

# NCTCOG Water Quality Protection Greenprint Lake Arlington Watershed and Lewisville Lake East Watershed

## Project Report

Prepared by The Trust for Public Land  
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*This project was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality*

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# **NCTCOG Water Quality Protection Greenprint**

## **Lake Arlington Watershed and Lewisville Lake East Watershed**

### **Summary Report**

#### **Abstract**

Increasing urbanization in North Central Texas watersheds can impact the quality of water entering local streams and may jeopardize regional drinking water reservoirs. A GIS analysis technique known as “Greenprinting”, developed by The Trust for Public Land (TPL), was used in selected watersheds in North Central TX to identify land areas that, if maintained as undeveloped, would offer significant benefit for water quality protection. The Lake Arlington Watershed and eastern drainage areas within the Lewisville Lake Watershed were the focus areas for this study.

The analysis framework for the project was designed by a panel of regional technical advisers, assembled by the North Central Texas Council of Governments (NCTCOG). The technical advisers considered water quality inventories across the two watersheds, current pollutant load profiles, watershed conditions, research from universities and public/private agencies, best available data, and similar water quality protection analyses. Six key landscape criteria for prioritizing areas for water quality protection were selected: land use with natural vegetated cover, proximity to streams, water erosion potential, floodplains, proximity to the reservoir, and proximity to ponds and wetlands. Maps, statistics, and tools were generated based on this analytical framework.

Stakeholders with broad representation across the two watersheds participated in workshops to guide design and emphasis for the project, to review analysis results, and to discuss implementation strategies for protection of critical areas for water quality.

#### **The Case for Strategic Water Quality Protection**

In the 2009 publication *Conservation: An Investment That Pays* (<http://www.tpl.org/publications/books-reports/park-benefits/investment-that-pays.html>), The Trust for Public Land states:

*Watershed conservation has proved to be a cost-effective alternative to expensive water-treatment technology in keeping drinking water clean.*

The report cites the following study:

*In 2002, The Trust for Public Land and the American Water Works Association conducted a study of 27 water suppliers and discovered that the more forest cover a watershed has, the fewer dollars suppliers must spend on treatment costs. According to the study, for every 10 percent increase in the source area’s forest cover, treatment and chemical costs decreased approximately 20 percent, up to about 60 percent forest cover.*

The National Research Council, in its 2002 publication *Riparian Areas: Functions and Strategies for Management* tells us:

*Nutrient cycling, contaminant filtration, water purification, bank stabilization, stream temperature maintenance, flow stabilization, flood attenuation, and habitat preservation are some of the numerous functions carried out by riparian zones.*

Protecting land in floodplains, wetlands, and riparian corridors not only provides strategic protection for water quality, it also provides opportunities for parkland, recreational open space, wildlife habitat, and scenic quality protection. In addition, avoiding development in areas with soils that exhibit high erosion potential greatly minimizes exacerbating effects of harmful runoff.

### **Water Quality Protection Greenprint - Project Overview**

North Central Texas Council of Governments (NCTCOG), through a grant provided by the U.S. EPA through TCEQ, partnered with the Trust for Public Land (TPL) in 2010-2011 to “Greenprint” two clusters of subwatersheds (HUC12’s) for North Texas. This work is part of a larger NCTCOG effort directed to the protection of the region’s water supply lakes. (<http://www.nctcog.org/envir/SEEscg/REF/index.asp>)

The objective of the Water Quality Greenprint was to provide a strategic plan for water quality protection in selected watersheds, by identifying land conservation priorities and determining areas most vulnerable to development. Key milestones in the project process included:

- Selection of watersheds for Greenprinting
- Regional community engagement
- Design and implementation of the analysis
- Location-specific profiling and overlay comparison
- Training on voluntary land conservation tools and strategies

### **Selection of Watersheds for Greenprinting**

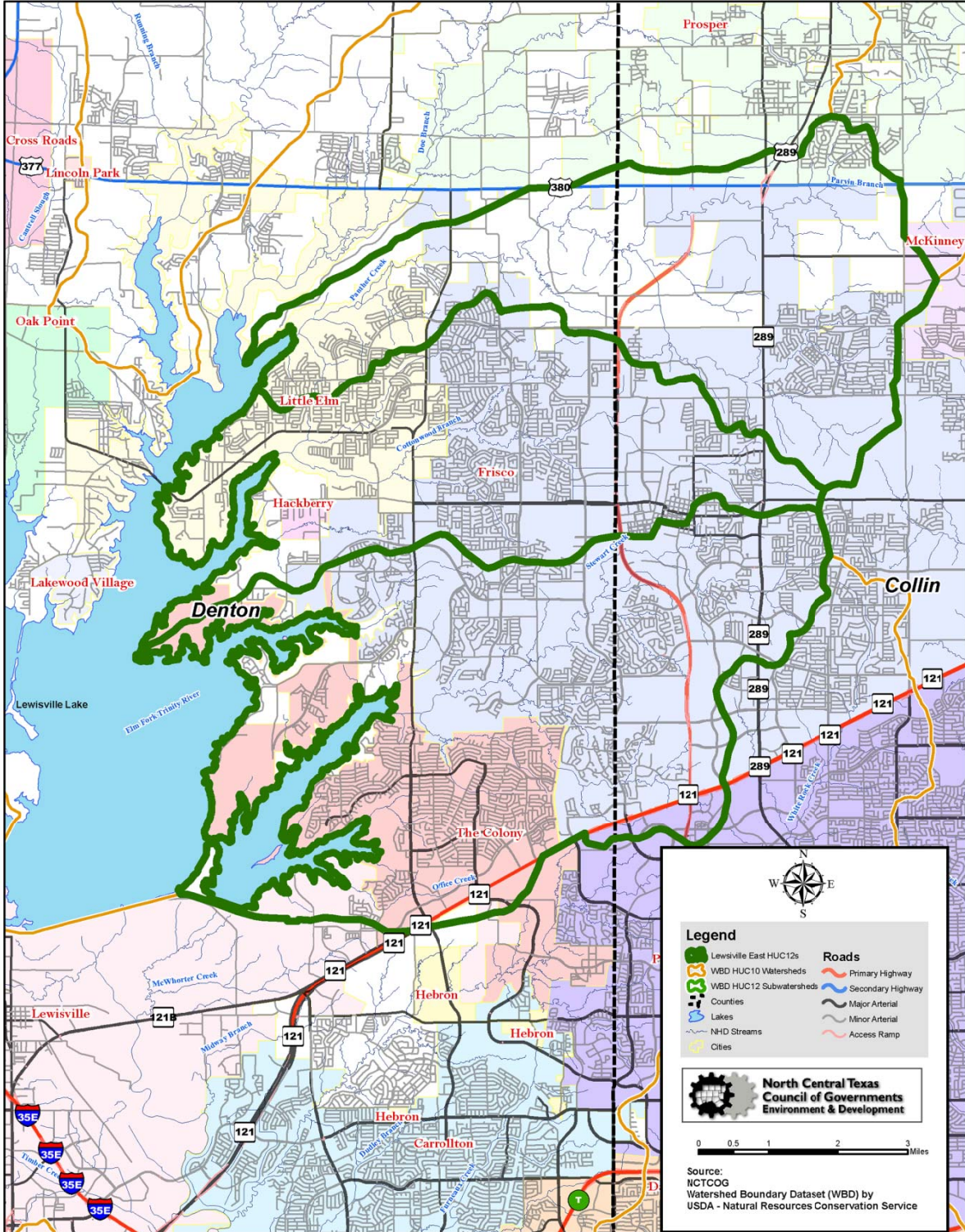
Nine clusters of subwatersheds to seven different water supply lakes in the North Central Texas region were considered for focal areas in the Greenprinting project. A structured screening process was used to identify watersheds best suited for validating the Greenprinting process in this region. Factors considered in the screening process included: subwatershed size, projected growth, jurisdictional makeup, immediate adjacency to a reservoir, land use profile, known water quality issues, extent of the floodplain, data availability, local leadership, and complimentary protection opportunities. Based on these criteria, NCTCOG’s Water Resources Council selected the following subwatersheds as pilots for Greenprinting:

- Lake Arlington - Quil Miller Creek subwatershed, Deer Creek subwatershed, Village Creek subwatershed, Wildcat Branch subwatershed
- Lewisville Lake East - Stewart Creek subwatershed, Cottonwood Creek subwatershed, Panther Creek subwatershed





# Lake Lewisville East Study Area Political Boundaries





## **Regional Community Engagement**

A strategic plan for water quality protection can only be successful if local constituents understand the recommendations, and have the tools and capacity to begin implementation. The Water Quality Greenprint project included a number of opportunities for stakeholders in the Lake Arlington Watershed and the Lewisville Lake East Watershed to participate in the process. Participants in each watershed community included city, county, and special district staff, as well as large businesses, property owners, and interested individuals. Stakeholders were given the opportunity to guide design and emphasis for the project, to review analysis results, and to discuss implementation strategies for watershed protection. Because project boundaries were defined by watershed drainage areas rather than jurisdictional boundaries, the process provided a unique context for local communities and organizations to come together to collaborate on regional issues.

Three stakeholder workshops were conducted in each watershed study area:

### Workshop 1: Project Kickoff and Definition

In October 2010, an initial workshop was held for Lake Arlington Watershed stakeholders, and a similar workshop was conducted for Lewisville Lake East stakeholders. The purpose of these meetings was to introduce the Greenprinting project to the community, describe the baseline approach that would be used for the analysis, and ask participants for guidance on design and emphasis for the project.

At these meetings, participants discussed the complementary relationship of the Greenprint analysis as a follow-on to the Lake Arlington Master Plan in the Lake Arlington Watershed and the *Water Quality Corridor Model (WQCM)* developed by University of North Texas in the Lewisville Lake watershed. Participants encouraged consideration of local master plans and pollutant load studies. It was also recommended that the Greenprint analysis incorporate factors such as the location of wells and septic systems, natural gas drilling, local environmental assessments, and regional growth projections.

### Workshop 2: Greenprint Draft Maps and Results Review

In April 2011, stakeholders were reconvened in each of the watershed study areas to review draft results of the Greenprint analysis. At these meetings, participants commented on the usefulness of the Greenprint to help make the case for other land protection initiatives such as shoreline protection, floodplain restrictions, and trails systems. Landowners attending the Lewisville Lake East meeting prompted discussion about potential impacts of the prioritization maps on private property. There was interest from all stakeholders in better understanding incentives and alternatives for land protection.

### Workshop 3: Training on Voluntary Land Conservation Tools

In June 2011, local government staff and land trust partners were invited to attend a training workshop on voluntary land conservation tools that can be employed to implement the Lake Arlington Watershed and Lewisville Lake East Watershed Greenprint. Guidance on mapping tools, funding options, strategies, and incentives for land conservation in Greenprint priority areas was provided.

## Design and Implementation of the Greenprint Analysis

Greenprinting is a unique resource analysis process developed by The Trust for Public Land (TPL). Greenprinting provides a systematic approach for identifying areas that offer the highest conservation benefit for water quality protection and other regional resource priorities. It uses GIS to make informed, strategic decisions about land conservation and resource protection priorities. The goal of the Greenprinting pilots for North Texas was to protect water quality through land conservation and strategic development considerations.

The NCTCOG Regional Ecosystem Forum (REF) provided the technical oversight for the project to ensure best available data and defensible science were used for the Greenprint analysis. Participating organizations and data providers included:

Alan Plummer Associates	Texas Commission on Environmental Quality
Bowman-Melton Associates	Texas Forest Service
City of Arlington	Texas Parks and Wildlife Department
City of Fort Worth	Texas Railroad Commission
City of Denton	Texas Water Development Board
City of Plano	Trinity River Authority
Freese and Nichols	University of North Texas
Half Associates, Inc	University of Texas at Arlington
Jacobs Engineering Group, Inc	Upper Trinity Regional Water District
Malcolm Pirnie	U.S. Army Corps of Engineers
Michael Baker Corporation	USDA Natural Resources Conservation Service
North Central Texas Council of Governments	U.S. Environmental Protection Agency
Tarrant Coalition for Environmental Awareness	U.S. Fish and Wildlife Service
Tarrant Regional Water District	U.S. Geological Survey
Texas AgriLife Extension Service	

The Greenprint process requires the identification of measureable, mappable criteria that characterize resource goals. For the Greenprint analysis in Lake Arlington and Lewisville Lake East watersheds, technical advisers listed above assisted in defining metrics specific to water quality protection.

The REF met 4 times over a 7-month period (October 29, 2010; December 15, 2010; February 23, 2011 via conference call; and April 11, 2011). These technical advisers began by considering baseline conditions in the watershed such as the 2010 Texas Water Quality Inventory, current pollutant load profiles, watershed current conditions, and local studies and research. There are no impaired water segments in the two project areas; however, there are some water quality concerns based on screening levels for Lake Arlington (chlorophyll-a), Lewisville Lake (ammonia, phosphorus, and nitrate), and Stewart Creek (ammonia, phosphorus, and nitrate). Pollutant load profiling results were reviewed from Texas AgriLife's 2010 SWAT analysis in the Trinity River Basin for the Lewisville Lake East watershed and Malcolm Pirnie's 2010 PLOAD analysis for the Lake Arlington Master Plan. Current conditions in the watershed reviewed by technical advisers included current population and housing density, existing land use, and protected land patterns.

Baseline criteria were then adapted from the Watershed Management Priority Index (WMPI) developed by University of Massachusetts Amherst, the USDA Forest Service, and the Trust for Public Land (<http://www.forest-to-faucet.org/pdf/WFMIS-overview.pdf>). Technical advisors reviewed this framework within the context of watershed reference conditions and available data to establish the following criteria for the Greenprint analysis framework:

- Landuse - Natural Vegetated Cover
- Proximity to Streams
- Water Erosion Potential
- Floodplains
- Proximity to the Reservoir
- Proximity to Ponds and Wetlands

The following table summarizes the data sources and methodology used to translate each of the above criteria into a priorities map. Criteria maps are expressed in terms of conservation value, on a scale of 0-5, with a score of 5 representing areas with highest priority for water quality protection. Special consideration was given to the interpretation of each data set with respect to relative conservation value of landscape characteristics.

