

Valuing Our Watersheds

A User's Guide to a North Central Texas Regional Ecosystem Framework

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First Edition

Prepared by the North Central Texas Council of Governments



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Foreword

This guide was developed by the North Central Texas Council of Governments (NCTCOG) to supplement two specific projects made possible by (1) Federal Highway and Administration and 50/50 state and local matching funds (2) American Recovery and Reinvestment Act funds from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality. This guide promotes the use of an ecosystem approach to help restore and sustain ecological conditions in the North Central Texas region. It is intended to be used by local governments, resource agencies, and other interested organizations and individuals to gain a better understanding of the ecosystem approach and how it can be used by North Central Texas communities.

NCTCOG's ecosystem approach is being accomplished through a Regional Ecosystem Framework, which uses watersheds as the organizing unit. This guide is intended to provide an introduction to a watershed-based approach to environmental management (Chapter 1), watersheds in North Central Texas (Chapter 2), and an organized framework that communities can use to address environmental issues at a watershed level (Chapter 3). Chapter 4 provides examples as to how watersheds have facilitated regional planning efforts to connect people, places, and programs—the basis of NCTCOG's Regional Ecosystem Framework. Chapter 5 captures some of the many watershed-related efforts going on across the country. The watershed concept is relatively new to communities in the North Central Texas region; therefore, the development of a user's guide to describe this approach, and ways in which it can be implemented, was a necessity.

This guide was modeled after Maryland Department of Natural Resources' "A User's Guide to Watershed Planning in Maryland," prepared in 2005 by the Center for Watershed Protection. NCTCOG would especially like to thank the Federal Highway Administration, who provided the funds and support to lay the groundwork of a watershed approach in North Central Texas. The funds were used to better integrate conservation and transportation planning, but the concepts can be applied to other efforts, as discussed in Chapter 4. A "Regional Ecosystem Forum," comprised of technical experts and resource agency representatives, was established in October 2010 to guide all Regional Ecosystem Framework-related efforts.

NCTCOG's guide will be updated annually as new projects begin and current ones end. The projects discussed in this guide are efforts that have been conducted through December 2010. The next update of this guide will likely occur in December 2011.

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Chapter 1: An Ecosystem Approach to Environmental Management

Federal agencies have been encouraging the use of a coordinated approach to restore or sustain the health of ecosystems for more than a decade. This ecosystem approach is being used and promoted in the North Central Texas region through a Regional Ecosystem Framework. Watersheds form the basis of this approach to connect people, places, and programs.

An ecosystem approach helps restore and sustain ecological systems

Former Vice President Al Gore's National Performance Review called for agencies of the federal government to adopt a proactive approach for ensuring a sustainable economy and environment through principles of ecosystem management.¹ As a result, the Interagency Ecosystem Management Task Force was established in August of 1993 to implement an ecosystem approach to environmental management. An ecosystem is an interconnected community of living things, including humans and the physical environment in which they interact. The goal of the ecosystem approach is to restore and sustain the health, productivity, and biological diversity of ecosystems while supporting sustainable economies and communities.²

Because ecosystems do not follow administrative boundaries, such as the borders of national parks and forests or political jurisdictions, working to restore or sustain ecosystem productivity involves a perspective that crosses those artificial boundaries. This entails a shift from a traditional focus on individual agency jurisdiction to a broader focus on the action of multiple agencies within larger ecological boundaries. Just as collaboration is important, finding ways to increase voluntary cooperation with state, tribal, and local governments, as well as with nongovernmental organizations and the public, is key to an effective ecosystem approach.²

The Interagency Ecosystem Management Task Force recommended that federal agencies adopt common principles for an ecosystem management approach. A series of principles were outlined specifically for the federal government, but can serve as a guide to any organization for implementing and participating in ecosystem-based management activities. These principles include:¹

1. Develop a shared vision of the desired ecosystem condition that takes into account existing social and economic conditions, and identify ways in which all parties can contribute to and benefit from, achieving ecosystem management goals.
2. Develop coordinated approaches among organizations to accomplish ecosystem objectives, collaborate on a continuous basis with federal, state, local, and tribal governments, and other stakeholders to address mutual concerns.
3. Use ecological approaches that restore or maintain the biological diversity, productivity, and sustainability of the ecosystem.
4. Support actions that incorporate sustained economic, socio-cultural, and community goals.
5. Respect and ensure private property rights and work cooperatively with private landowners to accomplish shared goals.
6. Recognize that ecosystems and institutions are complex, dynamic, and variable through time and over space.
7. Use an adaptive approach to management to achieve both desired goals and a new understanding of ecosystems.
8. Integrate the best science available into the decision-making process, while continuing research to improve scientific knowledge and understanding.
9. Establish baseline conditions for ecosystem functioning and sustainability against which change can be measured; monitor and evaluate actions to determine if goals and objectives are being achieved.

The Task Force also identified a series of actions the federal government should take to implement an ecosystem approach. These actions are also applicable to other organizations interested in an ecosystem approach, and include:¹

1. Ensure that all relevant and identifiable ecological and economic consequences (long and short term) are considered.
2. Improve coordination among concerned agencies.
3. Form partnerships between federal, state, and local governments, Indian tribes, landowners, and other stakeholders.
4. Improve communication with the public.
5. Carry out responsibilities more efficiently and cost-effectively.
6. Use the best science to address planning and problem solving.
7. Improve information and data management.

An ecosystem approach is being accomplished through a Regional Ecosystem Framework

The North Central Texas Council of Governments (NCTCOG) has established an ecosystem approach for the North Central Texas region through a Regional Ecosystem Framework (REF). This approach is intended to help restore and sustain ecological systems and their functions and values. As described in "Eco-Logical: An Ecosystem Approach to Developing Infrastructure Projects," there is no standard for developing a REF; however, Eco-Logical recommends that a REF consist of an "overlay" of maps of agencies' individual plans, accompanied by descriptions of conservation goals in the defined region(s). A REF can afford agencies a joint understanding of the locations and potential impacts of proposed infrastructure actions. With this understanding, they can more accurately identify the areas in most need of protection, and better predict and assess cumulative resource impacts. A REF can also streamline infrastructure development by identifying ecologically significant areas, potentially impacted resources, regions to avoid, and mitigation opportunities before new projects are initiated.³

NCTCOG's REF is based on a collaboratively developed vision of desired future conditions that integrates ecological, economic, and social factors.³ It is intended to protect, sustain, and restore vital ecosystems; provide recreational and mobility opportunities; and contribute to the health and quality of people and communities in North Central Texas. This is being accomplished on a watershed basis by connecting people, places, and programs.

Connecting People: REF was conceived by a team of representatives from eight federal agencies and four states. Recognizing that a new ecosystem approach is needed for major infrastructure development, a REF seeks to build and strengthen collaborative partnerships especially among federal, state, and local governments.³ NCTCOG is in the business of connecting people through collaborative partnerships, as the voluntary association of more than 200 local governments.

Connecting Places: REF is a proactive method for sustaining or restoring ecological systems and their functions and values...It is applied within a geographic framework defined primarily by ecological boundaries such as watersheds.³ NCTCOG is in the business of connecting places, as the Regional Geographic Information System (GIS) Clearinghouse.

Connecting Programs: REF is intended to shift the federal government's traditional focus from individual agency jurisdiction to the actions of multiple agencies within larger ecosystems. It seeks to identify and integrate management plans, prioritize opportunities, and document agreements among agencies regarding infrastructure projects.³ NCTCOG is in the business of connecting programs among many entities, as the regional comprehensive planning agency for North Central Texas.

Watersheds as the organizing unit

NCTCOG's REF is being accomplished on a watershed basis. A watershed is the area of land that drains to a common waterway, such as a stream, lake, estuary, wetland, aquifer, or even the ocean. Watersheds come in all shapes and sizes. They cross county, state, and national boundaries. In the continental United States, there are 2,110 watersheds; including Hawaii, Alaska, and Puerto Rico, there are 2,267 watersheds.⁴ We all live, work, and play in one or more watersheds.

