

# INTRODUCTORY GUIDE TO INTEGRATED ECOLOGICAL FRAMEWORK



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Project 0-6762

*Maximizing Mitigation  
Benefits—Making a Difference  
with Strategic Inter-Resource  
Agency Planning*



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***Maximizing Mitigation Benefits—Making a Difference  
with Strategic Inter-Resource Agency Planning***

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## CHAPTER **1** Introduction – Why This Guide?

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This guide introduces the *Integrated Ecological Framework* (IEF) to Texas Department of Transportation (TxDOT) engineers and planners. IEF is step-by-step approach to integrating ecological and transportation planning with the goal of avoiding impacts, minimizing mitigation costs, conserving resources, and improving project delivery. Transportation agencies do their best to avoid and minimize any impacts to the environment, but some impacts are unavoidable. Compensatory mitigation is used to offset these unavoidable impacts to the environment. The environmental permitting process under federal and state legislation constitutes a major component of the transportation project development and delivery process. Over \$3.3 billion is spent annually on compensatory mitigation under the Clean Water Act and Endangered Species Act programs (1), so there are significant incentives to minimize the cost of mitigation from transportation impacts.

### **Strategic Highway Research Program**

The Strategic Highway Research Program (SHRP2) addresses some of the most pressing needs related to the nation's highway system. The Transportation Research Board of the National Academies administers SHRP2 for the Federal Highway Administration (FHWA) and the American Association of State Highway Officials. SHRP2 Project C06, *Integration of Conservation, Highway Planning, and Environmental Permitting Using an Outcome-Based Ecosystem Approach*, produced a two-volume report and companion guides. This guide relies heavily on the SHRP2 C06 research, the IEF, and companion guidebooks as the basis for introducing IEF processes to practitioners at TxDOT. For more detailed guidance on the IEF, please refer to these SHRP2 research products:

- *An Ecological Approach to Integrating Conservation and Highway Planning*, Volume 1, [http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2\\_S2-C06-Rw-1.pdf](http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-C06-Rw-1.pdf) (2).
- *Manager's Guide to the Integrated Ecological Framework: Publication Draft*, [http://oregonstate.edu/inr/sites/default/files/documents\\_reports/Draft\\_IEF\\_Mgrs\\_Guide\\_Oct2013.pdf](http://oregonstate.edu/inr/sites/default/files/documents_reports/Draft_IEF_Mgrs_Guide_Oct2013.pdf) (3).
- *Practitioner's Guide to the Integrated Ecological Framework*. [http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2\\_S2-C06-RW-3.pdf](http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-C06-RW-3.pdf) (4).
- *Manager's Guide to the Integrated Ecological Framework*. [http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2\\_S2-C06-RW-4.pdf](http://onlinepubs.trb.org/onlinepubs/shrp2/SHRP2_S2-C06-RW-4.pdf) (5).



## CHAPTER 2 What Is Integrated Ecological Framework?

The IEF is a science-based approach, used by transportation planners and natural resource specialists, to identify ecological priorities and integrate them into transportation and infrastructure decision making.

The purpose of the IEF process is to:

- Conduct analyses and make decisions within a regional ecosystem context.
- Clearly identify and prioritize the important resources and their conservation requirements.
- Use spatial and quantitative assessment methods.
- Start very early in the transportation planning process.

The output and products from the IEF process are:

- Regional maps of conservation and restoration priorities.
- Regional maps identifying affected resources and the impacts from transportation development.
- A process for keeping these maps, databases, and agreements up-to-date (3).

IEF is intended to support both natural resources and transportation infrastructure development and to integrate the vision, goals, and objectives for each. By working together, instead of separately, state departments of transportation (DOTs), metropolitan planning organizations (MPOs), and resource agencies can achieve transportation/infrastructure needs and environmental goals. The IEF complements the FHWA's *Eco-Logical: An Ecosystem Approach to Developing Infrastructure* (6), which was signed by eight federal agencies.

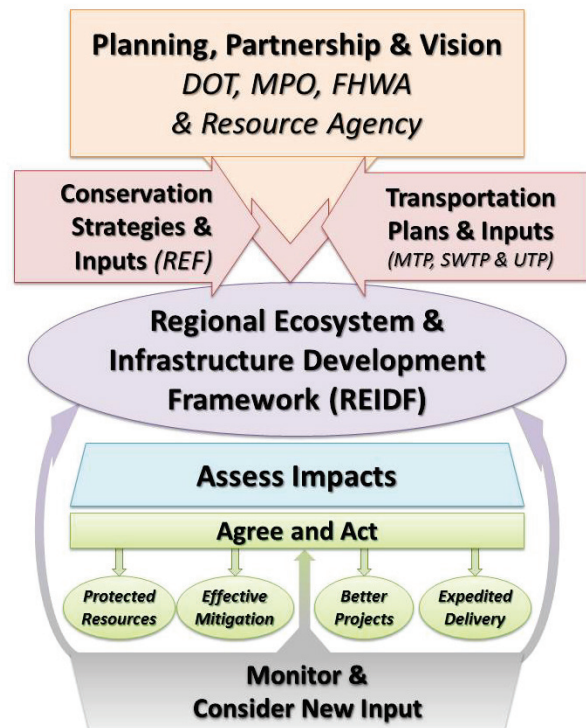


Figure 1. Integrated Ecological Framework (3,4).

