iSWM Technical Manual, iSWM Tools, and iSWM Program Guidance.

#### 3.2.3: Citizen participation and education efforts

As resources allow, educational materials will also be used to foster active citizen participation in improving water quality through the reporting of construction sites with poor housekeeping and sediment control practices. This public education effort may be combined with efforts described in other sections of the I-Plan to expand homeowner education efforts throughout the region to take advantage of economies of scale. Increasing citizen knowledge may increase the likelihood of stormwater violations being reported and subsequently may increase the number of construction sites being brought into compliance.

#### 3.2.4: Training workshops

As resources are available, NCTCOG will conduct training workshops for contractors, construction site owners, developers, and MS4 operators regarding stormwater management BMPs and encourage them to require training of their crews. Contractors, construction site owners, developers, and MS4 operators are responsible for ensuring compliance. Therefore, it is in their best interest to ensure that construction workers under their supervision are properly trained in the installation and maintenance of erosion and sediment controls. As resources are available, NCTCOG will develop training workshops about existing and emerging construction site BMPs and requirements. The workshops will be designed to help operators communicate requirements to employees. Private construction operations should not be the only target of this activity. Local government departments, municipal districts, and other government entities involved in construction, and their contractors and subcontractors, also must properly install and maintain erosion and sediment controls and educate their personnel. Training local government inspectors is also essential in the effort to improve compliance.

#### 3.2.5: Use of BMPs for infrastructure maintenance

MS4s engaged in infrastructure maintenance should utilize BMPs to reduce discharge that may contain sediment.

#### 3.2.6: Reevaluation of construction site education programs and possible voluntary certification program

The Coordination Committee, through the recommendations of the Stormwater technical subcommittee, will evaluate construction site training programs every five years in conjunction with the MS4 permit term for possible inclusion into a voluntary certification program.

**Table 24. Implementation Strategy 3.2 Summary — Construction sites**

| | |
|---|---|
| Targeted Source(s) | Construction, development, and redevelopment |
| Estimated Potential Load Reduction | IS 3.2 – 3.2.6 may result in a 4% reduction in bacteria loading implemented to the fullest extent possible over the next 25 years |
| Technical and Financial Assistance Needed | Technical: the expertise and assistance of stormwater management professionals will be necessary to develop educational and training materials |

| | |
|---|---|
| | Financial: salaries for additional inspectors for local communities, and financial support for educational materials and training will be funded through a mixture of state, local, and grant funding |
| Education Component | Educational materials explaining proper construction site practices will be developed and distributed to contractors, construction site owners, MS4 operators, developers, and citizens<br><br>Training workshops will be held for contractors, construction site owners and operators, developers, and MS4 operators regarding stormwater management BMPs |
| Schedule of Implementation | As resources are available, the implementation of these activities will begin immediately and will continue for the entire implementation process<br><br>At five year intervals efficacy of the strategies will be reevaluated |
| Interim, Measurable Milestone | Evaluations conducted regarding the need or requirement for staffing an appropriate construction inspection program and subsequent increases in staffing levels as needed<br><br>Development, distribution, and offering of educational materials and trainings |
| Progress Indicators | Increases in inspection capacity<br><br>Number of educational materials distributed and number of groups receiving educational materials<br><br>Number of trainings offered and number of attendees<br><br>Number of Strategies reevaluated |
| Monitoring Component | Annual report on progress indicators to the Coordination Committee from NCTCOG |
| Responsible Entity | MS4s will evaluate the need or requirement for staffing for appropriate construction inspection programs, increase staffing as needed and as resources are available, and report progress indicators to NCTCOG<br><br>NCTCOG and stakeholders will develop and distribute educational materials and develop and offer trainings as resources are available<br><br>NCTCOG will report to Coordination Committee on progress indicators<br><br>NCTCOG will coordinate a dialogue between the stakeholders and TCEQ targeting opportunities for enhancing the effectiveness of construction site inspections by TCEQ where feasible, through enhanced resources or inspection management strategies |

## Pets, Livestock, and Wildlife Implementation Strategies

*E. coli* bacteria are common inhabitants of the intestines of all warm-blooded animals, including mammals and birds. As such, the potential for bacteria loading in waterways from pets, livestock, wildlife, and unmanaged feral animals was an important consideration in the development of this I-Plan. Wildlife and feral hogs are naturally attracted to riparian corridors of streams and rivers. With direct access to the stream channel, the direct deposition of wildlife waste can be a concentrated source of bacteria loading to a water body. Fecal bacteria from wildlife are also deposited onto land surfaces, where it may be washed into nearby streams by rainfall runoff. Like wildlife, livestock can also be concentrated around riparian areas. In the Dallas-Fort Worth metropolitan area, there is little open space for the housing of livestock — with the notable exception of the floodplain. This close proximity to the Trinity River and major tributaries and the direct deposition of livestock waste as its own concentrated source cannot be ignored as a potential contributor to *E. coli* levels in the Project area.

For the sake of this I-Plan, pets are defined exclusively as cats and dogs. Table 25 details pet populations by impaired stream segment. With a cat and dog population well over a half million within the Project area, the probable contribution of their waste to *E. coli* levels makes them too important to ignore even with the difficulties in estimating actual loading levels.

**Table 25. Dog and Cat Population by Impaired Segment**

| AU | Est. number of households | Estimated number of Dogs and Cats* | |
|---|---|---|---|
| | | Dogs | Cats |
| 0805_03 | 93,765 | 59,259 | 66,854 |
| 0805_04 | 94,475 | 59,709 | 67,361 |
| 0822A_02 | 5,602 | 3,540 | 3,994 |
| 0822B_01 | 11,673 | 7,377 | 8,323 |
| 0841_01 | 5,935 | 3,751 | 4,232 |
| 0841_02 | 35,089 | 22,176 | 25,018 |
| 0841B_01 | 32,344 | 20,441 | 23,061 |
| 0841C_01 | 1,410 | 891 | 1,006 |
| 0841E_01 | 321 | 203 | 229 |
| 0841G_01 | 2,823 | 1,784 | 2,013 |
| 0841H_01 | 18,254 | 11,537 | 13,015 |
| 0841J_01 | 3,941 | 2,490 | 2,810 |
| 0841L_01 | 25,612 | 16,187 | 18,261 |
| 0841M_01 | 10,425 | 6,589 | 7,433 |
| 0841R_01 | 32,278 | 20,399 | 23,014 |
| 0841T_01 | 16,437 | 10,388 | 11,719 |
| 0841U_01 | 7,508 | 4,745 | 5,353 |
| **TOTAL** | **397,892** | **251,466** | **283,696** |

*0805 segment information from 2011 TCEQ report, *Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River, Dallas, Texas*; 0822 segment information from 2011 TCEQ report, *Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek*; and 0841 data from 2012 TAIER report, *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in the Lower West Fork Trinity River Watershed*

## Implementation Strategy 4.0: Feral hog management

According to the Texas Parks and Wildlife Department (TPWD), feral hogs are listed as a nuisance species in Texas, which means they can be taken anytime with no season or quotas. Feral hogs are domestic hogs that either escaped or were released for hunting purposes. Hogs have four continuously growing tusks (two on top, two on bottom) and their contact causes a continuous sharpening of the lower tusks — making them a formidable weapon. They have relatively poor eyesight but have keen senses of hearing and smell. Feral hogs are distributed throughout much of Texas, frequently sharing the same habitat as white-tailed deer. Populations in Texas are thought to be on the rise and that increase in population and distribution is due in part to intentional releases, improved habitat, increased wildlife management, and improved animal husbandry through disease eradication, limited natural predators, and high reproductive potential. There appear to be very few inhibiting factors to curtail the feral hog's population growth and distribution although extreme arid conditions may impede it.

Feral hogs compete directly with livestock as well as game and nongame wildlife species for food. However, the main damage caused to livestock and wildlife is indirect destruction of habitat and agriculture commodities. Rooting and trampling activity for food can damage agricultural crops, fields,

and livestock feeding and watering facilities. Critical to bacteria control efforts, feral hogs also destabilize wetland areas, springs, and creeks by excessive rooting and wallowing, and their waste contributes to bacteria loading (TPWD, 2003). Implementation strategies for feral hogs are summarized in Table 26.

#### 4.0.1: Annual feral hog management workshop

With continuous effort, feral hogs can be managed. The Texas Wildlife Damage Management Service, a division of the Texas AgriLife Extension Service, and TPWD are valuable resources for training, technical assistance, and direct control in wildlife damage management including feral hog populations. As resources allow, NCTCOG will take advantage of the services provided by the Texas Wildlife Damage Management Service and TPWD by arranging one feral hog management workshop for stakeholders annually for five years beginning in 2014. If interest in workshops remains strong after five years, NCTCOG will continue to arrange workshops within the area covered by this I-Plan.

#### 4.0.2: Feral hog management forum

With the intent of promoting coordinated control efforts, NCTCOG will facilitate a twice yearly forum of local municipalities and other agencies focused on feral hog control and education efforts, evaluating BMPs, and discussing existing programs regionally and nationally.

#### 4.0.3: Feral hog management program

With the widespread impact of feral hogs, their breeding success, and their ability to travel long distances using riparian corridors (TPWD, 2003), the Coordination Committee encourages all municipalities to adopt feral hog control programs and to communicate and cooperate on feral hog control and education efforts, including participation in the feral hog management forum.

#### 4.0.4: Feral hog management funding opportunities

NCTCOG and stakeholders will seek funding opportunities, including grants and Supplemental Environmental Projects (SEP), for municipalities with financial need for a feral hog control program.

**Table 26. Implementation Strategy 4.0 Summary — Feral hog management**

| | |
|---|---|
| Targeted Source(s) | Feral hogs |
| Estimated Potential Load Reduction | IS 4.0 – 4.0.4 may result in a 5% reduction in bacteria loading contributed by increasing numbers of feral hogs over 25 years |
| Technical and Financial Assistance Needed | Technical: existing resources such as feral hog management trainings offered by TPWD, Texas Wildlife Damage Management Service, and others<br><br>Financial: grant funding and existing program funding |
| Education Component | An annual training workshop will be offered to stakeholders<br><br>A feral hog forum will be initiated for control effort coordination |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue in five-year increments pending evaluation |

| | |
|---|---|
| Interim, Measurable Milestone | One workshops per year for five years<br><br>Number of feral hog forum meetings |
| Progress Indicators | Number of attendees at annual workshop<br><br>Number of stakeholders reached<br><br>Number of stakeholders participating in coordinated control efforts |
| Monitoring Component | NCTCOG will collect information regarding number of trainings and participants, and forum participation |
| Responsible Entity | Wildlife agencies will conduct feral hog management training<br><br>Appropriate stakeholders will attend and participate in feral hog forum meetings and efforts<br><br>NCTCOG will coordinate trainings and forum meetings and provide an annual report to Coordination Committee |

## Implementation Strategy 4.1: Ordinance evaluation for livestock waste management, stocking rates, and related measures

There is only one concentrated animal feeding operation (CAFO) within the Project area. Lone Star Park, a horse racing facility near the Lower West Fork Trinity River (Segment 0841_01), is the area's sole CAFO, however, it has no exposure and no discharge and is not thought to be a contributor to *E. coli* levels in the Lower West Fork. Other livestock in the watershed are maintained on pasture or in small horse stables that do not meet the regulatory definition of a CAFO.

In Chapter 4E, Grazing Management of the 2003 *National Management Measures to Control Nonpoint Pollution from Agriculture* report (EPA 841-B-03-004), the impact of livestock waste is discussed, including that livestock generate microorganisms in waste deposits as they graze on pasture and rangelands and these wastes contain fecal bacteria in numbers on the order of $10^5 – 10^8$ organisms per gram of waste, or $10^9 – 10^{10}$ excreted per animal per day. In addition to such indicator organisms, livestock can also serve as an important reservoir of pathogens such as *E. coli* O157:H7. The extent of manure and microorganism deposition on grazing land typically depends on livestock density or stocking rate.

Release of microbes from manure deposited on grazing land is influenced by time, temperature, moisture, and other variables. Enhanced survival of microorganisms in fecal deposits on grazing land has been documented and the bacterial pollution potential of fecal deposits on grazing land is significant. Research has shown that fecal coliforms may survive in soil only 13 days in summer and 20 days in winter, but that cow fecal deposits provide a protective medium that permit microorganisms to survive for more than a year. Runoff from grazed land can contain high numbers of indicator microorganisms — in one study, fecal coliform (FC) counts of $10^3 – 10^5$ organisms/100 mL in pasture runoff. Another study reported that fecal coliform in runoff from simulated grazing plots were always higher ($2.4 \times 10^5 – 1.8 \times$

$10^6$ FC/100 mL) than counts from the ungrazed control plots (1.5 x $10^3$ FC/100 mL). It is worth noting, however, that microorganism counts in runoff from grazing land are typically several orders of magnitude lower than numbers from land where manure is deliberately applied (USEPA, 2003).

Ordinance requirements among the municipalities in the Project area vary greatly and few of the cities have livestock registration programs making it difficult to assess livestock numbers and stocking rates. This kind of information is important not only because of the frequent proximity of livestock to water bodies but also because of the potential for overstocking and the resulting inability of the land to properly allow for enough infiltration of bacteria-laden stormwater.

As summarized in Table 27, the Coordination Committee recommends that all municipal MS4s in the Project area with livestock define and identify properties, including small commercial horse stables, and estimate those livestock numbers to distinguish land use for non-point sources by 2028. Additionally, municipalities with livestock should evaluate their ordinances and if necessary, amend them to include provisions for management of livestock waste, including stocking rates, and other measures restricting bacteria loading by 2033.

**Table 27. Implementation Strategy 4.1 Summary — Ordinance evaluation for livestock waste management, stocking rates, and related measures**

| | |
|---|---|
| Targeted Source(s) | Livestock |
| Estimated Potential Load Reduction | IS 4.1 may result in a 4% reduction over 25 years through changes that reduce direct and stormwater-related bacteria loads contributed by livestock |
| Technical and Financial Assistance Needed | Technical: some technical assistance regarding livestock may be needed to undertake this activity<br><br>Financial: existing local and grant funding as available |
| Education Component | As resources are available, NCTCOG and the Pets, Livestock, and Wildlife technical subcommittee will develop educational materials for livestock owners and property owners housing livestock and provide information to municipalities on stocking rates and livestock waste management |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Livestock defined and numbers estimated<br><br>Number of ordinances amended |
| Progress Indicators | By 2028, municipalities will have evaluated land use, defined and estimated livestock numbers<br><br>By 2033 ordinances will be evaluated and amended as necessary for proper management of livestock waste |

| | |
|---|---|
| Monitoring Component | NCTCOG will collect information regarding municipal activities |
| Responsible Entity | Municipalities will define livestock and estimate livestock numbers, evaluate ordinances with regards to livestock waste and amend as necessary<br><br>NCTCOG and Pets, Livestock, and Wildlife technical subcommittee will develop or find educational materials for livestock owners etc., develop/alter and provide information on stocking rates and livestock waste management to municipalities<br><br>NCTCOG will collect information on progress indicators and provide an annual report to the Coordination Committee |

## Implementation Strategy 4.2: Pet waste control measures

Most, if not all, municipalities in the Project area have some type of provisions concerning pet waste; however some may be too broad or general to be applied to public education and/or enforcement. Pet waste can contribute to *E. coli* levels in impaired waterways and highlight the importance of control measures (USEPA, 2003). By 2033 all municipal MS4s within the bacteria-impacted watersheds are encouraged to have provisions for pet waste pickup within their respective ordinances and active enforcement and public education programs in place. Table 28 below details the control measure for pet waste.