Criterion	Data	Source	Methodology
Landuse	Ecological Systems Landcover, 2007	TPWD	<p>The more native the vegetative cover (e.g. forested riparian zones), the greater the need for protection.</p> <p>5 = forested riparian and wetlands, grasslands, water  4 = shrub/brush  3 = barren, native invasive  2 = crop/pasture  0 = urban, residential</p>
Proximity to Streams	High-resolution streams, 2010	USGS NHD	<p>The closer to the stream the higher the need for protection.</p> <p>5 = 0-100 feet  4 = 100-200  3 = 200-300  0 = &gt; 300</p>
Proximity to Ponds and Wetlands	Ponds, 2010 Wetlands, 2010	USGS NHD TPWD	<p>The closer to the pond or wetland the higher the need for protection.</p> <p>5 = 0-100 feet  4 = 100-200  3 = 200-300  0 = &gt; 300</p>
Water Erosion Potential	Soils, 2010	SURGO	<p>The Water Erosion Potential (TX) is a qualitative interpretation which evaluates a soil's potential to erode through the action of water. The potential assumes that the area being affected is bare and smooth and is exposed to the water erosion processes. The soil water erosion potential provides the user with a qualitative rating of the vulnerability of the soil to the action of water and is not a measure of actual soil loss from erosion.</p> <p>The water erosion potential of the soil is based on those soil properties or a combination of soil properties and landscape characteristics that contribute to runoff and have low resistance to water erosion processes. Those soil features that contribute to water erosivity are surface-layer particle size, saturated hydraulic conductivity, and high runoff landscapes. Conversely, soil features that resist the erosive affect of water are high surface-layer organic matter content and low runoff landscapes. The water erosion potential interpretation is a function of the interaction between those soil features that make the soil susceptible to water erosion and those that resist the water erosion process.</p> <p>5 = Very high erosion potential  4 = High erosion potential  3 = Moderate erosion potential</p>

Floodplains	100 yr. floodplain,	FEMA (MSDIS)	Floodplain forest is, by definition, important with regards to quantity, quality, and timing of flow and therefore have a higher need for protection.  5 = 100 year floodplain
Proximity to the Reservoir	Reservoirs (Lake Arlington and Lake Lewisville)	USGS NHD	The closer to the reservoir the higher the need for protection.  5 = 0-600 feet 4 = 600-2000 3 = 2000-5000 0 = >5000

A composite priorities map was then created for water quality protection by assigning relative weights to each criterion above. Technical advisers were responsible for determining the relative weights, based on their specific expertise related to the methodology and datasets. Rationale for assigning a higher or lower weight to a specific criterion included:

- Importance of that criterion for water quality via land protection.
- Quality or currency of the data used
- Comprehensiveness of the data and analysis methodology
- Existing regulatory protection

The following relative weighting strategy was recommended, emphasizing the relative importance of natural vegetated land cover for overall water quality protection:

- Landuse - Natural Vegetated Cover 22%
- Proximity to Streams 18%
- Water Erosion Potential 18%
- Floodplains 17%
- Proximity to the Reservoir 13%
- Proximity to Ponds and Wetlands 13%

### **Water Quality Protection Priority Maps**

The following maps depict water quality protection priorities resulting from the Greenprint analysis. Priorities are shown in shades of red, with darker shades depicting areas of highest priority for water quality protection.

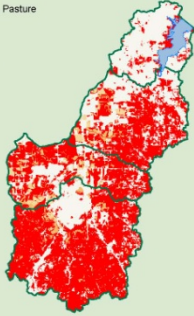


# NCTCOG Water Quality Protection Greenprint

## Lake Arlington Watershed

### Landuse

- Forest, Water, Crop, Pasture
- Shrub, Brush
- Barren
- Urban, Residential



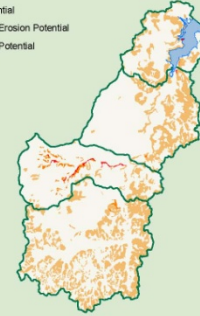
This map displays the Overall Water Quality Protection Priorities for the Lake Arlington Watershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%

### Water Erosion Potential

- High Erosion Potential
- Moderate To High Erosion Potential
- Moderate Erosion Potential



### Proximity to Streams

- 0 - 100 feet
- 100 - 200 feet
- 200 - 300 feet



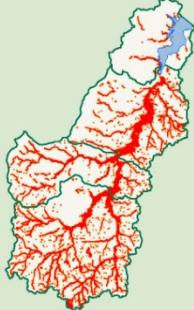
### Floodplains

- 100 Year Floodplain



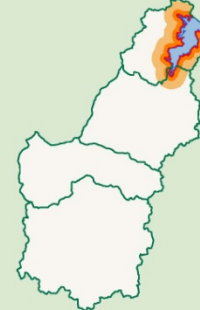
### Proximity to Ponds and Wetlands

- 0 - 600 feet
- 600 - 2000 feet
- 2000 - 5000 feet



### Proximity to the Reservoir

- 0 - 600 feet
- 600 - 2000 feet
- 2000 - 5000 feet



### Water Quality Protection Priorities

- High
- Moderate To High
- Moderate
- Greenprint Study Area
- Sub Watersheds
- Counties
- Protected Lands
- Cities

Information on this map is provided for purposes of discussion and visualization only. The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.

Map created by the Trust for Public Land on 5/14/2011. Created in ArcMap 9.3.5. Map Projection: NAD 83 Spheroid: Texas North Central Feet.

This document was created as part of a Greenprinting process with The Trust for Public Land. www.tpl.org

0 1 2 4 Miles

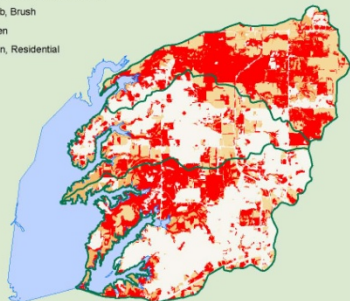


# NCTCOG Water Quality Protection Greenprint

## Lewisville Lake East Watershed

### Landuse

- Forest, Water, Crop, Pasture
- Shrub, Brush
- Barren
- Urban, Residential



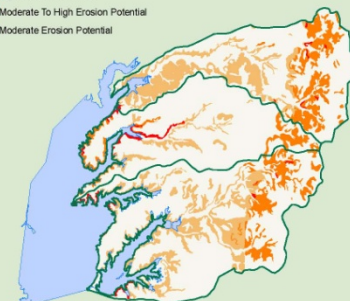
This map displays the Overall Water Quality Protection Priorities for the Lewisville Lake East Watershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%

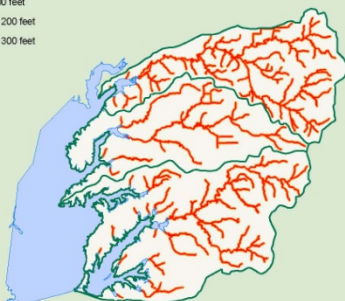
### Water Erosion Potential

- High Erosion Potential
- Moderate To High Erosion Potential
- Moderate Erosion Potential