Watersheds were chosen to serve as the basis of NCTCOG's REF efforts because the main goal is to protect water resources. Water is vital to life in North Central Texas. Without sufficient supplies of clean water for drinking and other uses, proper management of stream corridors so flooding and other risks are reduced, and strategic conservation of important open spaces within our watersheds, North Central Texas cannot continue to grow, develop, thrive, and maintain our quality of life. Effectively addressing these complex issues requires a cooperative, watershed-based approach, focused on the integrated health and orderly development of our region's water resources. This approach will also help meet other goals such as protecting, restoring, and sustaining vital ecosystems, providing recreational and mobility opportunities, and contributing to the health and quality of life of people and communities.

NCTCOG also chose watersheds as the organizing unit to be consistent with what federal agencies and other organizations are doing to protect water resources and the environment. This approach is supported by agencies such as the U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, and the U.S Army Corps of Engineers in efforts such as preventing pollution, protecting fish habitats, and/or to protecting wetlands.

Watersheds in the United States have been delineated by the federal government using a national standard hierarchical system based on surface hydrologic features and are classified into six types of hydrologic units. Each hydrologic unit is identified by a unique hydrologic unit code (HUC) consisting of two to twelve digits based on the six levels of classification:⁵

- 2-digit HUC: first-level (region)
- 4-digit HUC: second-level (subregion)
- 6-digit HUC: third-level (basin)
- 8-digit HUC: fourth-level (sub-basin)
- 10-digit HUC: fifth-level (watershed)
- 12-digit HUC: sixth-level (subwatershed)

For watershed planning purposes, the largest watershed management unit is the basin. A basin drains to a major receiving water such as a large river, estuary, or lake. In North Central Texas, the major drainage basins include the Trinity River, Brazos River, Sabine River, and the Sulphur River. The Upper Trinity River basin completely covers or crosses into 13 of NCTCOG's 16 counties. Basin drainage areas typically exceed several thousand square miles and often include major portions of a single state or even a group of states.⁶ For example, the Sabine River drainage basin crosses into the state of Louisiana.

Within each basin is a group of sub-basins that extend over several hundred square miles. Sub-basins are a mosaic of diverse land uses, including forests, crops, pasture, and urban areas.⁶ This is certainly true for the sub-basins of the Upper Trinity River basin. Several of these sub-basins cover the more urban landscapes of the Dallas-Fort Worth metroplex and the more rural landscapes of the surrounding areas.

Sub-basins are composed of a group of watersheds, which in turn, are composed of a group of subwatersheds.⁶ There are 302 subwatersheds that have been clustered into 21 "Regional Watersheds" in the North Central Texas 12-county metropolitan planning area (MPA). See Chapter 2 for more information on the watersheds of North Central Texas. None of these watersheds are fully contained within a single county, and each of these subwatersheds encompasses multiple jurisdictions. For instance, not even the largest city in the region, the City of Dallas, occupies an entire subwatershed. In addition, Rockwall County is the smallest county in the region, yet four watersheds intersect it.

NCTCOG's Regional Ecosystem Framework is based on vital ecosystems

NCTCOG's Regional Ecosystem Framework (REF) is a Geographic Information System (GIS) tool that uses 10 Vital Ecosystem Information Layers (VEIL) that are organized by subwatershed. Regional Ecological Assessment Protocol (REAP) rarity, diversity, and sustainability VEIL are based on ecoregions, but are translated to the watershed area. Using both frameworks in tandem allows for an effective look at the biotic and abiotic components of an area.

The VEIL include:

- Wetlands
- Surface Waters
- Impaired Water Segments
- Flood Zones
- Agricultural Lands
- Wildlife Habitats
- Natural Areas
- REAP Rarity
- REAP Diversity
- REAP Sustainability

These layers can be grouped into three major categories of ecological significance or concern.

Green Infrastructure

- Wildlife Habitat
- Natural Areas
- Agricultural Land

Water Quality and Flooding

- Impaired water segments
- Flood zones
- Surface Water Quantity
- Wetlands

Ecosystem Value

- Rarity
- Diversity
- Sustainability

The REF map shown in Figure 1.1 displays the composite score of all 10 VEIL layers for the Dallas-Fort Worth MPA. As shown in this figure, scores range from 14 to 37. The corresponding color ramp indicates an increasing value of the subwatershed in terms of individual VEIL attributes. For example, blue indicates those subwatersheds that either (1) constitute green infrastructure (wildlife habitat, natural areas, agricultural land) and/or, (2) indicate subwatersheds that have water quality concerns such as impaired water segments and flood zones where development should be cautioned; and/or (3) indicate the relative high presence or quantity of rare, diverse, or sustainable areas when compared to the rest of the ecoregion in an individual subwatershed. Yellow indicates those subwatersheds that offer lower ecological value, and/or have good water quality, and/or provide lower levels of rarity, diversity, or sustainability when compared to the rest of the subject ecoregion.

The REF offers a tool by which individual subwatersheds can be assessed based on multiple criteria and compared against neighboring subwatersheds or the region. While the composite map indicates many subwatersheds in the lower level scoring ranges, this does not necessarily indicate these subwatersheds do not offer value or do not have specific conservation needs for certain ecological aspects. This REF Composite map is the first screening tool that can be used to identify relative importance of an individual subwatershed at the regional level. Utilizing the individual 10 VEIL layer maps that offer additional information and value of each of the 10 VEIL layers is an important second step in defining what the key resources are in a subwatershed and how those resources may be valued depending on an infrastructure project. See Chapter 4 and accompanying appendices for an additional discussion of the VEIL layers, a

description of the data sources used, and the scoring assessment made to assign scores by layer and by subwatershed.