**Table 28. Implementation Strategy 4.2 Summary — Pet waste control measures**

| | |
|---|---|
| Targeted Source(s) | Pets |
| Estimated Potential Load Reduction | IS 4.2 may result in a 3% reduction over 25 years by assisting in reducing bacteria loads contributed by pets |
| Technical and Financial Assistance Needed | Technical: some technical assistance regarding pet may be needed to undertake this activity<br><br>Financial: existing local and grant funding as available |
| Education Component | NCTCOG will utilize existing pet waste public education programs<br><br>NCTCOG and the Pets, Livestock, and Wildlife technical subcommittee will develop or adapt educational materials on pet waste if needed |
| Schedule of Implementation | All municipalities are encouraged to have pet waste control measures within their ordinances by 2033 |
| Interim, Measurable Milestone | Ordinances changed to include pet waste control<br><br>Municipalities with active pet waste enforcement and education programs |

| | |
|---|---|
| Progress Indicators | The number of ordinances including pet waste control measures |
| Monitoring Component | NCTCOG will collect information regarding municipal activities |
| Responsible Entity | NCTCOG and Pets, Livestock, and Wildlife technical subcommittee will develop or modify educational materials on livestock waste management<br><br>NCTCOG will use and distribute existing pet waste education materials and report on progress indicators to the Coordination Committee<br><br>Municipalities will include pet waste control provisions in their ordinances, have active enforcement/public education efforts, and report progress indicators to NCTCOG |

## Implementation Strategy 4.3: Waterfowl management plan

Feeding of waterfowl in ponds and other waterways promotes higher waterfowl populations than would exist without feeding (Abulreesh, 2004). Excess nutrients in ponds caused by such high numbers of waterfowl and their droppings can result in water-quality problems including increased *E. coli* counts. All municipal MS4s within the bacteria-impaired waterways are encouraged to evaluate the need for a waterfowl management plan, with a focus on measures to discourage waterfowl feeding rather than population control measures. Table 29 expands on the details of a waterfowl management plan.

**Table 29. Implementation Strategy 4.3 Summary — Waterfowl management plan**

| | |
|---|---|
| Targeted Source(s) | Waterfowl |
| Estimated Potential Load Reduction | IS 4.3 may result in a 2% reduction over 25 years by reducing overloading of water bodies by waterfowl populations, and thereby reducing bacteria loads contributed by waterfowl |
| Technical and Financial Assistance Needed | Technical: some technical assistance regarding waterfowl may be needed to undertake this activity<br><br>Financial: existing local and grant funding as available |
| Education Component | As resources allow, existing or new educational materials will be developed for municipalities to educate their citizens on feeding of waterfowl |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | MS4s will evaluate the need for waterfowl management plans |
| Progress Indicators | Number of evaluations conducted by MS4s of the need for waterfowl management plans |

| | |
|---|---|
| | Number of waterfowl management plans or educational programs implemented<br><br>Number of educational materials distributed |
| Monitoring Component | NCTCOG will provide a report to the Coordination Committee on progress indicators |
| Responsible Entity | MS4s will evaluate the need for a waterfowl management plan, implement educational programs as needed, and report progress indicators to NCTCOG<br><br>NCTCOG will collect information from MS4s and report progress to the Coordination Committee |

## Implementation Strategy 4.4: Model ordinance development

As detailed in Table 30, NCTCOG and stakeholders will, as resources allow, develop a model ordinance for inclusion in the BMP Library (see Implementation Strategy 8.0) which will include provisions for pet and livestock waste removal and stocking rates.

**Table 30. Implementation Strategy 4.4 Summary — Model ordinance development**

| | |
|---|---|
| Targeted Source(s) | Pets and livestock |
| Estimated Potential Load Reduction | IS 4.4 may result in a 2% reduction over 25 years through the implementation of improved ordinances by MS4s that lead to a reduction in bacteria loading. |
| Technical and Financial Assistance Needed | Technical: no technical assistance will be necessary<br><br>Financial: grants and/or existing funding as appropriate |
| Education Component | Once model ordinance is developed, NCTCOG will refer stakeholders to the BMP Library |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and NCTCOG and the Pets, Livestock, and Wildlife technical subcommittee will begin work on developing or adapting a model ordinance |
| Interim, Measurable Milestone | Ordinances evaluated for pet waste control and livestock waste control provisions |
| Progress Indicators | Model ordinance developed |
| Monitoring Component | NCTCOG will collect information on availability of model ordinance in BMP Library |

| | |
|---|---|
| Responsible Entity | NCTCOG and Pets, Livestock, and Wildlife technical subcommittee will develop or modify a model ordinance for pet waste control and livestock waste control<br><br>NCTCOG place model ordinance in the BMP Library |

## Implementation Strategy 4.5: Pet waste collection stations and BMPs at parks

Increasing stormwater retention time over natural soils allows for greater infiltration of bacteria. In areas of parks with heavy use by dogs, horses, and other animals and the resulting potential for bacteria loading in nearby waterways, the use of BMPs can be particularly important. The Coordination Committee encourages the use of BMPs such as buffer strips, swales, and other methods to reduce bacteria loading from dog parks and other parks with concentrated animal presence to reduce bacteria loading from these sources. Furthermore, the Coordination Committee encourages all municipal MS4s within bacteria-impaired watersheds ensure adequate placement of pet waste collection stations in parks with the greatest potential to contribute to bacteria loading, such as those adjacent to waterways and parks with significant use by dogs, horses, or other animals. The details of implementation strategy 4.5 can be found in Table 31.

**Table 31. Implementation Strategy 4.5 Summary — Pet waste collection stations and BMPs at parks**

| | |
|---|---|
| Targeted Source(s) | Pets and horses |
| Estimated Potential Load Reduction | IS 4.5 may result in a 4% reduction in bacteria loading from parks with substantial animal use over 25 years |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary regarding park BMPs and pet waste collection stations<br><br>Financial: grants and/or existing funding as appropriate |
| Education Component | As resources are available, NCTCOG and the Pets, Livestock, and Wildlife technical subcommittee will develop or modify educational materials for park goers regarding pet waste collection and park BMPs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and NCTCOG and the Pets, Livestock, and Wildlife technical subcommittee will begin work on developing or adapting public education materials for park goers regarding pet waste and park BMPs<br><br>MS4s with parks used by pets will use BMPs in parks to help reduce bacteria loading |
| Interim, Measurable Milestone | Park BMPs implemented<br><br>Pet waste collection stations installed |
| Progress Indicators | Number of park BMPs implemented |

| | |
|---|---|
| | Number of pet waste collection stations installed |
| Monitoring Component | NCTCOG will collect information from MS4s regarding park BMPs and pet waste collection stations |
| Responsible Entity | MS4s with parks used by pets will implement BMPs and install pet waste collection stations as feasible, and report those measurements to NCTCOG<br><br>NCTCOG will collect BMP and collection station data and report those findings to Coordination Committee |

## Implementation Strategy 4.6: Distribution of pet waste education materials

*Doo the Right Thing* is an existing public education program through the RSWMCC's Public Education Task Force. *Doo the Right Thing* helps MS4s participating in the RSWMP educate their citizens on issues such as the potential health risks from pet waste, the impact of pet waste on water quality, and tips for dealing with pet waste. There are also posters, flyers, pledge forms, bag holders, and other education items available for distribution through the cooperative purchase program. In addition to maximizing distribution of pet waste education materials to their respective populations as a whole, the Coordination Committee encourages municipalities with pet adoption and/or pet registration programs to include distribution of pet waste education materials, such as those from *Doo the Right Thing*, as part of the pet adoption or registration process. Table 32 further explains the distribution of pet waste education materials.

**Table 32. Implementation Strategy 4.6 Summary — Distribution of pet waste education materials**

| | |
|---|---|
| Targeted Source(s) | Pet waste |
| Estimated Potential Load Reduction | IS 4.6 may result in a 2% reduction over 25 years through more responsible management and disposal of pet waste, thereby reducing pet waste available for transport to waterways |
| Technical and Financial Assistance Needed | Technical: no additional technical assistance is necessary<br><br>Financial: grants and/or existing funding as appropriate |
| Education Component | Use existing pet waste education materials and distribute to general public<br><br>When possible, include these educational materials with pet adoption and/or pet registration |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |

| | |
|---|---|
| Interim, Measurable Milestone | Increase in ordering of *Doo the Right Thing* materials through RSWMP Cooperative Purchase |
| Progress Indicators | Number of education items distributed |
| Monitoring Component | NCTCOG will collect information on number of pet waste materials purchased |
| Responsible Entity | MS4s will distribute pet waste education materials to general public, using existing contact opportunities such as pet registrations and adoptions<br><br>NCTCOG will collect pet waste education material purchase records and report to the Coordination Committee |

## Onsite Sewage Facility Implementation Strategies

An on-site sewage facility (OSSF — a term which encompasses all septic and aerobic systems) does not send waste through a system of pipes to be treated elsewhere. Instead, it uses a combination of physical and chemical methods to treat the waste at the owner's location. Estimates based on OSSF permit records suggest the Project area has at least 19,000 systems. However, the actual number and distribution of OSSFs in the region is unknown, and inventories of OSSFs are piecemeal.

Enforcement varies throughout the region and, depending on jurisdiction, is handled by several Authorized Agents — the Tarrant County Public Health Department, cities of Arlington and Grand Prairie, and the TCEQ Region 4 Office. A distribution map of OSSFs can be found in Figure 10. Furthermore, enforcement efforts can be ineffective if owners of failing OSSFs do not have the resources to repair or replace their systems or to pay fines associated with violations. Because properly functioning and maintained OSSFs contribute little to no bacteria to waterways, this I-Plan primarily focuses on OSSFs that are in danger of — or already are — unpermitted, failing, or poorly maintained. The following implementation activities are intended to address these systems.

### Implementation Strategy 5.0: Funding for failing OSSFs

As explained in Table 33, stakeholders and NCTCOG will seek funding to address failing OSSFs, through income-qualified programs to subsidize OSSF repair or connection to sanitary sewer systems. Possible funding sources may include American Dream Downpayment Initiative; USDA Home Repair Grant; Specially Adapted Housing Grants; USDA Rural Development Housing and Community Facilities Programs; the Rural Housing Insurance Fund grants; and TCEQ Supplemental Environmental Project-directed funds.

**Table 33. Implementation Strategy 5.0 Summary — Funding for failing OSSFs**

| | |
|---|---|
| Targeted Source(s) | Failing OSSFs |
| Estimated Potential Load Reduction | IS 5.0 may reduce the potential for bacteria loading from failing OSSFs by 2% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary regarding identifying failing OSSFs and potential repairs<br><br>Financial: grants, loans, SEPs and existing funding as appropriate |
| Education Component | Authorized agents and NCTCOG will collect and distribute information on funding availability |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Grants and other funding sources sought |
| Progress Indicators | Number of OSSF repaired, replaced, or eliminated due to connections with sanitary sewer systems |

| | |
|---|---|
| Monitoring Component | NCTCOG will collect reports from Authorized Agents |
| Responsible Entity | NCTCOG and Authorized Agents will collect and distribute funding information as appropriate for their organization<br><br>NCTCOG will collect information on funding availability and report to OSSF technical subcommittee and Coordination Committee |

## Implementation Strategy 5.1: Aerobic Treatment Unit maintenance

According to the National Environmental Services Center of the West Virginia University Research Corporation, aerobic treatment units (ATUs) are similar to septic systems in that they both use natural processes to treat wastewater. But unlike septic, which uses anaerobic processes, the aerobic treatment process requires oxygen. ATUs use a mechanism to inject and circulate dissolved oxygen inside the treatment tank. This mechanism requires electricity to operate. As a result, the basic unit tends to be more expensive to own and operate than a septic tank and requires more maintenance. The solids must be pumped out at much more frequent intervals, and the electrical-mechanical parts must be maintained (NESC, 2005). Most ATUs are sold with a two-year service contract, covering inspections and maintenance; however, manufacturers recommend that such a contract be extended for the life of the unit. The added complexity and need for homeowner attentiveness help make ATUs more likely to malfunction and impact bacteria loading in nearby waterways.

The TCEQ, Tarrant County, and the cities of Arlington and Grand Prairie are encouraged to develop policies to increase maintenance of ATUs, including mandatory lifetime maintenance contracts, more inspections on systems, and increased monitoring in areas with high concentrations of ATUs. The strategies for ATUs are detailed in Table 34.

### 5.1.1: Request to TCEQ for enforcement

TCEQ's role as a state regulator makes the agency a significant partner in this I-Plan's OSSF efforts. The TCEQ is encouraged to suspend or revoke licenses and registrations of poorly performing installers and maintenance providers.

### 5.1.2: Continuing education opportunities

As resources are available, NCTCOG and other stakeholders will work to develop outreach efforts and continuing education opportunities specific to district attorneys and justices of the peace to with the goal of increasing prosecution of OSSF violations. Such efforts will focus on the impact of OSSF violations on water quality.

### 5.1.3: Sample ordinance development

As resources are available, NCTCOG will provide sample ordinances for municipal authorized agents wishing to mandate OSSF maintenance and make the information available on the BMP Library.

### 5.1.4: Standardized service maintenance contract and inspection form

Although TCEQ is already required by 30 TAC 285.10 to provide a model order, ordinance, and resolution that can be used by authorized agents to meet the minimum requirements of OSSF laws and rules, that requirement does not address service maintenance contracts or inspection forms.

The Coordination Committee encourages TCEQ to develop a standardized service maintenance contract and inspection forms to serve as guidelines for authorized agents and municipalities.

**Table 34. Implementation Strategy 5.1 Summary — Aerobic Treatment Unit maintenance**

| | |
|---|---|
| Targeted Source(s) | Aerobic treatment units (ATU) |
| Estimated Potential Load Reduction | IS 5.1 -5.1.4 may reduce the potential for bacteria loading from failing ATUs by 2% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | Public education efforts for ATU owners regarding maintenance contract requirements<br><br>Educational efforts geared toward district attorneys and justices of the peace regarding environmental impact of malfunctioning OSSFs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Maintenance contracts for ATUs mandated as feasible by Authorized Agents<br><br>Educational materials developed or modified for enforcement decision makers<br><br>Sample ordinance development for Authorized Agents |
| Progress Indicators | Maintenance contract requirements in the majority of Authorized Agent jurisdictions<br><br>Number of educational opportunities for justices of the peace and district attorneys |
| Monitoring Component | NCTCOG will report on progress of contract requirements and educational opportunities |
| Responsible Entity | OSSF technical subcommittee and NCTCOG will develop or modify appropriate educational materials, and create or modify a model ordinance that addresses service maintenance contracts and instruction forms<br><br>NCTCOG will report progress to the Coordination Committee<br>NCTCOG will coordinate with TCEQ to explore options for developing standardized service maintenance contract and inspection forms if feasible, to improve OSSF management and monitoring |

## Implementation Strategy 5.2: OSSF education efforts for real estate agents, property inspectors, and homeowners

Further detailed in Table 35, NCTCOG, Authorized Agents, and other entities will, as resources are available, provide education opportunities to real estate agents, property inspectors, and consumers about identifying failing OSSFs and the consequences of inadequate maintenance and failure of OSSFs.

### 5.2.1: H-GAC curriculum

As resources are available, NCTCOG will pursue an agreement with the Houston-Galveston Area Council of Governments (H-GAC) regarding the use of H-GAC's Texas Real Estate Commission (TREC) approved curriculum for OSSF inspector training.

### 5.2.2: Training module evaluation and regional availability

By 2014, the OSSF Subcommittee will investigate potential training modules, including those available from H-GAC and other sources, with the goal of ensuring the regional availability of OSSF inspector training for property inspectors.

**Table 35. Implementation Strategy 5.2 Summary — OSSF education efforts for real estate agents, property inspectors, and homeowners**

| | |
|---|---|
| Targeted Source(s) | OSSFs |
| Estimated Potential Load Reduction | IS 5.2 – 5.2.2 may reduce the potential for bacteria loading from failing OSSFs due to poor homeowner, realtor, and inspector education by 2% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: technical assistance from H-GAC will be sought<br><br>Financial: grant funding and existing program funding |
| Education Component | NCTCOG, authorized agents, and other entities will, as resources are available, provide education opportunities to real estate agents, property inspectors, and consumers about identifying failing OSSFs and the consequences of inadequate maintenance and failure of OSSFs. |
| Schedule of Implementation | As resources are available, NCTCOG will immediately pursue an agreement with the H-GAC regarding the use of HGAC's Texas Real Estate Commission (TREC) approved curriculum for OSSF inspector training<br><br>By 2014, the OSSF technical subcommittee will investigate potential training modules with the goal of ensuring the regional availability of OSSF inspector training |
| Interim, Measurable Milestone | NCTCOG agreement with H-GAC<br><br>Potential training modules investigated |
| Progress Indicators | H-GAC curriculum in use in NCTCOG region<br><br>Other training modules used if appropriate |

| | |
|---|---|
| Monitoring Component | NCTCOG will report progress on obtaining the H-GAC curriculum and its use as well as use of other curricula |
| Responsible Entity | NCTCOG and Authorized Agents will provide educational opportunities for those involved in real estate transactions<br><br>OSSF technical subcommittee will investigate potential training modules<br><br>NCTCOG will pursue agreement with H-GAC to use their curriculum |

## Implementation Strategy 5.3: Property inspections and document review

Pre-sale real estate inspections should include a complete review of OSSF maintenance documents and system history. These documents are typically available through the homeowner and Authorized Agent and that information should be provided to the prospective home buyer. The prospective home buyer should also be made aware of the absence of OSSF maintenance documents. TREC requires property inspections at the time of sale, specifies education and certification requirements for licensed real estate salespersons and inspectors, and develops forms for use during sales and inspections. The Coordination Committee requests that the TREC use these forms to their full potential and modify each to provide additional resources for homeowners related to their OSSFs. To aid in home buyer education, materials selected and/or modified by the OSSF technical subcommittee will be made available online by NCTCOG. Expanded detail on property inspection and document review can be found in Table 36.

