Appendix F: Integrating Environmental and Transportation Planning

The North Central Texas Council of Governments (NCTCOG), as the Metropolitan Planning Organization (MPO) for the Dallas-Fort Worth region, is committed to integrating conservation and transportation planning during the transportation planning process and into project implementation and construction. This appendix provides an example of how the transportation and infrastructure development can utilize the ecosystem approach to identify important natural and social resources earlier in the transportation planning process and to determine mitigation strategies that help further preservation or restoration initiatives in line with the Regional Ecosystem Framework (REF).

NCTCOG proposes to utilize several different tools that will collectively produce a snapshot of a corridor or subwatershed that can be used to identify important environmental resources and present important ecosystem information at the subwatershed level. The tools discussed in the sections below include: NEPAssist (National Environmental Policy Act), Geographic Information System Screening Tool (GISST), Vital Ecosystem Information Layers (VEIL) and North Texas 2050 Policy Areas analysis (which both form the basis of the REF), and socioeconomic analysis using an Environmental Justice Index (EJI). The three pilot corridors—State Highway (SH) 170, SH 360, and Lake Lavon rail—facilitate the analyses below. This approach can be utilized by transportation planners or other infrastructure planners to assess the important features by subwatershed and provide a look at areas of relatively high concerns earlier in the planning process.

Introduction

The long-range transportation planning process is a system-level planning process. This process plans for infrastructure projects as far as 20 years into the future with little detail and much uncertainty. Traditionally, as transportation projects move through the project development process, a greater emphasis is placed on the environmental impacts associated with an individual project at each successive stage, as shown in Table F.1.

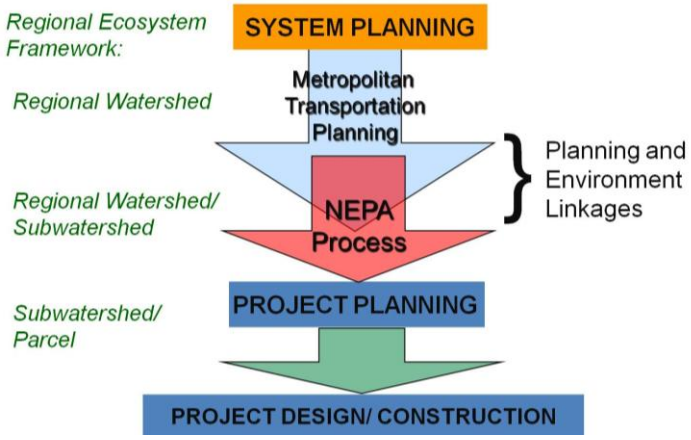
Table F.1: Transportation project development process.

	Number of Alternatives	Public Involvement	Project Detail
Metropolitan Transportation Plan (MTP)	Many, especially regarding various modes	General, system level (conducted by Metropolitan Planning Organization)	System level, focus on mode, capacity, and general environmental impacts (not on specific locations or strategies)
Corridor/Subarea Studies	Fewer (especially modes), with more emphasis on location concerns (alignments, stations)	More extensive, corridor level (conducted by transportation providers)	Feasibility level, focus on community, mobility cost, and fatal flaw environmental impacts
Environmental Assessment/ Environmental Impact Statement	Preferred Alternative – one, possibly two alternatives with concentration on design and environment: 1) enhancement 2) avoidance 3) mitigation	Most extensive, project level (conducted by transportation providers)	Engineering level, additional detail on engineering, cost, and environmental impacts

See Figure F.1 for a diagram of this process. The work supported by Federal Highway and Administration and 50/50 state and local matching funds was among several cooperative efforts providing a more comprehensive foundation for the REF.

Figure F.1: This figure identifies how the REF seeks to enhance the transportation project development process on a watershed basis to better link environmental and transportation planning.

Enhanced Transportation Project Development Process



All efforts are tied to the watershed geography and the REF's concept of connecting people, places, and programs. More specifically, this FHWA grant sought to: build and strengthen collaborative partnerships (connect people); identify vital ecosystems on a watershed basis to help determine potential impacts of transportation plans/projects (connect places); and integrate conservation and transportation planning (connect programs). The following sections will address these goals once the study area has been defined.

Define the study area

Three transportation corridors were chosen to support the development of a regional framework that integrates environmental and transportation planning, and includes the following three projects as identified in the metropolitan transportation plan, "Mobility 2030: The Metropolitan Transportation Plan for the Dallas-Fort Worth Area, 2009 Amendment."

- 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

These corridors were chosen because of a number of factors including development potential of the surrounding area, current land uses, length of time before project implementation, environmental resources, whether the road is a new facility or existing, and rural/urban character. NCTCOG also sought to have a mix of roadway and transit systems and did not want to interfere with projects already in the NEPA compliance process.

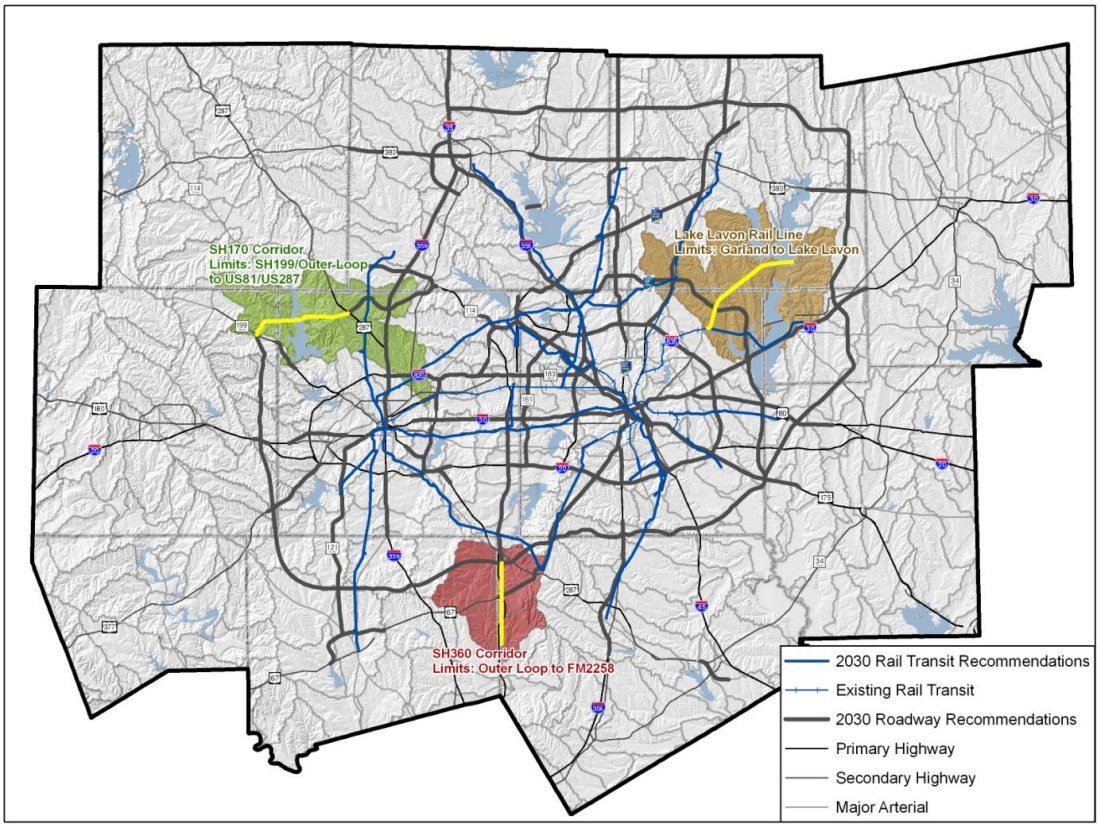
The subwatersheds that appeared to potentially be impacted by these proposed transportation corridors were chosen to make up the pilot areas; there are a total of 16. Five subwatersheds make up the SH 170 corridor pilot area, three make up the SH 360 corridor pilot area, and eight make up the Lake Lavon rail corridor pilot area. These subwatersheds are listed in Table F.2 and are highlighted with the 12-county MPA in Figure F.2. Table F.2 also identifies the Regional Watershed that these subwatersheds are a part of.

Table F.2: The subwatersheds making up the transportation pilot corridors and the Regional Watershed they are a part of.

Transportation Pilot Corridor	Subwatershed	Regional Watershed
SH 170	Indian Creek-Eagle Mountain Lake	Lake Worth/Eagle Mountain Lake
	Lower Walnut Creek	
	Dosier Creek-Eagle Mountain Creek	
	Whites Branch-Big Fossil Creek	West Fork below Lake Worth
	Henrietta Creek	Grapevine Lake
SH 360	Headwaters Mountain Creek	Arlington/Benbrook/Joe Pool/Weatherford Lakes
	Soap Creek	
	Armstrong Creek-Cottonwood Creek	Richland Chambers Lake
Lake Lavon Rail	White Rock Creek-Lake Lavon	Lake Lavon
	Price Creek-Lake Lavon	
	Camp Creek-Lake Ray Hubbard	Lake Ray Hubbard
	Cottonwood Creek East Fork Trinity River	
	Muddy Creek-Lake Ray Hubbard	
	Brown Brach Rowlett Creek	
	Pittman Creek-Spring Creek	
	Rowlett Creek-Lake Ray Hubbard	

Figure F.2: Map of the 12-county MPA identifying transportation corridors outlined in Mobility 2030, 2009 Amendment.[8] The subwatershed clusters making up the three transportation pilot areas are highlighted.

Transportation Pilot Subwatersheds* as Identified in Mobility 2030, 2009 Amendment



*This map is not intended to represent the exact alignments of the proposed transportation corridors.

The communities that are within these pilot areas—completely or partially—include:

- SH 170: City of Azle, Briar Census-Designated Place (CDP), Eagle Mountain CDP, City of Fort Worth, City of Haltom City, City of Haslet, City of Keller, City of Newark, City of North Richland Hills, Pecan Acres CDP, City of Pelican Bay, City of Reno, City of Rhome, City of Richland Hills, City of Saginaw, City of Sanctuary, and City of Watauga, and Denton, Parker, Tarrant, and Wise counties
- SH 360: City of Alvarado, City of Grand Prairie, City of Mansfield, City of Midlothian, and City of Venus, and Ellis and Johnson counties
- Lake Lavon rail: City of Allen, City of Dallas, Town of Fairview, City of Fate, City of Garland, City of Lavon, City of Lucas, City of Murphy, City of Nevada, City of Parker, City of Plano, City of Richardson, City of Rockwall, City of Rowlett, City of Sachse, Town of Saint Paul, and City of Wylie, and Collin, Dallas, and Rockwall counties

See Figure F.3, F.4, and F.5 for maps identifying the political boundaries within the pilot areas.

Figure F.3: The communities within the SH 170 Corridor Pilot Area.

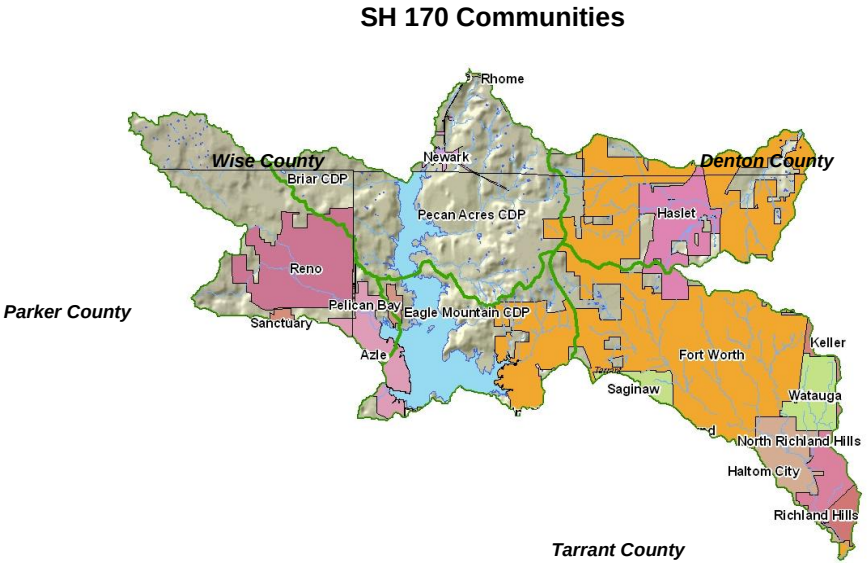
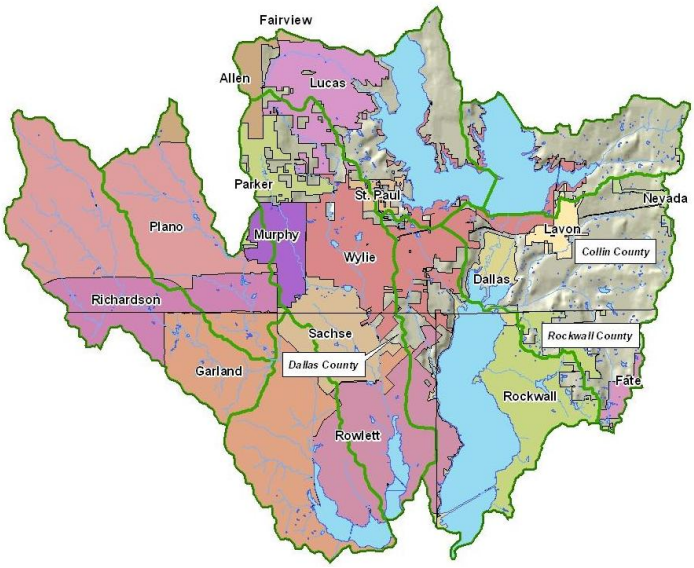


Figure F.4: The communities within the SH 360 Corridor Pilot Area.

Figure F.5: The communities within the Lake Lavon Rail Corridor Pilot Area.



Build and strengthen collaborative partnerships (connect people)

NCTCOG has long-standing, established partnerships with many key natural resource planning and protection agencies for coordinating and comparing planning efforts and products. This is not only a required task for Metropolitan Planning Organizations (MPO) under Section 6001 of SAFETEA-LU, but is important to the effort of linking conservation and transportation processes. Under this grant, NCTCOG invited resource agencies and other stakeholders to meetings, maintained communication through phone calls, emails, and web pages, and developed contact lists through a Customer Relationship Management (CRM) system to build and strengthen collaborative partnerships. NCTCOG continues to connect people to refine and expand the REF through the "Regional Ecosystem Forum"—a committee-like group that will guide REF efforts into the future.