Regional Ecosystem Framework Composite Map

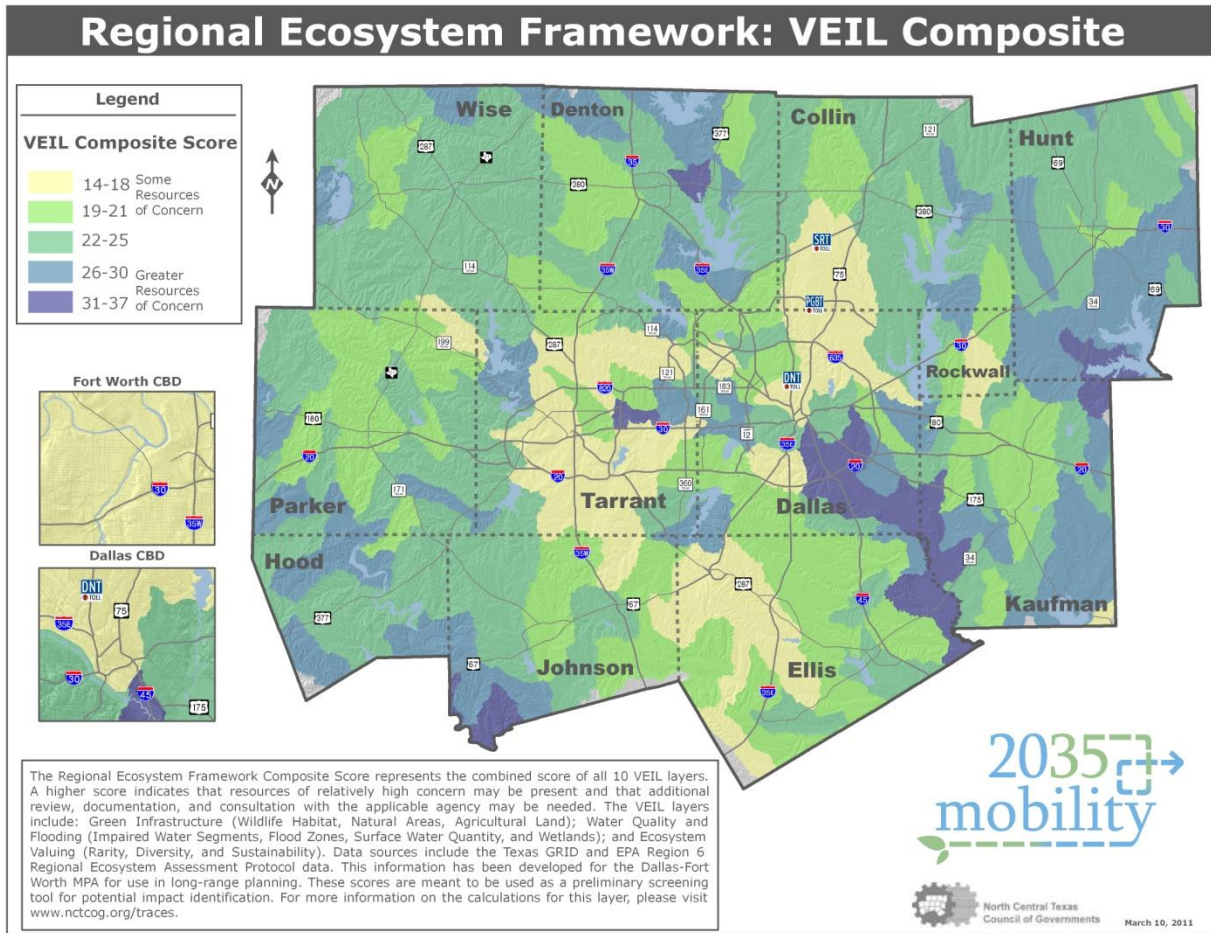


Figure 1.1: Regional Ecosystem Framework Vital Ecosystem Information Layers composite scores by subwatersheds within the 12-county MPA.

Chapter 2: Watersheds in North Central Texas

NCTCOG has organized the North Central Texas 12-county MPA into 21 “Regional Watersheds” by clustering 302 subwatersheds, 12-digit HUCs, delineated by the U.S. Department of Agriculture-Natural Resources Conservation Service. NCTCOG has further organized these 21 watersheds based on their drainage destination into three groupings—“river,” “lakes,” and “surrounding” watersheds.

As depicted in Figure 2.1, the five orange watersheds drain to the Upper Trinity River from the Dallas-Fort Worth urban area (“river” watersheds), the eight tan watersheds drain to water supply reservoirs of the Upper Trinity River basin (“lakes” watersheds), and the remaining eight multi-colored watersheds drain to lakes or rivers surrounding the Upper Trinity River basin (“surrounding” watersheds). Portions of some of these watersheds fall outside the 12-county MPA, which is defined by the red polygon in Figure 2.1. Only 282 of the 302 subwatersheds are actually within the 12-county MPA.



Figure 2.1: Map of the 21 watersheds that make up the 12-county MPA. The five orange and eight tan colored watershed clusters are part of the Upper Trinity River basin. The orange colored watershed clusters drain to the Trinity River and the tan colored watershed clusters drain to water supply reservoirs of the Upper Trinity River basin. The eight multi-colored clusters drain to rivers and lakes outside the Upper Trinity River basin.

The five watersheds that drain to the Upper Trinity River include:

1. West Fork below Lake Worth
2. Elm Fork below Lewisville Lake
3. Trinity River Headwaters
4. Ten Mile/Red Oak Creeks
5. East Fork below Lake Ray Hubbard

The eight watersheds that drain to water supply reservoirs of the Upper Trinity River basin include:

1. Arlington/Benbrook/Joe Pool/Weatherford Lakes
2. Lake Worth/Eagle Mountain Lake
3. Lake Bridgeport
4. Grapevine Lake
5. Lewisville Lake
6. Ray Roberts Lake
7. Lake Lavon
8. Lake Ray Hubbard

The eight watersheds that drain to lakes and rivers outside the Upper Trinity River basin are predominately rural and include:

1. Brazos River Upper
2. Brazos River Lower
3. Richland Chambers Lake
4. Trinity River below Dallas
5. Cedar Creek Lake
6. Lake Tawakoni
7. Lake Fork
8. Jim Chapman Lake

Appendix A provides more information about these watersheds, such as their size, the subwatersheds that make up those watersheds, and the communities present.

Chapter 3: Comprehensive Watershed Planning

Watershed planning is an important process by which communities can assess and prioritize both existing and potential future concerns occurring at the watershed level. Watershed-based planning efforts are typically conducted to protect the downstream water body of interest; however, these efforts may encompass broader management issues such as land use planning and zoning, recreational and aesthetic opportunities, water supply protection, and habitat management. A watershed plan is typically the result of such efforts to provide an organized framework for future management strategies. Watershed planning can occur at any level, although it is more common at the watershed or subwatershed scale. NCTCOG's REF is based on the goal of protecting water resources, and using watersheds as the geographical boundary in planning efforts is an effective way to achieve this goal.

A suggested eight-step approach to developing a watershed plan is presented in Appendix B. Communities and organizations should consider these steps in future watershed planning efforts. While NCTCOG has not, to date, developed a watershed plan, the steps outlined in Appendix B have helped NCTCOG better integrate conservation and planning as it relates to future development and growth, floodplain management, and water quality protection.

Watershed-based planning is important

Watershed planning allows local governments to target the problems specific to a watershed. It also provides local governments with a framework to prioritize valuable and sometimes scarce resources such as funding and staff time. Additional benefits of watershed planning are outlined in Table 3.1.⁶

Table 3.1: Benefits of watershed planning.⁶

Local Government Benefits	Administrative Benefits
<ul style="list-style-type: none"> • Enables analyses that are most meaningful at a watershed or subwatershed scale (e.g. nutrient loadings, impervious cover estimates, etc.) • Enables management at a scale necessary to ensure consistency with water quality standards and other requirements • Provides a framework for prioritizing resources (staff, conservation dollars, etc.) • Provides educational opportunities for citizens to understand how natural resources management interacts with existing and future development • Gives citizens an active voice in protecting and restoring natural resources that are important to the community 	<ul style="list-style-type: none"> • Provides a structure for communities to target geographic areas for land conservation and development to maximize the efficiency of community planning efforts • Enables more efficient management of permitting programs • Focuses data collection and analysis for environmental assessments • Provides benchmarks for measuring the success of management efforts
Environmental Benefits	Financial Benefits
<ul style="list-style-type: none"> • Improves quality of water for drinking and recreational use • Enhances water supply • Protects wildlife habitat and improves natural resources • Controls flooding by restoring riparian and wetland areas 	<ul style="list-style-type: none"> • Avoids development in sensitive areas and can help minimize compliance and mitigation costs • Improves water supply protection to reduce the need for costly drinking water treatment • Provides a framework and rationale to pursue various funding opportunities • Prevention and planning is less costly than restoration

Watershed planning should occur at the watershed or subwatershed level

Watersheds are typically defined according to the resource area or downstream water body of interest. Although there are no maximum size limits for defining a watershed, a manageable watershed for local planning efforts is usually no greater than 100,000 acres (~150 square miles). Larger watershed boundaries require the involvement of more jurisdictions and stakeholders.⁷ The average watershed and

subwatershed in the 12-county North Central Texas MPA are 618 and 35 square miles in size, respectively.