**Table 36. Implementation Strategy 5.3 Summary — Property inspections and document review**

| | |
|---|---|
| Targeted Source(s) | OSSFs |
| Estimated Potential Load Reduction | IS 5.3 may reduce the potential for bacteria loading from failing OSSFs due to homeowner ignorance or inexperience by 2% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | Development or modification of homebuyer educational materials including where to find OSSF maintenance documents and system history, and the potential consequences of the absence of OSSF maintenance documents.<br><br>Outreach to TREC regarding pre-sale inspections and OSSFs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Creation or modification of homebuyer education materials |
| Progress Indicators | Availability of education material through BMP Library (see IS 8.0) |

| | |
|---|---|
| Monitoring Component | NCTCOG will report on the progress of educational material creation and web availability |
| Responsible Entity | OSSF technical subcommittee and NCTCOG will develop or modify appropriate educational materials and ensure their availability online<br><br>OSSF technical subcommittee and NCTCOG will determine the best approach for outreach to TREC and implement<br><br>NCTCOG will report progress to Coordination Committee |

## Implementation Strategy 5.4: Services to annexed areas

The expansion of city boundaries frequently provides municipalities and homeowners alike with the opportunity to enjoy the benefits of sanitary sewer systems and wastewater treatment facilities. Detailed in Table 37, the Coordination Committee encourages municipalities to meet stated timelines for providing services when areas are annexed, especially with regard to connection with sanitary sewer systems.

**Table 37. Implementation Strategy 5.4 Summary — Services to annexed areas**

| | |
|---|---|
| Targeted Source(s) | OSSFs |
| Estimated Potential Load Reduction | IS 5.4 may reduce the potential for bacteria loading from failing OSSFs by 1% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: technical and engineering assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | Outreach to municipal MS4s regarding providing services to annexed areas |
| Schedule of Implementation | As resources are available, expanding sanitary sewer service to annexed areas within stated timelines will begin immediately and will continue throughout the entire implementation process |
| Interim, Measurable Milestone | Municipalities contacted |
| Progress Indicators | Annexed areas transitioning from OSSFs to sanitary sewer lines |
| Monitoring Component | Progress indicators reported to NCTCOG |
| Responsible Entity | Municipalities with annexed areas on OSSFs will transition to sanitary sewer systems as required and report progress to NCTCOG |

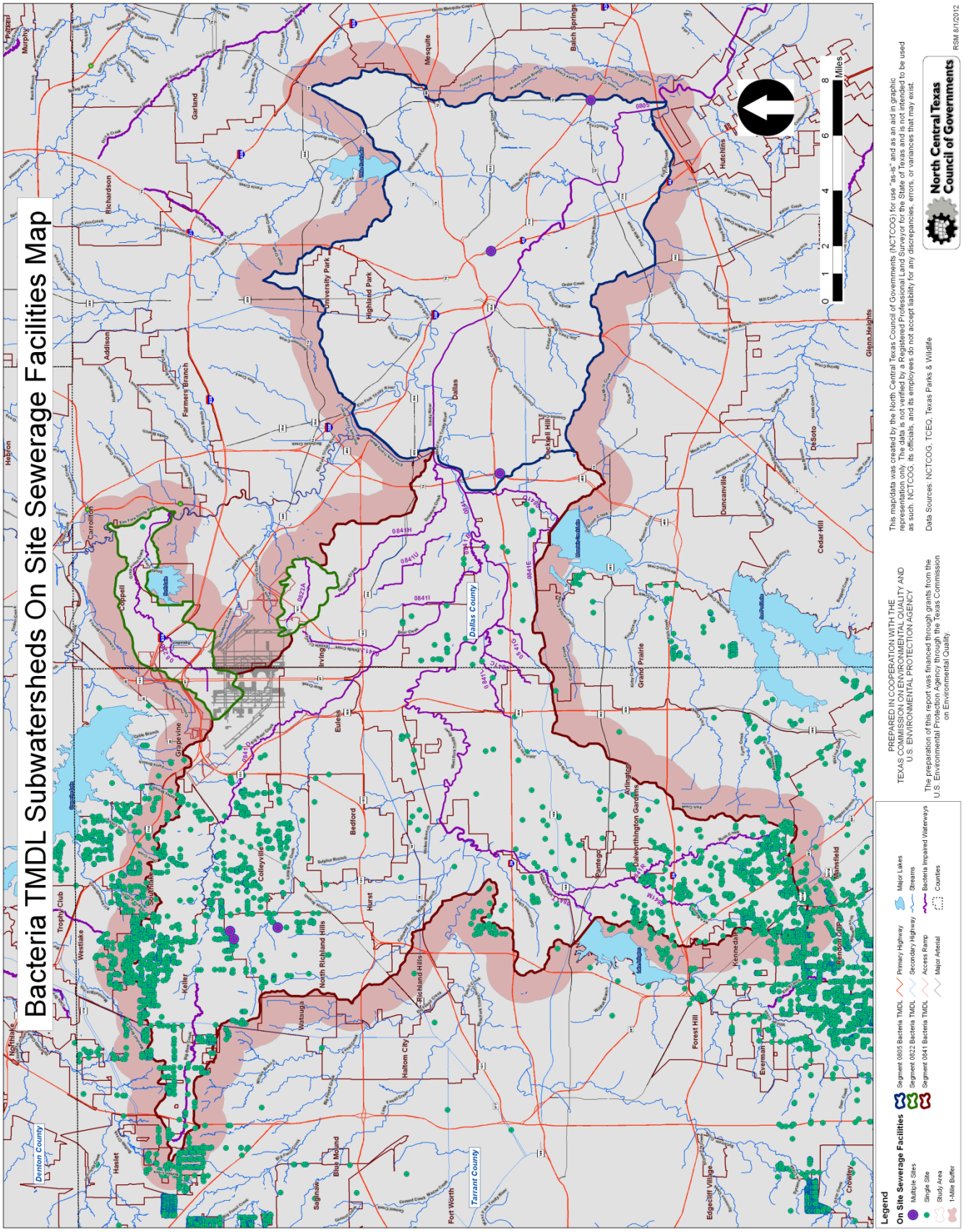
## Implementation Strategy 5.5: Replacement and conversion of poorly functioning OSSFs

MS4s with their own aging OSSFs are encouraged to convert any that are poorly functioning, including vault toilets associated with park and recreational facilities, to sanitary sewer, grinder pump systems, or upgraded OSSFs. Table 38 expands on the implementation strategy for replacing and converting poorly functioning OSSFs.

**Table 38. Implementation Strategy 5.5 Summary — Replacement and conversion of poorly functioning OSSFs**

| | |
|---|---|
| Targeted Source(s) | OSSFs |
| Estimated Potential Load Reduction | IS 5.5 may reduce the potential for bacteria loading from failing OSSFs by 1% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | Outreach to municipal MS4s regarding replacement or conversion of poorly functioning OSSFs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Municipalities contacted |
| Progress Indicators | Number of OSSFs replaced or converted |
| Monitoring Component | Number of OSSFs replaced or converted reported to NCTCOG |
| Responsible Entity | MS4s with their own aging OSSFs will replace or convert those systems as feasible and report those results to NCTCOG |

**Figure 10. OSSF Distribution Map with Impaired Segments**



## Monitoring Coordination Implementation Strategies

The Project area is home to approximately 365 miles of rivers and streams as defined by U.S. Census Bureau's TIGER/Line (Topologically Integrated Geographic Encoding and Referencing) data set (USCB, 2012). One hundred and fifty three of those miles are impaired by elevated *E. coli* levels. Understanding the condition of rivers and streams in the region through monitoring and analyzing monitoring data is critical for developing effective plans for maintaining, managing, and restoring the waterways.

There are several different surface water monitoring programs with data that help demonstrate the effectiveness of BMPs and other implementation strategies discussed in this I-Plan. One of the best known is the Clean Rivers Program (CRP). Established in 1991, the Texas Clean Rivers Program is a state fee-funded, non-regulatory program created to provide a framework and forum for managing water quality issues in a more holistic manner. The focus of the program is to work at the watershed level, within each river basin, by coordinating the efforts of diverse organizations. CRP is comprehensive — collecting samples region-wide, and should remain one of the primary sources of data for ambient water quality. This monitoring network includes dozens of sites and provides long-term data accredited through the National Environmental Laboratory Program (NELAP) for the evaluation of ambient conditions in the region's waterways. Monitoring sites are strategically chosen to give the greatest degree of coverage while also attempting to isolate individual waterways or their smaller units to allow for the accumulation of data with direct relevance to local conditions. Monitoring is conducted under a regional Quality Assurance Project Plan (QAPP) (TCEQ, 2012b).

The Regional Wet Weather Characterization Program (RWWCP) is a NCTCOG-coordinated program for Phase I MS4 regulated entities with stormwater permit requirements to monitor stormwater during wet weather (rainfall) events. NCTCOG assists local entities through a cooperative regional monitoring program designed to meet these requirements. The regional program includes the cities of Dallas, Fort Worth, Arlington, Garland, Irving, Plano, and Mesquite; the local districts of the Texas Department of Transportation (TxDOT); and the North Texas Tollway Authority (NTTA). Data is gathered quarterly, analyzed by a NELAP-accredited laboratory, and an annual report is provided to participants. The program operates in five-year terms in conjunction with the TPDES permit term.

Sampling resulting from an IDDE investigation can be useful in determining and eliminating some bacterial sources. An illicit discharge is any discharge to the MS4 not composed entirely of stormwater, except for discharges allowed under a TPDES permit. Non-stormwater discharges can originate from direct connections to the storm drain system from business or commercial establishments (illicit connections), or indirectly as improper surface discharges to the storm drain system.

Another potential source of information is effluent monitoring. Since 2010, new and renewed WWTF permits include an effluent monitoring requirement for *E. coli*. Currently required monitoring frequency is detailed in Table 6.

Texas Stream Team is a network of trained volunteers and supportive partners working to gather information about surface water quality in the state and ensure the information is publically available. Established in 1991, Texas Stream Team is administered through a cooperative partnership between Texas State University, TCEQ, and the EPA. For the purpose of this I-Plan, Stream Team volunteers are stakeholders in the Project area committed to helping fill gaps in monitoring data wherever possible.

The Coordination Committee encourages all feasible use of monitoring programs and the collective analysis of their respective data to help determine the efficacy of the implementation strategies within this I-Plan.

## Implementation Strategy 6.0: Routine sampling

Stakeholders currently participating in voluntary or permit-required monitoring programs, such as CRP, RWWCP, and WWTF effluent monitoring, will continue routine sampling as feasible. For voluntary programs such as CRP, the routine sampling will occur at the monitoring stations detailed in the QAPP and as resources allow. To help determine the efficacy of implementation strategies, the Monitoring Coordination technical subcommittee will provide analysis of routine sampling results for the Coordination Committee. Figure 11 shows the CRP monitoring locations on impaired segments in the Project area, while Table 39 summarizes the implementation strategy for routine sampling.

**Table 39. Implementation Strategy 6.0 Summary — Routine sampling**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 6.0 will allow tracking and verification of bacteria load reductions and may result in a 2% reduction over 25 years |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary should entities new to monitoring wish to participate<br><br>Financial: grants or existing funding as appropriate |
| Education Component | Some education of governing bodies may be necessary to start, maintain, or expand monitoring programs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Collective analysis of monitoring data |
| Progress Indicators | Number of results analyzed<br><br>Ability to compare results to efficacy of BMPs |
| Monitoring Component | Monitoring Coordination technical subcommittee will report analytical results to NCTCOG |
| Responsible Entity | Monitoring Coordination technical subcommittee will collectively analyze data to determine efficacy of implementation strategies<br><br>NCTCOG will compile results into a report for the Coordination Committee |

## Implementation Strategy 6.1: Monitoring coordination forum

A coordinated, regional approach to monitoring and data analysis is a key component of this implementation strategy. As resources are available, NCTCOG will facilitate a forum of monitoring participants, including those involved with CRP, RWWCP, IDDE, wastewater treatment effluent monitoring, and the Texas Stream Team. The schedule for forum meetings will be determined by forum participants, although meetings will take place at least annually. Table 40 details the strategies for the monitoring coordination forum.

### 6.1.1: Existing *E. coli* monitoring network evaluation

As part of the monitoring forum, the stakeholders will evaluate the existing *E. coli* monitoring network in the impaired subwatersheds and refine it based upon data gaps. Data considered may include CRP, RWWCP, IDDE monitoring, wastewater treatment facility effluent monitoring, and data collected by Texas Stream Team.

### 6.1.2: New source review for data

The monitoring forum will identify sources of data and existing monitoring which may not be appropriate for screening, for example monitoring data that are not collected under a QAPP or analyzed under a NELAP-accredited program, but that could be helpful in identifying bacteria sources.

### 6.1.3: Data assessment of overall trends for BMP efficacy

As monitoring results become available, the forum participants will evaluate CRP and RWWCP data to assess overall trends in water quality within the impaired water segments in the Greater Trinity River basin. These analyses may be used to determine efficacy of BMPs, overall improvement or degradation within the applicable sub-basins, and the potential need to implement additional BMPs. Data analysis results will be shared with the Coordination Committee annually.

### 6.1.4: Funding in relation to gaps in sampling data

Monitoring forum participants, including TRA, may work with TCEQ to address available funding in response to gaps in sampling data.

### 6.1.5: Reevaluating monitoring technologies for pilot projects and/or research partnerships

Monitoring forum participants will continue to reevaluate monitoring technologies, such as surrogate testing, no less than every five years for use in pilot projects or partnerships with researchers in local universities.

### 6.1.6: Evaluate need for online data consolidation and access

Accessing monitoring data online remains difficult for those without technical backgrounds in the monitoring field. Monitoring forum participants and the Coordination Committee will periodically evaluate the need for online data consolidation and access.