Identify and assess vital ecosystems (connect places)

To help connect places, NCTCOG assessed and identified vital ecosystems, as a basis for determining cumulative effects.[1] Cumulative impacts, as well as direct and indirect impacts, must be addressed or considered in the NEPA process.[2] In an effort to better link transportation planning and the NEPA process, NCTCOG analyzed vital ecosystems within the Council on Environmental Quality's (CEQ) three Environmental Impact Assessment components of: scoping ("count what counts"), describing the affected environment ("tell the story"), and determining the environmental consequences ("future with and without the project").[1] Much of the information presented in this section involves GIS analysis to help identify the functions and values of the region's subwatersheds.

Count what counts

The CEQ[1] and the Texas Department of Transportation (TxDOT)[3] guidance identify three essential elements for scoping, respectively:

1. Define the study area/geographic scope
2. Establish future year/timeframe for analysis
3. Identify resources/significant issues to consider (count what counts)

The study area for this analysis was defined by three transportation pilot corridors, which are aggregations of 12-digit HUCs, or subwatersheds. NCTCOG assessed and identified vital ecosystems for these pilot areas using current and two future conditions—2035 and 2050. The year 2035, a 25-year horizon, lines up with the development of the region's updated metropolitan transportation plan, "Mobility 2035: The Metropolitan Transportation Plan for North Central Texas," and other local, state, and federal planning initiatives. The year 2050 is significant with the development of North Texas 2050, a regional comprehensive plan for the 16-county Dallas-Fort Worth metropolitan area that seeks to provide sustainable solutions for this region that is expected to grow to nearly 11.5 million people by the year 2050.

NCTCOG consulted the TxDOT Environmental Affairs Division's Standards of Uniformity (SOU) to identify several vital ecosystems that may be impacted by infrastructure projects, like transportation, now and into the future. A SOU offers an established approach to satisfy legal, scientific, and other matters relevant to the environmental review and public involvement process of NEPA.[4] Assessing environmental impacts of a proposed transportation action or plan is one of many essential elements of NEPA decisionmaking.[5]

The following list represents the vital ecosystems thought to be important to the North Central Texas region. Most were identified from TxDOT's SOU; however, NCTCOG included additional resources to this list based on resource agency consultation. Only those that represent the natural environment were considered and are listed below.

Water resources:

- Waters of the U.S.
- Wetlands
- Threatened or impaired water segments
- Regulated Municipal Separate Storm Sewer Systems (MS4s)
- Floodplain
- Trinity River Corridor Development Regulatory Zone
- TPWD water conservation priorities (e.g. reduced water quality, introduced/invasive species)

Biological resources:

- Federally listed endangered species
- State listed endangered species
- Migratory bird habitats
- Essential fish/wildlife habitats
- Farmland
- Mature woody vegetation
- Native vegetation
- Dense mature brush
- TPWD vegetation types
- Height of trees
- Diameter of trees at breast height
- Percent tree canopy
- Significant biodiversity
- Open space
- TPWD land conservation priorities (e.g. land fragmentation, introduced/invasive species)

NCTCOG further refined this list to the 10 vital ecosystems as identified in Table F.3. Table F.3 also provides information on the data sources used to map these vital ecosystems to identify their location in the three pilot areas. NCTCOG only considered those resources that could be easily mapped through GIS. In addition, the data had to be readily available and fairly current. Through the identification of vital ecosystems in the region, consideration of potential environmental impacts in the transportation planning process and project implementation phases can be enhanced and more effective.

Table F.3: The 10 vital ecosystems and the data sources used to map them (Vital Ecosystem Information Layers, or VEIL).

Vital Ecosystem	Data Source
Wetlands	USGS, 2001 National Land Cover Database
Surface waters	USGS, National Hydrological Dataset
Flood zones	FEMA, Digital Flood Insurance Rate Maps
Agricultural lands	USGS, 2001 National Land Cover Database
Wildlife habitats	USGS, 2001 National Land Cover Database
Natural areas	North Texas 2050, Natural Policy Area
Impaired water segments	Texas Commission on Environmental Quality (TCEQ), 2008 Texas 303(d) List
Diversity	U.S. Environmental Protection Agency (EPA) Region 6, Texas Ecological Assessment Protocol (REAP)
Sustainability	EPA Region 6, REAP
Rarity	EPA Region 6, REAP

REAP diversity, sustainability, and rarity are determined and calculated at the ecoregion geography; however, these data were displayed at the subwatershed level to be consistent with NCTCOG's watershed-based approach to environmental management.

Integrate Conservation and Transportation Planning (connect programs)

NCTCOG as the MPO is committed to integrating conservation and transportation planning during the transportation planning process into project implementation and construction. This appendix provides examples, utilizing the pilot subwatersheds and transportation projects, of how the transportation and infrastructure development can utilize the ecosystem approach to identify important natural and social resources earlier in the transportation planning process and to determine mitigation strategies that help further preservation or restoration initiatives in line with the REF and regional priorities.

Tell the story

TxDOT guidance suggests that the first steps to characterizing the affected environment should be to describe—or "tell the story of the resource"—the current health, condition, or status of the resource, and provide historical context for understanding how the resource got to its current state.[3] Others might call this the baseline condition "without" the proposed transportation project. The CEQ[1]/TxDOT[3] guidance identifies three essential elements for this process, respectively:

1. Characterize the resource/describe the current health and historical context of each resource
2. Characterize the stresses affecting these resources, ecosystems, and human communities/ identify other reasonably foreseeable effects
3. Define a baseline condition (CEQ)

NCTCOG has characterized the three pilot areas by taking a firsthand look at existing concerns and vital ecosystems through field trips as well as overlaying several data layers with the pilot areas' subwatersheds. See Appendix G for a detailed look at these pilot areas, including location, land use, land cover, water resources, and ecological characteristics.

Future with and without the project

The vital ecosystems that were assessed as part of this grant helped identify potential future impacts the pilot corridors may have on these ecosystems. Three essential steps identified by CEQ[1]/TxDOT[3] guidance are summarized below, respectively:

1. Identify important cause-and-effect relationships/Identify direct and indirect impacts of proposed project

2. Determine magnitude and significance/Assess potential impacts
3. Modify to avoid, minimize, or mitigate for significant impacts/Assess mitigation issues

NCTCOG "valued" the pilot subwatersheds to describe their current and future conditions based on the GIS coverage of the 10 Vital Ecosystem Information Layers (VEIL) previously identified in Table F.3 and the policy recommendations of the region's preferred future, North Texas 2050. NCTCOG expanded this effort to the remaining subwatersheds within the 12-county MPA for inclusion in Mobility 2035. See Figure F.6 for a map of those values and Appendix E for a detailed description of how they were calculated.

If constructed, the SH 170, SH 360, and Lake Lavon rail corridors would have some level of impact on the vital ecosystems within the 16 pilot subwatersheds and beyond. These impacts may occur during or after the construction process and may be viewed as direct, indirect, or cumulative. For instance, the construction process can destroy wildlife habitats with the removal of trees and grasslands; a finished roadway can change the surrounding land use from, for example, a once natural area to a more residential or commercial area; one more mile of impervious surfaces may contribute to the exceedance of water quality standards in a nearby water segment. These impacts are typically viewed as negative; however, there are ways in which they can be avoided, minimized, or mitigated for with proper planning, project design, and implementation.

The following sections discuss the tools NCTCOG proposes to use to collectively produce a snapshot of a corridor or subwatershed that can be used to identify important environmental resources and present important ecosystem information at the subwatershed level. The three pilot corridors—State Highway (SH) 170, SH 360, and Lake Lavon rail—facilitate the analyses below. This approach can be utilized by transportation planners or other infrastructure planners to assess the important features by subwatershed and provide a look at areas of relatively high concerns earlier in the planning process.

State Highway 360 Corridor Environmental Evaluation

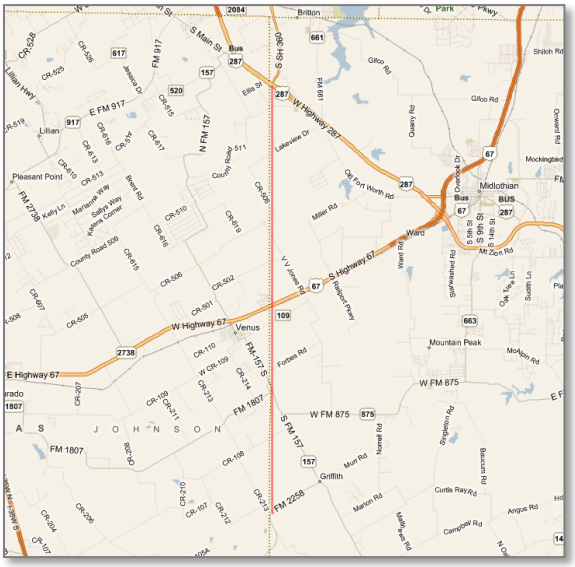
NEPAssist Analysis

An environmental snapshot of a corridor can be determined by utilizing NEPAssist,[6] an online web-based, password-protected tool developed by the U.S. Environmental Protection Agency (EPA) with enhancements made by Region 6 of the EPA. Through an inter-agency cooperative agreement with the Texas Department of Transportation (TxDOT), NCTCOG has access to this tool.

For the State Highway (SH) 360 Corridor Evaluation, a line was drawn in the approximate location of the future route as indicated in "Mobility 2030: The Metropolitan Transportation Plan for the Dallas-Fort Worth Area, 2009 Amendment." Figure F.6 displays the line drawn in the NEPAssist tool.

Figure F.6: Approximate alignment of SH 360 as indicated by the red line drawn in the NEPAssist tool.

SH 360 Corridor



NEPAssist also provides a "NEPAssist Analysis" option to provide a host of environmental data. The results of the NEPAssist Analysis for SH 360 are shown in Figure F.7. This information is helpful in determining whether the corridor falls within a certain distance of important Facility, Water, Ecology, and Other built and natural environment attributes.

Those attributes that return a "Yes" are highlighted in the results. For example, Figure F.7 says the SH 360 Corridor is within a National Land Cover Database (NLCD) wetland and also within 1000 meters of an NLCD wetland. The NEPAssist analysis also provides a Yes that the corridor is within 100 meters of a Regional Ecosystem Assessment Protocol (REAP) Rarity area that is within the Top 10 percent highest scores. This information is the type of information that could be valuable to planners, regulators, and NEPA reviewers as the corridor development process begins and alternative routes can be inputted into the tool to determine an optimum route.

Figure F.7: NEPAssist Analysis results for SH 360 Corridor; those attributes that return a "Yes" are highlighted.

SH 360 NEPAssist Analysis

Length of digitized line	10.96 mi
Facility	
Within 100 meters of a hospital?	no
Within 1000 meters of a hospital?	no
Within 100 meters of a TRI facility?	no
Within 1000 meters of a TRI facility?	no
Within 100 meters of a regulated facility?	no
Within 1000 meters of a regulated facility?	no
Within 100 meters of an airport?	no
Water	
Within 100 meters of a Wild and Scenic River?	no
Within an area over a Sole Source Aquifer?	no
Within the 100 year flood plain?	no
Within the 500 year flood plain?	no
Within an NLCD wetland?	**yes**
Within 1000 meters of an NLCD wetland?	**yes**
Ecology	
Within a federal/state park or wildlife area?	no
Within 1000 meters of a federal/state park or wildlife area?	no
Within a critical habitat area?	no
Within 1000 meters of a critical habitat area?	no
Within 100 meters of a REAP Composite area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Diversity area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Sustainability area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Rarity area that is within the Top 10% highest scores?	**yes**
Other	
Within 100 meters of a place on the National Historic Register?	no
Within 1000 meters of a place on the National Historic Register?	no
Within 100 meters of a school?	no
Within 1000 meters of a school?	no
Within a nonattainment area?	**yes**
Within a previous nonattainment, maintenance, or EAC area?	no

Additional analysis options in the NEPAssist tool include the following: GISST Analysis[7], Texas Grid Analysis (under construction), and an Environmental Justice Analysis. For the pilot corridors, the GISST Analysis was used to determine additional environmental criteria and areas of significant environmental value for use in the planning process.

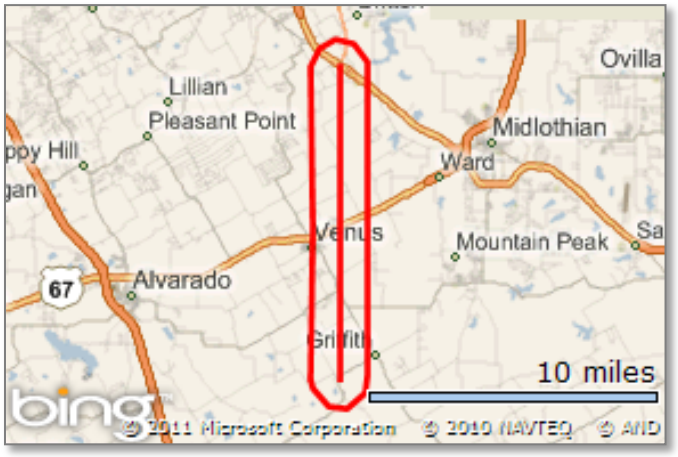
GISST Analysis

Figure F.8 displays the SH 360 Corridor with a 1.0 mile buffer. NEPAssist provides the opportunity to manipulate this buffer. The GISST Analysis uses this buffer to determine the values and data as displayed in Figure F.9. The score key to the right is used where medium-high and high scores are highlighted in yellow and medium, medium-low, and low scores are highlighted in blue in the results table.

	1 - Low
	2 - Medium Low
	3 - Medium
	4 - Medium High
	5 - High

Figure F.8: SH 360 Corridor with a 1.0 mile buffer as drawn in GISST.

SH 360 Buffer



The results table for the SH 360 GISST Analysis is provided below in Figure F.9. The GISST Analysis offers the following GISST Factors: Hydrologic Unit Code (HUC)-Related, Air, Socioeconomic, Other Water-Related, Toxicity, and Land Cover. For the pilot corridors, all but the Socioeconomic Factor were used. Appendix F.1 to this report provides definitions of these attributes as shown in Figure F.9.

The GISST creates scores for each dataset, which can be used as a comparative analysis tool. The scores represent the average score per factor for all grid cells that have more than 50 percent of their area within the defined polygon. The values represent the numerical value of the data for each factor. If there is no value present in the column, it indicates the factor is qualitatively ranked.