Watershed-based planning should take place at both the watershed and smaller subwatershed scales. Typically, the broad, “big picture” planning takes place at the watershed level, and the more refined objectives and implementation plans are pursued at a subwatershed level. Finally, individual projects and controls are carried out at the project or catchment level.⁷

Often times it may be more efficient to plan at the watershed scale and to assess the effectiveness of plan implementation at the subwatershed scale, where indicator response is more apparent. For example, many of the non-traditional goals of a multi-objective watershed master plan, such as the establishment of inter-jurisdictional greenways, wildlife corridors, and forest conservation areas, are easier to conceptualize and implement at the watershed scale.⁷

A community undertaking a watershed planning effort will need to determine whether the project area under consideration is part of a larger watershed or river basin with its own management goals. If so, the community needs to ensure that the planned activities complement the broader scale efforts. On the other end of the scale, a local government must also make sure that development and neighborhood level projects and activities are incorporated into and complement the overall watershed plan.⁷

Chapter 4: Integrate Conservation and Planning

The purpose of this chapter is to highlight examples of regional efforts that integrate conservation into planning using watersheds as the organizing unit. As discussed in Chapter 1, watersheds serve as the basis of NCTCOG's REF efforts because the main goal is to protect water resources. In doing so, however, additional issues may be addressed, such as improving habitat management and public health and providing recreational and mobility opportunities. Watersheds allow for a holistic and cumulative look at potential environmental impacts at a manageable geographical size. They also provide for a consistent approach for addressing environmental protection and conservation efforts.

NCTCOG has integrated conservation and planning using a watershed approach by connecting people, places, and programs through efforts such as long-range transportation planning, identifying current and future watershed priorities and floodplain mapping needs, and applying strategies aimed at protecting water supply reservoirs and restoring the Trinity River. Examples of involving stakeholders, defining geographical areas, and synching programs helped guide this approach and are outlined below.

Involving stakeholders helps identify watershed priorities

Water is vital to life in North Central Texas. The region's population is expected to reach approximately 12 million by 2050, and with this growth and prosperity brings ever-increasing demands on and stresses to local water resources. It is well understood that the built environment, including agricultural and urban areas, can have major impacts on water quality. In order to protect the region's water resources from these impacts, a collaborative, long-range effort involving all North Central Texas communities to ensure current and future protection efforts are being applied efficiently and effectively is needed. As a result, NCTCOG sought to connect people, places, and programs through a series of 14 watershed roundtable meetings to help identify watershed priorities.

As discussed in Chapter 2, the 12-county MPA has been organized into 21 Regional Watersheds by clustering more than 300 subwatersheds, 12-digit HUCs, delineated by the U.S. Department of Agriculture-Natural Resources Conservation Service (NRCS). Five of these 21 watersheds drain to the Trinity River from the urban area ("river" watersheds), eight drain to water supply reservoirs of the Upper Trinity River basin ("lakes" watersheds), and the remaining eight drain to lakes or rivers surrounding the Upper Trinity River basin ("surrounding" watersheds). The 14 meetings were held in each watershed though some were grouped as necessary. See Table 4.1.

Table 4.1: Watersheds where the 14 roundtable meetings were held in February and March 2010.

"River" Watershed Meetings	"Lakes" Watershed Meetings	"Surrounding" Watershed Meetings
West Fork below Lake Worth Watershed	Lake Lavon and Lake Ray Hubbard Watersheds	Richland Chambers Lake Watershed
Elm Fork below Lewisville Lake Watershed	Lake Worth/Eagle Mountain Lake and Lake Bridgeport Watersheds	Lake Tawakoni, Jim Chapman Lake, and Lake Fork Watersheds
Trinity River Headwaters Watershed	Lewisville Lake and Ray Roberts Lake Watersheds	Brazos Upper and Brazos Lower Watersheds
East Fork below Lake Ray Hubbard Watershed	Grapevine Lake Watershed	Cedar Creek Lake Watershed
Ten Mile/Red Oak Creeks and Trinity below Dallas Watersheds	Arlington/Benbrook/Joe Pool/Weatherford Lakes Watershed	

The primary goals of the meetings were to learn about local experiences in the watersheds, encourage more cooperation around the watershed and subwatershed geographies, and to help craft long-range strategies for restoring the Trinity River and protecting the region's water supply reservoirs. Presentations and panel discussions involving local agencies, as well as a feedback exercise provided great opportunities to discuss the importance of addressing common needs on a common watershed basis.

NCTCOG partnered with more than 35 organizations to help host the meetings as well as provide perspectives on the local watershed and details of current watershed protection efforts. Almost 250

people representing a variety of approximately 120 organizations were present at one or more of the 14 watershed roundtable meetings. These representatives consisted of mayors, city managers, county commissioners, consultants, city planners, floodplain administrators, stormwater managers, water district staff, horticulturalists, biologists, engineers, etc., all from a wide range of local governments, state and federal agencies, interested business leaders, and concerned citizens. The majority of attendees represented local cities while consultants consisted of the second largest type of organization present. This diverse group of organizations and representatives contributed to the unique experience each meeting had to offer.

The communities located in the watersheds and the characteristics of those watersheds also contributed to the meetings' unique dialogue. For instance, the conversations and presentations at the "river" meetings were centered on restoring the environmental resources in a more urban landscape, protecting those resources was the basis for discussions at the "lakes" meetings, and the topics discussed at the "surrounding" meetings were typical of a more rural landscape where preservation of these resources is key. In addition the feedback/discussion exercise addressed the opportunities, challenges, and/or accomplishments to protecting water quality in a particular watershed. See Table 4.2 for a summary of these comments organized by NCTCOG's goal of connecting people, places, and programs. See Appendix C for the full list of comments.

Table 4.2: A summary of comments received at the February/March 2010 watershed roundtable meetings organized by connecting people, places, and programs.

	"River" Watersheds	"Lakes" Watersheds	"Surrounding" Watersheds
Opportunities	People: 32% Places: 33% Programs: 35%	People: 39% Places: 20% Programs: 41%	People: 35% Places: 44% Programs: 21%
Challenges	Not collected	People: 47% Places: 27% Programs: 26%	People: 14% Places: 43% Programs: 43%
Accomplishments	People: 22% Places: 27% Programs: 51%	Not collected	Not collected

The majority of comments received were related to connecting programs, followed by connecting places then connecting people. Example comments include:

Connecting Programs

- Implement/further sustainable practices/development strategies
- Explore funding opportunities
- Consider a holistic/integrated approach

Connecting Places

- Preserve/protect specific areas and resources
- Identify/deal with watershed issues/pollutants
- Consider future conditions/changes

Connecting People

- More collaboration/coordination
- Improve/expand education/outreach
- Engage/involve a variety of interests

NCTCOG will continue to identify watershed issues and priorities through its REF initiative to guide long-range protection and restoration strategies. Without sufficient supplies of clean water for drinking and

other uses, proper management of stream corridors so flooding and other risks are reduced, and strategic conservation of important open spaces within the region's watersheds, North Central Texas cannot continue to grow, develop, thrive, and maintain its quality of life. Effectively addressing these complex issues requires a cooperative, watershed-based approach, focused on the integrated health and orderly development of the region's watersheds.

Mapping Needs Assessment prioritizes regional flood mapping needs

In 2009, NCTCOG teamed up with the Texas Water Development Board (TWDB) to assess flood mapping needs at the 12-digit HUC subwatershed level in the Upper Trinity River basin. With the completion of the Federal Emergency Management Agency's (FEMA) Map Modernization (Map Mod) Program in Fiscal Year 2008 and the beginning of the Multi-Year Risk MAP (Mapping, Assessment, and Planning), TWDB and the Texas Natural Resources Information System (TNRIS) realized the need to initiate a comprehensive Map Needs Assessment (MNA) for the State of Texas. The major tasks of this project were to collect, process, and prioritize regional flood mapping needs, and to develop procedures and guidelines for the statewide MNA process.⁸

The relative accuracy and validity of existing flood hazard data as well as the need for developing new flood hazard data for previously unmapped areas had to be assessed before the new cycle of map production process began. To achieve this objective, a MNA was necessary across Texas to determine if the current effective studies are still valid and identify the remaining floodplain mapping needs not addressed through Map Mod.⁸