**Table 40. Implementation Strategy 6.1 Summary — Monitoring coordination forum**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 6.1 – 6.1.6 will allow tracking and verification of bacteria load reductions and may result in a 2% reduction over 25 years |

| | |
|---|---|
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary should entities new to a given type of monitoring wish to participate<br><br>Financial: grants or existing funding as appropriate |
| Education Component | Some internal education may be necessary for some forum participants on new or existing monitoring methods or programs |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process with forum meetings taking place annually at a minimum |
| Interim, Measurable Milestone | Existing E. coli monitoring networks evaluated<br><br>New source review for data<br><br>Data assessment of overall trends for BMP effectiveness<br><br>Reevaluation of monitoring technologies<br><br>Online data consolidation and access evaluation |
| Progress Indicators | Number of existing monitoring sites evaluated<br><br>Number of data gaps identified<br><br>Number of new non-traditional monitoring sources identified<br><br>Number of data assessments (reports) in relation to BMP effectiveness<br><br>Number of pilot projects evaluated |
| Monitoring Component | NCTCOG will collect results of evaluations, assessments, and other results from the Monitoring Coordination Forum |
| Responsible Entity | Monitoring Coordination Forum or Monitoring Coordination technical subcommittee will evaluate existing E. coli monitoring and new sources for data, reevaluate monitoring technologies, evaluate online data access, and assess data for BMP effectiveness<br><br>NCTCOG will compile results into a report for the Coordination Committee |

## Implementation Strategy 6.2: Source identification and monitoring review

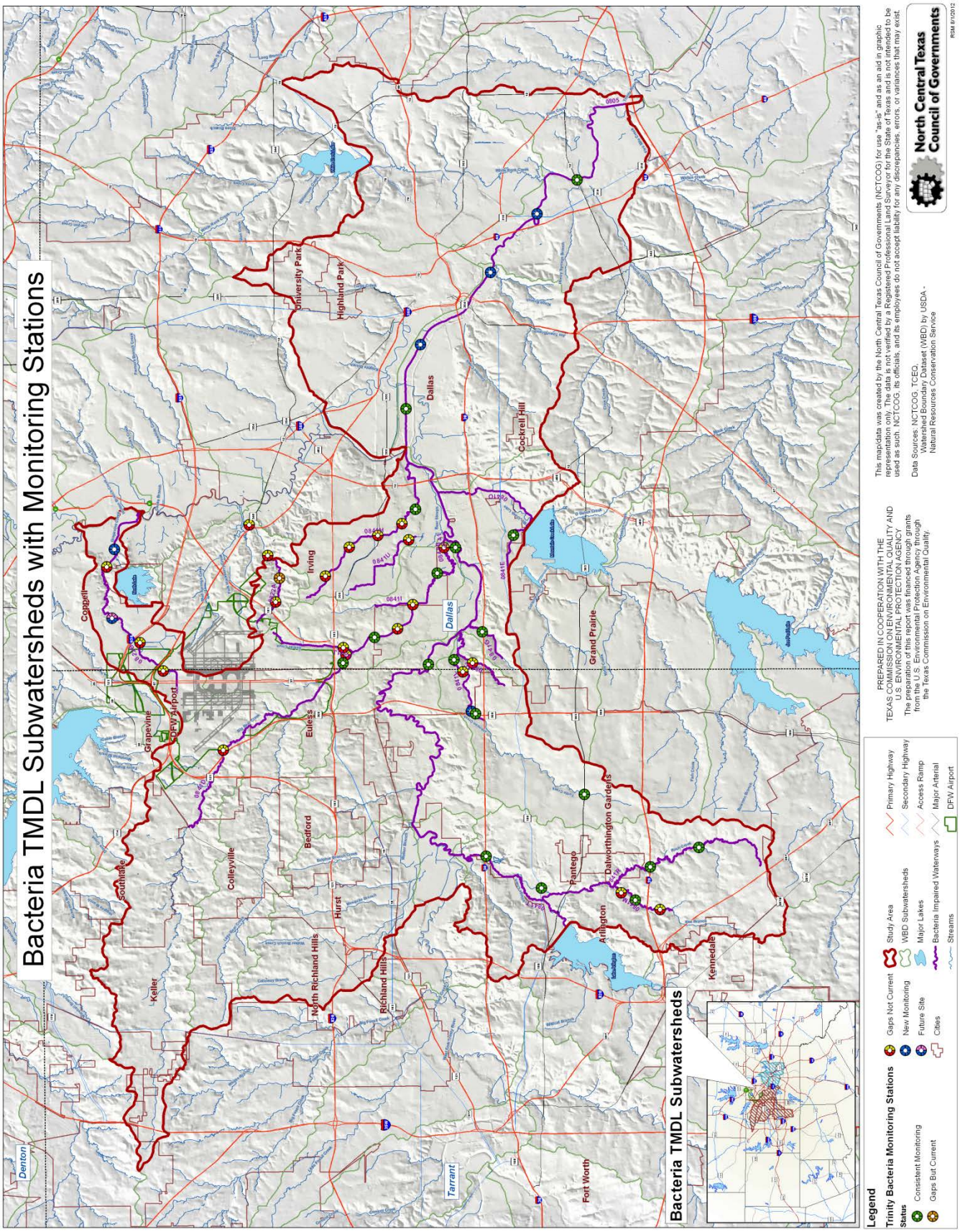
Accurate identification and quantification of *E. coli* sources in the project area is needed. Without this information it is difficult to accurately assess the impact of any one implementation strategy, or for that matter, the impact of any one source. As explained in Table 41, in 2018 the Coordination Committee will review monitoring techniques and determine whether it is appropriate, in terms of financial and

technical viability, to request the TCEQ make changes in their monitoring with particular regard to source identification.

**Table 41. Implementation Strategy 6.2 Summary — Source identification and monitoring review**

| | |
|---|---|
| Targeted Source(s) | Species-specific and/or human versus non-human contributors to bacteria loading |
| Estimated Potential Load Reduction | IS 6.2 may result in a 10% reduction over 25 years of calculated bacteria loading by allowing better identification and targeting of bacterial sources, with consequent reductions in loading |
| Technical and Financial Assistance Needed | Technical: assistance from experts in source identification may be necessary to assist Coordination Committee in decision-making<br><br>Financial: new source identification methods may have different costs than known methods |
| Education Component | The Coordination Committee and TCEQ will need to be aware of technological and cost changes of source identification |
| Schedule of Implementation | In 2018 the Coordination Committee will review monitoring techniques and technologies to see if requesting source identification by TCEQ is appropriate |
| Interim, Measurable Milestone | New source identification methods and costs identified |
| Progress Indicators | Greater source identification results available to better target effectiveness of implementation strategies |
| Monitoring Component | Report to the Coordination Committee on new source identification availability and costs |
| Responsible Entity | Monitoring Coordination technical subcommittee will identify and evaluate new methods, techniques, and costs for source identification<br><br>NCTCOG will prepare a report of the results from the technical subcommittee for the Coordination Committee<br><br>the Coordination Committee will evaluate new methods and determine if a request to TCEQ for guidance or approval on the new method or type of test is warranted<br><br>NCTCOG will coordinate dialogue between stakeholders and TCEQ to facilitate TCEQ consideration, and possible adoption or use of new source identification methods. |

**Figure 11. Monitoring Locations on Impaired Segments Map**



## Education and Outreach Implementation Strategies

The North Central Texas region is fortunate to benefit from the existence of many water-focused public education efforts. In addition to NCTCOG-coordinated programs such as *Doo the Right Thing*, yard waste efforts, cooperative purchase for stormwater education materials, and Texas SmartScape, there is also a partnership regarding fats, oils, and grease (FOG) with the North Texas Grease Abatement Council, the RSWMP's Public Education Task Force, and the efforts of the Trinity River Environmental Education Society (TREES).

### Implementation Strategy 7.0: Ongoing stormwater public education participation and inclusion of bacteria-specific materials

NCTCOG and municipal MS4 stakeholders will continue their participation in and support of existing stormwater education campaigns such as *Doo the Right Thing*, Texas SmartScape, FOG, and others through the RSWMP. A list of RSWMP participants can be found in Table 21. As funding is available, NCTCOG and stakeholders will develop or expand the availability of more bacteria-specific public education materials to RSWMP participants. Support will also continue for the existing stormwater education web page, www.dfwstormwater.com, and as funding and technology become available, NCTCOG will continue to enhance web site functions. The stormwater public education strategy is summarized in Table 42.

**Table 42. Implementation Strategy 7.0 Summary — Ongoing stormwater public education, participation, and inclusion of bacteria-specific materials**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.0 may result in a 4% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary to include bacteria-specific information into existing materials<br><br>Financial: grants or existing funding as appropriate |
| Education Component | Some educational components are already in place and in use<br><br>NCTCOG and the Education and Outreach technical subcommittee will adapt or develop appropriate educational materials for inclusion in existing stormwater educational programs and products<br><br>Outreach to RSWMCC and the Public Education Task Force for their support in adapting existing materials |
| Schedule of Implementation | Depending on resource availability, gathering bacteria-specific stormwater information will begin immediately and continue throughout the project |

| | |
|---|---|
| Interim, Measurable Milestone | MS4s and NCTCOG will continue existing public education programs as funding allows |
| Progress Indicators | Number of educational materials altered to include bacteria<br><br>Number of educational materials purchased<br><br>Number of educational materials distributed<br><br>Web page hits |
| Monitoring Component | NCTCOG will report on the progress of educational materials and education efforts<br><br>Existing MS4 reporting on stormwater public education efforts provided to NCTCOG for the collective annual report |
| Responsible Entity | The Education and Outreach technical subcommittee and NCTCOG will develop or adapt materials to include bacteria-specific topics in stormwater education<br><br>NCTCOG will compile MS4 public education efforts and the progress of development of bacteria-specific information for the Coordination Committee |

## Implementation Strategy 7.1: Education and Outreach Forum

As further detailed in Table 43, some or all of the members of the Education and Outreach Subcommittee will form an education and outreach forum that will interface with the RSWMP's Public Education Task Force, and other possible groups and organizations, such as the North Texas Grease Abatement Council and TREES, as necessary to facilitate greater regional understanding of the impact of bacteria on water quality. Additionally the Forum will work with the other technical subcommittees to coordinate public education messages.

**Table 43. Implementation Strategy 7.1 Summary — Education and Outreach Forum**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.1 may result in a 2% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: no technical assistance will be necessary<br><br>Financial: grants or existing funding as appropriate |
| Education Component | Some internal education may be necessary for some forum participants on existing public education programs |

| | |
|---|---|
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Partnerships formed with RSWMP's Public Education Task Force, North Texas Grease Abatement Council, and other relevant organizations |
| Progress Indicators | Number of partnerships or relationships formed |
| Monitoring Component | Number of partnerships or relationships formed and reported to NCTCOG |
| Responsible Entity | The Education and Outreach Forum or technical subcommittee will form partnerships with existing educational programs whose purposes align with the implementation strategies in this I-Plan and report on such progress to NCTCOG<br><br>NCTCOG will report on partnerships to the Coordination Committee |

## Implementation Strategy 7.2: Curriculum for Texas Education Agency

The Education and Outreach Forum will, as resources are available, coordinate with the Texas Education Agency (TEA) and local school districts to provide curriculum and tools for teachers and students, including an educator's 'tool box' with programs that may include Waters to the Sea, Real School Gardens, and Green Teacher, that educate children about water quality. Emphasis will be placed on keeping costs as low as possible to enhance the potential of a curriculum being widely used. The strategies for TEA materials are summarized in Table 44.

### 7.2.1: Local school district outreach

As TEA-approved materials become available, the Forum will educate/outreach to local school districts and teachers about their availability.

### 7.2.2: Reevaluation of TEA materials and effectiveness

The Forum will reevaluate the program in five years, in conjunction with the MS4 permit term, for ability to get programs and materials approved by TEA, the ability to conduct outreach locally, and local use of materials; and will communicate those results to the Coordination Committee.

**Table 44. Implementation Strategy 7.2 Summary — Curriculum for Texas Education Agency**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.2 may result in a 2% reduction over 25 years by providing educational resources regarding bacteria loading to educators within the Project area |
| Technical and Financial Assistance Needed | Technical: some technical assistance may be necessary to develop materials for TEA approval<br><br>Financial: grants or existing funding as appropriate |

| | |
|---|---|
| Education Component | The Education and Outreach Forum or technical subcommittee will, as resources are available, coordinate with TEA and local school districts to provide curriculum, modules, and tools for teachers and students, including an educator's 'tool box' with emphasis on keeping costs as low as possible to enhance the potential of a curriculum being widely used<br><br>Once curriculum are in place, outreach to local schools is necessary |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Requirements for TEA acceptance researched<br><br>Existing curriculum identified or new curriculum/modules developed<br><br>Curriculum/modules approved by TEA<br><br>Outreach to local schools |
| Progress Indicators | Number of modules available<br><br>Number of curriculum available<br><br>Number of students reached<br><br>Number of teachers or administrators contacted |
| Monitoring Component | NCTCOG will report on progress of educational materials |
| Responsible Entity | The Education and Outreach Forum or technical subcommittee will coordinate with TEA and local school districts to provide curriculum, modules, and tools to educate children about stormwater and water quality, and will reevaluate materials and relationship with TEA every five years in conjunction with the MS4 permit term<br><br>NCTCOG will provide an annual report to the Coordination Committee |

## Implementation Strategy 7.3: Education and outreach funding

As resources are available and with stakeholder input, NCTCOG will seek natural partnerships for long term funding of education and outreach efforts. These partnerships may include grants and other government-related funding sources. NCTCOG will serve as the primary contact on collaborative grants; working with stakeholders and the Stormwater Public Education Task Force for distribution. Non-governmental TMDL stakeholders may seek out additional funding sources such as sponsorships and donations for educational efforts. Table 45 summarizes the strategy for funding.

**Table 45. Implementation Strategy 7.3 Summary — Education and outreach funding**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.3 may result in a 2% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: no technical assistance is necessary<br><br>Financial: grants or existing funding as appropriate |
| Education Component | None |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Possible funding sources identified |
| Progress Indicators | The number of potential sources identified and number of applications for grants or other funding sources |
| Monitoring Component | NCTCOG will report on funding efforts |
| Responsible Entity | NCTCOG will seek natural partnerships for long term funding of education and outreach efforts<br><br>The non-governmental Education and Outreach Forum or technical subcommittee members and stakeholders may seek out additional funding sources such as sponsorships and donations for educational efforts |

## Implementation Strategy 7.4: Partnerships

The Coordination Committee encourages MS4s to seek out partnerships with environmentally-focused organizations, such as Keep Texas Beautiful/Keep America Beautiful, TREES, or other appropriate groups to further water quality outreach efforts via web links, etc. As further explained in Table 46, the Coordination Committee encourages municipalities to develop and increase the number of partnerships with local businesses, local volunteer groups, and service organizations to promote park stewardship and public education and to report the number of volunteer hours on their MS4 annual report.

**Table 46. Implementation Strategy 7.4 Summary — Partnerships**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.4 may result in a 2% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: no technical assistance is necessary<br><br>Financial: grants or existing funding as appropriate |
| Education Component | As resources are available, the Education and Outreach Forum or technical subcommittee will modify or develop public education materials for use by partnering organizations for use in parks<br><br>MS4s are encouraged to seek out and maintain partnerships with environmentally-focused organizations and utilize them as sources and distributors of information |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Materials developed and potential partnerships identified |
| Progress Indicators | Number of materials distributed<br><br>Number of partnerships formed or maintained<br><br>Number of parks with stewardship groups with educational efforts |
| Monitoring Component | NCTCOG will report on partnership efforts |
| Responsible Entity | MS4s will seek out and maintain partnerships to help disseminate water quality related education messages to targeted groups such as park visitors<br><br>The Education and Outreach Forum or technical subcommittee will modify or develop park-specific educational materials<br><br>NCTCOG will report on progress to the Coordination Committee |

## Implementation Strategy 7.5: Development of river-specific bacteria TMDL materials

National focus on bacteria TMDLs and loading has been primarily on the impacts to coastal waters and lake beaches. While these are important concerns, the methods for limiting bacteria loading for inland streams differ greatly and should be of equal concern. The Coordination Committee encourages the EPA to develop more river-specific bacteria TMDL procedures and educational materials and recognize the inherent differences between coastal and inland waters. Table 47 summarizes implementation strategy 7.5.

**Table 47. Implementation Strategy 7.5 Summary — Development of river-specific bacteria TMDL materials**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 7.5 may result in a 5% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: EPA may require some technical assistance in order to develop or add to materials with river-specific TMDL information<br><br>Financial: grants or existing funding as appropriate |
| Education Component | As resources are available, the EPA should modify or develop more public education materials focused on river-specific causes and sources of bacterial contamination in waterways |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | River-specific TMDL causes investigated |
| Progress Indicators | Number of river-specific TMDL materials developed |
| Monitoring Component | River-specific materials will be available on EPA's web site |
| Responsible Entity | The Education and Outreach technical subcommittee will formulate a letter from the Coordination Committee to the EPA formalizing the request for river-specific bacteria TMDL materials<br><br>NCTCOG will encourage EPA to develop, if feasible, river-specific TMDL materials for use by municipalities and others to use in attaining the contact recreation standard for water bodies |

## Implementation Strategy 7.6: Bacteria-specific outreach to volunteer service groups

Volunteer service groups already focused on tangentially-related quality of life projects, such as the Master Gardener, Composter, and Naturalist programs, are a natural fit with the TMDL I-Plan outreach efforts. Those involved with such programs have already expressed a desire to be more involved and more informed about plant selection, reducing fertilizer use, and knowing more about their local environment. Some practices, however, such as placing compost materials too close to waterways can exacerbate bacteria loading, making it as important to partner with such groups as it is to educate them about the causes of high bacteria levels in the region's waterways. As detailed in Table 48, the Coordination Committee encourages bacteria specific outreach by the MS4s and Education and Outreach Forum or technical subcommittee to volunteer service groups such as Master Gardeners, Master Composters, and Master Naturalists.

