AgriLIFE EXTENSION
Texas A&M System

B-6248
02/12

Cedar Creek Watershed Management

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Increasing pollution of Cedar Creek Reservoir has prompted the development of a watershed protection plan to reduce contaminants in the reservoir and to promote stewardship among area residents.

Reservoir managers are working with local residents, elected officials, and government agency representatives to develop a comprehensive program to protect the reservoir. The program has integrated water quality testing, citizen involvement, expert input, and computer models to:

- Analyze the source and amount of pollutants in the reservoir
- Illustrate past, present, and future reservoir conditions that result from various management practices
- Evaluate the economic effects of those practices to determine the most efficient use of funds to improve water quality in the reservoir

The resulting watershed protection plan is a flexible strategy of management practices and educational programs for targeted audiences and issues in the watershed. The watershed practices and the reservoir's water quality will be monitored regularly to gauge the program's success in improving water conditions.

Cedar Creek Reservoir

Cedar Creek Reservoir (Table 1) is part of a network of reservoirs and pipelines that provide water to over 30 municipalities in North Texas. Built by the Tarrant Regional Water District in the 1960s, the reservoir now stores over 678,000 acre feet of water. The water is transported westward toward Fort Worth via a 72 inch pipeline that serves the water district's customers en route.

Table 1. Cedar Creek Reservoir facts (Source: Tarrant Regional Water District, 2010)

Surface area	33,000 acres
Conservation storage	678,000 acre feet
Watershed size	1,007 square miles
Shoreline	220.26 miles
Maximum depth	70 feet
Origin	Cedar and Kings Creeks in the Trinity River Basin

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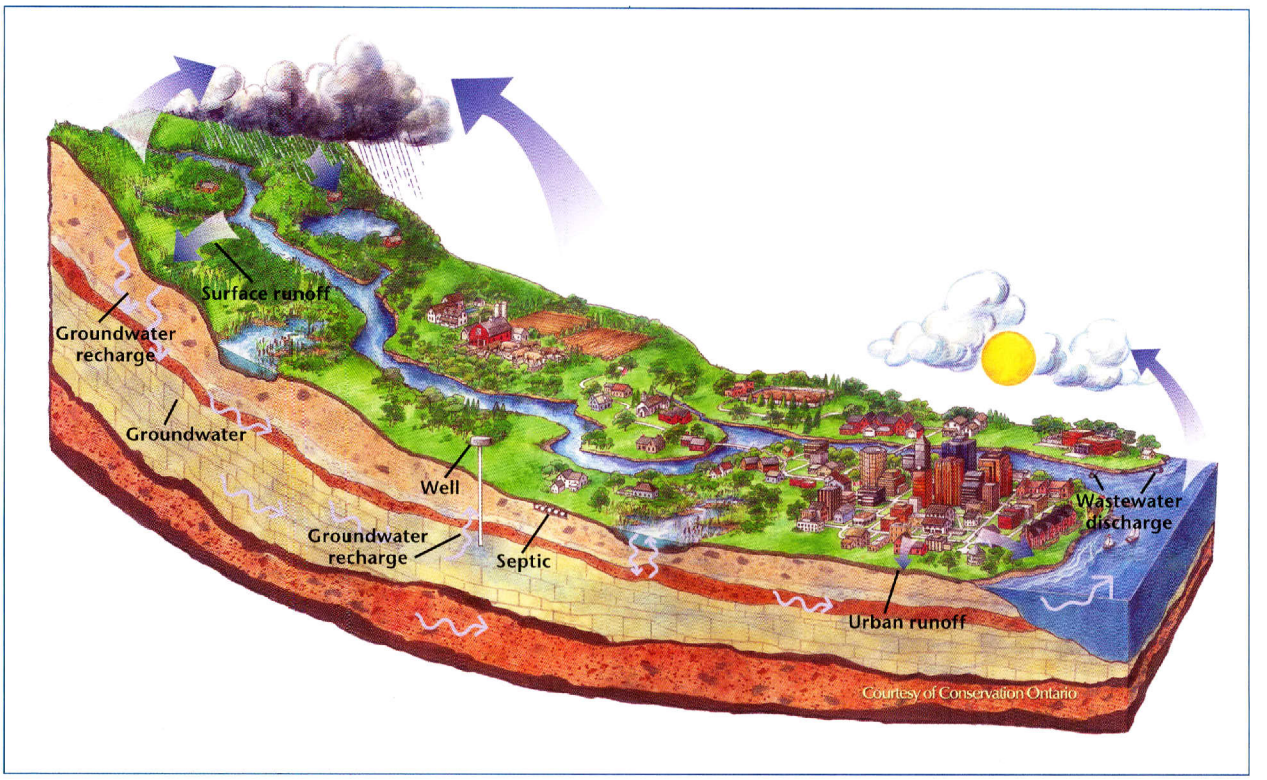