### Proximity to Streams

- 0 - 100 feet
- 100 - 200 feet
- 200 - 300 feet



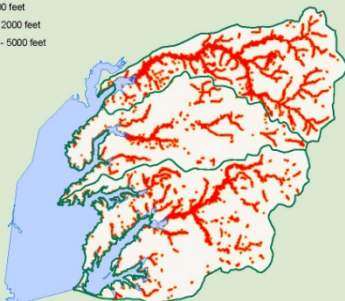
### Floodplains

- 100 Year Floodplain



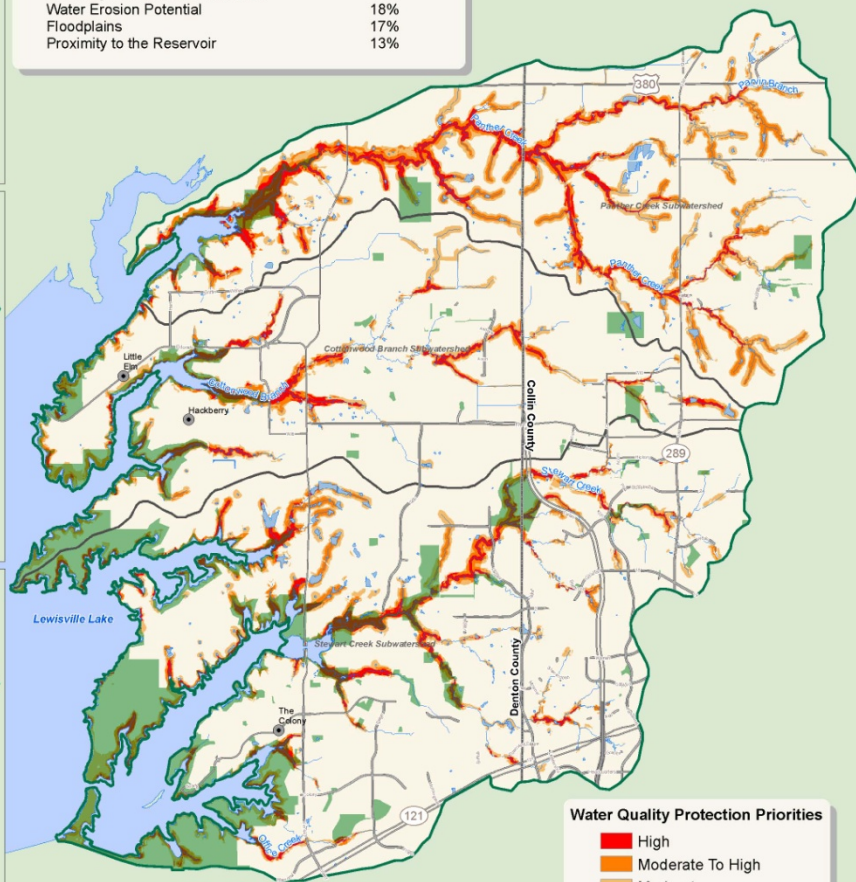
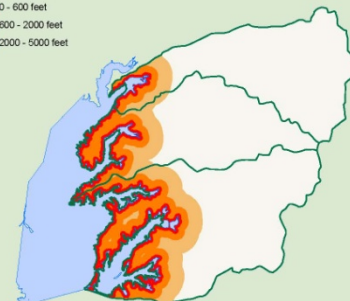
### Proximity to Ponds and Wetlands

- 0 - 600 feet
- 600 - 2000 feet
- 2000 - 5000 feet



### Proximity to the Reservoir

- 0 - 600 feet
- 600 - 2000 feet
- 2000 - 5000 feet



### Water Quality Protection Priorities

- High
- Moderate To High
- Moderate
- Greenprint Study Area
- Sub Watersheds
- Counties
- Protected Lands
- Cities

Information on this map is provided for purposes of discussion and visualization only. The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.

Map created by the Trust for Public Land on 5/14/2011. Created in ArcMap 9.3.0. Map Projection: NAD 83 SIP Texas North Central Feet

This document was created as part of a Greenprinting process with The Trust for Public Land. www.tpl.org

0 0.5 1 2 Miles







## Water Quality Protection Statistics by Watershed

The following reports present a statistical analysis of priority acres identified within each watershed study area, as well as within the subwatersheds that comprise each study area. The reports identify the extent of priority areas, and the extent of priority areas that currently have no permanent land protection status.

### Lake Arlington Watershed Statistics

 <b>Lake Arlington Water Quality Protection Greenprint</b> June 17, 2011 Protection Statistics Study Area Acreage: 89,185 Protected Land Acreage: 1,057**					
	Criteria	Priority Acres*	Percent of Study Area	UnProtected Priority Acres	Percent of Study Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	15,253	17.1%	14,865	16.7%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	52,572	58.9%	51,874	58.2%
	Proximity to Streams	17,057	19.1%	16,647	18.7%
	Proximity to Ponds and Wetlands	28,065	31.5%	27,539	30.9%
	Water Erosion Potential	23,355	26.2%	23,252	26.1%
	Floodplains	12,816	14.4%	12,435	13.9%
	Proximity to the Reservoir	8,864	9.9%	8,710	9.8%
*Priority Acres reflects a score of "3" or greater on a scale of 0-5. **Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.					
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### Subwatersheds within Lake Arlington Watershed

 <b>Wildcat Branch Subwatershed</b> June 17, 2011 Protection Statistics Subwatershed Acreage: 12,837 Protected Land Acreage: 308**					
	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	1,237	9.6%	1,185	9.2%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	1,734	13.5%	1,564	12.2%
	Proximity to Streams	1,964	15.3%	1,898	14.8%
	Proximity to Ponds and Wetlands	1,429	11.1%	1,374	10.7%
	Water Erosion Potential	3,309	25.8%	3,274	25.5%
	Floodplains	2,786	21.7%	2,723	21.2%
	Proximity to the Reservoir	7,635	59.5%	7,549	58.8%
*Priority Acres reflects a score of "3" or greater on a scale of 0-5. **Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.					
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### Village Creek Subwatershed

June 17, 2011

Protection Statistics

Subwatershed Acreage: 23,238

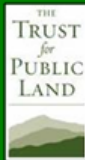
Protected Land Acreage: 196\*\*

	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	4,244	18.3%	4,197	18.1%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	12,991	55.9%	12,864	55.4%
	Proximity to Streams	4,484	19.3%	4,429	19.1%
	Proximity to Ponds and Wetlands	7,634	32.8%	7,527	32.4%
	Water Erosion Potential	5,606	24.1%	5,579	24.0%
	Floodplains	3,885	16.7%	3,849	16.6%
	Proximity to the Reservoir	1,229	5.3%	1,161	5.0%

\*Priority Acres reflects a score of "3" or greater on a scale of 0-5.

\*\*Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.

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### Deer Creek Subwatershed

June 17, 2011

Protection Statistics

Subwatershed Acreage: 18,204

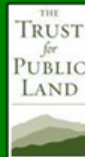
Protected Land Acreage: 131\*\*

	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	3,040	16.7%	3,001	16.5%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	11,775	64.7%	11,689	64.2%
	Proximity to Streams	3,344	18.4%	3,300	18.1%
	Proximity to Ponds and Wetlands	5,581	30.7%	5,519	30.3%
	Water Erosion Potential	2,712	14.9%	2,698	14.8%
	Floodplains	2,131	11.7%	2,097	11.5%
	Proximity to the Reservoir	0	0.0%	0	0.0%

\*Priority Acres reflects a score of "3" or greater on a scale of 0-5.

\*\*Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.

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### Quil Miller Subwatershed

June 17, 2011

Protection Statistics

Subwatershed Acreage: 34,905

Protected Land Acreage: 421\*\*


	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	6,732	19.3%	6,482	18.6%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	26,072	74.7%	25,757	73.8%
	Proximity to Streams	7,264	20.8%	7,020	20.1%
	Proximity to Ponds and Wetlands	13,422	38.5%	13,119	37.6%
	Water Erosion Potential	11,729	33.6%	11,701	33.5%
	Floodplains	4,014	11.5%	3,766	10.8%
	Proximity to the Reservoir	0	0.0%	0	0.0%

\*Priority Acres reflects a score of "3" or greater on a scale of 0-5.

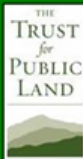
\*\*Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.