**Table 48. Implementation Strategy 7.6 Summary — Bacteria-specific outreach to volunteer service groups**

| | |
|---|---|
| Targeted Source(s) | Nonpoint sources |
| Estimated Potential Load Reduction | IS 7.6 may result in a 2% reduction over 25 years by providing resources for the implementation of other ISs and for education and outreach to the public in an effort to gain widespread cooperation for bacteria load reduction activities |
| Technical and Financial Assistance Needed | Technical: no technical assistance is necessary<br><br>Financial: grants or existing funding as appropriate |
| Education Component | As resources are available, the Education and Outreach Forum or technical subcommittee will modify or develop public education materials focused on the impact of certain activities on bacteria levels in waterways and geared toward volunteer service groups<br><br>MS4s and the Education and Outreach Forum or technical subcommittee will conduct outreach to volunteer service organizations regarding the region's bacteria TMDL and its causes |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Materials developed<br><br>Volunteer service organizations identified |
| Progress Indicators | Number of materials distributed<br><br>Number of service groups contacted and engaged |
| Monitoring Component | NCTCOG will report on outreach efforts |
| Responsible Entity | Education and Outreach Forum or technical subcommittee will develop or |

| | |
|---|---|
| | modify educational materials for volunteer service groups<br><br>MS4s and Education and Outreach Forum or technical subcommittee will conduct outreach to service organizations and report progress of the outreach to NCTCOG<br><br>NCTCOG will compile an annual report for the Coordination Committee |

# Best Management Practices Library Implementation Strategies

## Implementation Strategy 8.0: Best Management Practices Library

BMPs, whether they are structural, procedural, or educational, are a major component of this I-Plan. In order for stakeholders to maximize limited funds, minimize implementation of ineffective projects, and take full advantage of the depth of regional knowledge and experience, a clearinghouse for BMPs is necessary. An online BMP library will provide avenues for knowledge and experience sharing, cost effectiveness, training tools, sample ordinances, research results, and virtually any additional type of information deemed appropriate by the stakeholders. Although not created yet, the page will likely branch from NCTCOG's existing Greater Trinity TMDL web page, http://www.nctcog.org/envir/SEEclean/wq/tmdl/index.asp. As funding is available, NCTCOG will develop and maintain the online comprehensive BMP library including topics important to the implementation strategies detailed in this I-Plan. The strategies for the BMP Library are detailed in Table 49.

### 8.0.1: Stormwater

The Coordination Committee will annually review new projects and their BMPs through the TPDES-required Annual Report for stormwater permit holders for possible inclusion in the I-Plan as pilot projects and for inclusion in the online BMP Library. Other stormwater related topics may include the effectiveness of aeration/fountains, permeable pavement, cost/benefit analysis, and riparian buffers. Links or information on applicable city ordinances, sample ordinances addressing topics such as, impervious surfaces, stormwater fees, IDDE, waste hauler permitting and regulation, and stormwater enforcement will also be included. Additionally, information will be available on lessons learned from pilot projects, studies, and regionally developed initiatives.

#### *8.0.1.1: BMP pilot projects and funding*

Daily municipal operations and special projects provide natural opportunities to incorporate and study BMP effectiveness. Similarly, the Dallas-Fort Worth area is home to multiple universities with high academic standards and students in need of research projects. As such, stakeholders will investigate potential BMPs for bacteria load reduction, such as street sweeping and aeration, potentially using local pilot and demonstration projects funded by grants, or through the Texas AgriLife Extension, and local universities such as the University of Texas at Arlington, Texas Christian University, University of North Texas, and others. Stakeholders will also establish a list of potential pilot projects for outside evaluation and bacteria mitigation projects for state SEP funds, grant funds, or other sources.

### 8.0.2: Construction BMPs

#### *8.0.2.1: Inclusion of construction BMPs in ordinances, including LID, Green Infrastructure, and iSWM*

The Coordination Committee encourages municipalities within bacteria-impaired watersheds to adopt BMPs for development including adoption of ordinances specifying no net discharge of stormwater during reasonable rain events from new developments

and redevelopments, utilizing Green Infrastructure (GI), iSWM, or LID in all pertinent construction projects, smarter use of buffers and green space, and provisions for tree removal and replacement.

#### *8.0.2.1: Post construction BMP review in conjunction with MS4 permit requirements*

Reevaluation and review of BMPs does not end when construction is completed. Stakeholders are encouraged to review post construction BMPs following changes in MS4 permit requirements or with direction from TCEQ or EPA.

### 8.0.3: Online resource for construction and development-related BMPs, including cost/benefit information and educational materials

As resources are available, NCTCOG will include in the online BMP Library development-related BMPs for permeable pavement, no net discharge sample ordinances, information on buffers and green space, and GI, iSWM, and LID construction. Educational materials with information on costs and economic benefits for municipalities to use for citizens, city councils, and business interests will also be available. As resources are available, NCTCOG will also create or make available development-related educational resources for the general public.

### 8.0.4: Use of demonstration projects and Green Infrastructure in municipal projects

MS4s and stakeholders are encouraged to use demonstration projects and incorporate GI, LID, or iSWM into their own developments whenever feasible as pilot projects and report those findings for inclusion in the BMP Library.

### 8.0.5: BMPs for Animal-Related Topics

As resources are available, NCTCOG will make available the Library BMPs and animal-related topics including pet waste public education efforts such as *DOO the Right Thing*, sample ordinances for feral hog control, wildlife/waterfowl feeding prohibition, success stories, and livestock waste control and stocking rates.

#### *8.0.5.1: Educational materials*

As resources are available, educational materials regarding wildlife feeding, and waste management for commercial stable operators, livestock owners, and other groups will be provided.

#### *8.0.5.2: Pilot project evaluation*

The City of Dallas is currently constructing the Texas Horse Park stable near the Upper Trinity River. The stable project plans to use horse manure for the production of biogas. The City of Dallas will evaluate their biogas project from Texas Horse Park stable waste by 2018 and provide that information to NCTCOG for inclusion in the BMP Library so that other jurisdictions may then evaluate the project for potential expansion.

### 8.0.6: Park-specific BMPs

As resources are available, NCTCOG will include in the BMP Library park-specific BMPs such as cost effective techniques, effectiveness of no mow areas, mowing height, use of permeable

pavement in parking lots, erosion minimization practices, and riparian buffers. As resources are available, sample signage, lessons learned from other cities, success stories, BMP affordability, and public education materials on park BMPs will also be provided. The Coordination Committee encourages municipalities using BMPs to educate park users regarding the intent and necessity of the BMPs as well as ways in which citizens can help. One example, is adding appropriate signage regarding impacts of pet waste at parks with intensive use by pets and owners. The Committee also recommends municipalities consider park usage data in deciding sign need and location.

### 8.0.7: OSSF BMPs

As resources are available, NCTCOG will include OSSF BMPs in the online BMP Library and stakeholders will conduct outreach to municipalities most impacted by OSSFs including information on retirement/closure procedures.

#### *8.0.7.1: Web-based homeowner education*

Authorized agents and other stakeholders are concerned that homeowners do not know enough about maintaining an OSSF to identify problems and solutions in order to prevent failures. As resources are available, NCTCOG will create or adapt a website to provide homeowner education on OSSFs. As technology and resources are available, a possible interactive function of this website could encourage OSSF owners to sign up for automatic reminders of required maintenance activities. The interaction has the potential to not only benefit the homeowner, but also serve as an information gathering tool for NCTCOG and the stakeholders regarding ownership, permitting, and maintenance of OSSFs. Other possible elements of the website may include an online pump-out and maintenance log for homeowners, information on grey water recapture systems for homeowners as well as for system builders and installers, lists of licensed maintenance providers, a list of Authorized Agents and contact information, and educational materials on septic-appropriate detergents, water softeners, and legal requirements concerning OSSF modifications. Municipalities, counties, communities, homeowner associations and other interested parties would be able to post a link to the website from their websites, creating a familiar portal for residents.

#### *8.0.7.2: Additional educational materials*

As resources are available NCTCOG will create or adapt collateral material, such as flyers, advertisements, mailers, and other marketing pieces for distribution at schools, in newspapers and publications, and to real estate agents, property inspectors, and OSSF builders/installers that address the aforementioned topics for homeowners.

### 8.0.8: Monitoring Coordination BMPs

As resources are available, NCTCOG will make available a BMP Library, which will include monitoring-specific topics such as BMP cost information, success stories, testing surrogates, potential new testing methods and materials, and examples of successful monitoring program implementation.

### 8.0.9: Public Education BMPs

Although the benefits may be hard to quantify, public education is an important part of reducing bacteria loading in the Project area's waterways through public awareness, buy in, and behavior change. Public education is also part of the TPDES Phase I and Phase II permits and there is considerable knowledge within the area regarding successful projects and techniques, volunteer organization, school curricula, and available materials. The public education section of the BMP Library will provide a clearing house of that information. Included in the BMP Library will be materials from stakeholders on educational efforts such as the City of Irving's Night Hikes and the Dallas Downriver Club's Moonlight Floats, in order to encourage public awareness and stewardship of area waterways. Other items for possible inclusion include guides for citizens on how to become involved in the decision-making process or in local efforts such as river clean-ups or Stream Team. As available, case studies showing benefits, economic and otherwise, from improved water quality and public education and participation will also be included. The web presence will be reevaluated annually by the Education and Outreach subcommittee.

**Table 49. Implementation Strategy 8.0 Summary — Best Management Practices Library**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 8.0 – 8.0.9 may result in a 5% reduction of bacteria loading over 25 years by providing a venue for the widespread dissemination of materials on the efficacy, cost effectiveness, and appropriateness of BMPs in the Project area |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | NCTCOG will work with existing RSWMP and TMDL groups to raise awareness of BMP Library |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Creation or modification of existing web page(s) |
| Progress Indicators | The number of portions of the BMP Library available online |
| Monitoring Component | Annual reports to the Coordination Committee regarding materials available online<br><br>Annual review by Coordination Committee and all technical subcommittees of web pages and contents |
| Responsible Entity | NCTCOG, as funding is available, will create or modify existing web page(s) for the online BMP Library<br><br>All technical subcommittees will provide NCTCOG with appropriate topic |

| | |
|---|---|
| | BMPs and other related information, including pilot project results for posting<br><br>The Coordination Committee will review new pilot projects annually for inclusion in BMP Library |

## Implementation Strategy 8.1: BMP project funding and evaluation

As resources are available, NCTCOG and stakeholders will identify low-interest loans, grant opportunities, and other funding sources, and facilitate BMP projects benefitting the region. As feasible, NCTCOG will also develop a method for sharing funding opportunities with interested parties. NCTCOG and stakeholders will seek funding opportunities, including grants and the TCEQ's Supplemental Environmental Projects (SEP), for MS4s with financial need for BMP implementation and evaluation of BMP effectiveness. NCTCOG and stakeholders will also pursue funding opportunities for a regional stormwater media campaign that specifically addresses bacteria and will be facilitated through the existing RSWMP Stormwater Public Education Task Force. The summary for implementation strategy 8.1 can be found in Table 50.

**Table 50. Implementation Strategy 8.1 Summary — BMP project funding and evaluation**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 8.1 may result in a 10% reduction of bacteria loading over 25 years by providing funding and a venue for the widespread dissemination of information that is not currently available on the effectiveness of BMPs |
| Technical and Financial Assistance Needed | Technical: technical and engineering assistance may be necessary<br><br>Financial: grant funding and existing program funding |
| Education Component | Stakeholders and NCTCOG will collect and distribute information on funding availability |
| Schedule of Implementation | As resources are available, the implementation of this activity will begin immediately and will continue for the entire implementation process |
| Interim, Measurable Milestone | Number of grants and/or other funding sources awarded<br><br>Number of BMPs installed |
| Progress Indicators | Number of BMPs evaluated and results of those evaluations posted to the BMP Library |
| Monitoring Component | MS4s will report on BMP funding received to NCTCOG<br><br>MS4s will collect data on BMP effectiveness |
| Responsible Entity | MS4s will seek funding opportunities for the purpose of evaluating BMP effectiveness |

| | |
|---|---|
| | MS4s will collect data on BMP effectiveness and report results to NCTCOG<br><br>NCTCOG will develop a method for sharing information on funding opportunities<br><br>NCTCOG will report on funding received by stakeholders and BMP information shared to the Coordination Committee<br><br>NCTCOG will make information on BMP evaluations available on the BMP Library |

## Implementation Strategy Evaluation

### Implementation Strategies 9.0: Implementation Strategy Evaluation

This I-Plan is a multi-year document with numerous implementation strategies intended to reduce bacteria loading in the waterways of the Project area. Given the broad scope of the I-Plan and the difficulties in attributing numeric values to the various bacteria sources, regular review of the implementation strategies is necessary for ongoing successful results. As such, all implementation strategies will be reevaluated on a regular basis. Current provisions call for each strategy to be reevaluated by its respective subcommittee annually. Any recommendations for changes will then be forwarded to the Coordination Committee, which will also meet annually to assess any proposed changes and edit the I-Plan if necessary, either through modifications, adoptions, or deletions of provisions or even entire strategies. The Coordination Committee may choose at a later date to modify the evaluation schedule for any given implementation strategy. The details of implementation strategy evaluation can be found in Table 51.

**Table 51. Implementation Strategy 9.0 Summary — Implementation Strategy Evaluation**

| | |
|---|---|
| Targeted Source(s) | All potential sources |
| Estimated Potential Load Reduction | IS 9.0 may result in a 5% reduction over 25 years by evaluating the efficacy of all implementation strategies and bacteria load reduction activities and adjusting the I-Plan as appropriate |
| Technical and Financial Assistance Needed | Technical: technical assistance may be necessary to evaluate some implementation strategies<br><br>Financial: existing funding as appropriate |
| Education Component | None |
| Schedule of Implementation | The technical subcommittees will evaluate their area-appropriate implementation strategies annually or as appropriate for a given strategy |

| | |
|---|---|
| | The Coordination Committee will evaluate implementation strategies annually or as appropriate for a given strategy |
| Interim, Measurable Milestone | Over 25 years, all implementation strategies will be evaluated annually or as deemed appropriate by the technical subcommittees and Coordination Committee |
| Progress Indicators | The number of Implementation strategies evaluated |
| Monitoring Component | Annual status report to the Coordination Committee from the technical subcommittees through NCTCOG |
| Responsible Entity | Technical subcommittees will evaluate the implementation strategies under their area of expertise and provide recommendations to the Coordination Committee through NCTCOG<br><br>NCTCOG will compile an annual report for the Coordination Committee with the results from the implementation strategy evaluations conducted by the technical subcommittees<br><br>The Coordination Committee will evaluate the analysis of the implementation strategies by the technical subcommittees and if warranted, make adjustments to the I-Plan |

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# Appendix A: Coordination Committee and Technical Subcommittee Membership

## Coordination Committee

| Organization | Member | Alternate |
|---|---|---|
| Arlington Conservation Council | Danny Kocurek | Grace Darling |
| City of Arlington | Bill Brown | Joe Gildersleeve |
| City of Bedford | William Shelton | |
| City of Cockrell Hill | Hector Saenz | Bret Haney |
| City of Coppell | Mike Garza | Ken Griffin |
| City of Dallas | Susan Alvarez | Chris Kaakaty |
| City of Euless | Ron Young | Allen Harts |
| City of Fort Worth | Mike Kazda | TC Michael |
| City of Grand Prairie | Cindy Mendez | Echo Rexroad |
| City of Grapevine | Dewey Stoffels | Gregg Moss |
| City of Irving | Garry Fennell | Wayne Lee |
| City of Keller | James Whitt | Not designated |
| City of Kennedale | Rachel Roberts | Larry Hoover |
| City of North Richland Hills | Stephanie East | Jo Ann Stout |
| Dallas Area Rapid Transit (DART) | Jon "Tad" Heimburger | Not designated |
| Dallas County Utility & Reclamation District | Rick Bordges | Not designated |
| Dallas Downriver Club | Eric Neilsen | Bryan Jackson |
| Dallas Regional Chamber | Fred Guerra | Amy Gibson |
| Dalworth Soil and Water Conservation District | Virgil Helm | Elizabeth Narcho |

| Organization | Member | Alternate |
|---|---|---|
| DFW International Airport | Muhammad Rafique | |
| Fort Worth Chamber of Commerce | Matt Geske | Not designated |
| Greater Fort Worth Sierra Club | Bonnie Bowman | Bob Scott |
| North Texas Tollway Authority | Amitis Meshkani | Eric Hemphill |
| Park Cities Municipal Utility District (MUD) | Rob McCormic | Matt Waldran |
| Southwest Paddler | Marc McCord | Not designated |
| Tarrant County | Becca Grassl-Petersen | Robert Berndt |
| Tarrant Regional Water District | Darrel Andrews | Mark Ernst |
| Texas Department of Transportation (TxDOT) | Jim Crisp | John Hart<br>Mary Hobson |
| Trinity River Authority (TRA) | Glenn Clingenpeel | Angela Kilpatrick |
| Trinity River Environmental Education Society (TREES) | Bob Horton | Fran Burns |

## Technical Subcommittee Members

Note: Technical support and expertise provided at each subcommittee meeting by John Mummert, TCEQ Region 4.