The GISST developers stress looking for areas of relatively high concern–criterion scores of 4 or 5 that might indicate a potential environmental impact or an accumulation of potential environmental impacts. As shown in Figure F.9, the GISST Results indicate high values for the SH 360 Corridor for:

Unified Watershed Assessment – 5
Aquifer Geology – 4
Number of Regulated Facilities – 4
Road Density – 4
Nonattainment – 5
Distance to Water – 5
% Wildlife – 4
% Agriculture – 4
Area Perimeter Ratio – 5
Land Use Ranking – 4

When combined with the NEPAssist Analysis "Yes" indicators, the high values (4 and 5) resulting from the GISST Analysis can be used to screen different alignment alternatives and indicate where resources should be directed for additional studies, what the relative environmental vulnerability of some resources is, and what potential environmental impacts may exist.

SH 360 GISST Analysis

Toxicity

Factor	Value	Score
TRI Releases to Air (lbs)	0	1
TRI Releases to Water (lbs)	0	1
TRI Releases to Land (lbs)	0	1
TRI Toxicity Releases to Air (lbs)	0	1
TRI Toxicity Releases to Water (lbs)	0	1

Land Cover

Factor	Value	Score
% Wildlife	47.82	4
% Agriculture	44.60	4
% Wetlands	.04	1
Area Perimeter Ratio	231.79	5
Land Use Ranking		4

Other Water-Related

Factor	Value	Score
Distance to Water (feet)	0	5
Stream Density (miles / sq mi)	1.07	2
Channel/Canal Density (miles / sq mi)	0	1
% Surface Water	.40	1
% 100 Year Flood	4.23	1
% 500 Year Flood	4.23	1
Aquifer		1
Groundwater Probability		1
Soil Permeability		1

HUC-Related

Factor	Value	Score
Surface Water Use		3
Storet Exceedences		3
Rainfall		3
Unified Watershed Assessment		5
Average Flow		3
Aquifer Geology		4

Air

Factor	Value	Score
Number of Regulated Facilties	3	4
Road Density (miles/sq mi)	2.28	4
Nonattainment		5

Figure F.9: GISST Analysis Results for the SH 360 Corridor within a 1.0 mile buffer.

Regional Ecosystem Framework (REF) Analysis

The NEPAssist and GISST Analysis results can identify potential impacts or important resources to consider within a certain distance of an indicated alignment. The REF however can provide a comparison between a larger geography, the subwatershed and its important features, or the Vital Ecosystem Information Layers (VEIL). The REF at the subwatershed level provides an additional screening tool that indicates the relative importance of 10 different resources that form a snapshot of the ecosystem in that subwatershed. Furthermore, utilizing the North Texas 2050 Policy Area Overlays provides additional information that could be important when determining the type of transportation facility and the potential mitigation strategies that may benefit a particular subwatershed more than traditional strategies. The REF results for the VEIL and North Texas 2050 Policy Areas are displayed for each of the pilot subwatersheds and transportation projects.

Vital Ecosystem Information Layers (VEIL) Analysis

The three subwatersheds that make up the SH 360 Corridor Pilot Area include Headwaters Mountain Creek, Soap Creek, and Armstrong Creek-Cottonwood Creek subwatersheds. Figure F.10 represents the REF scores, as presented in Appendix E, for each VEIL for the three subwatersheds that SH 360 passes through. The subwatersheds are numbered the following way for reference purposes:

1) Headwaters Mountain Creek
2) Soap Creek
3) Armstrong Creek – Cottonwood Creek

As indicated in Figure F.10, these three subwatersheds have a score of 1 for Diversity, Wetlands, Natural Area, and Impaired Waterways, indicating very low diversity on average, few to no wetlands, few to no natural areas, and few to no impaired waterways. However, Surface Water Quantity, Floodplain, Rarity, and Sustainability measures are somewhat indicative of a potential concern in several of these subwatersheds. The REF indicates that for the SH 360 Corridor Pilot Area, Agricultural and Wildlife Habitat are relatively more significant resources than the others, particularly in Subwatershed 1 for Agriculture. The individual scores for each subwatershed are summarized in Table F.4.

Figure F.10: Subwatershed scores for the SH 360 Corridor Pilot Area indicating the presence of a particular VEIL within that subwatershed. The yellow line represents the SH 360 Corridor.

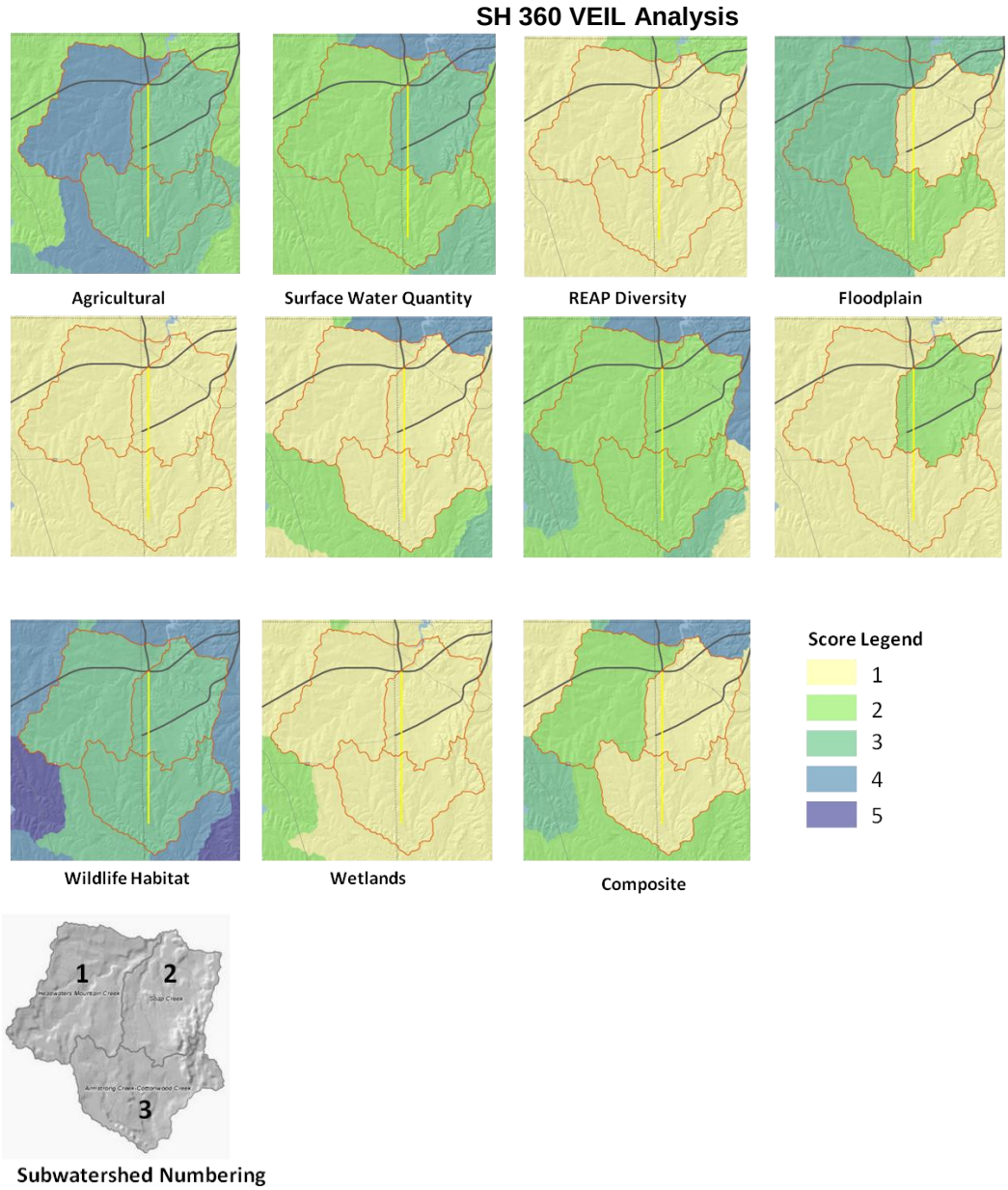
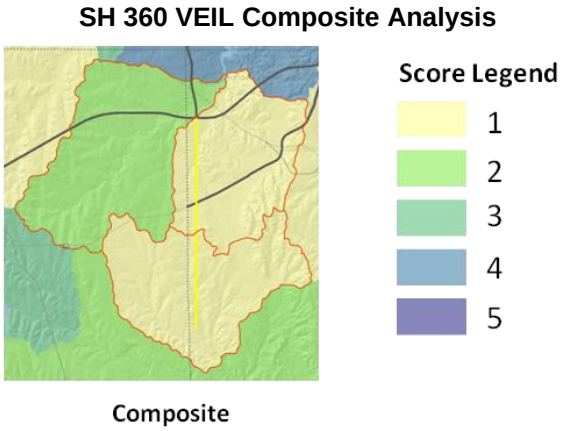


Table F.4: VEIL scores for the SH 360 Corridor Subwatersheds.

	VEIL									
Subwatershed	**Agricultural**	**Surface Water Quantity**	**Diversity**	**Floodplain**	**Wildlife Habitat**	**Impaired Waterways**	**Natural Area**	**Rarity**	**Sustainability**	**Wetlands**
1) Headwaters Mountain Creek	4	2	1	3	3	1	1	2	1	1
2) Soap Creek	3	3	1	1	3	1	1	2	2	1
3) Armstrong Creek-Cottonwood Creek	3	2	1	2	3	1	1	2	1	1

The REF also provides a Composite Score for all 10 VEIL as shown in Figure F.11. This score indicates that the three subwatersheds when collectively viewed in comparison to all the other 282 subwatersheds in the Metropolitan Planning Area (MPA) could be regarded as more suitable for infrastructure development due to their relatively low individual VEIL scores. The individual layer scores as discussed previously provide an indication that the important resources of focus for these subwatersheds are Agricultural and Wildlife Habitat.

Figure F.11: VEIL composite score for the SH 360 Corridor Subwatersheds. The yellow line represents the SH 360 Corridor.



North Texas 2050 Policy Area Analysis

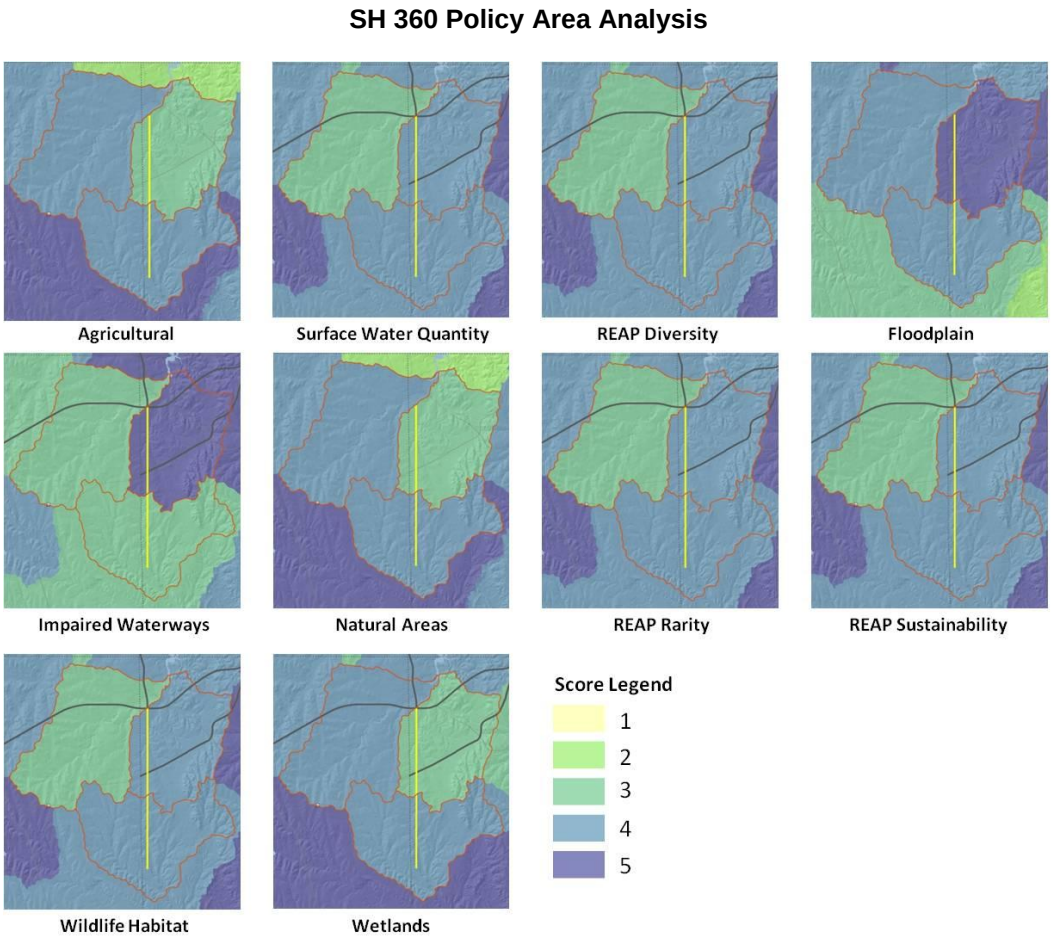
The REF has provided additional overlay tools to assess the percentage of policy areas identified by North Texas 2050 that fall within individual subwatersheds and a corresponding relative importance of each VEIL in that policy area. This methodology to determine these values and the associated percentages of each Policy Area by subwatershed are described in Appendix E and D, respectively. Table F.5 provides the scoring strategy applied to each Policy Area by VEIL.

Table F.5: VEIL and assigned relative importance using North Texas 2050 Policy Areas (5 = Most Important, 1 = Least Important).

	Policy Area and Related VEIL Score				
VEIL	**Natural**	**Rural**	**Separate Community**	**Outer Tier**	**Inner Tier**
Wetland	5	4	2	3	1
Impaired	5	2	4	3	1
Surface Water Quality	5	3	4	2	1
Rarity	5	3	4	2	1
Sustainability	5	3	4	2	1
Wildlife Habitat	5	3	4	2	1
Diversity	5	3	4	2	1
Floodplain	1	2	3	4	5
Agricultural	2	5	4	3	1
Natural	2	5	4	3	1

Figure F.12 shows the results of the Policy Area Overlay for each VEIL for the SH 360 Corridor Subwatersheds. As indicated in Figure F.12, all three subwatersheds for each VEIL have a score of 3, 4, or 5 when considering the Policy Area Overlays. Subwatershed 2 has a score of 5 for Floodplain and Impaired Waterways. The reason for these high scores across the board can be explained by the subwatersheds' location. They are located south of the Dallas-Fort Worth urban area, and are made up of a mix of Natural, Separate Community, Rural, and Outer Tier areas. Generally, the natural features are more important to these areas, which would play a major role in escalating a VEIL's importance.