Figure 1. Example of a watershed with multiple land uses. (Source: Conservation Ontario, 2009)

Cedar Creek Watershed

A watershed is an area of land that drains into a common water body, such as a river, lake, or ocean (Fig. 1). For the Cedar Creek Watershed (Fig. 2), the common body of water is the Cedar Creek Reservoir.

The boundaries of a watershed are defined by the lay of the land—they are the outermost areas that divert rainfall and streams into a specific collection point. Watersheds include various human populations, land uses (Fig. 3), wildlife, and biological and ecological processes.

The Cedar Creek Watershed is 1,007 square miles, overlapping parts of Henderson, Kaufman, Rockwall, and Van Zandt Counties in north central Texas.

On a larger scale, watersheds fit into river basin systems. The Cedar Creek Watershed is located in the Trinity River Basin (Fig. 4).

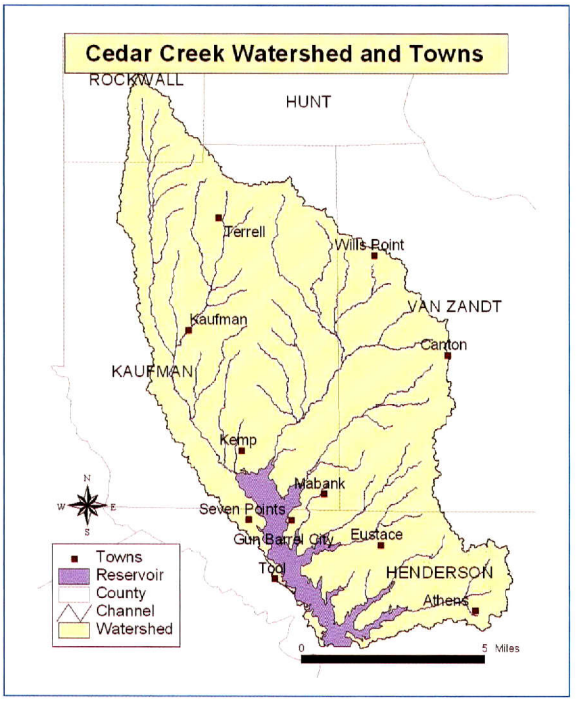

Figure 2. Cities and county boundaries in the Cedar Creek Watershed. (Source: Texas A&M University Spatial Sciences Laboratory, 2007)

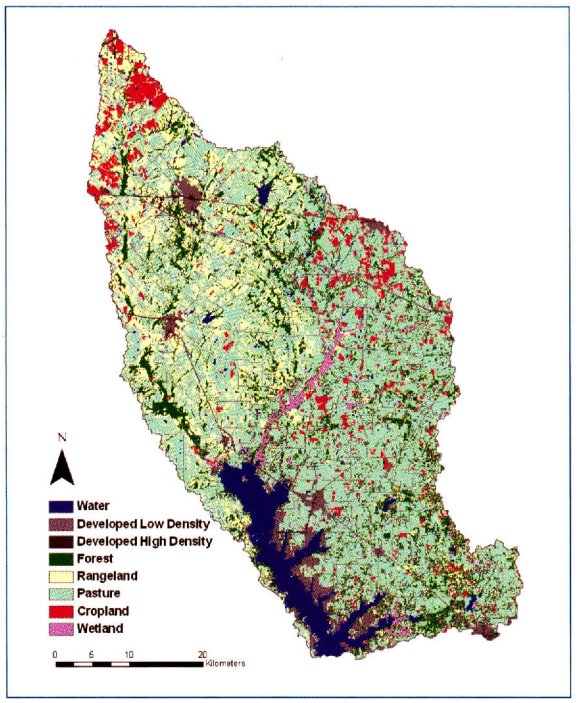

Figure 3. Land uses in the Cedar Creek Watershed. (Source: Texas A&M Spatial Sciences Laboratory, 2007)