### Education and Outreach

| Member | Organization |
|---|---|
| Bonnie Bowman | Greater Fort Worth Sierra Club |
| Bob Horton | TREES |
| Frank Librio | City of Dallas |
| Amitis Meshkani | North Texas Tollway Authority (NTTA) |
| Tiffany Moss | DFW Airport |
| Eric Neilsen | Dallas Downriver Club |
| Karen Siddall | City of Irving |

### Monitoring Coordination

| Member | Organization |
|---|---|
| Susan Alvarez | City of Dallas |
| Rich Grayson | Dallas Downriver Club |
| John Hart | TxDOT |
| Angela Kilpatrick | TRA |
| Nusrat Munir | City of Dallas |
| Eric Neilsen | Dallas Downriver Club |
| Echo Rexroad | City of Grand Prairie |
| Jeff Shiflet | City of Irving |
| Vicki Stokes | City of Forth Worth |
| Tim Wentrcek | DFW Airport |
| Paul White | City of Dallas |

### Onsite Sewage Facilities

| Member | Organization |
|---|---|
| Becca Grassl-Petersen | Tarrant County |
| Chris Hughes | DFW Airport |
| Werner Rodriguez | City of Grand Prairie |
| Jeff Shiflet | City of Irving |

**Parks and Recreation**

(suspended meetings in February 2012)

| Member | Organization |
|---|---|
| Bonnie Bowman | Greater Fort Worth Sierra Club |
| Timothy Hamilton | City of Grapevine |
| Louise Hanson | City of Dallas |
| Eric Neilsen | Dallas Downriver Club |
| Tammy Walters | DFW Airport |
| Mark Woolsey | City of Forth Worth |

**Pets, Wildlife, and Livestock**

| Member | Organization |
|---|---|
| Bonnie Bowman | Greater Fort Worth Sierra Club |
| Don Burns | City of Dallas |
| John Hart | TxDOT |
| Tad Heimburger | DART |
| Virgil Helm | Dalworth SWCD |
| Brett Johnson | Texas Parks and Wildlife Department (TPWD) |
| Danny Kocurek | Arlington Conservation Council |
| Suzanne Tuttle | City of Forth Worth |
| David Waidler | AgriLife |
| Tammy Walters | DFW Airport |

**Planning and Development**

| Member | Organization |
|---|---|
| Greg Ajemian | City of Dallas |
| Peter Blanchette | City of Dallas |
| Bill Brown | City of Arlington |
| Fred Guerra | Dallas Regional Chamber |
| Mark Rauscher | City of Forth Worth |
| Rachel Roberts | City of Kennedale |

**Stormwater**

| Member | Organization |
|---|---|
| Susan Alvarez | City of Dallas |
| Bill Brown | City of Arlington |
| Stephanie Corso | City of Bedford |
| Garry Fennell | City of Irving |
| Mike Garza | City of Coppell |
| Timothy Hamilton | City of Grapevine |
| John Hart | TxDOT |
| Mike Kazda | City of Fort Worth |
| Danny Kocurek | Arlington Conservation Council |
| Rob McCormic | Park Cities MUD |
| Muhammad Rafique | DFW Airport |

**Wastewater**

| Member | Organization |
|---|---|
| Glenn Clingenpeel | TRA |
| Kent Conkle | City of Grapevine |
| Joe Gildersleeve | City of Arlington |
| Chris Hughes | DFW Airport |
| Chris Kaakaty | City of Dallas |
| Mike Kazda | City of Fort Worth |
| Cindy Mendez | City of Grand Prairie |
| Manny Ojo | City of Dallas |
| Ana Peña-Tijerina | City of Fort Worth |
| Jerry Pressley | City of Fort Worth |
| Ken Rosenberry | City of Irving |
| Anthony Wynn | City of Bedford |

# Appendix B: Allocated Loads for TMDLs

The information included in the following tables was taken directly from TMDL reports and technical support documents for the three TMDL projects covered by this I-Plan: *Two Total Maximum Daily Loads for Indicator Bacteria in the Upper Trinity River, Dallas, Texas (2011); Two Total Maximum Daily Loads for Indicator Bacteria in Cottonwood Branch and Grapevine Creek (2011);* and *Technical Support Document for Total Maximum Daily Loads for Indicator Bacteria in the Lower West Fork Trinity River Watershed (2012).*

**Commonly used abbreviations:**

AU = assessment unit
cfs=cubic feet per second
cms = cubic meters per second
Criterion = 126 MPN/100 mL
$FDA_{SWP}$ = fractional proportion of drainage area under jurisdiction of stormwater permits
FDC=flow duration curve
FG = future growth loads from potential permitted facilities
gpcd = gallons per capita per day
LA = allowable load from unregulated sources (predominately nonpoint sources)
$LA_{USL}$ = upstream load allocations entering the AU
$LA_{AU}$= allowable loads from unregulated sources within the AU
LDC=load duration curve
MGD = millions of gallons per day
MOS = margin of safety load
MPN = most probable number of bacteria forming units
$Q_{inlet}$ = median value of the high flow regime entering the AU
$Q_{Trib}$ = median value of the very high flow regime at the tributary or upstream AU outlet(s) to an impaired AU
TMDL = total maximum daily load
$WL_{ASW}$ = waste load from all permitted stormwater sources
$WLA_{WWTF}$ = waste load allocation from WWTFs

## Upper Trinity River, Segments 0805_03 and 0805_04

**TMDL Calculations**

The TMDL was calculated based on the median flow in the 0-20 percentile range (highest flow regime) from the LDC developed for the outlet of each AU. Each term in the TMDL equation was determined based on the equations provided previously.

Table 52 summarizes the calculation of the TMDL and $LA_{USL}$ terms for each AU. Table 53 summarizes the $WLA_{WWTF}$ for the TPDES-permitted facility within the study area. Compliance is achieved when the discharge limits are met. Table 53 does not provide wasteload allocations for permitted facilities not expected to contribute bacteria loadings. The future growth component for AU 0805_04 of the TMDL will be available to the permitted facilities if future in-steam monitoring indicates the need for specific wasteload allocations. Because the entire drainage areas of both 0805_04 and 0805_03 are under the jurisdiction of stormwater permits, stormwater loadings originating from unregulated areas within each AU ($LA_{UA}$) are zero, and all stormwater loadings are assigned to $WLA_{SW}$.

Table 54 summarizes the computation of future capacity for the combined AUs. The computation of future growth for AUs 0805_04 and 0805_03 is summarized in Table 55. Table 56 summarizes the TMDL calculations for AUs 0805_04 and 0805_03. In Table 56, the future capacity for WWTF has been added to the $WLA_{WWTF}$ and $LA_{AU}$ and $LA_{USL}$ have been added to give LA. The allocations for $WLA_{WWTF}$ are based on one-half of the water quality criterion for E. coli in freshwater of 126 MPN/100 mL.

**Table 52. Summary of TMDL and upstream load allocation calculations for each AU**
(loading expressed in billion MPN/day)

| AU | Receiving Water | Upstream Allowable Loading $Q_{inlet}$[a] (cms) \| $LA_{USL}$[b] | | Downstream Allowable Loading Outlet Flow [c](cms) \|TMDL[d] | |
|---|---|---|---|---|---|
| 0805_04 | Upper Trinity River | 195.75 (6913 cfs) | 21,310 | 210.23 (7424 cfs) | 22,890 |
| 0805_03 | Upper Trinity River | 210.23 (7424 cfs) | 22,890 | 235.54 (8318 cfs) | 25,640 |

[a] Inlet median value from highest flow regime
[b] Inlet allowable loading; median value from highest flow regime
[c] Outlet median value from highest flow regime
[d] Outlet allowable loading; median value from highest flow regime

**Table 53. Wasteload allocations for TPDES permitted facilities**

| Receiving Water | AU | TPDES Number | NPDES Number | Facility Name | Final Permitted Flow (MGD) | $WLA_{WWTF}$ (billion MPN/day) |
|---|---|---|---|---|---|---|
| Upper Trinity River | 0805_04[a] | — | — | — | — | 0 |
| Upper Trinity River | 0805_03 | 10060-001 | TX0047830 | Dallas Central | 200 | 477.0 |

[a] Wasteload allocations are not provided for TPDES WQ0004161-000, WQ0004663-000, WQ0004765-000, and WQ0014699-001.

**Table 54. Future capacity calculations for impaired AUs**

| 2005 Wastewater Flow (gpcd) | Population Increase 2005 to 2030 | Dallas Central Full Permitted Flow (MGD) | Dallas Southside Full Permitted Flow (MGD) | Future Capacity of Impaired AUs (MGD) |
|---|---|---|---|---|
| 153 | 151,106 | 200 | 110 | 14.9 |

**Table 55. Future growth calculations for AUs 0805_04 and 0805_03**

| Receiving Water | AU | Percent of Combined Drainage Area | Apportioned Future Capacity (MGD) | Future Growth (billion MPN/day) |
|---|---|---|---|---|
| Upper Trinity River | 0805_04 | 46.64% | 6.950 | 16.57 |
| Upper Trinity River | 0805_03 | 53.36% | 7.950 | 18.96 |

**Table 56. *E. coli* TMDL summary calculations for the Upper Trinity River AUs 0805_04 and 0805_03**
(all loads expressed as billion MPN/day)

| AU | TMDL[a] | $WLA_{WWTF}$[b,c] | $WLA_{SW}$[d] | $LA_{AU}$[e] | $LA_{USL}$ | MOS[h] | Future Growth[i] |
|---|---|---|---|---|---|---|---|
| 0805_04 | 22,890 | 0 | 1,480 | 0 | 21,310[f] | 78.79 | 16.57 |
| 0805_03 | 25,640 | 477.0 | 2,123 | 0 | 22,890[g] | 137.8 | 18.96 |

[a] TMDL = Median flow (high flow regime) * Criterion (126 MPN/100 mL) * Conversion Factor; where the Conversion Factor = $8.64 \times 10^8$ 100 mL/$m^3$ * seconds/day.
[b] No WWTF discharges into AU04
[c] Loads from the Dallas Central WWTF calculated as Permitted Flow (MGD) * Conversion Factor * Criterion/2 (63 MPN/day); where Permitted Flow = 200 MGD; Conversion Factor = $3.7854 \times 10^7$ 100 mL/MGD
[d] $WLA_{SW}$ = (TMDL - $WLA_{WWTF}$ - $LA_{USL}$ - FG - MOS) * $FDA_{SWP}$; where FG = future growth loads from potential permitted facilities and $FDA_{SWP}$ (fractional proportion of drainage under jurisdiction of stormwater permits) = 1.000
[e] $LA_{AU}$ = TMDL - MOS - $WLA_{WWTF}$ - $WLA_{SW}$ - $LA_{USL}$ - FG; because the entire drainage area of AU04 and AU03 is covered by MS4 permits the $LA_{AU}$ = 0.000
[f] $LA_{USL}$ = $Q_{inlet}$ * Criterion (126 MPN/day) * Conversion Factor = $8.64 \times 10^8$ 100 mL/$m^3$ * seconds/day
[g] $LA_{USL}$ = $Q_{inlet}$ * Criterion (126 MPN/day) * Conversion Factor = $8.64 \times 10^8$ 100 mL/$m^3$ * seconds/day
[h] MOS = 0.05 * (TMDL - $LA_{USL}$)
[i] Future Growth = surface water quality standard/2 (63 MPN/day) * FC (MGD) * $FDA_{AU}$ * Conversion Factor = $3.7854 \times 10^7$ 100 mL/MGD

## Cottonwood Creek and Grapevine Branch, Segments 0822A_02 and 0822B_01

**TMDL Calculations**

The TMDL was calculated based on the median flow in the 0-10 percentile range (high flow regime) from the LDC developed for the most downstream station within each AU, which is station 17166 in AU 0822A_02 and station 20311 in AU 0822B_01. Each term in the TMDL equation was determined based on the equations provided previously. Table 57 summarizes the calculation of the TMDL for each AU. Table 58 summarizes the computation of future growth for the combined AUs.

The entire drainage area of AU 0822A_02 is located within jurisdictional areas regulated by stormwater permits, and 84.8% of the drainage area of AU 0822B_01 is located within the jurisdictional areas regulated by stormwater permits (6,437 acres out of 7,593 acres under stormwater permit regulation). Table 59 summarizes the computation of term $WLA_{SW}$. Since the entire drainage of AU 0822A_02 is within the jurisdictional areas regulated by stormwater permits, the LA associated with this AU is zero. For AU 0822B_01, 1,156 acres (or 15.2% of its drainage area) are not regulated by stormwater permits, and the LA was computed from the value of terms in Table 60.

Table 61 summarizes the TMDL calculations for AUs 0822A_02 and 0822B_01. Table 62 includes the final TMDL allocations including the future growth component designated as $WLA_{WWTF}$. Allocations to permitted MS4 entities are designated as $WLA_{SW}$. The allocations are based on the current geometric mean criterion for *E. coli* in freshwater of 126 MPN/100 mL, with the exception of the Future Growth component. The Future Growth component is based on one-half the current geometric mean criterion (63 MPN/100 mL) to provide instream and downstream capacity.

**Table 57. Summary of TMDL calculations for Cottonwood Branch and Grapevine Creek**

| Segment | Stream Name | Station | Median Value of High Flow Regime | TMDL (billion MPN/day) |
|---|---|---|---|---|
| 0822A_02 | Cottonwood Branch | 17166 | 0.3402 cms (12.01 cfs) | 37.04 |
| 0822B_01 | Grapevine Creek | 20311 | 1.802 cms (63.65 cfs) | 196.22 |

**Table 58. Future growth computations for Cottonwood Branch and Grapevine Creek**

| Segment | Stream Name | 2005 Population | 2030 Population | Population Increase 2005 to 2030 | Additional Wastewater Production (MGD) | Future Growth (billion MPN/day)* |
|---|---|---|---|---|---|---|
| 0822A | Cottonwood Branch | 19,499 | 20,328 | 829 | 0.089 | .212 |
| 0822B | Grapevine Creek | 20,807 | 22,622 | 1,815 | 0.195 | .464 |

* Future growth includes a reduction for MOS of 5%

**Table 59. Regulated stormwater computations for Cottonwood Branch (0822A_02) and Grapevine Creek (0822B_01)**
(all loads expressed as billion MPN/day)

| AU | TMDL | $WLA_{WWTF}$ | Future Growth | MOS | $FD_{ASWP}$ | $WLA_{SW}$ |
|---|---|---|---|---|---|---|
| 0822A_02 | 37.04 | 0.00 | 0.21 | 1.85 | 1.000 | 34.97 |
| 0822B_01 | 196.22 | 0.00 | 0.46 | 9.81 | 0.848 | 157.60 |

**Table 60. Non-regulated stormwater computations for Cottonwood Branch and Grapevine Creek**

| AU | LA (Billion MPN/day) |
|---|---|
| 0822A_02 | 0 |
| 0822B_01 | 28.34 |

**Table 61. TMDL allocation summary for Cottonwood Branch and Grapevine Creek**
(all units in billion MPN/day)

| AU | Stream Name | TMDL[a] | $WLA_{WWTF}$[b] | $WLA_{SW}$[c] | LA[d] | MOS[e] | Future Growth[f] |
|---|---|---|---|---|---|---|---|
| 0822A_02 | Cottonwood Branch | 37.04 | 0.00 | 34.97 | 0 | 1.85 | 0.21 |
| 0822B_01 | Grapevine Creek | 196.22 | 0.00 | 157.60 | 28.34 | 9.81 | 0.46 |

[a] TMDL = Median flow (high flow regime) * 126 MPN/100 mL * Conversion Factor; where the Conversion Factor = 8.64E+08 100 mL/$m^3$ * seconds/day
[b] No WWTF discharges into AUs 0822A_02 and 0822B_01
[c] $WLA_{SW}$ = (TMDL - $WLA_{WWTF}$ - FG - MOS) * $FDA_{SWP}$
[d] LA = TMDL - $WLA_{WWTF}$ - MOS - $WLA_{SW}$ - FG; because the entire drainage area of 0822A_02 is covered by MS4 permits its LA = 0.000
[e] MOS = 0.05 * TMDL
[f] Future Growth = Criterion /2 (63 MPN/day) *$Flow_{2005}$ * ($Pop_{30}$ – $Pop_{05}$) * Conversion Factor; where $Flow_{2005}$ = 107 gpcd, $Pop_{30}$ is the estimated population within the watershed for year 2030 and Pop05 is the estimated population within the watershed for year 2005; and Conversion Factor = 37.854 100 ml/gpcd