Figure F.12: North Texas 2050 Policy Area Overlays for the SH 360 Corridor Subwatersheds by VEIL. The yellow line represents the SH 360 Corridor.

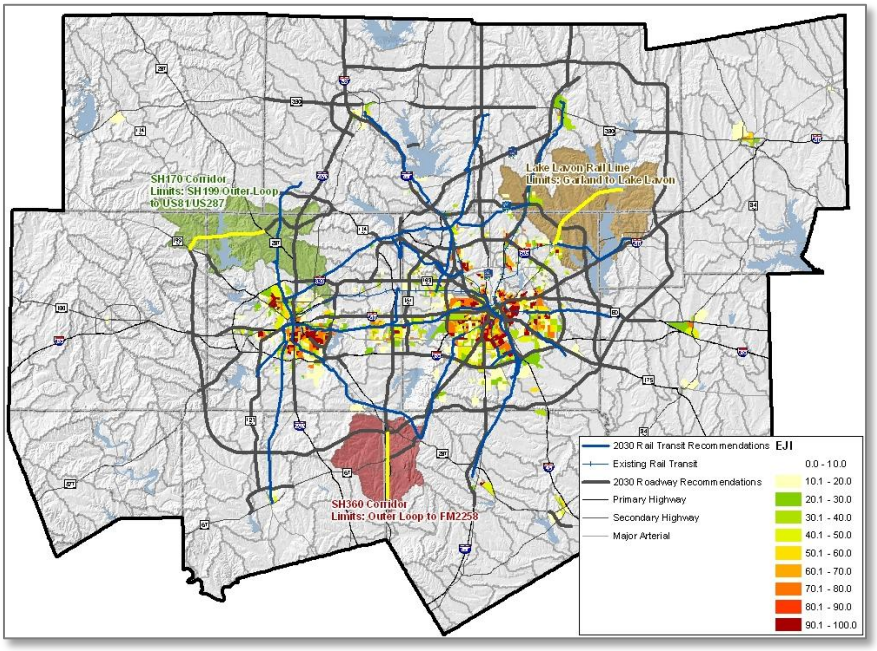


Socioeconomic Analysis

The socioeconomic attributes of an area are as important as the natural and built environment characteristics. NCTCOG, as the MPO, strives to integrate considerations for social and economic attributes of communities into the transportation planning process. NCTCOG has developed an Environmental Justice Index (EJI) that scores three variables: persons per square mile, percent below poverty, and percent minority. The scores are assigned based on density and a comparison to the regional average; the scores are multiplied to obtain an EJI of 1 to 100. The block groups are displayed based on their EJI score in intervals of 10, from 1 to 100. The data used for this Index are from the 2000 Census. Figure F.13 indicates the varying EJI scores in relation to the location of the pilot subwatersheds and corridors. Additional analysis is provided for each Pilot Corridor.

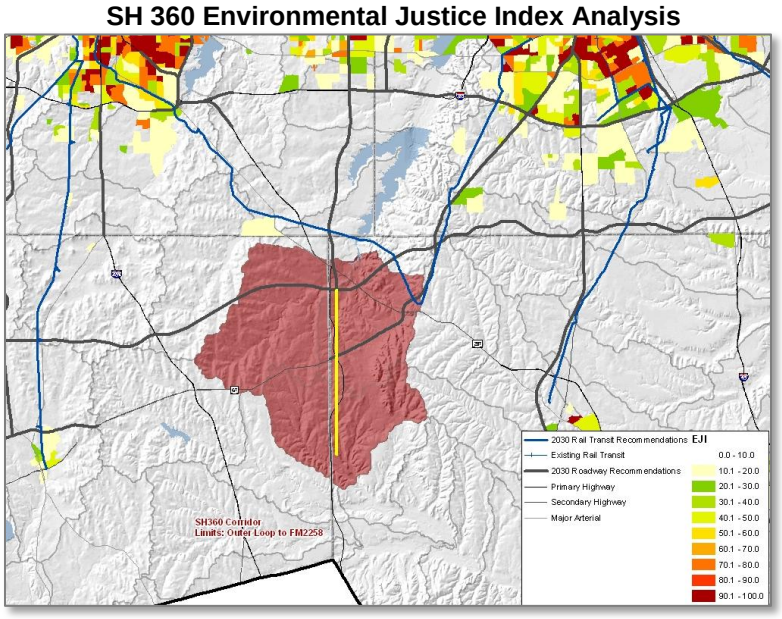
Figure F.13: Pilot Corridor Subwatersheds and Environmental Justice Index values within the 12-county MPA.

Pilot Corridor Subwatersheds and Environmental Justice Index



SH 360 is located within a relatively undeveloped part of the region as discussed in Appendix G. As indicated in Figure F.14, there are no block groups highlighted for the EJI score for any of the corridor's subwatersheds. This could mean one or a combination of several things: very low population density and/or presence of no or low to moderate low-income and/or minority populations. The individual scores for each block group that make up the subwatersheds can be produced, but are not shown for this analysis.

Figure F.14: Environmental Justice Index values within the SH 360 Corridor Subwatersheds.



State Highway 170 Corridor Environmental Evaluation

The following data were obtained by the same method as presented in the SH 360 Corridor Environmental Evaluation above.

NEPAssist Analysis

The results of the NEPAssist Analysis for SH 170 are shown in Figure F.15. Those attributes that return a "Yes" are highlighted in the results. For example, Figure F.15 says the SH 170 Corridor is within a 1000 meters of a regulated facility, within the 100- and 500-year floodplain, within 100 meters of a REAP Rarity area that is within the Top 10 percent highest scores, within 100 and 1000 meters of a school, within a nonattainment area, and within a previous nonattainment, maintenance, or Early Action Compact (EAC) area.

Figure F.15: NEPAssist Analysis results for SH 170 Corridor; those attributes that return a "Yes" are highlighted.

SH 170 NEPAssist Analysis

Length of digitized line	21.12 mi
Facility	
Within 100 meters of a hospital?	no
Within 1000 meters of a hospital?	no
Within 100 meters of a TRI facility?	no
Within 1000 meters of a TRI facility?	no
Within 100 meters of a regulated facility?	no
Within 1000 meters of a regulated facility?	**yes**
Within 100 meters of an airport?	no
Water	
Within 100 meters of a Wild and Scenic River?	no
Within an area over a Sole Source Aquifer?	no
Within the 100 year flood plain?	**yes**
Within the 500 year flood plain?	**yes**
Within an NLCD wetland?	no
Within 1000 meters of an NLCD wetland?	no

Ecology	
Within a federal/state park or wildlife area?	no
Within 1000 meters of a federal/state park or wildlife area?	no
Within a critical habitat area?	no
Within 1000 meters of a critical habitat area?	no
Within 100 meters of a REAP Composite area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Diversity area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Sustainability area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Rarity area that is within the Top 10% highest scores?	**yes**
Other	
Within 100 meters of a place on the National Historic Register?	no
Within 1000 meters of a place on the National Historic Register?	no
Within 100 meters of a school?	no
Within 1000 meters of a school?	**yes**
Within a nonattainment area?	**yes**
Within a previous nonattainment, maintenance, or EAC area?	**yes**

GISST Analysis

Figure F.16 displays the SH 170 Corridor with a 1.0 mile buffer. The results table for the SH 170 GISST Analysis using this buffer is provided below in Figure F.17.

Figure F.16: SH 170 Corridor with a 1.0 mile buffer as drawn in GISST.

SH 170 Buffer

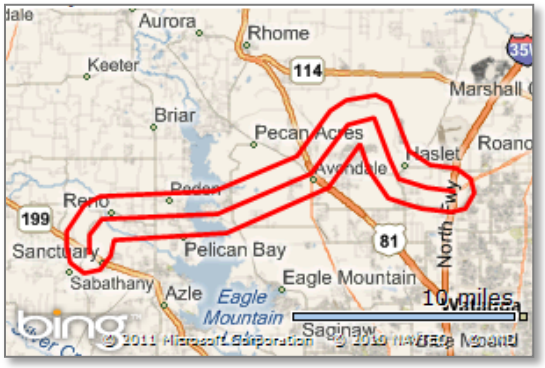


Figure F. 17: GISST Analysis result for the SH 170 Corridor within a 1.0 mile buffer.

SH 170 GISST Analysis

HUC-Related

Factor	Value	Score
Surface Water Use		2
Storet Exceedences		1
Rainfall		3
Unified Watershed Assessment		5
Average Flow		3
Aquifer Geology		4

Air

Factor	Value	Score
Number of Regulated Facilties	12	5
Road Density (miles/sq mi)	3.21	5
Nonattainment		5

Other Water-Related

Factor	Value	Score
Distance to Water (feet)	0	5
Stream Density (miles / sq mi)	.82	1
Channel/Canal Density (miles / sq mi)	0	1
% Surface Water	4.53	1
% 100 Year Flood	10.77	1
% 500 Year Flood	12.45	1
Aquifer		1
Groundwater Probability		1
Soil Permeability		2

Toxicity

Factor	Value	Score
TRI Releases to Air (lbs)	0	1
TRI Releases to Water (lbs)	0	1
TRI Releases to Land (lbs)	0	1
TRI Toxicity Releases to Air (lbs)	0	1
TRI Toxicity Releases to Water (lbs)	0	1

Land Cover

Factor	Value	Score
% Wildlife	71.47	5
% Agriculture	13.95	1
% Wetlands	.03	1
Area Perimeter Ratio	360.62	5
Land Use Ranking		4

These GISST Results indicate high values for the SH 170 Corridor for:

Unified Watershed Assessment – 5
Aquifer Geology – 4
Number of Regulated Facilities – 5
Road Density – 5
Nonattainment – 5
Distance to Water – 5
% Wildlife – 5
Area Perimeter Ratio – 5
Land Use Ranking – 4

Regional Ecosystem Framework (REF) Analysis

Vital Ecosystem Information Layers (VEIL) Analysis

The five subwatersheds that make up the SH 170 Corridor Pilot Area include Lower Walnut Creek, Indian Creek-Eagle Mountain Lake, Dosier Creek-Eagle Mountain Creek, Henrietta Creek, and Whites Branch-Big Fossil Creek. Figure F.18 represents the REF scores, as presented in Appendix E, for each VEIL for the five subwatersheds that SH 170 passes through. The subwatersheds are numbered the following way for reference purposes:

1) Lower Walnut Creek
2) Dosier Creek – Eagle Mountain Creek
3) Indian Creek – Eagle Mountain Lake
4) Henrietta Creek
5) Whites Branch-Big Fossil Creek

As indicated in Figure F.18, these five subwatersheds have a score of 1 for Impaired Waterways, Natural Area, and Wetlands, indicating very few to no impaired waterways, few to no wetlands, and few to no natural areas. However, Diversity, Agricultural, and Sustainability measures are somewhat indicative of a potential concern in several of these subwatersheds. The REF indicates that for the SH 170 Corridor Pilot Area, Surface Water Quantity, Floodplain, Wildlife Habitat, and Rarity are relatively more significant resources than the others, particularly in Subwatershed 2 and 3 for Wildlife Habitat, Floodplain, and Rarity. The individual scores for each subwatershed are summarized in Table F.6.

The VEIL composite scores presented in Figure F.19 indicate that for Subwatershed 1, 4, and 5, there are fewer sensitive resources when compared to Subwatershed 2 and 3. Subwatershed 2 is towards the higher end of the vulnerability scale and indicates that for this corridor, additional information and studies would be needed, especially related to Surface Water Quantity (presence of a lake), Wildlife Habitat, Floodplain (presence of a lake), and Rarity. Individual data layers would help assess why these resources are so important in these subwatersheds.

Figure F.18: Subwatershed scores for the SH 170 Corridor Pilot Area indicating the presence of a particular VEIL within the subwatershed. The yellow line represents the SH 170 Corridor.

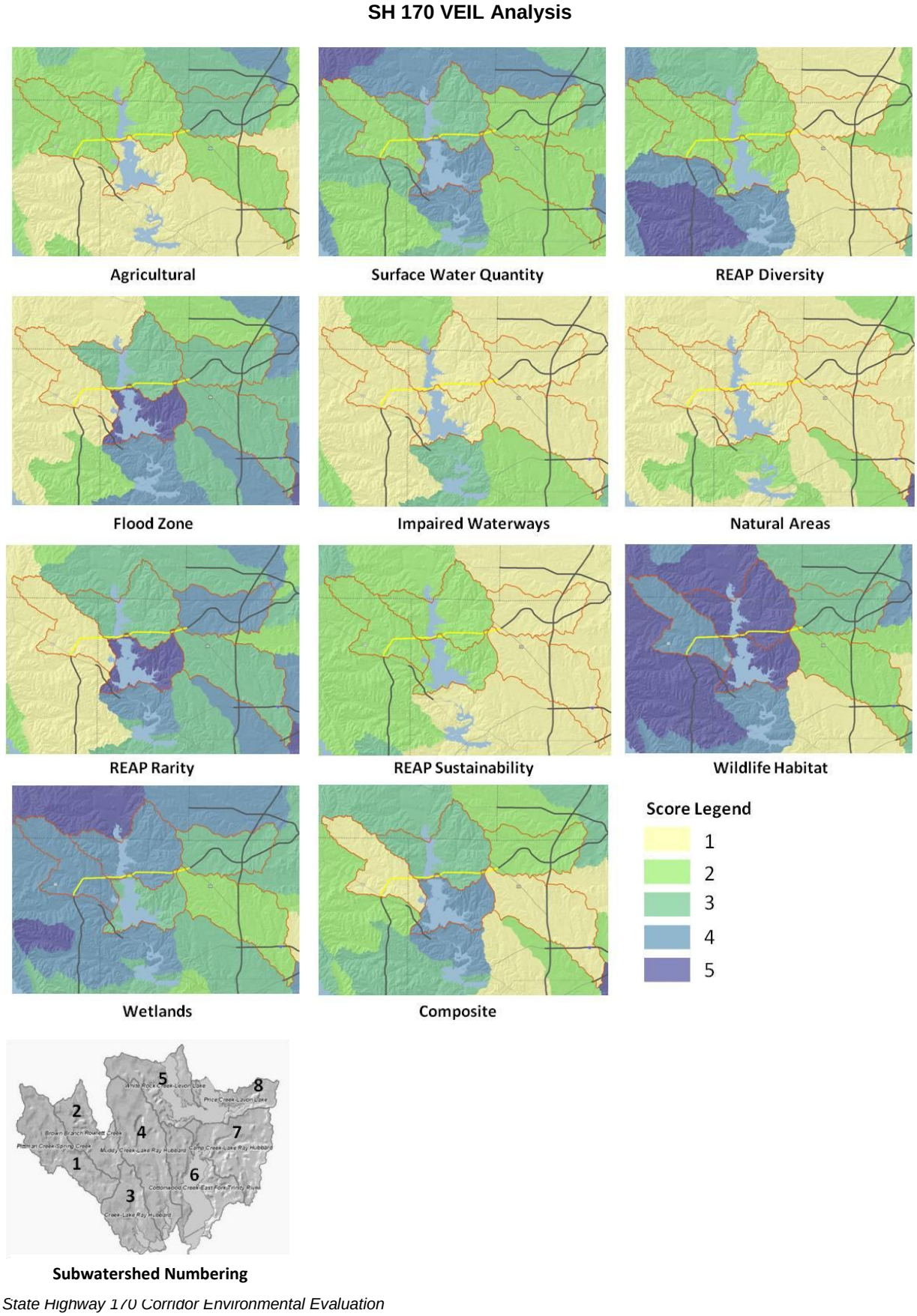
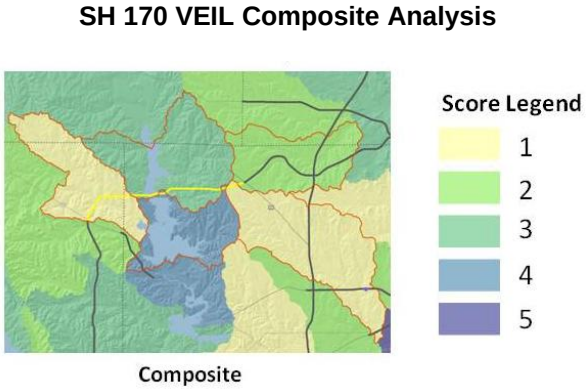


Table F.6: VEIL scores for the SH 170 Corridor Subwatersheds.