Water quality

In the late 1980s, the Tarrant Regional Water District began long-term water quality monitoring of the chemical properties of the water in its reservoirs, including Cedar Creek Lake. Over the past 20 years, the tests have found increasing amounts of chlorophyll-*a*, the major type of chlorophyll in green algae. Scientists use the amount of chlorophyll-*a* in water to indicate the amount of algae present.

The increase of nutrients to Cedar Creek Reservoir has led to high pH and chlorophyll levels in the water. It also reduces the amount of dissolved oxygen in the reservoir. These changes can degrade the lake's water supply, wildlife habitat, and recreational uses.

As a result, Cedar Creek Reservoir has been listed since 2002 on the Texas Water Quality Inventory, which lists threatened and impaired water bodies as a way to prompt management action.

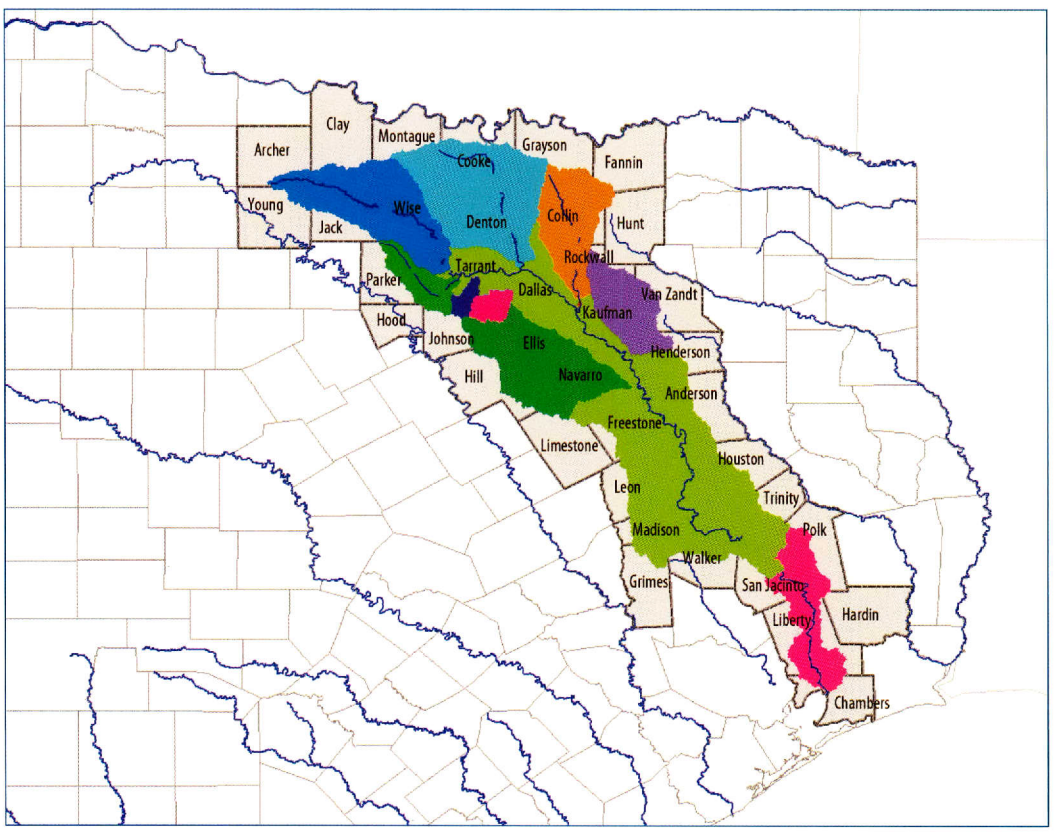

Figure 4. Greater Trinity River Basin and its surrounding counties. (Source: Texas Water Development Board, 2007)