The Map Mod Program conducted countywide Flood Insurance Studies (FIS) to produce new Digital Flood Insurance Rate Maps (DFIRM). At the completion of Map Mod, 126 Texas counties—roughly 50 percent of the state by area—had been mapped with new studies, redelineation, or digital conversion. However, 128 Texas counties did not receive DFIRMs at all during Map Mod. Within the North Central Texas region, only 4 percent of stream miles were updated with floodplains produced from new detailed engineering studies. As a result, there was a significant need for detailed floodplain mapping within the state and specifically within the North Central Texas region.⁸

The NCTCOG Upper Trinity River Basin MNA Project served as a pilot project to kick off the Texas statewide MNA, helped define the MNA procedures and process for Texas, and will help improve efficiencies for future projects in other regions or watersheds. NCTCOG worked with Half Associates, Inc. and Michael Baker Jr., Inc. to complete the project. Below is a description of the three project phases.⁸

Phase 1 of this MNA Project included the collection of all existing scoping data that were produced during FEMA's Map Modernization Program, development of fourteen criteria for prioritizing the collected mapping needs, consideration of the preliminary FEMA Risk MAP Coordinated Needs Management Strategy (CNMS) elements, creation of a MNA database, and preparation of the data for use during the stakeholder outreach meetings.⁸

Phase 2, the Stakeholder Input Phase, included outreach and education to inform the stakeholders and gain their support for the MNA process as well as provide input of mapping requests and needs. Five stakeholder outreach meetings and an open house throughout the NCTCOG region were conducted in July and August 2009.⁸

During Phase 3 of the MNA Project, the mapping requests gathered during the Stakeholder Input Phase were compiled, quantified, prioritized, and ranked by applying the prioritization criteria. Unit cost estimates for new flood studies were developed and applied to the map requests and a Final Mapping Plan was prepared.⁸

The final deliverable consisted of a map showing the spatial distribution of the 12-digit HUC subwatersheds based on the prioritization ranking. See Figure 4.1. Red subwatersheds have a low ranking and blue subwatersheds have a high ranking. Blue subwatersheds have a higher priority for floodplain mapping needs. Gray subwatersheds did not contain mapping requests.⁸

Ranked Subwatersheds in the Upper Trinity River Basin

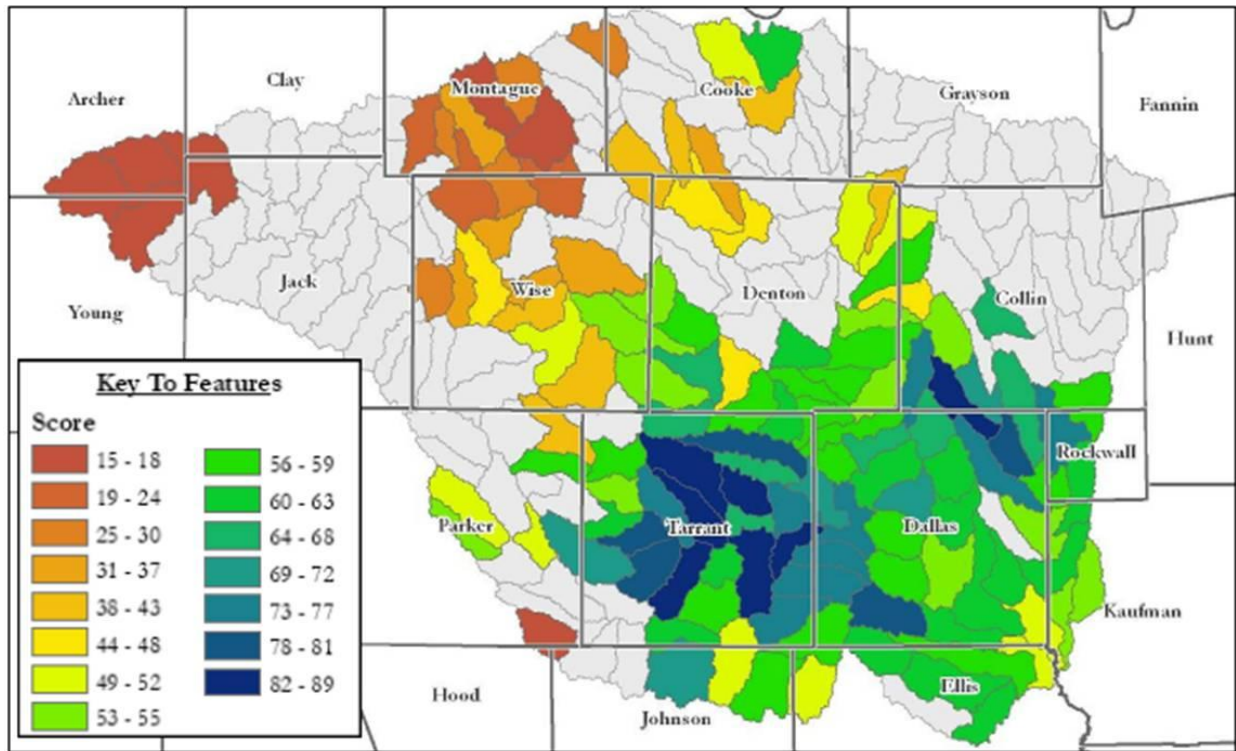


Figure 4.1: Spatial distribution of subwatersheds based on prioritization ranking. Red subwatersheds have a low ranking and blue subwatersheds have a high ranking. Blue subwatersheds have a higher priority for floodplain mapping needs. Gray subwatersheds did not contain mapping requests.⁸

The MNA Project was one of NCTCOG's initial efforts of integrating conservation and planning at the subwatershed level. Having access to current and detailed floodplain mapping can help local governments and other organizations make better floodplain management decisions. As a result, areas within the floodplain may be protected to reduce flood risks, protect water quality, provide recreational opportunities, etc. This project helped define the basis of NCTCOG's REF of connecting, people, places, and programs.

Future regional goals shape current decisions

NCTCOG, in coordination with the University of Texas at Arlington, the Urban Land Institute's North Texas District Council, and numerous other partners, began the Vision North Texas partnership in 2005 to increase awareness about the growth expected in North Texas and to involve people and organizations in initiatives that accommodate that growth successfully and sustainably. Several years of discussions took place to find solutions for a region that is expected to grow to nearly 11.5 million people by the year 2050. In 2010, these efforts resulted in the release of a regional comprehensive plan for the 16-county Dallas-Fort Worth metropolitan area, North Texas 2050. Recent efforts by NCTCOG have attempted to relate North Texas 2050 to the region's subwatersheds to help guide planning and conservation efforts at the subwatershed level.

Throughout the Vision North Texas process, nearly 97 percent of regional stakeholders have expressed strong support for a preferred future that is "Better than Business as Usual," which is the continuation of current trends and policies. North Texas 2050 proposes a Vision Statement and a set of twelve Guiding Principles for the region's growth and development. It describes a "Preferred Future" for North Texas by identifying five policy areas—natural, rural, separate community, outer tier, and inner tier—and two types

of important centers—employment centers and mixed use centers—that are focal points for the region and its communities.⁹

The five policy areas are:⁹

1. **Natural Areas:** This policy area is comprised of the places where our region's natural and environmental features should be the focus. It encourages the preservation and protection of open spaces, public parks, greenways, lake shores, stands of trees, and floodplains. Future development that occurs in these types of natural areas should be planned such that these important environmental features are protected. Financial incentives and best practices are provided in this policy area that assist and encourage property owners and developers to take advantage of the natural amenities—parks, trails, and lakes—as they plan future development in these natural areas.
2. **Rural Areas:** These areas provide people with the choice of a rural or country lifestyle and where businesses in agriculture or ranching can thrive. Rural areas have large lots, ranches, and farms—all with low population and density. In addition to offering a rural lifestyle, this area encourages the creation of new businesses, such as alternative energy production based on the renewable resources that exist in these areas or that provide local goods and produce to meet the needs of people in the other parts of the region.
3. **Separate Community Areas:** These areas are envisioned as a collection of diverse communities, each with its own center and distinct character. They are generally separated from the central urban areas of the region by rural or natural areas. Their traditional core areas—often historic downtowns—offer unique features and support community pride. Actions and policy recommendations focus on economic growth that makes the traditional core areas sustainable over time, and on ways to distinguish one community from another.
4. **Outer Tier Areas:** The region's preferred future envisions these areas in 2050 as a major part of the region's more urban area that offers different options for living and working from the inner tier areas, though still in an urban setting. Policies for these areas focus on steps to ensure greenfield development occurs in a sustainable way and follows the principles of North Texas 2050, actions to maintain and support existing neighborhoods, and emphasis on the establishment of distinct identities when new neighborhoods and communities are created.
5. **Inner Tier Areas:** These areas are envisioned as the core of the region, and are nearly entirely developed with little land remaining for new (greenfield) development. These areas face challenges of infrastructure repair. Some neighborhoods are desirable and thriving, while others suffer from neglect and blight. The inner tier areas contain both major employment locations and major commercial destinations. Action for these areas focuses on getting the most out of the investments and community assets already made, such as reinvestment and reuse of older buildings, infill development, and ways to keep the older neighborhoods prosperous.