	VEIL									
Subwatershed	**Agricultural**	**Surface Water Quantity**	**Diversity**	**Floodplain**	**Wildlife Habitat**	**Impaired Waterways**	**Natural Area**	**Rarity**	**Sustainability**	**Wetlands**
1) Lower Walnut Creek	2	2	2	1	4	1	1	1	2	1
2) Dosier Creek – Eagle Mountain Lake	1	4	2	5	5	1	1	5	2	1
3) Indian Creek – Eagle Mountain Lake	2	3	2	3	5	1	1	3	2	1
4) Henrietta Creek	3	2	1	3	3	1	1	4	1	1
5) Whites Branch – Big Fossil Creek	2	2	1	3	2	1	1	3	1	1

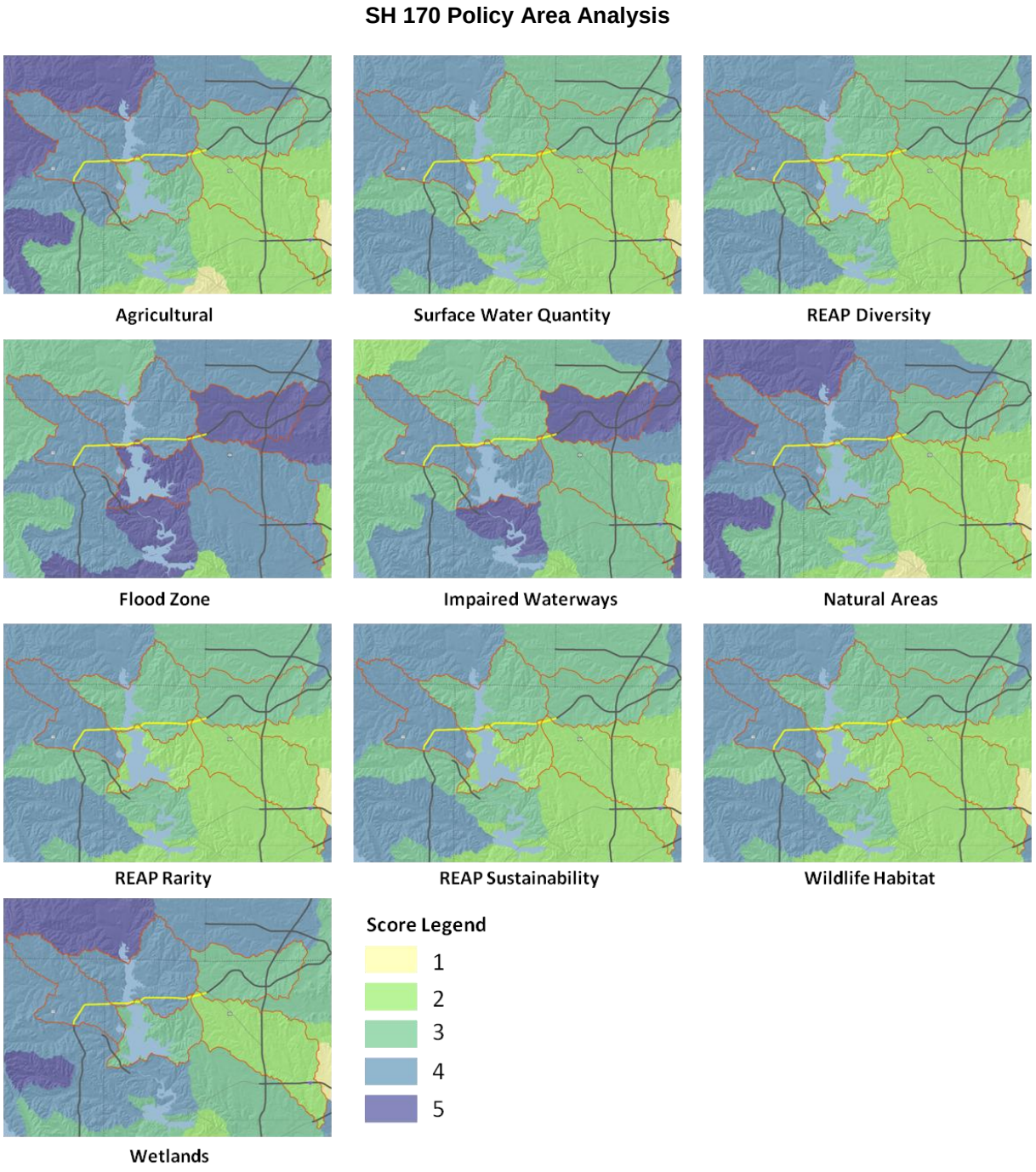
Figure F.19: VEIL composite score for the SH 170 Corridor Subwatersheds. The yellow line represents the SH 170 Corridor.



North Texas 2050 Policy Area Analysis

Figure F.20 shows the results of the Policy Area Overlays for each VEIL for the SH 170 Corridor Subwatersheds. The scoring strategy presented in Table F.5 was applied here as well. As indicated in Figure F.20, the subwatershed scores range from 2 to 5. Subwatershed 4 has a score of 5 for impaired waterways, while Subwatershed 2 has a score of 5 for both Floodplain and Impaired Waterways. Subwatershed 2, 4, and 5 are predominately located in the Outer Tier area, while Subwatershed 1 and 3 are predominately Rural. Surface water and natural areas are important features to all five subwatersheds, particularly in Subwatershed 2. In general, Subwatershed 1, 3, and 4 are located in areas where these VEILs are considered more important.

Figure F.20: North Texas 2050 Policy Area Overlays for the SH 170 Corridor Subwatersheds by VEIL. The yellow line represents the SH 170 Corridor.

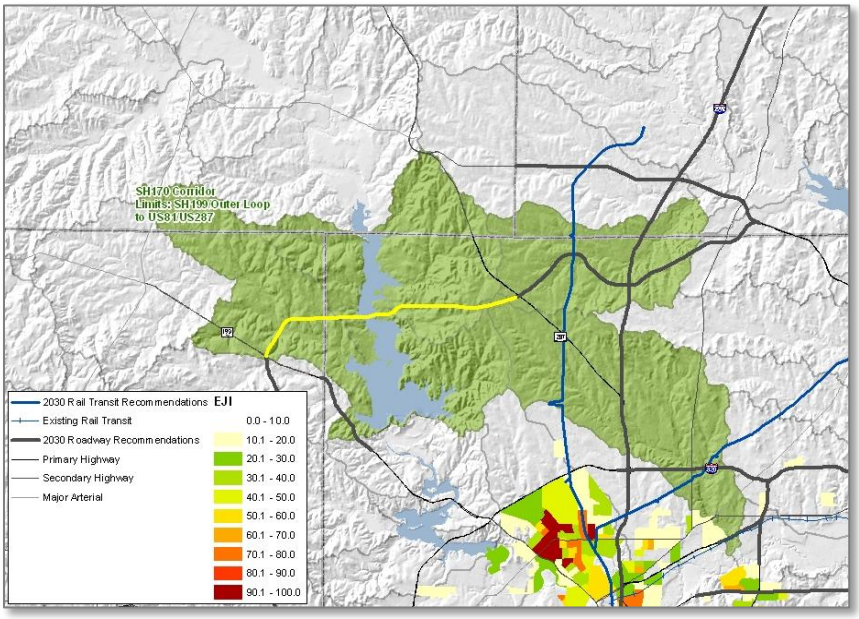


Socioeconomic Analysis

As indicated in Figure F.21, there are no block groups highlighted for the EJI score for any of the subwatersheds within the SH 170 Corridor. This could mean one or a combination of several things: very low population density and/or presence of no or low to moderate low-income and/or minority populations.

Figure F.21: Environmental Justice Index values within the SH 170 Corridor Subwatersheds

SH 170 Environmental Justice Index Analysis



Lake Lavon Rail Corridor Environmental Evaluation

The following data were obtained by the same method as presented in the SH 360 and SH 170 Corridor Environmental Evaluation above.

NEPAssist Analysis

The results of the NEPAssist Analysis for the Lake Lavon Rail are show in Figure F.22. Those attributes that return a "Yes" are highlighted in the results. For example, Figure F.22 says the Lake Lavon Rail Corridor is within 1000 meters of a Toxics Release Inventory (TRI) facility, within 100 and 1000 meters of a regulated facility, within the 100- and 500-year floodplain, within 1000 meters of an NLCD wetland, within 100 meters of a REAP Rarity area that is within the Top 10 percent highest scores, within 100 and 1000 meters of a school, within a nonattainment area, and within in a previous nonattainment, maintenance, or EAC area.

Figure F.22: NEPAssist Analysis results for Lake Lavon Rail Corridor; those attributes that return a "Yes" are highlighted.

Lake Lavon Rail NEPAssist Analysis

Ecology	
Within a federal/state park or wildlife area?	no
Within 1000 meters of a federal/state park or wildlife area?	no
Within a critical habitat area?	no
Within 1000 meters of a critical habitat area?	no
Within 100 meters of a REAP Composite area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Diversity area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Sustainability area that is within the Top 10% highest scores?	no
Within 100 meters of a REAP Rarity area that is within the Top 10% highest scores?	**yes**
Other	
Within 100 meters of a place on the National Historic Register?	no
Within 1000 meters of a place on the National Historic Register?	no
Within 100 meters of a school?	**yes**
Within 1000 meters of a school?	**yes**
Within a nonattainment area?	**yes**
Within a previous nonattainment, maintenance, or EAC area?	**yes**

Length of digitized line	19.34 mi
Facility	
Within 100 meters of a hospital?	no
Within 1000 meters of a hospital?	no
Within 100 meters of a TRI facility?	no
Within 1000 meters of a TRI facility?	**yes**
Within 100 meters of a regulated facility?	**yes**
Within 1000 meters of a regulated facility?	**yes**
Within 100 meters of an airport?	no
Water	
Within 100 meters of a Wild and Scenic River?	no
Within an area over a Sole Source Aquifer?	no
Within the 100 year flood plain?	**yes**
Within the 500 year flood plain?	**yes**
Within an NLCD wetland?	no
Within 1000 meters of an NLCD wetland?	**yes**

GISST Analysis

Figure F.23 displays the Lake Lavon Rail Corridor with a 1.0 mile buffer. The results table for the Lake Lavon Rail GISST Analysis using this buffer is provided below in Figure F.24.

Figure F.23: Lake Lavon Rail Corridor with a 1.0 mile buffer as drawn in GISST

Lake Lavon Rail Buffer

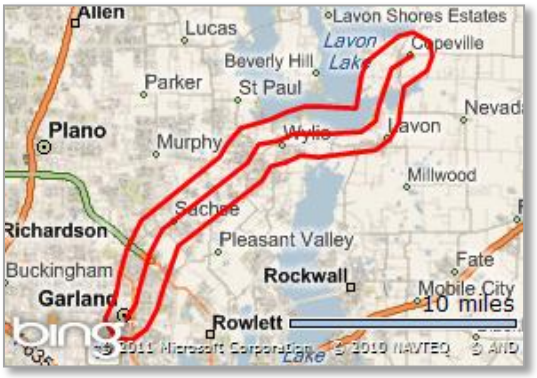


Figure F.24: GISST Analysis result for the Lake Lavon Rail Corridor within a 1.0 mile buffer.