**Table 62. Final TMDL allocations for Cottonwood Branch and Grapevine Creek**
(all units in billion MPN/day)

| AU | Stream Name | TMDL | $WLA_{WWTF}$* | $WLA_{SW}$ | LA | MOS |
|---|---|---|---|---|---|---|
| 0822A_02 | Grapevine Creek | 37.04 | 0.21 | 34.97 | 0 | 1.85 |
| 0822B_01 | Cottonwood Branch | 196.22 | 0.46 | 157.60 | 28.34 | 9.81 |

* $WLA_{WWTF}$ = $WLA_{WWTF}$ + Future Growth

## Lower West Fork Trinity and Impaired Tributaries, Segments 0841, 0841B, 0841C, 0841E, 0841G, 0841H, 0841J, 0841L, 0841M, 0841R, 0841T, and 0841U

**TMDL Calculations**

Table 63 summarizes the allowable loading of *E. coli* that the 13 water bodies within the 0841 TMDL watersheds can receive on a daily basis was determined based on the median value within the very high flow regime of the FDC (or 5% flow exceedance value) for the outlet of each AU. For each AU with tributary and upstream load allocations, the following approach was taken:

- Lower West Fork Trinity River (0841_01), $LA_{USL}$ = sum of the allowable loading calculated at the outlet of Lower West Fork Trinity River (0841_02), Bear Creek (0841B), Dalworth Creek (0841G), Delaware Creek (0841H), Johnson Creek (0841L), Mountain Creek (0841O), and West Irving Branch (0841U).
- Lower West Fork Trinity River (0841_02), $LA_{USL}$ = the sum of the loading calculated at the outlet of West Fork Trinity River (0806) and Village Creek (0841T).
- Bear Creek (0841B), $LA_{USL}$ = the loading calculated at the outlet of Big Bear Creek (0841D), Dry Branch (0841I), and Estelle Creek (0841J).
- Johnson Creek (0841L), $LA_{USL}$ = the loading calculated at the outlet of Arbor Creek (0841C).
- Rush Creek (0841R), $LA_{USL}$ = the loading calculated at the outlet of Kee Branch (0841M).
- Village Creek (0841T), $LA_{USL}$ = the loading calculated at the outlet of Rush Creek (0841R).

Table 64 details the daily allowable loading of *E. coli* assigned to $WLA_{WWTF}$ was determined based on the full permitted flow of the two WWTFs located in the TMDL watersheds. A $WLA_{WWTF}$ was only applied to AUs that directly receive discharge from a WWTF. The $WLA_{WWTF}$ calculated for the City of Forth Worth Village Creek WWTF was thus applied to the TMDL Lower West Fork Trinity River segment 0841_02, and the $WLA_{WWTF}$ calculated for the TRA Central Regional WWTF was applied to the TMDL for Lower West Fork Trinity River segment 0841_01.

In terms of future growth, the majority of the TMDL watersheds are serviced by the TRA Central Regional WWTF. As shown in Table 65, anticipated expansion of the TRA Central Regional WWTF that will result in an additional 43 MGD capacity was the basis for the future growth allocation within Lower West Fork Trinity River (0841_01). The Future Growth component for Arbor Creek (0841C), Copart Branch Mountain Creek (0841E), Dalworth Creek (0841G), Delaware Creek (0841H), Estelle Creek (0841J), Johnson Creek (0841L), Kee Branch (0841M), and West Irving Branch (0841U), which are serviced by the TRA Central Regional WWTF, were not explicitly derived since all wastewater collected within these AUs is subsequently discharged outside of their watersheds and into Lower West Fork Trinity River (0841_01).

The future growth allocations for AUs within the TMDL watersheds that have portions of their area outside of the TRA Central Regional WWTF service area were calculated based on population projections and per capita wastewater use. The resulting future wastewater flow was then converted into a loading.

Based on the MS4 permitted areas, most of the AUs within TMDL watersheds are completely within the jurisdiction regulated by stormwater permits. The AUs that are not 100% within the urbanized area include Lower West Fork Trinity River (0841_01), Bear Creek (0841B), Copart Branch Mountain Creek (0841E), and Rush Creek (0841R). Table 66 summarizes the computation of term $WLA_{SW}$.

The $LA_{AU}$ is the allowable bacteria loading assigned to unregulated sources within each TMDL watershed. For most of the AUs within the TMDL watersheds, their entire area is regulated by stormwater permits. Therefore, for most AUs the $LA_{AU}$ term is zero. For Lower West Fork Trinity River (0841_01), 1,727 acres or 24.3% of its drainage area is not regulated by stormwater permits. For Bear Creek (0841B), 432 acres or 0.9% of its drainage area is not regulated by stormwater permits. For Copart Branch Mountain Creek (0841E), 150 acres or 24.7% of its drainage area is not regulated by stormwater permits. For Rush Creek (0841R), 494 acres or 2.8% of its drainage area is not regulated by stormwater permits (Table 67).

Table 68 summarizes the TMDL calculations for the 13 impaired AUs comprising the TMDL watersheds. Each of the TMDLs was calculated based on the median flow in the 0-10 percentile range (very high flow regime) for flow exceedance from the LDC developed for the outlet of each AU. Allocations are based on the current geometric mean criterion for *E. coli* in freshwater of 126 MPN/100 mL for each component of the TMDL.

The final TMDL allocations include the future growth component within the $WLA_{WWTF}$ while allocations to permitted MS4 entities are designated as $WLA_{sw}$ (Table 69). The LA component of the final TMDL allocations includes both tributary and upstream bacteria loadings ($LA_{USL}$) and loadings arising from within each segment from non-permitted sources ($LA_{AU}$).

**Table 63. Summary of TMDL and load allocations from upstream and tributaries ($LA_{USL}$) calculations**

| AU | Segment Name | Upstream Allowable Loading | | Downstream Allowable Loading | |
|---|---|---|---|---|---|
| | | $Q_{inleta}$ [a] (cms) | $LA_{USL}$ [b] (billion MPN/100 mL) | Outlet Flow [c] (cms) | TMDL[d] (billion MPN/100 mL) |
| 0841_01 | Lower West Fork Trinity River | 139.54 | 15,191 | 150.59 | 16,390 |
| 0841_02 | Lower West Fork Trinity River | 82.70 | 9,003 | 105.16 | 11,448 |
| 0841B | Bear Creek | 12.66 | 1,378 | 23.15 | 2,520 |
| 0841C | Arbor Creek | 0 | 0 | 0.46 | 50.10 |
| 0841E | Copart Branch Mountain Creek | 0 | 0 | 0.24 | 25.92 |
| 0841G | Dalworth Creek | 0 | 0 | 0.55 | 59.37 |
| 0841H | Delaware Creek | 0 | 0 | 2.21 | 240.4 |
| 0841J | Estelle Creek | 0 | 0 | 0.79 | 85.46 |
| 0841L | Johnson Creek | 0.46 | 50.10 | 5.21 | 567.0 |
| 0841M | Kee Branch | 0 | 0 | 1.78 | 194.1 |
| 0841R | Rush Creek | 1.78 | 194.1 | 8.57 | 933.2 |
| 0841T | Village Creek | 8.57 | 933.2 | 12.10 | 1,317 |
| 0841U | West Irving Branch | 0 | 0 | 0.86 | 93.17 |

[a] Inlet median value from very high flow regime for all tributaries and upstream AUs
[b] Inlet allowable loading; median value from very high flow regime for all tributaries and upstream AUs
[c] Outlet median value from very high flow regime
[d] Outlet allowable loading; median value from very high flow regime

**Table 64. Regulated wastewater treatment facility computations**

| AU | TPDES Number | Facility Name | Final Permitted Flow (MGD) | *E. coli* $WLA_{WWTF}$ (billion MPN/day) |
|---|---|---|---|---|
| 0841_01 | WQ0010303-001 | TRA Central Regional WWTF | 189 | 450.7 |
| 0841_02 | WQ0010494-013 | City of Fort Worth Village Creek WWTF | 166 | 395.9 |
| 0841D | WQ0011032-001 | Alta Vista Mobile Home Park* | 0.008 | 0.019 |

* Although the Alta Vista Mobile Home Park does not discharge to an impaired AU, it is in the TMDL watershed. For this reason, the facility has a WLA.

**Table 65. Future Wastewater Service Area (WWSA) growth computations for the TMDL watersheds**

| AU | 2010 Population outside the TRA Central WWSA | 2040 Population Projection outside the TRA Central WWSA | Population Increase 2010 to 2040 outside the TRA Central WWSA | Per Capita Wastewater Use outside the TRA Central WWSA (gpcd) | Additional Wastewater Production (MGD) | Future Growth (billion MPN/day) |
|---|---|---|---|---|---|---|
| 0841_01[a] | 0 | 0 | 0 | 0 | 43 | 102.5 |
| 0841_02 | 89,631 | 119,715 | 30,084 | 101.77 | 3.06 | 7.301 |
| 0841B | 3,003 | 3,761 | 758 | 101.77 | 0.077 | 0.1840 |
| 0841C[b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841E [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841G [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841H [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841J [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841L [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841M [b] | 0 | 0 | 0 | 0 | 0 | 0 |
| 0841R | 4,319 | 7,873 | 3,554 | 101.77 | 0.362 | 0.8626 |
| 0841T | 23,599 | 53,443 | 29,844 | 101.77 | 3.04 | 7.243 |
| 0841U [b] | 0 | 0 | 0 | 0 | 0 | 0 |

[a]Future Growth for 0841_01 is based exclusively on the 43 MGD expansion of the TRA Central WWTF.
[b]Future Growth was not explicitly derived since all wastewater collected within the AU is discharged to 0841_01.

**Table 66. Regulated stormwater computation for TMDL Watersheds**
(all loads expressed as billion MPN/day)

| AU | TMDL (MPN/day) | $WLA_{WWTF}$ (MPN/day) | Future Growth (MPN/day) | $LA_{USL}$ (MPN/day) | MOS (MPN/day) | $FDA_{SWP}$ | $WLA_{SW}$ (MPN/day) |
|---|---|---|---|---|---|---|---|
| 0841_01 | 16,394 | 450.7 | 102.5 | 15,191 | 60.15 | 1.000 | 589.6 |
| 0841_02 | 11,448 | 395.9 | 7.301 | 9,003 | 122.3 | 1.000 | 1,920 |
| 0841B | 2,520 | 0 | 0.1840 | 1,378 | 57.09 | 1.000 | 1,085 |
| 0841C | 50.10 | 0 | 0 | 0 | 2.505 | 1.000 | 47.59 |
| 0841E | 25.92 | 0 | 0 | 0 | 1.296 | 1.000 | 24.62 |
| 0841G | 59.37 | 0 | 0 | 0 | 2.969 | 1.000 | 56.41 |
| 0841H | 240.4 | 0 | 0 | 0 | 12.02 | 1.000 | 228.4 |
| 0841J | 85.46 | 0 | 0 | 0 | 4.273 | 1.000 | 81.19 |
| 0841L | 567.0 | 0 | 0 | 50.10 | 25.84 | 1.000 | 491.0 |
| 0841M | 194.1 | 0 | 0 | 0 | 9.704 | 1.000 | 184.4 |
| 0841R | 933.2 | 0 | 0.8626 | 194.1 | 36.95 | 0.972 | 681.4 |
| 0841T | 1,317 | 0 | 7.243 | 933.2 | 19.22 | 1.000 | 357.9 |
| 0841U | 93.17 | 0 | 0 | 0 | 4.658 | 1.000 | 88.51 |

**Table 67. Computed unregulated stormwater term for AUs within TMDL watersheds**

| AU | $LA_{AU}$ (billion MPN/day) | | AU | $LA_{AU}$ (billion MPN/day) |
|---|---|---|---|---|
| 0841_01 | 0 | | 0841J | 0 |
| 0841_02 | 0 | | 0841L | 0 |
| 0841B | 0 | | 0841M | 0 |
| 0841C | 0 | | 0841R | 22.58 |
| 0841E | 0 | | 0841T | 0 |
| 0841G | 0 | | 0841U | 0 |
| 0841H | 0 | | | |

**Table 68. TMDL allocation summary for impaired AUs within the Lower West Fork Trinity River Watershed**
(all loads expressed as billion MPN/day)

| AU | Stream Name | TMDL | MOS | $WLA_{WWTF}$ | $WLA_{SW}$ | $LA_{AU}$ | $LA_{USL}$ | LA Total | Future Growth |
|---|---|---|---|---|---|---|---|---|---|
| 0841_01 | Lower West Fork Trinity River | 16,394 | 60.15 | 450.7 | 589.6 | 0 | 15,191 | 15,334 | 102.5 |
| 0841_02 | Lower West Fork Trinity River | 11,448 | 122.3 | 395.9 | 1,920 | 0 | 9,003 | 9,003 | 7.301 |
| 0841B | Bear Creek | 2,520 | 57.09 | 0.0191 | 1,085 | 0 | 1,378 | 1,388 | 0.184 |
| 0841C | Arbor Creek | 50.10 | 2.505 | 0 | 47.59 | 0 | 0 | 0 | 0 |
| 0841E | Copart Branch Mountain Creek | 25.92 | 1.296 | 0 | 24.62 | 0 | 0 | 6.070 | 0 |
| 0841G | Dalworth Creek | 59.37 | 2.969 | 0 | 56.41 | 0 | 0 | 0 | 0 |
| 0841H | Delaware Creek | 240.4 | 12.02 | 0 | 228.4 | 0 | 0 | 0 | 0 |
| 0841J | Estelle Creek | 85.46 | 4.273 | 0 | 81.19 | 0 | 0 | 0 | 0 |
| 0841L | Johnson Creek | 567.0 | 25.84 | 0 | 491.0 | 0 | 50.10 | 50.10 | 0 |
| 0841M | Kee Branch | 194.1 | 9.704 | 0 | 184.4 | 0 | 0 | 0 | 0 |
| 0841R | Rush Creek | 933.2 | 36.95 | 0 | 678.7 | 22.58 | 194.1 | 216.7 | 0.8626 |
| 0841T | Village Creek | 1,317 | 19.22 | 0 | 357.9 | 0 | 933.2 | 933.2 | 7.243 |
| 0841U | West Irving Branch | 93.17 | 4.658 | 0 | 88.51 | 0 | 0 | 0 | 0 |

**Table 69. Final TMDL allocations for impaired AUs**
(all loads expressed as billion MPN/day)

| AU | TMDL | $WLA_{WWTF}$* | $WLA_{SW}$ | LA | MOS |
|---|---|---|---|---|---|
| 0841_01 | 16,394 | 553.3 | 589.6 | 15,191 | 60.15 |
| 0841_02 | 11,448 | 403.2 | 1,920 | 9,003 | 122.3 |
| 0841B | 2,520 | 0.203 | 1,085 | 1,378 | 57.09 |
| 0841C | 50.10 | 0 | 47.59 | 0 | 2.505 |
| 0841E | 25.92 | 0 | 24.62 | 0 | 1.296 |
| 0841G | 59.37 | 0 | 56.41 | 0 | 2.969 |
| 0841H | 240.4 | 0 | 228.4 | 0 | 12.02 |
| 0841J | 85.46 | 0 | 81.19 | 0 | 4.273 |
| 0841L | 567.0 | 0 | 491.0 | 50.10 | 25.84 |
| 0841M | 194.1 | 0 | 184.4 | 0 | 9.704 |
| 0841R | 933.2 | 0.8626 | 678.7 | 216.7 | 36.95 |
| 0841T | 1,317 | 7.243 | 357.9 | 933.2 | 19.22 |
| 0841U | 93.17 | 0 | 88.51 | 0 | 4.658 |

*$WLA_{WWTF}$ includes the future potential allocation to wastewater treatment facilities.