The two major types of centers are employment and mixed use centers. These centers are intended to be places that people can easily park their cars, or arrive by public transportation, and be able to shop, eat, and take advantage of many other services offered in these centers. The employment centers are home to a large, diverse business community and home to many corporate headquarters. The preferred future identifies four types of mixed use centers: Regional, Metropolitan, Community, and Neighborhood. The four centers provide a variety of uses, including both employment and residential, and at least a moderate intensity of development. They are all envisioned to be mixed use and pedestrian friendly, as well as having access to public transportation and rapid transit lines. Transit-Oriented Development (TOD) is expected around transit stations in all four types of mixed use centers.⁹

Along with these policy area recommendations, the preferred future is illustrated with a diagram of a Preferred Physical Development Pattern for the year 2050, which identifies the five policy areas and two major types of centers. See Figure 4.2. The Preferred Future Development Pattern is a blend of the best elements and characteristics of the four Alternative Future Scenarios—Connected Centers, Return on Investment, Diverse, Distinct Communities and Green Region—that were examined in 2009 as alternatives to Business As Usual. This physical development pattern is served by an investment framework that integrates eight areas of investment—regional ecosystem, community character and form, economy, housing, mobility, climate resilience, education, and health. It provides policy recommendations

related to each of the five policy areas and two center types as well as for the eight investment framework areas.⁹

Preferred Future Diagram

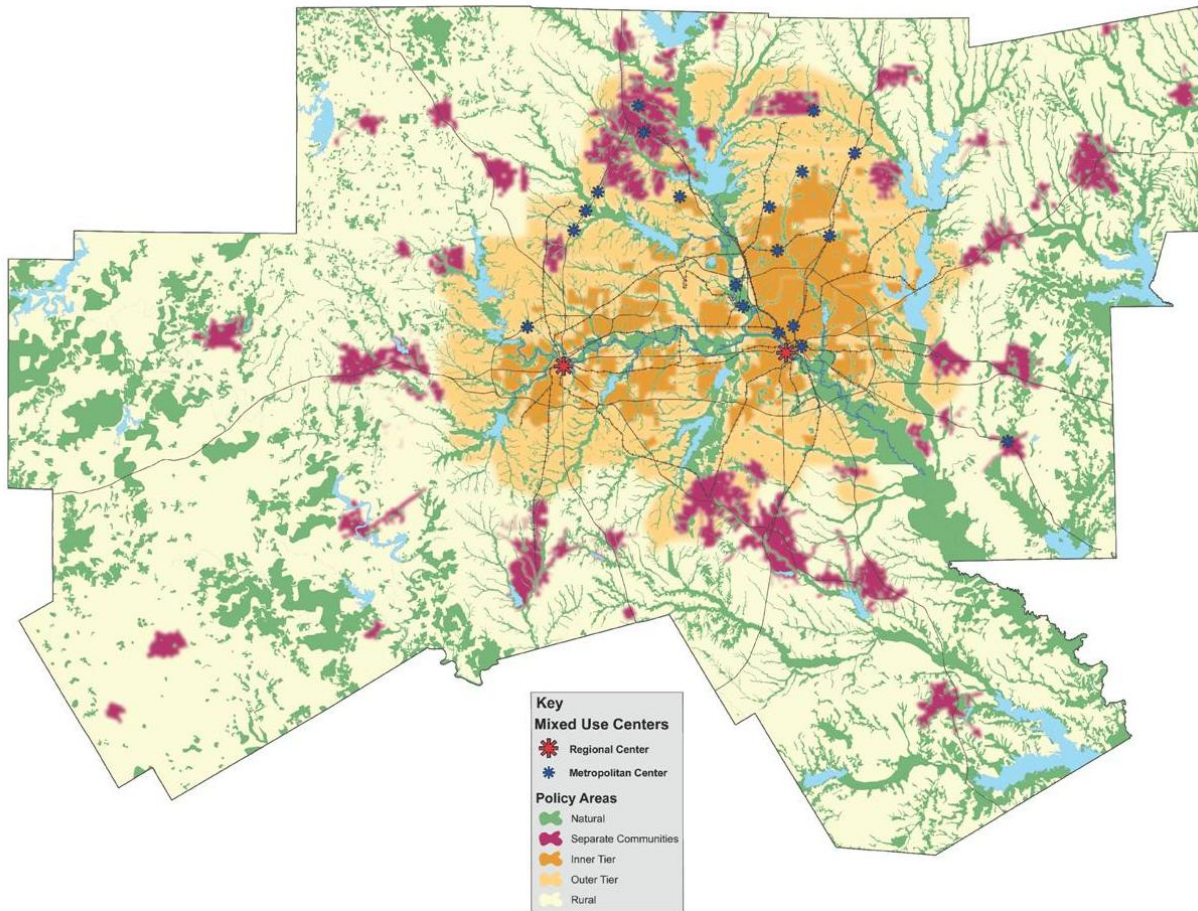


Figure 4.2: Illustration of a Preferred Physical Development Pattern for the year 2050.⁹

The eight areas of investment are:⁹

1. **Regional Ecosystem Framework:** REF provides communities necessary information about the benefits of the natural assets that may be affected by future development as it pushes out further into our natural and rural areas. The REF provides property owners, service providers, and local governments tools for making informed decisions. REF is an approach to development that seeks to protect the vitality of the environment and the health of the region's residents because the ecosystems are an essential part of the region's infrastructure investments.
2. **Community Character and Form:** North Texas 2050 envisions a future with many neighborhoods and communities, all thriving but each different. In this way, the region as a whole will offer choices that are attractive to all the diverse households that are expected to live here.
3. **Economy:** The focus for the region's economy is based on the strengths of the many unique and highly desirable communities, each of which may have a different economic emphasis. It also seeks to nurture the region's natural assets and use them as a basis for the future economy, as it strives to make this a sustainable economy. Policy recommendations support increased collaboration at the regional level, as well as support for action that retains the distinctive economic role of the individual communities and employment centers in the region.
4. **Housing:** We will need to provide a mix of housing types to meet the changing needs of the future population and market demand in our region. As our region strives to be sustainable and

successful, we will need to align housing choices with job locations to decrease commutes, increase productivity, and improve our air quality.

5. **Mobility:** Our region's ability to move goods and people from place to place in a sustainable and efficient way is essential to our region. This concept stresses a variety of efficient mobility options that meet the region's travel needs, gain the greatest benefit from investments in mobility, and make the region more sustainable.
6. **Climate Resilience:** The North Texas 2050 preferred future should help reduce the region's carbon footprint that would have resulted from Business As Usual, because it is comparable to the four alternative future scenarios studied by Vision North Texas, which reduced carbon dioxide emissions 7 to 10 percent below the 2030 projection. These policy recommendations reduce vehicle miles traveled (VMT) and lower energy consumption, thus helping the region grow in a more environmentally sustainable way.
7. **Education:** The vision of a better future includes support for innovative people. This concept stresses that all North Texans should have access to the schools, people, and technology they need for success in learning throughout their lives. Investment in educational institutions, at all levels, is essential to provide this access.
8. **Health:** North Texas 2050 goes beyond the traditional focus on sick care and advocates the creation of healthy communities; those that address issues of aging, air and water quality, and access to good education opportunities, healthy foods, and safe activity centers.