Sources and causes of pollution

The high levels of chlorophyll-*a* in the lake are caused by large concentrations of nutrients and sediment that run off from the surrounding watershed. Sediments carry nutrients, which feed algae. These nutrients and sediments are referred to as the *pollutant load.* The *total pollutant load* in a watershed is the amount of pollutants from both point sources and nonpoint sources:

- **Point source pollution** comes from a specific discharge point; examples are industries, stormwater collection systems, and municipal wastewater treatment plants.
- **Nonpoint source pollution** comes from sources that are spread out across the landscape, making the polluted water more difficult to collect and treat. Examples are city streets, farm fields, home lawns, and onsite septic systems.

Point source pollution in the watershed

The primary point sources of pollution in the Cedar Creek Watershed are wastewater treatment plants. When the watershed protection plan was developed, there were nine wastewater treatment plants in the Cedar Creek Watershed. The treatment plants use a variety of methods to comply with current state standards.

Nonpoint source pollution in the watershed

Urban areas such as Terrell and Rockwall have grown significantly in recent years. Agriculture also continues to be a predominant land use in the watershed. According to Geographic Information Systems (GIS) modeling, over 64 percent of the land area in the watershed is grassland or pasture; 6 percent is cropland; and over 6 percent is urban area.

Fertilizers can be a significant source of nonpoint source pollution. In the past, the overuse or misuse of fertilizers on crops and lawns has sent nitrogen and phosphorus over land into streams during heavy rains. Also, some livestock practices—such as overgrazing and allowing cattle to roam freely along streams—encourage the erosion of stream banks and sedimentation of water bodies.

Solving the problem: Watershed protection planning

To address the rising chlorophyll-*a* levels in Cedar Creek Reservoir, a watershed protection strategy was established in 2009 to determine the extent of the pollution problems in the lake and to develop a structured course of action to improve water quality.

The planning efforts are being guided by a stakeholder-approved goal of reducing phosphorus loads generated by the watershed by 35 percent. The plan has outlined a multi-year implementation strategy to:

- Reduce the increase in chlorophyll-*a* through the use of best management practices (BMPs) that are designed to reduce the flow of nutrients into the reservoir
- Educate local agricultural producers, municipal officials, homeowners, and youths on stormwater control, nutrient management, and stewardship

Management measures

Computer modeling and consultation with local experts on the Cedar Creek Watershed have identified and ranked the areas that may produce the most phosphorus, nitrogen, and sediment. Watershed planners have also evaluated a variety of nutrient-reducing practices to determine those that can reduce the most pollution per dollar allocated. Funding to implement the BMPs will be allocated to the areas where pollution can be reduced the most.

Practices: Watershed planners have determined that the most cost-effective practices are filter strips, grade stabilization structures, prescribed grazing measures, wastewater treatment plant upgrades, grassed waterways, and the subsidized conservation of croplands into pasture.

Locations: Using the Soil and Water Assessment Tool, a computer model, the plan-

ners have determined the priority areas in the watershed where the management practices will be implemented.

Education: An informational program will be directed to multiple audiences with the goals of improving watershed literacy and stewardship.

Below are descriptions of the various potential management practices that have been identified as economical options for protecting Cedar Creek Reservoir.

Land-use-specific BMPs: Cropland

Despite accounting for only 6 percent of the land use in the Cedar Creek Watershed, croplands account for a large part of the pollution in the reservoir. The croplands in the Kings Creek area through southern Rockwall and northwest Kaufman Counties contribute a significant amount of the nutrients and sediment in Cedar Creek Reservoir. In all, 42 percent of phosphorus loadings and 23 percent of nitrogen loadings originate on watershed croplands.

To reduce this pollution, the plan recommends the adoption of several cropland BMPs: filter strips, grade stabilization, grassed waterways, terracing, and the subsidized conversion of cropland to pastures.