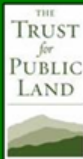
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## Lewisville Lake East Watershed Statistics

 <b>Lewisville Lake East Water Quality Protection Greenprint</b> June 17, 2011 Protection Statistics Study Area Acreage: 51,746 Protected Land Acreage: 5,580**						
	Criteria	Priority Acres*	Percent of Study Area	UnProtected Priority Acres	Percent of Study Area	
<b>Overall Greenprint Results</b>						
	Water Quality Protection Priorities	9,390	18.1%	6,811	13.2%	
<b>Water Quality Protection Criteria</b>						
	Landuse - Natural Vegetated Cover	22,047	42.6%	18,039	34.9%	
	Proximity to Streams	11,107	21.5%	9,777	18.9%	
	Proximity to Ponds and Wetlands	14,499	28.0%	11,938	23.1%	
	Water Erosion Potential	14,179	27.4%	12,057	23.3%	
	Floodplains	7,141	13.8%	4,758	9.2%	
	Proximity to the Reservoir	16,037	31.0%	11,686	22.6%	
		*Priority Acres reflects a score of "3" or greater on a scale of 0-5. **Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.				
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## Subwatersheds within Lewisville Lake East Watershed

 <b>Cottenwood Branch Subwatershed</b> June 17, 2011 Protection Statistics Subwatershed Acreage: 14,228 Protected Land Acreage: 1,064**						
	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area	
<b>Overall Greenprint Results</b>						
	Water Quality Protection Priorities	1,953	13.7%	1,364	9.6%	
<b>Water Quality Protection Criteria</b>						
	Landuse - Natural Vegetated Cover	4,482	31.5%	3,768	26.5%	
	Proximity to Streams	2,372	16.7%	2,113	14.8%	
	Proximity to Ponds and Wetlands	3,029	21.3%	2,445	17.2%	
	Water Erosion Potential	2,237	15.7%	1,645	11.6%	
	Floodplains	2,115	14.9%	1,584	11.1%	
	Proximity to the Reservoir	4,526	31.8%	3,709	26.1%	
		*Priority Acres reflects a score of "3" or greater on a scale of 0-5. **Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.				
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 <b>Panther Creek Subwatershed</b> June 17, 2011 Protection Statistics Subwatershed Acreage: 15,383 Protected Land Acreage: 631**						
	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area	
<b>Overall Greenprint Results</b>						
	Water Quality Protection Priorities	3,823	24.9%	3,456	22.5%	
<b>Water Quality Protection Criteria</b>						
	Landuse - Natural Vegetated Cover	9,007	58.5%	8,551	55.6%	
	Proximity to Streams	4,542	29.5%	4,282	27.8%	
	Proximity to Ponds and Wetlands	5,855	38.1%	5,470	35.6%	
	Water Erosion Potential	5,646	36.7%	5,374	34.9%	
	Floodplains	1,932	12.6%	1,619	10.5%	
	Proximity to the Reservoir	2,028	13.2%	1,686	11.0%	
		*Priority Acres reflects a score of "3" or greater on a scale of 0-5. **Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.				
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## Stewart Creek Subwatershed

June 17, 2011

Protection Statistics

Subwatershed Acreage: 22,135

Protected Land Acreage: 3,249\*\*

	Criteria	Priority Acres*	Percent of Area	UnProtected Priority Acres	Percent of Area
<b>Overall Greenprint Results</b>					
	Water Quality Protection Priorities	3,615	16.3%	2,414	10.9%
<b>Water Quality Protection Criteria</b>					
	Landuse - Natural Vegetated Cover	8,558	38.7%	6,249	28.2%
	Proximity to Streams	4,193	18.9%	3,527	15.9%
	Proximity to Ponds and Wetlands	5,615	25.4%	4,397	19.9%
	Water Erosion Potential	6,296	28.4%	5,239	23.7%
	Floodplains	3,094	14.0%	1,971	8.9%
	Proximity to the Reservoir	9,483	42.8%	6,928	31.3%
*Priority Acres reflects a score of "3" or greater on a scale of 0-5.		© 2011 The Trust for Public Land. All Rights Reserved.			
**Protected Acres is based on Protected Land obtained from North Center Texas Council of Governments.					

## Overlay Comparisons

Contextual overlay maps can help inform conservation priorities. Interactive mapping tools included with the Greenprint provide flexible exploration of overlay data with respect to identified priority locations for water quality protection. An extensive set of overlay data was collected as part of the Greenprint process:

Data Layer	Data Source
100 Year Floodplain	NCTCOG, FEMA
2005 Landuse	NCTCOG
2007 TPWD Ecological Systems Landcover	TPWD
City Boundaries	NCTCOG
County Boundaries	NCTCOG
Fort Worth WD boundary	NCTCOG
Gas and Oil Wells	Texas Railroad Commission
LAMP Study Area	Malcom Pirnie
Lake Arlington Future Landuse	NCTCOG
Lake Lewisville Future Landuse	NCTCOG
Lakes and Ponds	USGS NHD
Nitrogen Load Profile	Malcom Pirnie, Texas Agrilife
NRCS Dams	NRCS
NTMWD boundary	NCTCOG
Parcels: Collin County Denton County Johnson County Tarrant County	NCTCOG
Phosphorus Load Profile	Malcom Pirnie, Texas Agrilife
Protected Lands	NCTCOG

Population Density (2010 projected)	ESRI
Regional Growth Projections	NCTCOG??
Reservoirs	TWDB
Sewer Service Areas	NCTCOG, TCEQ
Subwatersheds	USGS NHD
Streams	USGS NHD
Suspended Solids Profile	Malcom Pirnie, Texas Agrilife
TCEQ Waterbodies of Concern	TCEQ
Wastewater Facilities	TCEQ
Waterbodies of Concern: Village Creek (chlorophyll-a) Stewart Creek (ammonia, phosphorus, nitrate) Lake Arlington (chlorophyll-a) Lake Lewisville (ammonia, phosphorus, nitrate)	TCEQ
Wetlands (Derived from 2007 Ecological Systems Landcover)	TPWD
Woodbine Outcrop (recharge)	City of Denton Water Utilities

The following sample maps illustrate the value of considering overlay data as context for water quality protection priorities, such as evaluating:

- **urgency** based on projected growth for the region, and,
- **vulnerability** by showing phosphorus load potential as identified by the Lake Arlington Master Plan PLOAD analysis and the Texas AgriLife SWAT analysis in the Lake Arlington and Lewisville Lake East watersheds respectively.