## **Does TxDOT NEPA Assignment Fit in the IEF Process?**

Federal law allows states to obtain the authority from FHWA to review and approve environmental documents required under the National Environmental Policy Act (NEPA). This passing of authority from the FHWA to states is referred to as “NEPA Assignment.” Texas Senate Bill 466 waived Texas’ sovereign immunity from suit in federal court for NEPA decisions and enabled TxDOT to obtain NEPA Assignment. TxDOT NEPA assignment began in summer 2014.

NEPA assignment practices at TxDOT complement the IEF process by standardizing early coordination with resources agencies, early environmental project scoping and risk assessments to determine NEPA class of action, and documentation requirements. The importance of conducting scoping and risk assessments early in project development pays dividends. The total project cost is more than just the direct cost of time and materials at the time of scoping. One should also consider the cost of delay in letting, delays in construction, the time value of money, the lost opportunity cost not using a new facility, and waiting for its completion.

## **MAP-21 Planning Rules and Programmatic Mitigation**

States and MPOs may develop programmatic mitigation plans to address potential environmental impacts of future transportation projects as part of the statewide or metropolitan transportation planning process. Proposed transportation planning rules, §450.214 and §450.320 *Development of Programmatic Mitigation Plans*, jointly issued by FHWA and the Federal Transit Administration, provide a statutory framework for the optional development of programmatic mitigation plans as part of the statewide and metropolitan planning process. This document is available at:

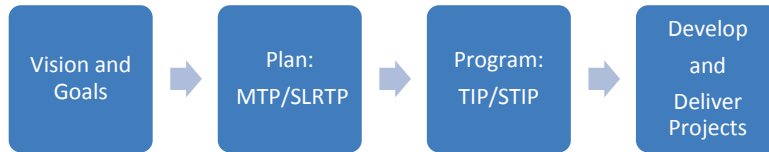
<https://www.federalregister.gov/articles/2014/06/02/2014-12155/statewide-and-nonmetropolitan-transportation-planning-metropolitan-transportation-planning>.

Programmatic mitigation plans can identify options for mitigating impacts to environmental resources early in project development. Examples of resources that the programmatic mitigation plan might identify include wetlands, streams, rivers, stormwater, parklands, cultural resources, historic resources, farmlands, threatened and endangered species or other environmental resource mitigation sites, and resource areas of high value or concern. The plans may adopt or develop standard measures or operating procedures for mitigating certain types of impacts, and include development of mitigation or conservation banks, in-lieu-fee programs, or consolidated mitigation areas. The proposed rule also includes processes for consultation resource agencies and the integrating the programmatic mitigation plan with other plans, including watershed plans, ecosystem plans, species recovery plans, growth management plans, State Wildlife Action Plans, and land use plans.

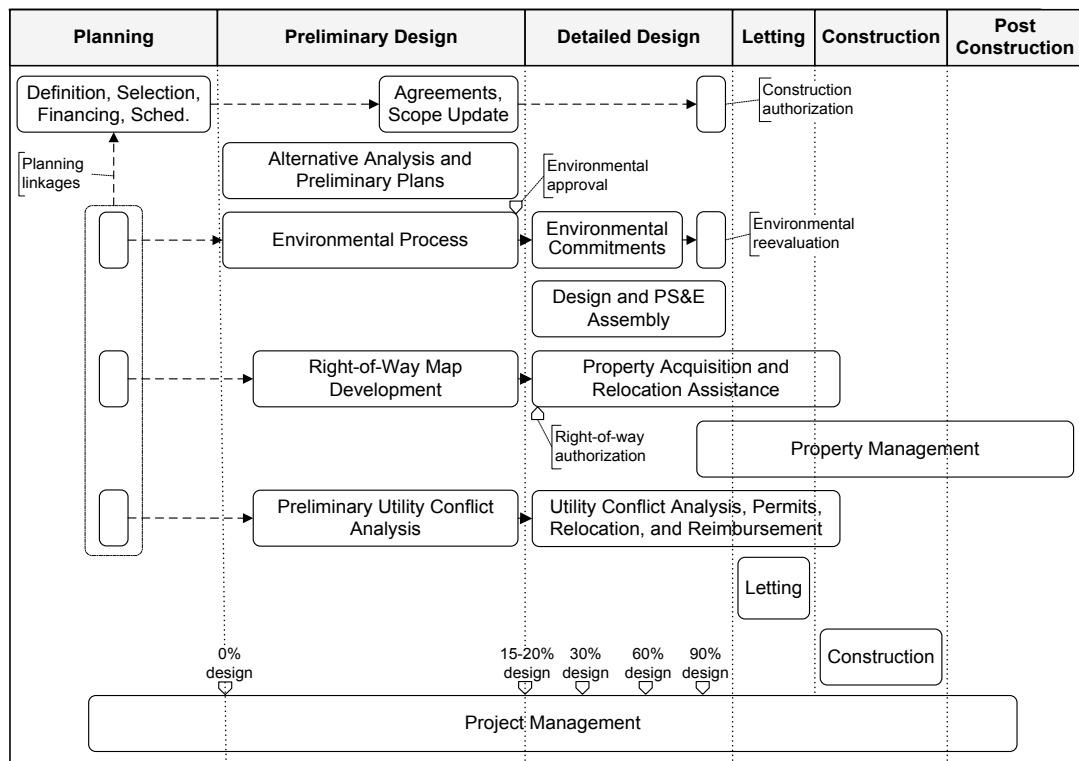
## **The Transportation Planning and Project Development Process**