Proposed practice: Filter strips

Filter strips are vegetated areas situated between surface water bodies (such as streams and lakes) and cropland, grazing land, forestland, or land that has been disturbed by clearing or new construction. They are generally located where runoff water leaves a field. Also known as buffer strips and vegetative filter strips, these areas trap and filter sediment, organic material, nutrients, and chemicals from the runoff water (Fig. 5).

Proposed practice: Grade stabilization

Grade stabilization structures reinforce lakesides, gullies, and stream banks (Fig. 6). They reduce erosion and sedimentation from steep embankments that are likely to lose soil during storms. To be most effective, the structures must be located properly.

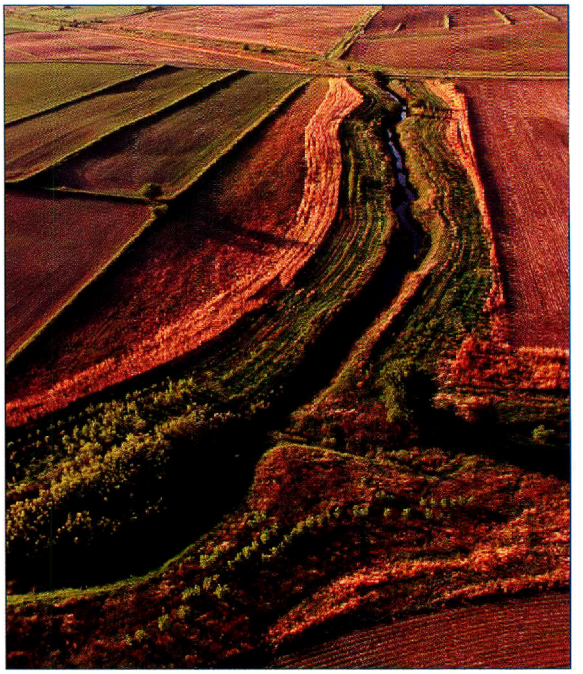

Figure 5. Filter strip. (Source: U.S. Department of Agriculture–Natural Resources Conservation Service)

Figure 6. Grade stabilization structure. (Source: USDA–NRCS)

Proposed practice: Grassed waterways

Grassed waterways are natural or constructed channels that use plants to concentrate and slow water flow (Fig. 7). Established properly, grassed waterways can safely transport large amounts of runoff down slopes.

This conservation practice can reduce the amount of sediment and pollutants that flow into nearby water bodies. The vegetation minimizes erosion, improves soil aeration, and removes nutrients from the water.

Figure 7. Grassed waterway. (Source: USDA–NRCS)

Figure 8. Terracing. (Source: USDA–NRCS)

Proposed practice: Terracing

A terrace is a series of earthen embankments constructed across a field at vertical and/or horizontal intervals based on land slope, crop rotation, and soil conditions (Fig. 8). Terracing is recommended for land with a grade of 2 percent or higher. Because the construction, operation, and maintenance of terraces are significant, they will be located only in selected areas of highest priority in the Cedar Creek Watershed.

Proposed practice: Pasture and range planting (conversion of cropland to pasture)

Native or introduced vegetation can be planted in pastures and croplands to retain some of the rainwater, reducing runoff. The plants also absorb nutrients from the water and prevent them from reaching waterways. Grasses, shrubs, trees, and other plants are used to restore the plant communities to historically natural conditions while meeting the nutritional needs of livestock and wildlife (Fig. 9).

Figure 9. Pasture planting. (Source: USDA NRCS)

Land-use specific BMPs: Pasture and rangeland

Most of the land in the Cedar Creek Watershed is utilized as rangelands and pasturelands. Although pastures produce much less runoff pollution than do urban and cropland areas, BMPs are still needed in overgrazed and heavily fertilized areas. If overgrazed, pastures and rangeland will not have enough vegetation to capture and absorb polluted runoff.

Proposed practice: Prescribed grazing

Prescribed (rotational) grazing is a management practice in which livestock are rotated to different pastures at regular intervals (Fig. 10). The rotation keeps the grass healthy and allows it to establish a dense stand, which reduces soil erosion and retains soil nutrients.