North Texas 2050 also provides an Action Package that contains tools and techniques that are needed to help make the preferred future vision a reality. The Action Package includes incentives, best practices, model ordinances and templates, technical assistance, benchmarks and indicators, as well as ideas for collaboration and coordination. Local governments and other communities are encouraged to consult these resources to help guide current and near future decisions to achieve the North Texas 2050 preferred future.⁹

NCTCOG has been working to relate this work to the more than 400 subwatersheds in the 16-county North Central Texas region. See Appendix D for an excel file of this effort. Recognizing the vision for these subwatersheds will help to ensure current and future development and management strategies will meet the goals and priorities of the region's preferred future. NCTCOG also used the five policy areas—Natural, Rural, Separate Community, Outer Tier, and Inner Tier—to value the subwatersheds within the 12-county MPA for the 10 VEIL layers, as identified in a previous section, based on the goals and priorities of these policy areas. There are a few exceptions, but in general, the areas surrounding the Dallas-Fort Worth urban core are identified as being less suitable for infrastructure development due to the VEIL layers being regarded as more important to this area, and should therefore be avoided. See Appendix E and F for more information.

Linking conservation and transportation planning is important

Despite the statutory emphasis on transportation planning in the last three transportation bills, the environmental analyses produced to meet the requirements of the National Environmental Policy Act (NEPA) have often been conducted *de novo*—disconnected from the analyses used to develop long-range transportation plans, statewide and metropolitan Transportation Improvement Programs, planning-level corridor/subarea/feasibility studies, or the Federal Transit Administration's planning alternatives analyses. Furthermore, while planning efforts are required at both transportation and resource agencies, historically these efforts have been conducted with little or no coordination between the agencies until the project development process is initiated or plans are implemented.

Concepts to establish a more refined approach to integrate both infrastructure and conservation planning efforts earlier in the project development process have been emphasized and specifically incorporated into the statewide and metropolitan transportation planning process regulations outlined in the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) transportation bill. Section 6001 of SAFETEA-LU requires that transportation planning agencies consult, as appropriate, with natural resource planning and protection agencies to coordinate and compare their planning efforts and products. These efforts lead to a more informed transportation planning decision-making, including the integration of natural resource considerations with transportation needs, prioritized

mitigation areas, and the identification of mitigation opportunities having the greatest potential to restore the environmental functions that may be affected by a proposed transportation project.

As a Metropolitan Planning Organization (MPO), NCTCOG has developed strategies and programs to encourage a more robust review and consideration of environmental impacts and develop mitigation strategies during the long-range transportation planning process to mitigate potential environmental impacts associated with transportation infrastructure. The ecosystem approach to infrastructure development, as outlined in Eco-Logical, echo's SAFETEA-LU's and previous transportation bill's focus on the integration of environment and transportation infrastructure concerns and establishes a conceptual framework to carry out and integrate environmental and infrastructure plans.

Utilizing an Ecosystem Approach to Mitigation for Transportation

Eco-Logical suggests that integrated planning is the foundation for an ecosystem approach to infrastructure development, as well as for any ecosystem-based mitigation agreements. The benefits of a REF include, but are not limited to:³

- Promoting an open dialogue where mutual objectives can be established by all agencies and partners
- Providing a joint understanding of the locations and potential impacts of proposed infrastructure actions
- Identifying areas in most need of protection
- Better predicting and assessing cumulative resource impacts
- Streamlining infrastructure development by identifying ecologically significant areas, potentially impacted resources, regions to avoid, and mitigation opportunities before new projects are initiated

An example of the integration of transportation and conservation planning is supported in Appendix F. This appendix provides an in-depth review of how the Regional Ecosystem Framework can improve the decision-making process for infrastructure projects, in this case, transportation projects. Additionally, the Regional Ecosystem Framework was incorporated into "Mobility 2035: The Metropolitan Transportation Plan for North Central Texas" as the MPO supports utilizing planning tools such as the REF to expedite project delivery, improve the decision-making process, encourage transportation projects that consider priority ecosystems, and promote a broader approach to mitigation such as the ecosystem-based approach.

To support the Regional Ecosystem Framework and to assess its use in transportation planning, three transportation corridors identified in the metropolitan transportation plan, "Mobility 2030: The Metropolitan Transportation Plan for the Dallas-Fort Worth Area, 2009 Amendment," were chosen and include:

- State Highway (SH) 170 corridor: between Interstate Highway 35-West in Fort Worth and SH 199 west of Azle
- SH 360 corridor: between the Outer Loop and Farm to Market Road (FM) 2258 in northwest Ellis County
- Lake Lavon rail corridor: from downtown Garland to southeast Collin County

See Appendix G for a detailed look at these three pilot areas to help characterize the potentially affected environment.

Greenprinting allows for a conservation vision

NCTCOG, through a grant provided by the EPA through the TCEQ, contracted with the Trust for Public Land (TPL) in 2010 to "Greenprint" two clusters of subwatersheds—Lake Arlington and Lewisville Lake East—for North Texas. This effort is directed to the protection of the region's water supply lakes and will continue through the end of May 2011. Greenprinting is a systematic approach for identifying areas that offer the highest conservation benefit for water quality protection and other regional resource priorities.

The Greenprint study for North Texas will provide a watershed-wide strategic plan for water quality protection via land conservation, “score” properties based on resource and opportunity criteria, and use overlays to depict complementary conservation opportunities. Two stakeholder groups and one technical advisory group are guiding the Greenprinting process.

TPL assisted NCTCOG in the selection of seven subwatersheds for detailed water quality protection analysis. Four subwatersheds within the Lake Arlington watershed and three subwatersheds within the Lewisville Lake East watershed were chosen to guide this analysis. See Figure 4.3 and 4.4 for maps of these areas. To date, two stakeholder meetings and two technical advisory meetings were held in October 2010 and December 2010. The Regional Ecosystem Forum is serving as the technical advisory group and will provide input on REF-related efforts even after this project has ended. The purpose of the stakeholder meetings was to gather input on water quality protection criteria and related overlay analysis variables, while the purpose of the technical advisory meetings was to seek advice and assistance in modeling methodology and data collection.