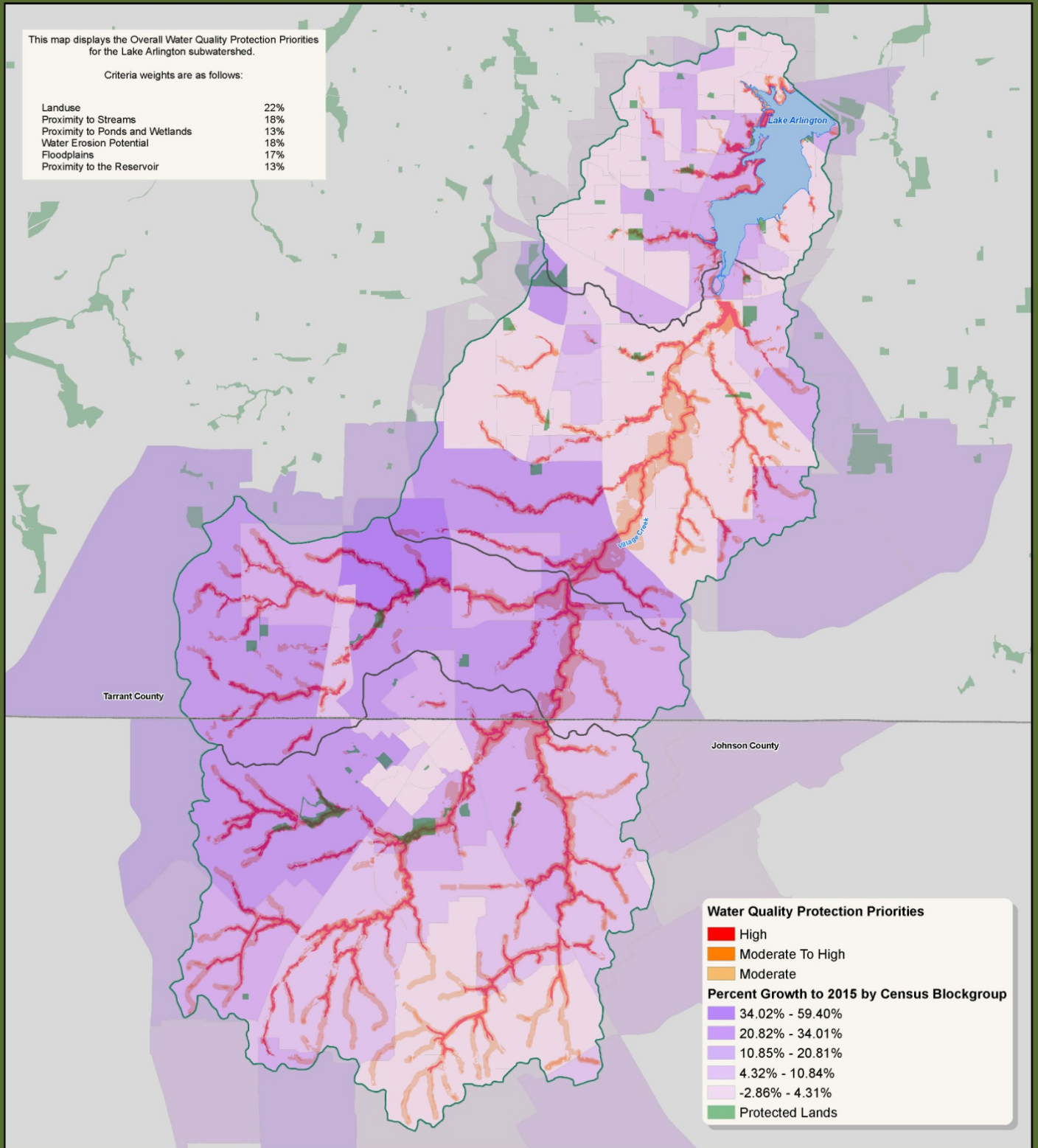
# NCTCOG WATER QUALITY PROTECTION GREENPRINT

## LAKE ARLINGTON WATERSHED - HIGH GROWTH AREAS

This map displays the Overall Water Quality Protection Priorities for the Lake Arlington subwatershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%



**Water Quality Protection Priorities**

- High
- Moderate To High
- Moderate

**Percent Growth to 2015 by Census Blockgroup**

- 34.02% - 59.40%
- 20.82% - 34.01%
- 10.85% - 20.81%
- 4.32% - 10.84%
- -2.86% - 4.31%
- Protected Lands

00.45.9 1.8 Miles

Information on this map is provided for purposes of discussion and visualization only.  
 The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.  
 Map created by the Trust for Public Land on 9/27/2011. Created in ArcMap 9.3.0. Map Projection: NAD 83 SP Texas North Central Feet.  
 This document was created as part of a Greenprinting process with The Trust for Public Land: www.tpl.org



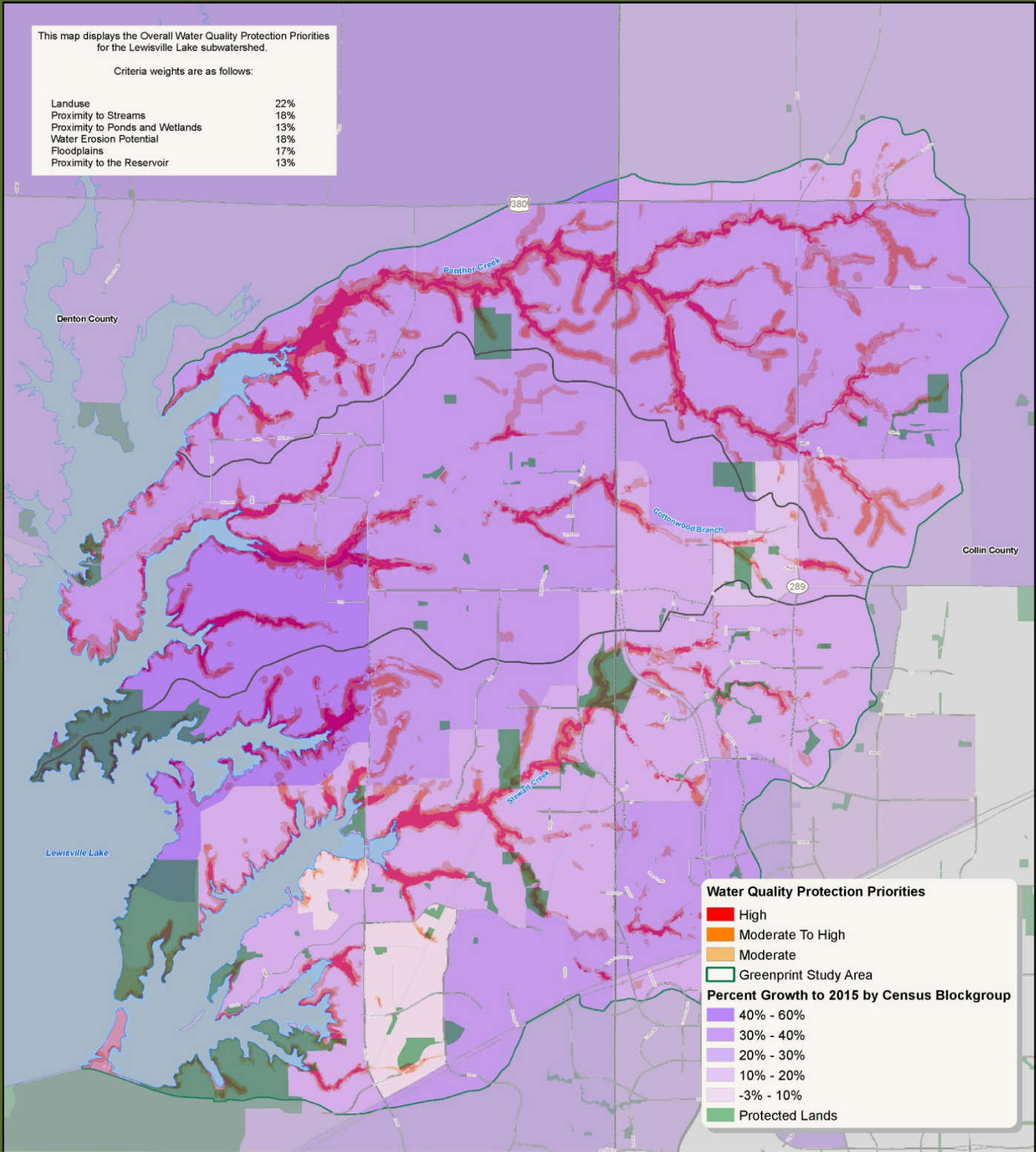
# NCTCOG WATER QUALITY PROTECTION GREENPRINT

## LEWISVILLE LAKE EAST WATERSHED - HIGH GROWTH AREAS

This map displays the Overall Water Quality Protection Priorities for the Lewisville Lake subwatershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%