Lake Lavon Rail GISST Analysis

HUC-Related

Factor	Value	Score
Surface Water Use		3
Storet Exceedences		3
Rainfall		4
Unified Watershed Assessment		5
Average Flow		3
Aquifer Geology		3

Other Water-Related

Factor	Value	Score
Distance to Water (feet)	0	5
Stream Density (miles / sq mi)	1.08	2
Channel/Canal Density (miles / sq mi)	0	1
% Surface Water	10.81	2
% 100 Year Flood	22.91	2
% 500 Year Flood	23.49	2
Aquifer		1
Groundwater Probability		1
Soil Permeability		1

Toxicity

Factor	Value	Score
TRI Releases to Air (lbs)	37575	1
TRI Releases to Water (lbs)	300	1
TRI Releases to Land (lbs)	37877	1
TRI Toxicity Releases to Air (lbs)	74398	1
TRI Toxicity Releases to Water (lbs)	553	1

Land Cover

Factor	Value	Score
% Wildlife	44.75	4
% Agriculture	10.50	1
% Wetlands	2.22	1
Area Perimeter Ratio	271.93	5
Land Use Ranking		4

These GISST Results indicate high values for SH170 Corridor for:

Rainfall – 4
Unified Watershed Assessment – 5
Distance to Water – 5
% Wildlife – 4
Area Perimeter Ratio – 5
Land Use Ranking – 4

Regional Ecosystem Framework (REF) Analysis

Vital Ecosystem Information Layers (VEIL) Analysis

The eight subwatersheds that make up the Lake Lavon Rail Corridor Pilot Area include White Rock Creek-Lavon Lake, Price Creek-Lavon Lake, Camp Creek-Lake Ray Hubbard, Cottonwood Creek-East Fork Trinity River, Muddy Creek-Lake Ray Hubbard, Brown Branch-Rowlett Creek, Pittman Creek-Spring Creek, and Rowlett Creek-Lake Ray Hubbard subwatersheds. Figure F.25 represents the REF scores, as presented in Appendix E, for each VEIL for the three subwatersheds that Lake Lavon Rail Corridor passes through. The subwatersheds are numbered the following way for reference purposes:

1) Pittman Creek – Spring Creek
2) Brown Branch – Rowlett Creek
3) Rowlett Creek – Lake Ray Hubbard
4) Muddy Creek – Lake Ray Hubbard
5) White Rock Creek – Lake Lavon
6) Cottonwood Creek – East Fork Trinity River
7) Camp Creek – Lake Ray Hubbard
8) Price Creek – Lake Lavon

As indicated in Figure F.25, the VEIL score for Impaired Waterways and Natural Area for most of these subwatersheds is 1, indicating very few to no impaired waterways and few to no natural areas. However, Diversity and Sustainability measures are somewhat indicative of a potential concern in subwatersheds 3 and 6. The REF indicates that for the Lake Lavon Rail Corridor Pilot Area, the remaining VEILs provide a diverse set of scores from 1 to 5 for each subwatershed. The individual scores for each subwatershed are summarized in Table F.7.

The VEIL composite scores presented in Figure F.26 indicate that Subwatershed 7 contains more sensitive resources when compared to Subwatershed 1 to 6 and 8. This indicates that additional information and studies would be needed, especially for Floodplain, Surface Water Quantity (presence of a lake), Rarity, Wildlife Habitat, and Wetlands. Individual data layers would help assess why these resources are so important in these subwatersheds.

Figure F.25: Subwatershed scores for the Lake Lavon Rail Corridor Pilot Area indicating the presence of a particular VEIL within the subwatershed. The yellow line represents the Lake Lavon Rail Corridor.

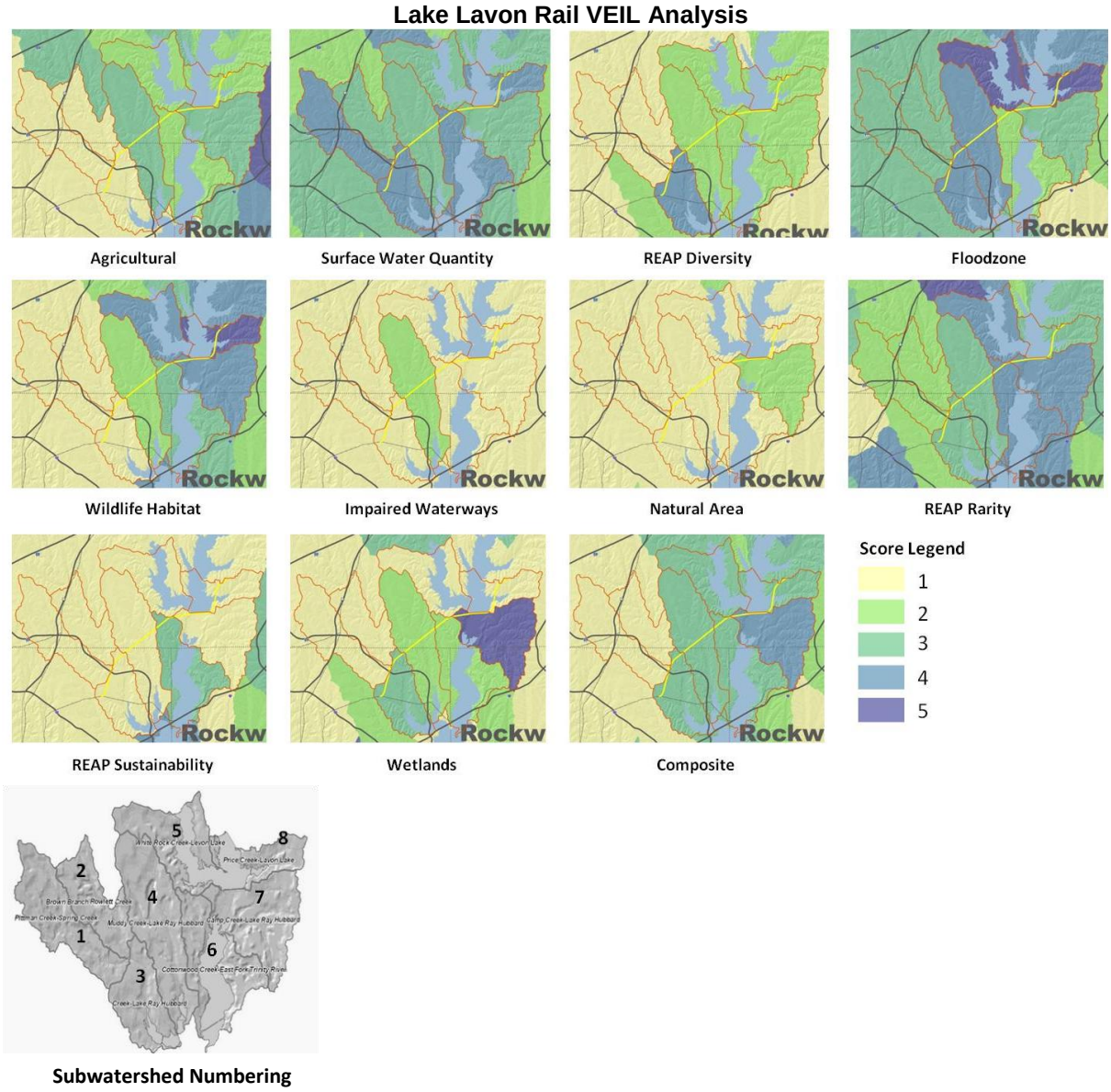
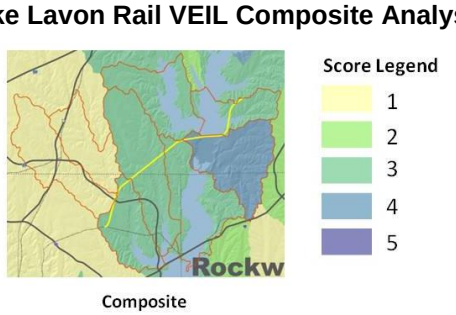


Table F.7: VEIL scores for the Lake Lavon Rail Corridor Subwatersheds.

	VEIL									
Subwatershed	**Agricultural**	**Surface Water Quantity**	**Diversity**	**Floodplain**	**Wildlife Habitat**	**Impaired Waterways**	**Natural Area**	**Rarity**	**Sustainability**	**Wetlands**
1) Pittman Creek – Spring Creek	1	4	1	3	1	1	1	2	1	1
2) Brown Branch Creek – Lake Ray Hubbard	1	3	1	3	1	1	1	2	1	1
3) Rowlett Creek – Lake Ray Hubbard	1	4	4	4	1	1	1	3	1	3
4) Muddy Creek – Lake Ray Hubbard	3	3	2	4	2	2	1	3	1	2
5) White Rock Creek – Lake Lavon	2	3	2	5	4	1	1	4	1	1
6) Cottonwood Creek – East Fork Trinity River	2	4	2	2	3	1	1	4	3	2
7) Camp Creek – Lake Ray Hubbard	3	3	2	3	4	1	2	4	1	5
8) Price Creek – Lake Lavon	2	4	2	5	5	1	1	3	1	1

Figure F.26: VEIL composite score for the Lake Lavon Rail Corridor Subwatersheds. The yellow line represents the Lake Lavon Rail Corridor.

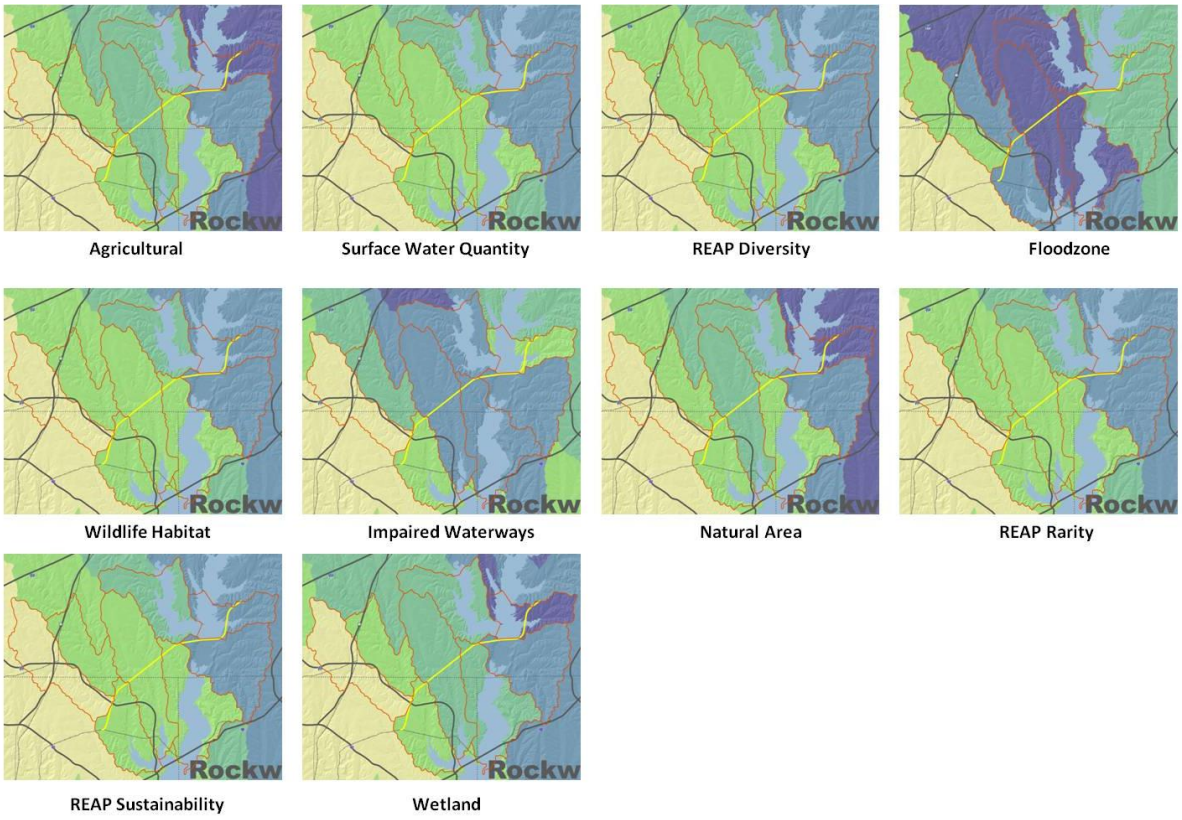


North Texas 2050 Policy Area Analysis

Figure F.27 shows the results of the Policy Area Overlays for each VEIL for the Lake Lavon Rail Corridor Subwatersheds. The scoring strategy presented in Table F.5 was applied here as well. As indicated in Figure F.27, Subwatershed 1 scored a 1 or 2 for every VEIL, while Subwatershed 7 scored a 4 or 5. Subwatershed 1 consists mainly of the Inner Tier and Outer Tier Policy Areas, and Subwatershed 7 is a mix of Natural, Rural, Separate Community, and Outer Tier Policy Areas, where these VEILs are generally more important. Subwatershed 8 is predominately Rural and Natural, while Subwatershed 2 to 6 are more similar to Subwatershed 1, but contain more natural areas.

Figure F.27: North Texas 2050 Policy Area Overlays for the Lake Lavon Rail Corridor Subwatersheds by VEIL. The yellow line represents the Lake Lavon Rail Corridor.

Lake Lavon Rail Policy Area Analysis

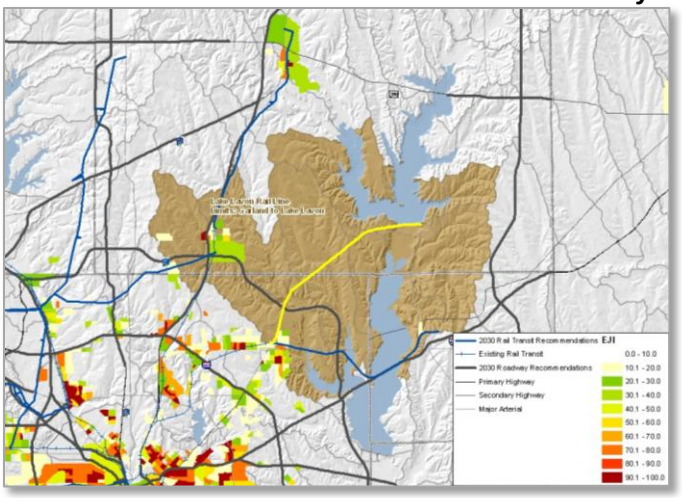


Socioeconomic Analysis

As indicated in Figure F.28, there are a few block groups highlighted with scores from 10 to 100 throughout the pilot subwatersheds; however, there are few along the corridor. In Downtown Garland, the origination of the Lake Lavon rail line, there are clusters of block groups with EJI scores of 10 to 100 that are highlighted. This indicates an importance to evaluate the needs and desires of the populations and provide sufficient opportunities for their engagement in the planning and project development process.

Figure F.28: Environmental Justice Index values within the Lake Lavon Rail Corridor Subwatersheds.

Lake Lavon Rail Environmental Justice Index Analysis



Integrating Environmental and Transportation Planning Discussion

The information provided in this Appendix in addition to that of Appendix G provide a fairly robust look at multiple land use, natural and built environment, and social considerations important in the pilot subwatersheds and within a 1.0 mile buffer of the pilot corridors.

Utilizing tools such as NEPAssist, GISST Analysis, and the REF can help inform the decision-making process for transportation projects earlier in the process. This information can be used as screening tools in the planning and project development process and indicate potential mitigation strategies that may be more appropriate based on the ecosystem approach.

NCTCOG proposes to use these tools to develop an environmental evaluation for the updated MTP, Mobility 2035. A comprehensive Environmental Evaluation such as that shown in Table F.8 and F.9 is proposed to be developed for all additional capacity facilities in the MTP. An additional summary of the REF layers could also be added to a similar table for a robust analysis.

