



Lake Lewisville Watershed, Texas

City of Denton Watershed Protection Program

Permitting Authority:
Texas Commission on Environmental Quality

Pollutants of Concern in Watershed:
Nutrients, ammonia, pesticides/herbicides, and sediment

Permittee Point of Contact:
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Permit Types: Individual and general permits to publicly owned treatment works to control discharges of industrial process wastewater and industrial, municipal, and construction storm water

Permit Issued: Various dates

Permit Information:
www.cityofdenton.com/pages/mygovenvironmentalwater319demo.cfm
www.cityofdenton.com/pages/utlilwaterwatershed.cfm

Overview

The Lake Lewisville watershed has been experiencing significant development pressures, so in 2001 the city of Denton, Texas, the largest city in the watershed, developed several watershed-based programs to address water quality concerns and storm water permitting requirements. While Lake Lewisville is not currently listed as impaired under the state's Clean Water Act (CWA) section 303(d) list, the city has taken some proactive measures to protect the water quality of the lake. The city has leveraged multiple funding sources for this. Specifically, Denton has implemented a water quality monitoring program, employed land use planning and management tools, and disseminated critical information to the public aimed at changing residential land use practices.

Watershed Approach Background

Lake Lewisville is an important source of drinking water and recreation, and Denton is the largest municipality within the Lake Lewisville watershed. Although Lake Lewisville is not currently impaired, it is under risk of impairment due to development and other pressures in the watershed. The Texas Commission on Environmental Quality (TCEQ) ranked Lake Lewisville 96th out of 102 lakes in the state for eutrophication. In addition, increasing development has caused Lake Lewisville to have the highest number of new or amended wastewater permits of any lake in the state. Several of the watersheds draining to Lake Lewisville are rapidly developing and face heightened water quality concerns. To address overall impacts to Lake Lewisville and to comply with National Pollution Discharge Elimination System (NPDES) Phase II storm water requirements, Denton initiated a Watershed Protection Program.

Watershed: <i>Lake Lewisville, Texas</i>		
Key Water Quality Concerns: <i>Nutrients, ammonia, pesticides and herbicides, and total suspended solids</i>		
Stakeholder Involvement Techniques:		
<ul style="list-style-type: none"> <i>Watershed monitoring database used by communities</i> <i>Integrated land use & monitoring data to educate public about threats to water quality</i> <i>"Find Your Watershed" web page for citizens as education/resource tool</i> 		
Case Study Issues of Interest		
Type of Point Sources	POTW Discharges	✓
	Industrial Process/Nonprocess Wastewater Discharges	✓
	Concentrated Animal Feeding Operations	
	Municipal Separate Storm Sewer System Discharges	✓
	Construction Site Stormwater Discharges	✓
	Industrial Facility Stormwater Discharges	✓
	Combined Sewer Overflows	
Highlighted Approach(es)	Statewide Watershed Approach	
	Implementation of Water Quality Standards	
	Implementation of Total Maximum Daily Loads or Other Watershed Pollutant Reduction Goals	✓
	Permit Coordination/Synchronization	
	Integrated Municipal Requirements	
	Point Source – Point Source Water Quality Trading	
	Point Source – Nonpoint Source Water Quality Trading	
	Discharger Association	
Coordinated Watershed Monitoring	✓	

Before initiating its Watershed Protection Program in 2001, the city and its partner, the University of North Texas (UNT), received a grant in 1998 from the U.S. Environmental Protection Agency's (EPA) Environmental Monitoring for Public Access and Community Tracking (EMPACT) program. The purpose of the grant was to establish a program called ECOPLEX (Environmental Condition On-Line Dallas-Fort Worth Metroplex). Among other environmental indicator tools, this project established two *real-time* water quality monitoring locations and a Web site to provide public access to the data (see the ECOPLEX sidebar below). The city based its Watershed Protection Program on the concepts employed under the ECOPLEX project; therefore, the program includes an extensive watershed-based monitoring component, land use management element, and public education.

ECOPLEX

The objective of the ECOPLEX project is, by using both innovative and proven environmental monitoring technologies, to collect real-time environmental data to inform the citizens of Denton, the Elm Fork watershed, and the Dallas/Fort Worth metropolitan area of current, historical, and near-term forecasts of environmental conditions. Biological, physical, and chemical data are continuously measured at Lake Lewisville and telemetered to UNT for analysis and display in near real-time on the Web site (www.ecoplex.unt.edu).

The parameters measured include clam gape, temperature, dissolved oxygen, conductivity, turbidity, pH, depth, fluorescence, and chlorophyll a). These parameters or indicators are monitored at a site in Lake Lewisville and a site in Pecan Creek—a tributary to Lake Lewisville.

The biological data collected include data on clam behavior (*Corbicula fluminea*). A colony of clams has been placed at the monitoring locations along with sensors to detect valve movement (gape). When conditions become unfavorable to the clams, such as when the water contains high concentrations of toxic pollutants, the clams tend to close their valves. When this behavior is observed, an automated water sampler is activated. UNT then analyzes the sample to evaluate toxicity and identify the contaminants.