**Water Quality Protection Priorities**

- High
- Moderate To High
- Moderate
- Greenprint Study Area

**Percent Growth to 2015 by Census Blockgroup**

- 40% - 60%
- 30% - 40%
- 20% - 30%
- 10% - 20%
- -3% - 10%
- Protected Lands



Information on this map is provided for purposes of discussion and visualization only.  
 The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.  
 Map created by the Trust for Public Land on 6/27/2011. Created in ArcMap 9.3.5. Map Projection: NAD 83 SP Texas North Central Feet.  
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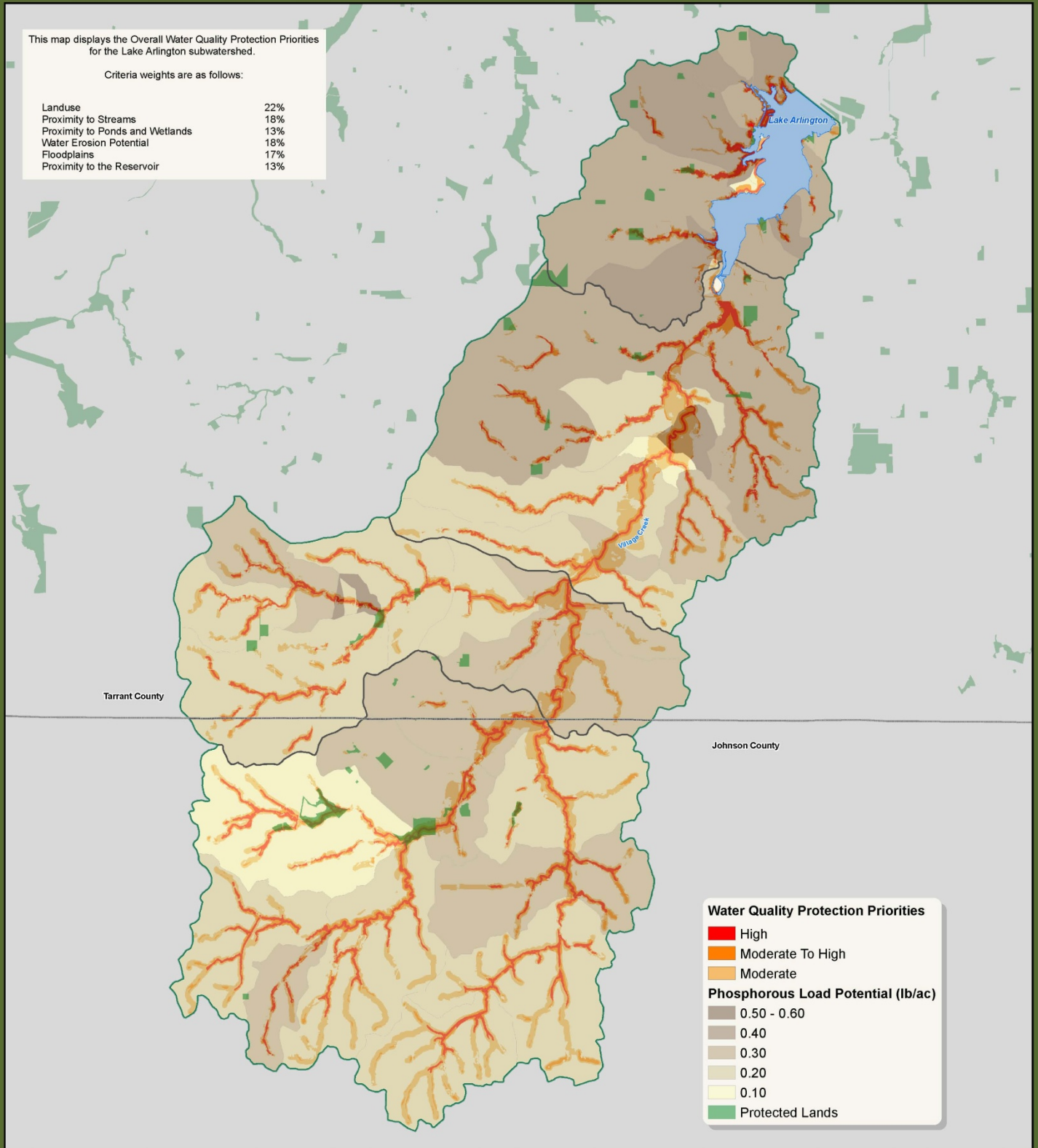
# NCTCOG WATER QUALITY PROTECTION GREENPRINT

## LAKE ARLINGTON WATERSHED - PHOSPHOROUS LOAD POTENTIAL

This map displays the Overall Water Quality Protection Priorities for the Lake Arlington subwatershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%



0.45 0.9 1.8 Miles

Information on this map is provided for purposes of discussion and visualization only.  
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 Map created by the Trust for Public Land on 8/27/2011. Created in ArcMap 9.3.5. Map Projection: NAD 83 SP Texas North Central Feet.  
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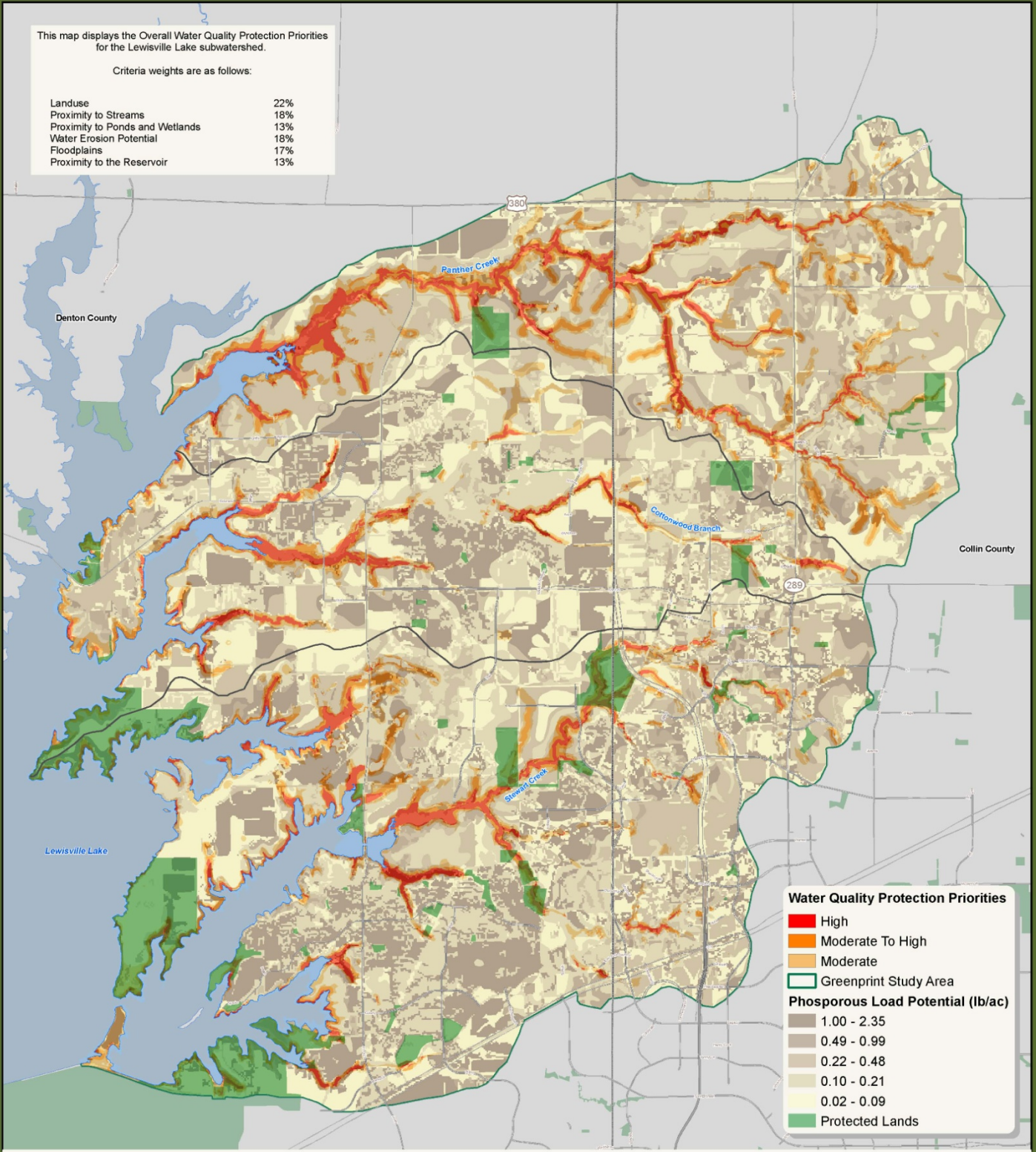
# NCTCOG WATER QUALITY PROTECTION GREENPRINT