Table F.8: Summary of the NEPAssist Analysis Results for the three Pilot Corridors presented in Figure F.7, F.15, and F.22.

	NEPAssist Analysis Results																												
	Facilities							Water						Ecology									Other						
Corridor	Within 100 meters of a hospital?	Within 1000 meters of a hospital?	Within 100 meters of a TRI facility?	Within 1000 meters of a TRI facility?	Within 100 meters of a regulated facility?	Within 1000 meters of a regulated facility?	Within 100 meters of an airport?	Within 100 meters of a Wild and Scenic River?	Within an area overa a Sole Source Aquifer?	Within 100 year flood plain?	Within 500 year flood plain?	Within NLCD wetland?	Within 1000 meters of NLCD wetland?	Within a federa/state park or wildlife area?	Within 1000 meters of a federal/state park or wildlife area?	Within a critical habitat area?	Within 1000 meters of a critical habitat area?	Within 100 meters of a REAP Composite area that is within the top 10% highest scores?	Within 100 meters of a REAP Diversity area that is within the top 10% highest scores?	Within 100 meters of a REAP Sustainability area that is within the top 10% highest scores?	Within 100 meters of a REAP Rarity area that is within the top 10% highest scores?	Whith 100 meters of a place on the NHR?	Whith 1000 meters of a place on the NHR?	Within 100 meters of a school?	Within 1000 meters of a school?	Within a nonattainment area?	Within a previous nonattainment, maintenance, or EAC area?
SH360	N	N	N	N	N	N	N	N	N	N	N	Y	Y	N	N	N	N	N	N	N	Y	N	N	N	N	Y	N
SH170	N	N	N	N	N	Y	N	N	N	Y	Y	N	N	N	N	N	N	N	N	N	Y	N	N	N	Y	Y	Y
Lake Lavon Rail	N	N	N	Y	Y	Y	N	N	N	Y	Y	N	Y	N	N	N	N	N	N	N	Y	N	N	Y	Y	Y	Y

Table F.9: Summary of the GISST Analysis Results for the three Pilot Corridors presented in Figure E9, F.17, and F.24.

	GISST Analysis Results																										
	HUC Related						Air			Other Water Related								Toxicity					Land Cover				
Corridor	Surface Water Use	Storet Exceedences	Rainfall	Unified Watershed Assessment	Average Flow	Aquifer Geology	# Regulated Facilities	Road Density (miles/sq. mi)	Nonattainment	Distance to Water (feet)	Stream Density (miles/sq. mi)	Channel/Canal Density (miles/sq mi)	% Surface Water	%100 Year Flood	%500 Year Flood	Aquifer	Groundwater Probability	Soil Permeability	TRI Releases to Air (lbs)	TRI Releases to Water (lbs)	TRI Releases to Land (lbs)	TRI Toxicity Releases to Air (lbs)	TRI Toxicity Releases to Water (lbs)	% Wildlife	% Agriculture	%Wetlands	Area Permiter Ratio	Land Use Ranking
SH360	3	3	3	5	3	4	4	4	5	5	2	1	1	1	1	1	1	1	1	1	1	1	1	4	4	1	5	4
SH170	2	1	3	5	3	4	5	5	5	5	1	1	1	1	1	1	1	2	1	1	1	1	1	5	1	1	5	4
Lake Lavon Rail	3	3	4	5	3	3	*	*	5	5	2	1	2	2	2	1	1	1	1	1	1	1	1	4	1	1	5	4

As shown in these tables, several resources with a Y ("Yes") or scores of 4 or 5 are highlighted in red. These resources would be considered of importance to decision makers and further analysis related to identifying these early on could be completed with information provided in NEPAssist or from the GISST Texas GRID data.

Additionally, with scores from the REF added in, subwatersheds ranking higher or more sensitive to development would be highlighted and inform decisions relating to location, mitigation, etc. Utilizing additional data during the project development process, such as the Texas GRID data could help determine optimum alignments to avoid potential impacts or sensitive resources. This type of evaluation is not presented here, but is proposed as a next step in NCTCOG's assessment of new facilities in its MTP.

Results of NCTCOG's Integrated Planning and Next Steps

Table F.10 summarizes the results of the FHWA grant and how the development of a REF has moved NCTCOG towards implementation of the eight-step framework for integrated planning as presented in "Eco-Logical":

Table F.10: Summary of the results of the FHWA grant and how the development of a REF relates to "Eco-Logical's" eight-step framework for integrated planning.

Relative Completeness	Eight-Step Framework	Comments
	**1) Build and Strengthen Collaborative Partnerships**	Collaborative partnerships between NCTCOG, the MPO, and resource agencies such as the EPA, USACE, USFWS, NRCS, TPWD, and other federal, state, regional, and non-profit agencies have been strengthened through the development of the REF. Data compiled from all agencies have assisted NCTCOG in building an environmental data inventory that was not as robust prior to the grant. Additional partnerships are being formed through complimentary programs, some of which were discussed in the User's Guide. Partnerships that the MPO has formed will only be strengthened as the MPO moves into the next phases of integrating transportation and environmental planning.
	**2) Identify Management Plans**	The identification of management plans resulted in a compendium of important strategic and management plans from resource agencies. This document was produced in 2009 and is in need of updating. The document provides a snapshot of the important goals of a number of resource agencies important to transportation planning and project development. This document can be found as Appendix F.2.
	**3) Integrate Plans**	Eco-Logical succinctly summarizes the integration of plans in three steps: 1) Overlaying Maps; 2) Defining a Region; 3) Describing the REF in Writing. NCTCOG has collected many data sets and evaluated many maps during the development of the REF. NCTCOG has also defined the region of interest for transportation projects as the MPA boundary. More precisely, NCTCOG has identified the subwatershed as the foundational geography for the REF and for evaluating/screening ecosystem data for infrastructure projects. NCTCOG in its partnership with EPA Region 6 has access to the Texas GRID, GISST, REAP, and NEPAssist; data that were integrated and compiled at a regional level by multiple partners and resource agencies. This data set offers the ultimate compilation of data for planning decision-making for the Dallas-Fort Worth region and has been a great asset to NCTCOG's efforts to establish a REF.
Ongoing	**4) Assess Effects**	The REF, as shown in this Appendix, can and will be used to evaluate or assess transportation planning decisions on a regional scale. The REF and associated data will help look for areas of relatively high concern at a regional scale to determine where conservation priorities may lie and how they relate to regional growth policy scenarios. This information can be carried into the NEPA process for transportation projects and can help inform decision-making early on. The updated MTP for the Dallas-Fort Worth area will include a regional Environmental Evaluation for assessing effects of the proposed transportation system.

Relative Completeness	Eight-Step Framework	Comments
Ongoing/ Additional Work Needed	**5) Establish and Prioritize Opportunities**	The GISST/Texas GRID/REAP data provide good indication of vulnerability of grid cells (0.25km^2) by a score of 1 to 5. Aggregating this data to the subwatershed level provides a relative good indication of vulnerability of a resource for the entire subwatershed. This more expansive look (subwatershed) and detail view (grid cell) provide a screening level tool that can then be drilled down to the grid cell level to indicate relative importance of a resource within a subwatershed. Additionally, the Texas GRID data that are being utilized was developed by EPA in cooperation with multiple resource agencies and relies on resource agency data inputs. The use of the REAP data, particularly the Rarity, Sustainability, and Diversity layer will assist in the establishment of priority areas in the region for conservation, preservation, or restoration.
Ongoing/ Additional Work Needed	**6) Document Agreements**	NCTCOG has existing agreements in place with TxDOT to have access to NEPAssist and the GISST data and all future REAP/GISST data updates. Additionally, the MPO has a Section 214 Agreement with the USACE to expedite Section 404 permits for regional priority transportation projects. Similar agreements are currently not in place as they specifically relate to Eco-Logical and integrated planning; however, the MPO will continue to identify opportunities to partner with resource agencies.
Additional Work Needed	**7) Design Projects Consistent with Regional Ecosystem Framework**	NCTCOG intends to offer the REF as an online resource for transportation planners or consultants working on transportation NEPA documents. It is hoped that with this information, additional products, and public outreach, transportation projects will be planned and designed consistent with the REF priorities and regional goals. Additionally, it is hoped that mitigation alternatives will utilize an ecosystem-based approach consistent with the REF priorities and identified areas of vulnerability.
Additional Work Needed	**8) Balance Predictability and Adaptive Management**	NCTCOG's REF and additional supporting tools will assist in balancing predictability of decisions and support adaptive management during the transportation planning/project development process. Additional work is needed to see this as an outcome of these efforts.

While the foundation for the REF has been developed, there are still significant items that will need to be completed to maintain the momentum gained during this process. The upkeep of the REF is an ever-changing process as new data develops from partner agencies.

Furthermore, incorporating an ecosystem approach with mitigation decisions will be an important step to implementing the REF priorities. Utilizing a transportation project to carry out a new approach to mitigation decisions would be the ultimate outcome of this process, but is realistically a long-term goal that will need to be approached in an innovative partnership yet to be developed. Developing ecosystem-based mitigation agreements is one step in the process of moving to a holistic view of mitigation opportunities and is something the MPO would like pursue with partner agencies in the coming years.

While not discussed in detail in this Appendix, the REF does provide a potential tool to assess cumulative impacts to a subwatershed based on past, present, and planned development/infrastructure projects. The REF provides information that can support a cumulative impacts assessment and the subwatershed geography provides a more holistic view than assessments performed locally. This cumulative view also informs decisions related to mitigation opportunities.

While significant progress to implement an ecosystem-based approach to developing infrastructure projects has been made with a REF, utilizing these tools to inform the decision making process on a real project is the ultimate outcome and the next step. The use of the pilot corridors and subwatersheds has enabled NCTCOG to develop a system-level approach for the MTP and has provided opportunities to evaluate the utility of available data and tools for use in development of multiple infrastructure types. Furthermore, the partnerships and relationships established with key resource agencies during this process will be valuable as the Dallas-Fort Worth MPO strives to plan, design, and construct transportation projects that are more sensitive to wildlife and their ecosystems.

References

[1]Council on Environmental Quality. "Considering Cumulative Effects Under the National Environmental Policy Act." 1997, http://ceq.hss.doe.gov/nepa/ccenepa/ccenepa.htm.

[2]Federal Highway Administration. Questions and Answers Regarding the Consideration of Indirect and Cumulative Impacts in the NEPA Process. http://www.environment.fhwa.dot.gov/projdev/qaimpact.asp.

[3]Texas Department of Transportation. "Guidance on Preparing Indirect and Cumulative Impact Analyses." 2006, http://nepa.fhwa.dot.gov/ReNEPA/ReNepa.nsf/home.

[4]Texas Department of Transportation. "Standards of Uniformity." 2009, http://www.txdot.gov/txdot_library/consultants_contractors/publications/environmental_resources.htm.

[5]Federal Highway Administration. NEPA and Transportation Decisionmaking. http://www.environment.fhwa.dot.gov/projdev/pd3tdm.asp.

[6]U.S. Environmental Protection Agency. "NEPAssist." 2010, https://oasext.epa.gov/NEPA/. This program is password protected, access is granted to those agencies with a nexus to NEPA.

[7]U.S. Environmental Protection Agency, Region 6. "Geographic Information Systems Screening Tool." 2010, https://oasext.epa.gov/NEPA/. This program is available via the NEPAssist web tool. It is password protected, access is granted to those agencies with a nexus to NEPA.

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Appendix F.1: Description of GISST and GISST Table Headings

Region 6 GISST

The GISST gives NEPAssist users several options to calculate various physical, environmental, and demographic data for a user-defined area. It creates scores for each dataset, giving it the power to be used as a comparative analysis tool. Medium-high and high scores are highlighted in yellow in the results table. Medium, medium-low, and low scores are highlighted in blue in the results table.

Additional information can be found in the GISST User's Manual: www.epa.gov/earth1r6/6en/xp/enxp2a3.htm.

Additional information can be found in the TEAP Report: www.epa.gov/region6/6en/xp/enxp2a4.htm.

GISST Table Headings

Score represents the average score per factor for all grid cells that have more than 50 percent of their area within the defined polygon.

Value represents the numerical value of the data for each factor. If there is no value present in this column, it indicates that the factor is qualitatively ranked.

GISST Factors: HUC-related

Surface Water Use

Description: Score for 8-digit hydrologic units based on the percentage of streams that meet their designated use. This is an indicator of water quality.

Data Source: USGS 8-digit HUCs, EPA W.A.I.T. Report, and EPA Region 6
Documentation Source: Page A-2 of the GISST User's Manual 2005

Ranking	Value
1	$\geq$ 99% water supports designated use
2	98-76% water supports designated use
3	No data
4	75-50% water supports designated use
5	< 50% water supports designated use

STORET Exceedances

Description: Score for 8-digit hydrologic units based on the number of STORET exceedances per square mile. This is an indicator of water quality.

Data Source: USGS 8-digit HUCs, STORET database, and EPA Region 6
Documentation Source: Page A-3 of the GISST User's Manual 2005

Ranking	Value
1	$< 5.00 \times 10^{-12}$ exceedances/ft^2
2	$5.00 \times 10^{-12} \leq$ exceedances/ft$^2 < 5.00 \times 10^{-11}$
3	$5.00 \times 10^{-11} \leq$ exceedances/ft$^2 < 5.00 \times 10^{-10}$
4	$5.00 \times 10^{-10} \leq$ exceedances/ft$^2 < 5.00 \times 10^{-9}$
5	$\geq 5.00 \times 10^{-9}$ exceedances/ft^2

Rainfall

Description: Score for 8-digit hydrologic units based on the average annual rainfall for the HUC.

Data Source: USGS 8-digit HUCs, Spatial Climate Analysis Center (Oregon State University) and EPA Region 6
Documentation Source: Page A-4 of the GISST User's Manual 2005

Ranking	Value
1	< 12.5 in/yr
2	12.6-25 in/yr
3	26-37.5 in/yr
4	37.6-49 in/yr
5	≥ 50 in/yr

Unified Watershed Assessment

Description: Score for 8-digit hydrologic units based on priority watersheds as identified by State agencies for water quality issues

Data source: USGS 8-digit HUCs and EPA Region 6
Documentation Source: Page A-10 of the GISST User's Manual 2005

Ranking	Value
1	Low State Priority
3	Medium State Priority
5	High State Priority

Average Flow

Description: Score for 8-digit hydrologic units based on the average flow of the streams in the HUC.