Watershed Approach Strategy

The city's Watershed Protection Program has three components: monitoring, land use planning and management, and public information dissemination. In addition, the city recently received a CWA section 319 grant from TCEQ and is developing a Watershed Protection Plan using existing watershed-based monitoring and management techniques implemented under the Watershed Protection Program. (TCEQ administers the section 319 program in Texas for nonagricultural management projects.)

Watershed-Based Monitoring

There are three main watersheds in Denton: Cooper Creek, Hickory Creek, and Pecan Creek. City staff further delineated approximately 71 subbasins and established sampling stations within each. The city began monitoring these 71 subbasins during base-flow conditions in January 2001. It also established four permanent monitoring stations near the ends of the three major watersheds, above the confluence of the watersheds with Lewisville Lake. These permanent stations include a station both above and below the Pecan Creek Water Reclamation Plant's outfall. The city conducts monthly sampling at each of more than 70 stations. (Pesticide monitoring is conducted March–August.) The city has installed in-stream monitoring devices, performs quarterly storm water monitoring, and performs biannual biological monitoring, specifically for macroinvertebrates. Real-time monitoring is conducted in one subbasin as well (i.e., the Lake Lewisville subbasin).

The city collects and analyzes approximately 400,000 individual measurements annually to assess water quality conditions in the watershed. In addition, it conducts 900–1,000 dry-weather screening inspections each year to detect illicit discharges, such as pesticide and construction runoff, to establish baseline conditions and to prioritize *issue areas* or locations of concern.

Watershed-Based Management

The city layers the data collected through watershed monitoring on an existing geographic information system (GIS) and uses the tool to target areas of greatest water quality concern and graphically display spatial and temporal trends to determine the quality of the city's surface water. For example, the city used the system to determine that Hickory Creek, of all the subwatersheds in the Lake Lewisville watershed, discharges the greatest amounts of total nitrogen, total phosphorus, and total suspended solids. The city subsequently applied for a section 319 grant from TCEQ to address the problems in Hickory Creek. (For more information, see the Watershed Approach Highlights section.)

In addition, using GIS, Denton performed analyses during the initial monitoring efforts to determine which land uses (zoning categories) were associated with certain parameters. In general, Housing and Planned Development land uses were consistently associated with elevated conductivity and total dissolved solids concentrations. High turbidity values were consistently associated with the Planned Development land use category. The city assumes that this relationship is caused by the active construction occurring in those areas. Total Housing, Total Business, and Planned Development land use categories were consistently associated with high levels of the pesticides diazinon and chlorpyrifos. High herbicide (triazine) concentrations were most strongly associated

with Planned Development land use as well. The city hypothesized that high pesticide and herbicide concentrations were likely due to chemical management of residential and commercial lawns.

From this information, the city determined that more public education was needed regarding nonpoint source pollution, specifically to provide the public with tips on reducing pesticide runoff and other runoff to the creek.

Watershed-Based Public Information Campaign

The city has created a “Find Your Watershed” Web page for residents to locate their watersheds and learn about water quality impairments (<http://gisweb.cityofdenton.com/website/watershedlaunchpage.htm>). The Web page also provides information to residents to answer three basic watershed questions: “What is a watershed?” “Why is it important?” and “What areas of concern do we look for in the watershed?”

The Web page was designed to encourage public interest and participation in the health and maintenance of Denton’s watershed and drinking water resource. The Web page allows residents to enter a street address and generate a map of their subwatershed displaying various layers of data. The Web site also includes graphs depicting long-term trends in water quality levels of pH, dissolved oxygen, salinity, turbidity, several pesticides, and conductivity, as well as monthly values for each.

In addition to providing overall trend information to residents on its Web site, Denton hopes to include monitoring data from all of its permanent stations on the ECOPLEX Web site in the near future. It also hopes to include UNT real-time data on the site.

Watershed Protection Planning

In 2005 TCEQ awarded a section 319 grant to Denton entitled “Control of Nonpoint Source Loads in the Hickory Creek Sub-basin of the Lake Lewisville Watershed as a Component of a Watershed Based Water Quality Trading Program.” The primary goal of this project is to reduce sediment and nutrient loads to the Hickory Creek arm of Lake Lewisville by rewarding management activities (i.e., best management practices or BMPs) that enhance surface water resources. The knowledge gained, however, eventually will be applied throughout the Lake Lewisville watershed. This project builds on the knowledge the city gained from a 2004 CWA section 104(b)(3) grant project titled, *Incentives for Action: Incorporating Trading Options into Watershed Improvement Plans for Lake Lewisville*. The section 319 grant is expected to last about 40 months, with the first half focusing on assessment and monitoring and the last half focusing on implementing BMPs, post-BMP monitoring, and evaluating incentives for nonpoint source pollution controls.

The Hickory Creek watershed is in Denton County. The area is mainly rural, containing large amounts of open space and bottomland hardwood forests. However, development is increasing within the watershed, creating increases in runoff volumes and reductions in open space. Past TCEQ monitoring efforts have resulted in it placing Hickory Creek on the 303(d) list of impaired waters as a *nutrient enrichment concern* due to high ammonia concentrations from unknown point and nonpoint sources.