## LEWISVILLE LAKE EAST WATERSHED - PHOSPHOROUS LOAD POTENTIAL

This map displays the Overall Water Quality Protection Priorities for the Lewisville Lake subwatershed.

Criteria weights are as follows:

Landuse	22%
Proximity to Streams	18%
Proximity to Ponds and Wetlands	13%
Water Erosion Potential	18%
Floodplains	17%
Proximity to the Reservoir	13%



**Water Quality Protection Priorities**

- High
- Moderate To High
- Moderate
- Greenprint Study Area

**Phosphorous Load Potential (lb/ac)**

- 1.00 - 2.35
- 0.49 - 0.99
- 0.22 - 0.48
- 0.10 - 0.21
- 0.02 - 0.09
- Protected Lands



Information on this map is provided for purposes of discussion and visualization only.  
 The preparation of this report was financed through grants from the U.S. Environmental Protection Agency through the Texas Commission on Environmental Quality.  
 Map created by the Trust for Public Land on 6/27/2011. Created in ArcMap 9.3.0; Map Projection: NAD 83 SP Texas North Central Feet.  
 This document was created as part of a Greenprinting process with The Trust for Public Land www.tpl.org



## Training on Voluntary Land Conservation Tools

As a final step in the Greenprinting process, local government staff and land trust partners were invited to attend a training workshop on voluntary land conservation tools that can be employed to implement the Lake Arlington Watershed and Lewisville Lake East Watershed Greenprint. Guidance on funding options and strategies for land conservation in Greenprint priority areas was provided.

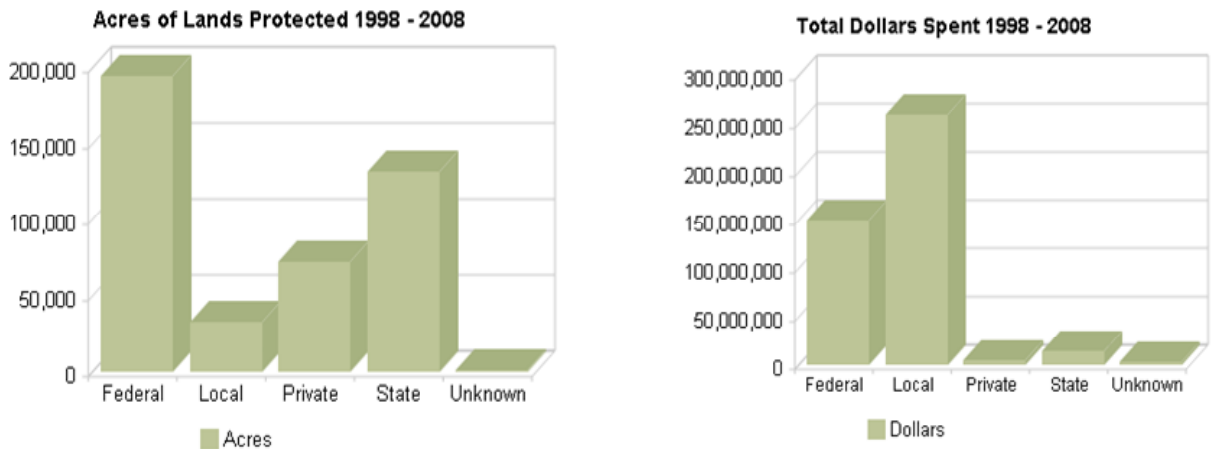
### Funding Options

TPL's Conservation Finance Team assists communities in identifying and securing public financing. TPL is the leading source in the nation for research, education and policy information for conservation funding. Helping communities to secure dedicated conservation funding is often the tipping point that can lead to deeper ecological responsibility, including more prudent land use, better managed growth, and the increased protection of natural landscapes.

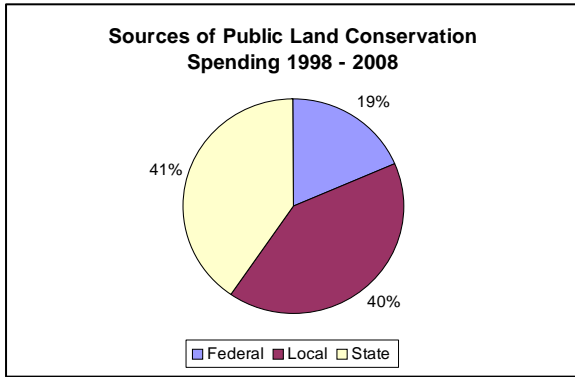
It is rare that any conservation project can be funded through a single source. TPL encourages an approach known as the "*funding quilt*" to describe the diverse set of reliable, long-term funding sources (local, state, federal, and private) that must come together to achieve strategic land conservation objectives. Every project's funding quilt is unique and evolves over time due to changing fiscal and political fortunes.

The following charts were created based on information available online through TPL's Conservation Almanac ([www.conservationalmnanc.org](http://www.conservationalmnanc.org)). These charts depict a broad view of the funding quilt at both a national and state level for the state of Texas. Local spending results only represent County investments, and do not currently include spending data from cities and towns.

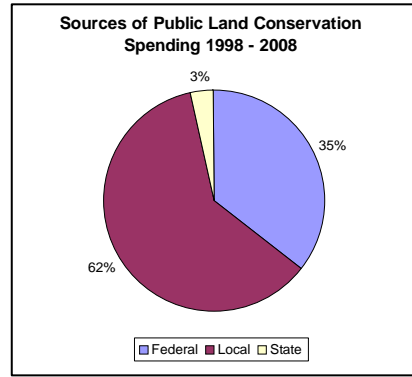
### *Texas Land Conservation Activity*



*The National Funding Quilt*



*The Texas Funding Quilt*



**Appendix A** provides a summary report prepared by TPL’s Conservation Funding Team, that describes funding options and opportunities that might be considered when constructing a funding quilt for protection of water quality in North Central Texas based on Greenprint priority areas.

Strategies and Incentives for Land Protection

TPL’s mission is to help conserve land for parks, greenways, recreation areas, watersheds and wilderness. To date, TPL has helped protect some 4,200 properties, totaling almost three million acres in 47 states. In Texas, TPL has helped protect 121 properties comprising almost 36,705 acres.

In the Greenprint Training Workshop for local government staff and land trusts, TPL described opportunities, constraints, and considerations for Fee Simple land protection vs. Conservation Easement land protection.

**Appendix B** provides a summary of this training discussion.