Lake Arlington Watershed

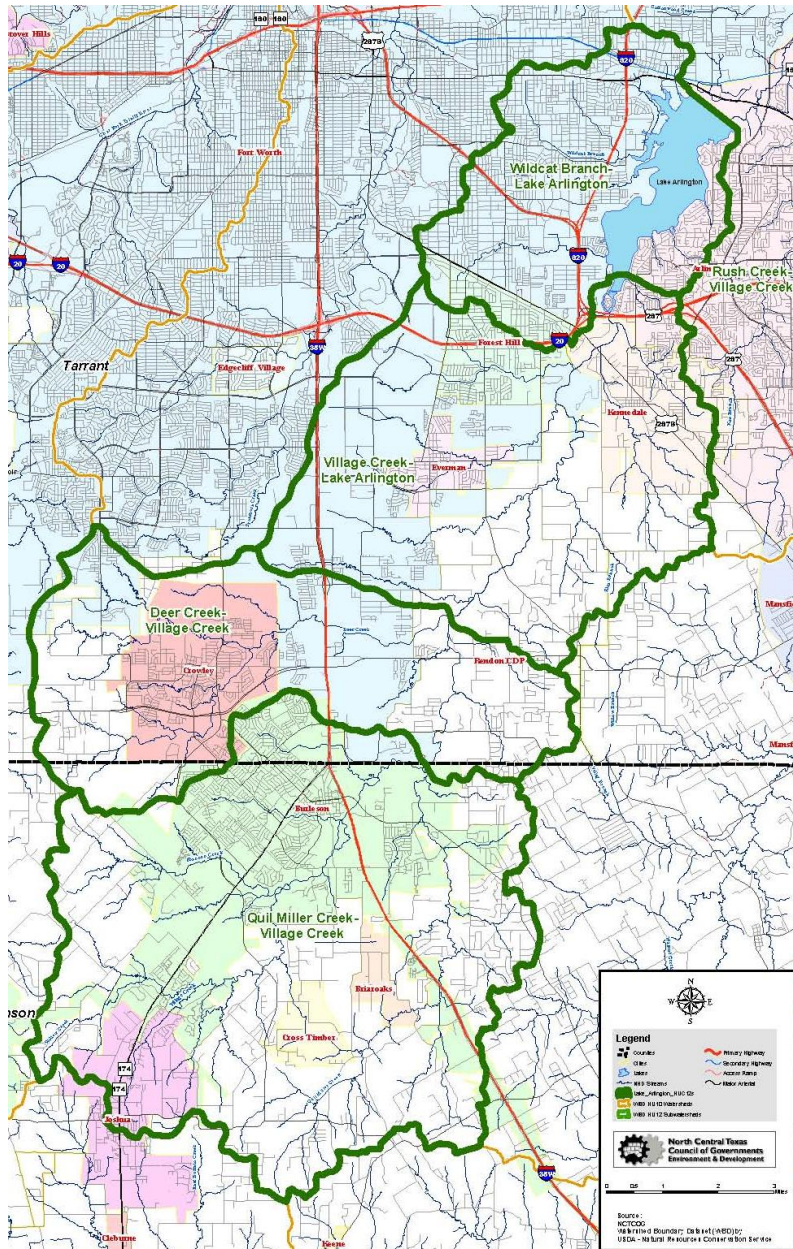


Figure 4.3: The four subwatersheds (defined by the green polygons) that make up the Lake Arlington watershed—Wildcat Branch-Lake Arlington, Village Creek-Lake Arlington, Deer Creek-Village Creek, Quil Miller Creek-Village Creek. The communities are also identified.

Lewisville Lake East Watershed

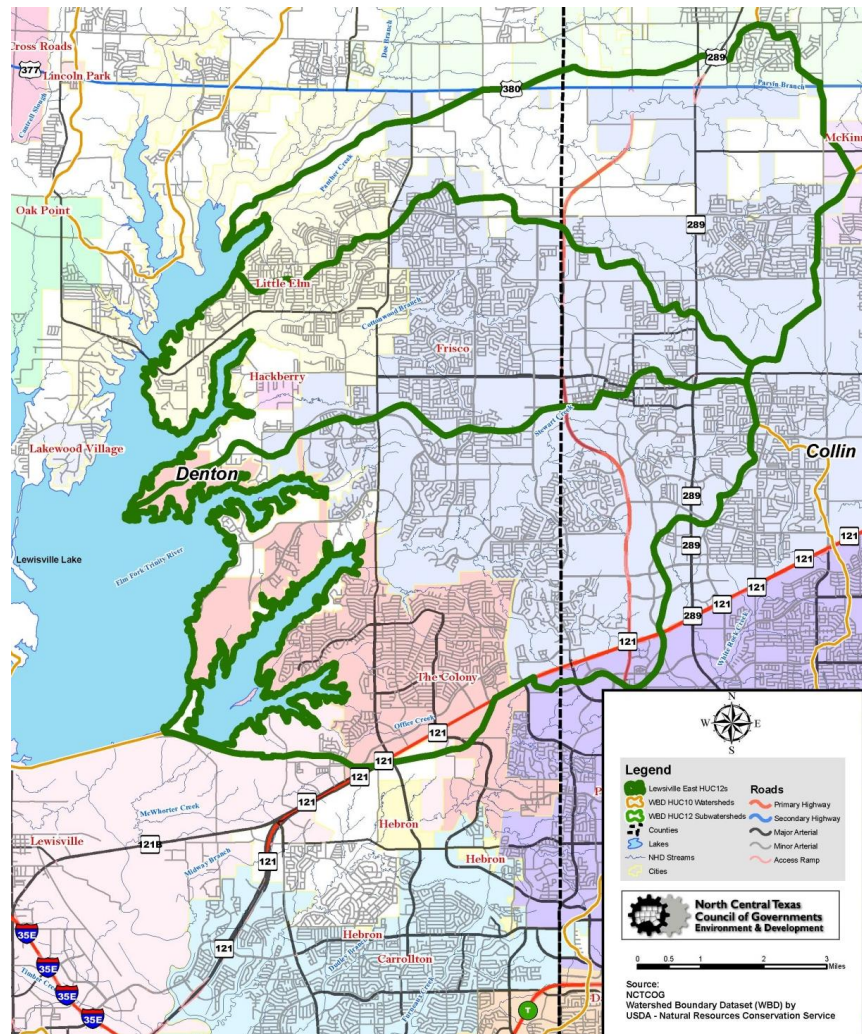


Figure 4.4: The three subwatersheds (defined by the green polygons) that make up the Lewisville Lake East watershed—Stewart Creek, Cottonwood Creek, and Panther Creek. The communities are also identified.

Based on the input gathered at the meetings, TPL is in the process of refining the Greenprint model framework and identifying the best data sources to support the water quality protection analysis. Future work involves finalizing the Greenprint, reconvening stakeholders and technical advisors to weight model criteria, scoring parcels within the subwatersheds to identify property-specific conservation opportunities, comparing the Greenprint results with other watershed priorities and stressors, and creating Greenprint maps and summary to describe the project results.

Future efforts will integrate conservation and planning

NCTCOG will continue to promote and employ the REF through other regional efforts under the Regional Ecosystem Forum’s—a committee-like group—guidance and expertise. Some of the watershed-related projects planned for the near future include wastewater infrastructure planning throughout the North Central Texas region and TMDLs for bacteria in the Upper Trinity River. Wastewater infrastructure is very similar to transportation infrastructure, and will provide a perfect opportunity to apply the process developed through the transportation project funded by the FHWA grant and state and local matching funds discussed previously.

Chapter 5: Watershed Resources

The purpose of this chapter is to highlight examples of efforts occurring outside the North Central Texas region that integrate conservation and planning using watersheds as the organizing unit. This chapter is not intended to be a comprehensive look at all the great efforts going on across the country. It simply recognizes the fact that the North Central Texas region is not unique in this watershed-based approach. The efforts of other areas that are discussed in this chapter may supplement or help guide current or future local efforts.

Maryland's Watershed Resources Registry improves watershed planning

According to the May-June 2010 National Wetlands Newsletter article titled, "Achieving Ecosystem Health Using a Watershed Approach," federal, state, and local agencies are working to improve watershed planning and protect important environmental resources in Maryland through the use of a Watershed Resources Registry (WRR), a GIS-based mapping tool. This registry will help regulators and planners across different agencies and programs characterize and identify potential watershed needs, as well as target suitable opportunity sites for protection and restoration of important resources.

Yadkin-Pee Dee River Basin Priority Watersheds Atlas helps recognize priorities

The Yadkin-Pee Dee River Basin Priority Watershed Atlas helps planners in the basin evaluate the river's conservation and restoration priorities, thanks to a \$51,000 grant from the 2009 American Reinvestment and Recovery Act. These funds supported a partnership among four Councils of Governments in the river basin to evaluate the basin's 232 watersheds to determine their need for improvement or protection. Planning software was used to analyze publicly-available data describing land use and land cover in the river basin and estimate water quality in each watershed, with highly accurate results. This approach suggests a simple and affordable approach to water quality planning to be used elsewhere in the Triad and North Carolina.¹⁰

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