The objectives of the section 319 project are, through stakeholder dialogue, information exchange, and targeted research, to do the following:

- ◆ Create an agricultural and urban partnership through development of a Watershed Protection Plan
- ◆ Identify existing storm water management BMPs that can be upgraded to achieve water quality objectives
- ◆ Implement water quality BMPs in the Hickory Basin that demonstrate sediment and phosphorus control
- ◆ Identify incentive-based approaches to enhance the rate of BMP implementation
- ◆ Establish a water quality approach that can be expanded throughout the Lake Lewisville watershed.

In June 2006, the city submitted a draft BMP Implementation Plan describing the BMP demonstration projects it

Watershed Protection Plan Elements

As part of the section 319 grant project, the city is required to develop a Watershed Protection Plan for Hickory Creek. The plan is to include the nine EPA Watershed Protection Plan elements:

- ◆ Identify the causes and sources of pollutants
- ◆ Estimate load reductions
- ◆ Describe the nonpoint source management measures that will need to be implemented
- ◆ Estimate the amounts of technical and financial assistance needed
- ◆ Describe the information and education component
- ◆ Estimate a schedule for implementing the nonpoint source management measures
- ◆ Describe the interim, measurable milestones
- ◆ Develop a set of criteria that can be used to determine whether loading reductions are being achieved
- ◆ Describe the monitoring component

proposes to implement in the Hickory Creek subwatershed. The city has proposed installing BMPs on city-owned properties: an airport, fire station, and public park. The total capital cost to implement BMPs at all three sites is estimated to be approximately \$100,000, not including monitoring or engineering costs. The plan estimates that the average, weighted-cost for removing pollutants will be \$427 per ton of sediment, \$559 per pound of phosphorus, and \$73 per pound of nitrogen.

The city's next steps in the BMP implementation process will be to perform monitoring before designing and constructing the BMPs. The city plans to continue monitoring activities during the installation process.

The city is also in the process of identifying incentives for private entities to implement BMPs within the watershed. Water quality trading is being considered as one option.

Factors Considered During Development

Denton is implementing the Watershed Protection Program to proactively improve water quality in the watersheds that drain to Lake Lewisville. The lake is not listed as impaired on the state's section 303(d) list, and no total maximum daily load (TMDL) has been developed for it or any of the city's receiving waterbodies. Denton is using its own resources, as well as state and federal grant funding, to make improvements. The ultimate aim of these efforts is to keep Lake Lewisville off the 303(d) list, which would require TMDL development to address the sources of impairment.

Watershed Approach Effectiveness

Denton assesses the effectiveness of its watershed-based approach according to decreases in pollutant loads over time. First, it uses the monitoring program to locate and eliminate specific *hotspots* of pollution, such as discharges from industrial facilities or drilling operations for gas wells. Second, Denton uses monitoring activities to isolate specific

activities and land uses (i.e., construction sites) within monitored watersheds to improve the enforcement of regulations. Finally, it uses monitoring data to identify those areas where public education should be employed to improve water quality. Denton has been very successful in educating the public about appropriate pesticide application methods.

In addition, Denton has improved its municipal planning using the data obtained under the watershed-based monitoring program. The data has further helped the city better implement the resulting plans and has provided it a means to demonstrate the impacts of its municipal decisions through improved or protected water quality. Finally, Denton has been able to use the data and expertise gained to apply for and receive grants that will further expand its application of watershed-based approaches.

Lessons Learned & Next Steps

The city reports that the watershed-based approach requires additional staff time, resources and commitment during the initial stages of planning and implementation, and a secure source of long-term funding, which can be challenging for municipalities to obtain. The city also notes that it is critical to involve the public early in a watershed-based approach. The city reported that they were able to engage the public by packaging watershed-based information in an easy-to-read and understandable format. Denton was able to use the Internet to help spread this information.

Denton has incorporated the watershed-based monitoring and public outreach approaches into its NPDES Storm Water Management Plan. These approaches will support compliance with many of the six minimum measures required for storm water management programs under the Phase II regulations. The city also intends to continue working with TCEQ and EPA to explore water quality trading through the section 319 grant and to propose the development a watershed-based permit incorporating the city's storm water, pretreatment, and wastewater regulatory requirements.

Resources

City of Denton. 2006a. Hickory Creek 319 Project—Meeting Information. www.cityofdenton.com/pages/mygovenvironmentalwater319meetinginfo.cfm

City of Denton. 2006b. City of Denton, Hickory Creek Watershed 319 Grant: (Draft) BMP Implementation Plan. Prepared for TCEQ. www.cityofdenton.com/pages/mygovdeptsutilsenvirowater319grantbmp.cfm

Smith, Rodney. 2003. Abstract for presentation titled, *City of Denton Watershed Mapping and Public Information Website*. <http://gis.esri.com/library/userconf/proc03/p0803.pdf>

Note: All Web references current as of July 6, 2007.