Data source: USGS 8-digit HUCs and EPA Office of Water
Documentation Source: Page A-12 of the GISST User's Manual 2005

Ranking	Value (Mean flow)
1	> 10,000 ft^3/s
2	9,999-1,000 ft^3/s
3	999-100 ft^3/s
4	99-0.1 ft^3/s
5	0 or no data

Aquifer Geology

Description: Score for 8-digit hydrologic units based on the average geology in the area and the level of protection it provides the aquifer.

Data source: USGS 8-digit HUCs & geology layers and EPA Region 6
Documentation Source: Page A-15 of the GISST User's Manual 2005

Ranking	Value (Mean flow)
1	No aquifer or massive shale/metamorphic/igneous
2	Weathered/glacial till
3	Sandstone/limestone

Ranking	Value (Mean flow)
4	Sand/gravel
5	Basalt/Karst limestone

GISST Factors: Air

Number of Regulated Facilities

Description: Number of EPA regulated facilities in the cell.

Data source: EPA's Facility Registry System
Documentation Source: Modified from Page A-65 of the GISST User's Manual 2005

Ranking	Value
1	0 facilities in grid cell
2	1 facility in the grid cell
3	2 facilities in the grid cell
4	3 facilities in the grid cell
5	$\geq$ 4 facilities in the grid cell

Road Density

Description: Presence Road miles per square mile.

Data source: Census Bureau 2002 TIGER Line Files, Feature Class A, Road
Documentation Source: Modified from Page A-35 of the GISST User's Manual 2005

Ranking	Value
1	$\leq$ 1.2 road miles per square mile
2	1.3-1.8 road miles per square mile
3	1.9-2.2 road miles per square mile
4	2.3-2.6 road miles per square mile
5	> 2.6 road miles per square mile

Nonattainment

Description: Presence of counties listed as being in nonattainment for air quality issues

Data source: EPA Nonattainment status as of 03/2009 for 8-hr Ozone and PM10 per EPA OAQPS and EPA Region 6
Documentation Source: Modified from Page A-39 of the GISST User's Manual 2005

Ranking	Value
1	County in attainment status
5	County NOT in attainment status

GISST Factors: Socioeconomic

Population Density

Description: People per square mile.

Data source: Census Bureau 2000 PL94-171 Dataset
Documentation Source: Modified from Page A-54 of the GISST User's Manual 2005

Ranking	Value
0	0 people per square mile
1	1-200 people per square mile
2	201-1000 people per square mile
3	1001-5000 people per square mile
4	> 5000 people per square mile

Educational Attainment

Description: Score based on the highest average education level achieved.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-43 of the GISST User's Manual 2005

Ranking	Value
1	College Degree
2	Some college (no degree)
3	High School Diploma (or GED)
4	9^{th}-12^{th} Grade (No diploma)
5	< 9^{th} grade

Age of Housing Unit

Description: Score for the age of housing units within the specified area.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Modified from Page A-60 of the GISST User's Manual 2005

Ranking	Value
1	% built after 1980
2	% built between 1970-1979
3	% built between 1960-1969
4	% built between 1950-1959
5	% built before 1950

For those factors using state averages, the following table summarizes information for the states in EPA Region 6.

Criteria	Arkansas	Louisiana	New Mexico	Oklahoma	Texas
% Economically Stressed Households	30.3	31.8	28.7	28.9	23.6
% Without High School Degree	24.69	25.19	21.15	19.39	24.35
% Children Under 7	9.51	9.97	10.07	9.53	10.86
% 55 & Older	23.57	20.03	20.34	22.36	17.52
% Children Under 1	1.33	1.46	1.42	1.4	1.59
% Low/No Ability to Speak English	1.35	1.03	5.12	1.57	7.55
% Linguistically Isolated Households	1.0	1.72	6.43	1.57	7.2
% Foreign Born Population	2.76	2.59	8.22	3.82	13.91

% Children Under 1

Description: Percentage of population under 1 year of age.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-51 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Children under 7

Description: Percentage of population under 7 years of age

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-48 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% 55 and Older

Description: Percentage of population over 54 years of age.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-50 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Unemployed

Description: Percentage of the population that is unemployed.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-44 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Economically Stressed

Description: Percent of households with income under $20,000.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-44 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Without a High School Degree

Description: Percent of persons not having a high school degree.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Page A-42 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Low/No ability to speak English

Description: Percentage of population over 4 years of age with little or no ability to speak English.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Modified from Page A-58 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

% Linguistically Isolated

Description: Percentage of households that are linguistically isolated.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Modified from Page A-59 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average

Ranking	Value
5	≥ 2 x State average

% Foreign Born

Description: Percentage of population born in another country.

Data source: Census Bureau 2000 SF3 Dataset
Documentation Source: Modified from Page A-60 of the GISST User's Manual 2005

Ranking	Value
1	< State average
2	State average to 1.33 x State average
3	1.34 x State average to 1.66 x State average
4	1.67 x State average to 1.99 x State average
5	≥ 2 x State average

GISST Factors: Other Water-related

Distance to Water

Description: Distance to water in feet.

Data source: Census Bureau 2002 TIGER Line Files, Feature Class H, Hydrography (CFCC: H00 - H22)
Documentation Source: Page A-7 of the GISST User's Manual 2005

Ranking	Value
1	> 8,100 feet
2	8,100-2,700 feet
3	2,699-900 feet
4	899-301 feet
5	≤ 300

Stream Density

Description: Stream/Shoreline miles per square mile.

Data source: Census Bureau 2002 TIGER/Line Files
Documentation Source: Page A-6 of the GISST User's Manual 2005

Ranking	Value
1	< 0.917 stream miles/square mile
2	0.917 to 1.15 stream miles/square mile
3	1.16 to 1.43 stream miles/square mile
4	1.44 to 1.7 stream miles/square mile
5	> 1.7 stream miles/square mile

Channel/Canal Density

Description: Channel/Canal miles per square mile.

Data source: Census Bureau 2002 TIGER Line Files, Feature Class H, Hydrography (CFCC: H20, H21, and H22)

Documentation Source: Modified from Page A-16 of the GISST User's Manual 2005

Ranking	Value
1	< 0.916 canal miles/square mile
2	0.916 to 1.13 canal miles/square mile
3	1.14 to 1.42 canal miles/square mile
4	1.43 to 1.6 canal miles/square mile
5	> 1.6 canal miles/square mile

% Surface Water
Description: Percentage of area that is surface water.

Data source: Census Bureau 2000 TIGER Line Files, Feature Class H Hydrography (CFCC: H30 - H60)
Documentation Source: Modified from Page A-22 of the GISST User's Manual 2005

Ranking	Value
1	< 10%
2	10-19%
3	20-29%
4	30-39%
5	≥ 40%

% 100 year Floodplain

Description: Percentage of cell within the 100 year Flood Plain.

Data source: FEMA Q3 Flood Data (Zone = A, AE, AH, V, VE, & UNDES). Data is available for selected counties
Documentation Source: Modified from Page A-14 of the GISST User's Manual 2005

Ranking	Value
1	< 20% of the grid cell
2	20-29% of the grid cell
3	30-39% of the grid cell
4	40-49% of the grid cell
5	≥ 50% of the grid cell

% 500 year Floodplain

Description: Percentage of cell within the 500 year Flood Plain.

Data source: FEMA Q3 Flood Data (Zone = A, AE, AH, V, VE, UNDES, & X500). Data is available for selected counties only
Documentation Source: Modified from Page A-14 of the GISST User's Manual 2005

Ranking	Value
1	< 20% of the grid cell
2	20-29% of the grid cell
3	30-39% of the grid cell
4	40-49% of the grid cell
5	≥ 50% of the grid cell

Aquifer

Description: Presence of a sole source aquifer within the study area.

Data source: EPA Region 6.
Documentation Source: Page A-13 of the GISST User's Manual 2005

Ranking	Value
1	Sole Source Aquifer NOT present in grid cell
5	Sole Source Aquifer present in grid cell

Groundwater Probability

Description: Average groundwater probability score.

Data source: STATSGO (NRCS) and EPA Region 6
Documentation Source: Page A-8 of the GISST User's Manual 2005

Ranking	Value
1	≤ 2.5% probability of groundwater being within 6-8 feet of the surface
2	2.6-5% probability of groundwater being within 6-8 feet of the surface
3	5.1-10% probability of groundwater being within 6-8 feet of the surface
4	10.1-20% probability of groundwater being within 6-8 feet of the surface
5	> 20% probability of groundwater being within 6-8 feet of the surface

Soil Permeability

Description: Average soil permeability score.

Data source: STATSGO (NRCS) and EPA Region 6
Documentation Source: Page A-20 of the GISST User's Manual 2005

Ranking	Value
1	< 0.02 in/hr
2	0.02-0.6 in/hr
3	0.61-2.0 in/hr
4	2.01-5.99 in/hr
5	≥ 6.00 in/hr

GISST Factors: Toxicity

TRI Releases to Air

Description: Total pounds of chemicals released to air.

Data source: EPA's 2007 Toxic Release Inventory (TRI).
Documentation Source: Page A-40 of the GISST User's Manual 2005

Ranking	Value
1	≤ 300,000 lbs
2	299,999-1,000,000 lbs
3	1,000,001-2,000,000 lbs
4	2,000,001-5,000,000 lbs
5	> 5,000,000 lbs

TRI Releases to Water

Description: Total pounds of chemicals released to water.

Data source: EPA's 2007 Toxic Release Inventory (TRI).
Documentation Source: Page A-5 of the GISST User's Manual 2005

Ranking	Value
1	≤ 300,000 lbs
2	299,999-1,000,000 lbs
3	1,000,001-2,000,000 lbs
4	2,000,001-5,000,000 lbs
5	> 5,000,000 lbs

TRI releases to Land

Description: Total pounds of chemicals released to land.

Data source: EPA's 2007 Toxic Release Inventory (TRI).
Documentation Source: Page A-40 of the GISST User's Manual 2005

Ranking	Value
1	≤ 300,000 lbs
2	299,999-1,000,000 lbs
3	1,000,001-2,000,000 lbs
4	2,000,001-5,000,000 lbs
5	> 5,000,000 lbs

TRI Toxicity Releases to Air

Description: Total pounds of chemicals released to air modified by the toxicity of the chemicals.

Data source: EPA's 2007 Toxic Release Inventory (TRI).
Documentation Source: Page A-63 of the GISST User's Manual 2005

Ranking	Value
1	≤ 300,000 lbs
2	299,999-1,000,000 lbs
3	1,000,001-2,000,000 lbs
4	2,000,001-5,000,000 lbs
5	> 5,000,000 lbs

TRI Toxicity Releases to Water

Description: Total pounds of chemicals released to water modified by the toxicity of the chemicals.

Data source: EPA's 2007 Toxic Release Inventory (TRI).
Documentation Source: Page A-62 of the GISST User's Manual 2005

Ranking	Value
1	≤ 300,000 lbs
2	299,999-1,000,000 lbs
3	1,000,001-2,000,000 lbs
4	2,000,001-5,000,000 lbs

Ranking	Value
5	> 5,000,000 lbs

GISST Factors: Land Cover

% Wildlife

Description: Percentage of cell that is identified as wildlife habitat.

Data source: 2001 National Land Cover Dataset (Codes 11-12, 41-43, 52, 71, 90, & 95)
Documentation Source: Page A-23 of the GISST User's Manual 2005

Ranking	Value
1	< 20% of the grid cell
2	20-29% of the grid cell
3	30-39% of the grid cell
4	40-49% of the grid cell
5	≥ 50% of the grid cell

% Agriculture

Description: Percentage of cell that is identified as agricultural land.

Data source: 2001 National Land Cover Dataset (Codes 81-82)
Documentation Source: Page A-21 of the GISST User's Manual 2005

Ranking	Value
1	< 20% of the grid cell
2	20-29% of the grid cell
3	30-39% of the grid cell
4	40-49% of the grid cell
5	≥ 50% of the grid cell

% Wetlands

Description: Percentage of the cell that is identified as a wetland.

Data source: National Land Cover Dataset (Codes 90 and 95)
Documentation Source: Page A-22 of the GISST User's Manual 2005

Ranking	Value
1	< 20% of the grid cell
2	20-29% of the grid cell
3	30-39% of the grid cell
4	40-49% of the grid cell
5	≥ 50% of the grid cell

Area Perimeter Ratio

Description: Area of wildlife habitat land use divided by perimeter of wildlife habitat land use.

Data source: 2001 National National Land Cover Dataset (Codes 11-12, 41-43, 52, 71, 90, & 95)
Documentation Source: Modified from Page A-25 of the GISST User's Manual 2005

Ranking	Value
1	≤ 1.00
2	1.01-2.00
3	2.01-3.00
4	3.01-4.00
5	> 4.00

Land Use Ranking

Description: Index measuring the quality of land use for wildlife habitats.

Data source: Based on 2001 National Land Cover Data (NLCD) cell values. Formula:
(((number of cells = 24/ total number of cells) * 1) + ((number of cells = 23/ total number of cells) * 1) + ((number of cells = 21/ total number of cells) * 3) + ((number of cells = 22/ total number of cells) * 3) + ((number of cells = 31/ total number of cells) * 3) + ((number of cells = 32/ total number of cells) * 3) + ((number of cells = 81/ total number of cells) * 3) + ((number of cells = 82/ total number of cells) * 3) + ((number of cells = 12/ total number of cells) * 5) + ((number of cells = 11/ total number of cells) * 5) + ((number of cells = 41/ total number of cells) * 5) + ((number of cells = 42/ total number of cells) * 5) + ((number of cells = 43/ total number of cells) * 5) + ((number of cells = 52/ total number of cells) * 5) + ((number of cells = 71/ total number of cells) * 5) + ((number of cells = 90/ total number of cells) * 5) + ((number of cells = 95/ total number of cells) * 5))
Documentation Source: Page A-24 of the GISST User's Manual 2005

Ranking	Value
1	≤ 1
2	1.1-2
3	2.1-3
4	3.1-4
5	> 4

Federal Species

Description: Presence of Federally Listed Threatened & Endangered Species.

Data source: Texas Parks & Wildlife Department's Biological and Conservation Database
Documentation Source: Page A-26 of the GISST User's Manual 2005

Ranking	Value
1	Species NOT present in grid cell
5	Species present in grid cell

State Species

Description: Presence of State Listed Threatened & Endangered Species.

Data source: Texas Parks & Wildlife Department's Biological and Conservation Database
Documentation Source: Page A-27 of the GISST User's Manual 2005

Ranking	Value
1	Species NOT present in grid cell
5	Species present in grid cell

Appendix F.2: Resource Agency Management Plan Summary