Figure 10. Prescribed grazing. (Source: USDA–NRCS)

In addition to reducing pollutants in runoff, these proposed management measures can also benefit the landowner directly. Reducing nutrient runoff keeps the nutrients on the landowner's property, which reduces the need for additional fertilizers. The practices also keep soil on a property, which is critical for maintaining healthy plants and animals on the land.

Urban stormwater management

Urban areas account for only 6.4 percent of the total land area in the Cedar Creek Watershed. However, runoff from streets, roofs, and other hard surfaces can carry pollutants into Cedar Creek Reservoir. This runoff, made worse during major rains, is referred to as *stormwater.*

Under the Clean Water Act, major urban areas must obtain a permit from the EPA to discharge stormwater into streams as part of the Municipal Separate Storm Sewer System (MS4) program. At this time, no municipality in the Cedar Creek Watershed is large enough to require this permit. However, parts of southern Rockwall County may be annexed by the city of Rockwall, which operates under a Phase II permit of the MS4 guidelines.

Because the urban populations in the watershed are small and geographically dispersed, rules and ordinances have been proposed for them at the county or watershed level, including:

- Regulation of construction and road improvement practices
- Regular inspection and repair of onsite sewage facilities
- Restrictions on the fertilization and irrigation of large properties such as city-owned athletic complexes

Proposed practice: 2,000 foot buffer strip around the lake (urban nutrient management)

Another proposed strategy is to discourage the use of fertilizers by residents of communities next to Cedar Creek Reservoir. If the proposal is approved, a 2,000 foot buffer strip would be established around the reservoir where the use of phosphorus fertilizers can be discouraged.

In this area, regulations would limit the amount, source, placement, form, and timing of the application of phosphorus fertilizer. Preliminary soil testing is also an important element of nutrient management. The regulations would:

- Encourage residents to use nitrogen-based fertilizers only
- Make the proper fertilizer blends available to watershed residents
- Encourage the use of landscaping techniques that require limited fertilizer and irrigation

City-specific wastewater treatment plant management measures

The plan also recommends upgrades to the nine wastewater treatment plants operating in the watershed. The improvements are based on a report by Alan Plummer Associates Inc. in 2008. Discharges from wastewater treatment plants are regulated by the Texas Commission on Environmental Quality as part of its regulation and permitting process.

The report proposes that each plant implement a series of graduated improvements. It outlines a total of 44 structural improvements, each accounting for an individual plant's permit status. These improvements would reduce pollutant discharges beyond the current requirements.

These upgrades will be mandated as watershed populations grow and new wastewater treatment plants are built. As the existing plants grow and expand, they will be required to meet the more rigorous discharge standards.

Education and outreach

To succeed, the Cedar Creek Watershed Protection Plan must do more than implement structural water-management practices. It must also educate people on how to improve their stewardship of watershed resources. To begin this education process, a campaign has been developed to inform people living in the watershed that their actions affect lake water quality. The program aims to help reverse the trend of increasing pollutants entering Cedar Creek Reservoir.

The campaign will:

- Encourage the use of best management practices on multiple levels
- Target specific audiences such as youths, homeowners, agricultural producers, and recreationists
- Explain why structural practices need to be adopted and maintained
- Encourage personal actions such as limiting the use of landscape fertilizers, maintaining septic systems, and preventing litter.

Summary

The Cedar Creek Watershed Protection Plan is an overall strategy for addressing the water quality problems in Cedar Creek Reservoir. It emphasizes that every person living, working, or playing in the watershed contributes to the water quality of the reservoir.

Planners have identified and prioritized major sources of pollutants in Cedar Creek Reservoir, and they have selected structural and non-structural best management practices to reduce reservoir contamination. The aim is to significantly improve reservoir quality.

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This publication was funded by the North Central Texas Water Quality Project administered by the Texas Water Resources Institute, with funds provided through a grant from the Natural Resources Conservation Service, U.S. Department of Agriculture, under Agreement No. 68-7442-10-496.

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