# Appendix C: Segments and assessment units in project area

**Table 70. Segment number with physical description and year listed**

| Segment number | Name | Description | Year listed on 303(d) |
|---|---|---|---|
| 0805_03 | Upper Trinity River | From the confluence of Fivemile Creek upstream to the confluence of Cedar Creek. | 1996 |
| 0805_04 | Upper Trinity River | From confluence of Cedar Creek upstream to confluence of Elm Fork Trinity River. | 1996 |
| 0822A_02 | Cottonwood Branch | A 3. 5 mile stretch of Cottonwood Branch running upstream from approximately 0.5 miles downstream of N.Story Rd. to Valley View Rd, Dallas, Co. | 2006 |
| 0822B_01 | Grapevine Creek | From the confluence with Elm Fork Trinity River in Dallas County upstream to its headwaters west of International Parkway at DFW Airport in Tarrant County. | 2006 |
| 0841_01 | Lower West Fork Trinity River | Lower West Fork Trinity River from a point immediately upstream of the confluence of the Elm Fork Trinity River in Dallas County to a point immediately upstream of the confluence of Johnson Creek in Dallas County. | 1996 |
| 0841_02 | Lower West Fork Trinity River | Lower West Fork Trinity River from a point immediately upstream of the confluence of Johnson Creek in Dallas County to a point immediately upstream of the confluence of Village Creek in Tarrant County. | Not yet listed |
| 0841B_01 | Bear Creek | Bear Creek from confluence with West Fork Trinity River, to the confluence with of Big Bear and Little Bear Creek just upstream of HWY 183 in Euless, Tarrant County, TX. | 2006 |
| 0841C_01 | Arbor Creek | Arbor Creek from confluence with Johnson Creek upstream to Duncan Perry Road in Grand Prairie, TX. | 2006 |
| 0841E_01 | Copart Branch | Copart Branch Mountain Creek from | 2006 |

| Segment number | Name | Description | Year listed on 303(d) |
|---|---|---|---|
| | Mountain Creek | confluence with unnamed oxbow (NHD RC 12030102044758) to approximately 0.3 miles upstream of Camden Road on the former Dallas Naval Air Station property, Dallas County. | |
| 0841G_01 | Dalworth Creek | Dalworth Creek from confluence with Lower West Fork Trinity to headwaters area just west of 22nd Street NW in Grand Prairie, Dallas County. | 2006 |
| 0841H_01 | Delaware Creek | Delaware Creek from confluence with Lower W. Fork Trinity to Finley Road in Irving. | 2006 |
| 0841J_01 | Estelle Creek | Estelle Creek from confluence with Bear Creek upstream to Valley View Lane in Irving, Dallas County. | 2006 |
| 0841M_01 | Kee Branch | Kee Branch from confluence with Rush Creek to upper end of the creek (NHD RC 12030102000165). | 2006 |
| 0841R_01 | Rush Creek | Rush Creek from confluence with Village Creek to headwater area just east of Calender Road in Arlington, Tarrant County. | 2006 |
| 0841T_01 | Village Creek | Village Creek from confluence with West Fork Trinity River to SH 303 approx. 0.75 miles downstream of Lake Arlington. | 2010 |
| 0841U_01 | West Irving Branch | West Irving Branch from approx. 0.4 mi. downstream of Oakdale Rd. to headwater area in Wyche Park (NHD RC 12030102044201) in Irving, Dallas County. | 2006 |

# Appendix D: Public comments and responses

| Commenting Organization or Individual | Date | Comment | Response |
|---|---|---|---|
| | | | |
| Arlington Conservation Council | 7/7/2012 | 4.81 line 5 and 4.10 line 2 seem to be missing a word | Corrected. |
| Upper Trinity Regional Water District | 7/19/2012 | Useful tools for bacteria reduction efforts | Copies of E. *coli* reduction strategy for Willamett, OR TMDL I-Plan and Coa, et al 2009 article on optical brighteners will be provided to appropriate technical subcommittee for evaluation. |
| City of Kennedale | 7/28/2012 | Consolidated for readability. On p. 50: Add comma after "stormwater." Revise comma placement, add "to." Add comma before "such as."<br><br>On p. 53:<br>"…adoption of ordinances specifying no net discharge of stormwater during reasonable rain events."<br><br>I think during the meeting someone suggested making this statement more clear and realistic. That comment may have been addressed by you already by adding the phrase "during reasonable rain events."<br><br>On p. 61, Item 4.8: Add "to" after "watersheds." Add comma before "such as."<br><br>On p. 63, Item 5.3: Remove comma after "Grand Prairie."<br><br>On p. 64, Item 5.5.1: This sentence is a bit long and may be confusing. Perhaps break it into two sentences?<br><br>On p. 67, Item 6.2.3: sub- basins — is there an extra space between "sub-" and "basins"?<br><br>On p. 68: Add comma before "which." | Corrections made where appropriate. |

| Commenting Organization or Individual | Date | Comment | Response |
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| DFW International Airport | 7/31/2012 | I think it is deceptive to state there is large presence of these impaired water bodies on DFW Airport. The headwaters of these creeks did originate on Airport property, but actually comprise very little of the property itself. Cottonwood Branch portion on DFW Airport includes less than a mile of ephemeral stream channel that is completely dry a majority of the year. I think this statement should be revised to state the Cities within the watersheds for Grapevine Creek and Cottonwood Branch include Irving, Coppell, and Grapevine in addition of Dallas-Fort Worth International Airport. | Wording changed. |
| City of Dallas | 8/8/2012 | Graphics: The figures and graphics are really hard to read, especially when converted to black and white PDF format. Please check for graphic contrast for printing in black and white print format, and consider using 11 x 17 sized drawings, especially for illustrating the regional conditions. | Maps will be available online at greater resolution. For ease of printing, the I-Plan is designed for 8 1/2" x 11" paper. |
| City of Dallas | 8/8/2012 | Impaired waters versus TMDL-defined waters: There are many streams in North Texas that may be listed on the current Section 303 (d) list as being impaired, but that may not yet have defined TMDLs. While the desire to be able to add to this document at a later date is appreciated, please be careful with respect to labeling of impaired waters versus those stream bodies that have defined TMDLs. As an example, Figure 1 shows the project area: however the impaired waters are not easily discernible graphically with respect to the TMDL segments. Other examples would be Figures 4 and 10 that are labeled across the top as “Impaired Segments/ Impaired Tributaries” and along the bottom as “TMDL subwatersheds.” | Maps have been updated to include only those impaired tributaries with TMDLs addressed in this I-Plan and emphasis added on those segments. |
| City of Dallas | 8/8/2012 | Formulas: To enhance the readability of this document, we suggest placing the formulas and related factor descriptions into inset boxes. | Many formulas within the Introduction section have been placed into text boxes for easier reading. Those in Appendix C, Allocated Loads, have not. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Global Categories: Several of the Best Management Practices (BMPs), such as establishing a BMP library, providing outreach, and developing model ordinances are repeated in several categories. To streamline the document, we suggest listing once in the category that most applies (for instance outreach and education), and simply indicating that it covers multiple other categories, or referencing it in the applicable category. | Implementation Strategies (IS) for the BMP Library and IS have been added to the I-Plan and mention of them in other IS sections removed to avoid redundancy. |
| City of Dallas | 8/8/2012 | I-Plan Review: We suggest a global one-year reporting period and 5-year I-Plan management measure review process, and to describe that process in one place rather than in each section. | The Coordination Committee determines the review period. As of the July 2012 peer review draft I-Plan, the IS review period was annually. |
| City of Dallas | 8/8/2012 | Appendix B Coordination: Please check contents of Appendix B Matrix with the text for consistency. | Appendix B eliminated in favor of individual IS summaries. |
| City of Dallas | 8/8/2012 | Units: Please either provide a handy conversion factor from Hectares to Acres, or provide both measures where used; most lay-persons and many professionals in Texas do not use Standard International format as a day-to-day unit of measurement. | Hectares removed and replaced with acres. |
| City of Dallas | 8/8/2012 | Grammar: Please use Active-Imperative verb tense, and watch for the use of double negatives. Also, please check that all acronyms and abbreviations (include those from Appendix B) are included in that Table. (e.g. rather than “the Coordinating Committee recommends”….”Do whatever” (see proposed language in 2.6, below) | Changed where feasible. In some cases, adding imperative verbs may change the intent of an implementation strategy and as such, will need to be referred to the Coordination Committee. |
| City of Dallas | 8/8/2012 | Table of Acronyms and Abbreviations: Please check that all acronyms and abbreviations (include those from Appendix B) are included in this Table. Suggest including: E. coli as used in lieu of EC as in table, iSWM (integrated Stormwater Management), NELAP (National Environmental Laboratory Accreditation Program…..it is NELAP certification), H-GAC (Houston Galveston Area Council), iSWM (integrated Stormwater Management), CC (????), TSC (Technical Steering Committee?), SWMP (Stormwater Management Plan), SSS (Sanitary Sewer System?), TEA (Texas Education Agency). | Corrected. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Executive Summary: Table 1 referenced, but not found. | Table moved and reference corrected. |
| City of Dallas | 8/8/2012 | Introduction: a. Suggest adding the word "primary" before "Contact recreation" wherever it occurs in the first paragraph. | Corrected. |
| City of Dallas | 8/8/2012 | Introduction: b. Suggest merging the last two paragraphs so that this watershed description is consistent with the descriptions used for the other watersheds. | Watershed description is consistent with other watersheds. No change made. |
| City of Dallas | 8/8/2012 | Introduction: c. Waste Load Allocations, lower page 30: In the Formula that reads "Criterion/2*FC (MGD)*FDA*Conversion Factor", there is no definition for "Criterion" — Can this be clarified? | Inset table of commonly used abbreviations added. |
| City of Dallas | 8/8/2012 | Introduction: d. Watershed Summary, pages 15 and 16: It may be helpful to include a table of the designated reaches and stream segments, or include similar information in Tables 8 and 9 under Section 2.0 Stormwater. It makes it easier to figure out the exact limits of impaired waters, and may help streamline some of the text concerning affected stream segments | See Appendix C. |
| City of Dallas | 8/8/2012 | 4) Section 1.0, Wastewater: Table 5: Please add the permit effective date of 11/08/2007d into the blank cell for Dallas Central WWTF. Add the related footnote <d> that reads: "Permit renewal is pending." Also, there is a superscript with a double ** — however, there are no corresponding footnotes. | Footnote added, superscript corrected. |
| City of Dallas | 8/8/2012 | Stormwater a. Section 2.2, Waste Hauler Regulations: We suggest moving this section in its entirety to Section 1.6, and renumbering the other remaining Wastewater and Stormwater sections accordingly. Most municipalities manage their respective liquid waste and waste hauler programs through their wastewater utility programs. | Liquid waste hauler implementation strategies moved to become section 1.7. |
| City of Dallas | 8/8/2012 | Stormwater b. Section 2.4, Local SEPs: Please revise last commitment from "100 percent of large municipalities" to 75 percent. | Corrected. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Stormwater c. Section 2.6, Land Use and Business Evaluation: We suggest the following revised text for this section, with associated revisions to Appendix B and in Table 1 on page 32:<br>"Section 2.6, Stormwater Regulatory Review: Analyses by the Project's technical review subcommittee members revealed a potential gap in many existing stormwater codes and regulations with respect to addressing discharges with the potential to carry bacteria. As currently written, many rules, including the base stormwater discharge permits, focus on chemical or physical constituents, such as toxic chemicals or sediment, but may not completely address bacterial sources or discharges. Examples of facilities that may pose a risk for bacterial discharge include, but are not limited to: Slaughter houses and meat-processing facilities, stables and pet-boarding facilities, produce packing facilities and farmer's markets.<br>Municipalities review their respective codes and ordinances and revise as necessary to prohibit the discharge of bacteria, nutrients, and other substances that could contribute to bacterial growth in the environment.<br>TCEQ is encouraged to review, and as necessary amend the TPDES No. TXR050000, Multi-Sector General Permit to require facilities located in bacteria-impaired watersheds with operations having the potential to discharge bacteria, (such as the current Sector U), to perform benchmark sampling for bacteria." | Wording in section 2.2 altered to reflect intent of comments. |
| City of Dallas | 8/8/2012 | 6) Section 3.0, Planning and Development: Please clarify who measures participation, and how performance on each goal is assessed. (Note, this may be a global comment, however, it was noted for Strategy 3.1.2). | Section 3.0.2 detailed municipal ordinance evaluation. Municipalities will be responsible for evaluating their own ordinances. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Pets, Livestock, Wildlife a. Explore SWM fee programs for animal owners: Consider adding a strategy for communities to explore revisions to existing stormwater fee programs to apply to animal owners. Such a fee could be implemented as a part of the pet registration program, and would be used to implement bacteria-related water quality improvement measures. | Proposed new implementation strategies will be forwarded to the appropriate subcommittee for consideration and may, through them, be referred to the Coordination Committee for adoption. |
| City of Dallas | 8/8/2012 | Pets, Livestock, Wildlife b. Explore planting regulations that limit year-round habitat for birds: Consider adding a planning strategy and related development regulations that promote landscaping/re-vegetation with deciduous woody plant species that do not enhance habitat for normally migratory bird species. Plant species that are evergreen year-round provide cover and habitat for birds that would not normally be present year-round. Since previous studies by the TCEQ indicate that a considerable percentage of the identified bacteria may be attributed to avian species, this strategy may help address that source. | Proposed new implementation strategies will be forwarded to the appropriate subcommittee for consideration and may, through them, be referred to the Coordination Committee for adoption. |
| City of Dallas | 8/8/2012 | Pets, Livestock, Wildlife c. Strategy 4.5 Waterfowl Management Plan: Suggest rewording last sentence from “with attention to prohibitions on the feeding of waterfowl” to “with a focus on measures to discourage waterfowl feeding rather than…” | Change made. |
| City of Dallas | 8/8/2012 | a. OSSF Inventory: Suggesting adding a strategy to develop an inventory of OSSFs that could be implemented in areas with elevated concentrations of bacteria, and poor documentation of existing OSSFs. The inventory could be used to focus other related OSSF strategies such as education, and connection to municipal systems where available. | Proposed new implementation strategies will be forwarded to the appropriate subcommittee for consideration and may, through them, be referred to the Coordination Committee for adoption. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Education, Outreach, a. Outreach to OSSF installers: Incorporate a BMP to provide applicable training to OSSF installers concerning bacterial impacts of failing OSSF systems. | BMPs for the BMP Library (IS 8.0) will be determined at a later date. The suggestion will be forwarded to the appropriate subcommittee. |
| City of Dallas | 8/8/2012 | Education, Outreach, b. Yard Waste program: consider adding a BMP to provide outreach and education concerning yard waste impacts including how yard waste can contribute to bacterial loading. | Yard waste education is an existing program through the Regional Stormwater Management Program's Public Education Task Force and relates to IS 7.0. |
| City of Dallas | 8/8/2012 | Education, Outreach, c. Alternative Media/Messages: Consider implementing alternative media and messages to reach market sectors that may not be traditionally affected by bacterial sources. | Suggestion will be brought to the Education and Outreach subcommittee. |
| City of Dallas | 8/8/2012 | Appendix A, a. We suggest consideration of including a title, or position, so that if the personnel listed under Appendix A leave their position, there is room for another comparable person from that entity to participate in future efforts. | Replacement and succession of Coordination Committee members is addressed in the Coordination Committee Ground Rules and is determined by the appointing agency. |
| City of Dallas | 8/8/2012 | Appendix B, a. While Appendix B includes much of the data that is required under an I-Plan, we received several comments that it is not easy for a lay person to follow and understand. If it is possible to simplify this table, it may be easier to comprehend.<br>b. Also — this table needs to be cross-checked against text to make sure the two are consistent.<br>c. 11x17 paper?<br>d. Active imperative verb tense for responsible entity might help stream line; e.g. “TCEQ: provide NCTCOG information concerning permit requirements.” | The Matrix (formerly Appendix B) has been eliminated and this information has been included as a summary after each implementation strategy. Wording has been adjusted to match language in IS narrative section. Active verb tense is used whenever possible without changing the meaning agreed to by the Coordination Committee. |

| Commenting Organization or Individual | Date | Comment | Response |
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| City of Dallas | 8/8/2012 | Appendix D provides the information I was looking for earlier in the document; suggest either incorporating into one of the tables in the text, or providing a very obvious reference. | References to Appendix C have been included earlier in the I-Plan. |
| City of Dallas | 8/8/2012 | Consider implementing requirements for Nelap certification or other Quality Assurance Protocols on bacterial sampling and analyses so that data sets can be used to support consistent, sound science and decision making. | Laboratories used by CRP and regional wet weather monitoring are currently NELAP certified. Recommendation to consider appropriateness of certification for remaining types of monitoring will be referred to the appropriate subcommittee. |

# Appendix E: Formal support for I-Plan

*Pending*