Ideally, the IEF process is integrated into the planning process when transportation agencies are preparing goals, transportation plans, programming, and developing projects. The IEF builds on existing metropolitan transportation plans (MTPs) and statewide long-range plans that result from the ongoing transportation planning process and plan updates.





In practical terms, the success of the IEF process depends on implementing conservation strategies and agreements into the stages of the transportation project delivery process. The project development process consists of: project planning, preliminary design, detailed design (preparing PS&E), letting, and construction. Figure 2 represents a generic project delivery process for traditional design-bid-build highway projects. The IEF process can be scaled to the project development process early to begin in project planning stages or in preliminary design.









**Figure 2.**  
Project Delivery Process.



## CHAPTER 3 How to Use IEF Process

The IEF was designed by its developers as a nine-step process. For this guide, the IEF has been condensed into six steps (combining Steps 5–8 in the original nine-step process). This IEF process guide is presented in a condensed format to serve as an introductory guide more suitable for new practitioners. Table 1 shows the IEF steps.

**Table 1.** Integrated Ecological Framework Steps.

IEF STEPS (Condensed)	Outcomes	
<b>Step 1:</b> Build collaborative partnerships and regional vision.	Stakeholders agree on vision, roles and responsibilities.	
<b>Step 2:</b> Create a regional ecosystem framework (REF).	Define your ecosystem and its important elements.	
<b>Step 3:</b> Define transportation and infrastructure scenarios.	Define your transportation plan's effect on the region.	
<b>Step 4:</b> Create a regional ecosystem and infrastructure development framework (REIDF).	Describe the transportation system intersecting with the ecosystem.	
<b>Step 5:</b> Implement agreements, permits, crediting strategies, programmatic mitigation, and prioritize ecological actions.	Stakeholder agreements that preserve both ecosystem and transportation system.	
<b>Step 6:</b> Monitor and update the REF and REIDF.	Keep score and measure progress.	

The steps in the guide represent a process that is needed to achieve the desired IEF outcomes. Not every step needs to occur in sequence and more than one step may occur at the same time. The IEF steps in detail follow.

## Step 1: Build Collaborative Partnerships and Regional Vision

*Build support among relevant stakeholders to achieve a statewide or regional vision and planning process that integrates conservation and transportation/infrastructure planning (3, 4).*

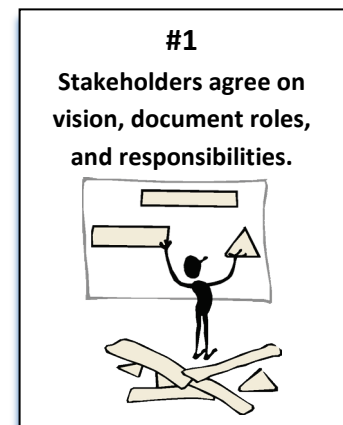
### What Do I Do in Step 1?

- **Define the geographic planning area.**  
Identify the planning region using watersheds, ecoregions, or political boundaries. These are typically going to be MPO boundaries or ecoregions, but the area can be on a smaller, corridor, or watershed scale if you are concerned about a particular project or resource.
- **Identify the stakeholders, transportation planning agencies, and resource agencies.**  
Identify the major government and planning agencies. The agencies involved may depend on how your planning area is defined. For example, which U.S. Army Corps of Engineers district, MPO and member cities, or TxDOT district are going to be involved and represented. In many cases, these functions can be performed by an existing technical committee at the MPO or Council of Governments.

### Step 1: Outcomes

A memorandum of understanding with:

- Stakeholder and agency goals.
- Resource priorities and major areas of concern.
- Anticipated mitigation needs.
- Roles responsibilities, processes, and timelines.

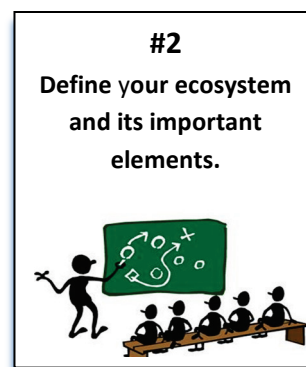


## Step 2: Create a Regional Ecosystem Framework (REF)

*Develop an overall environmental conservation strategy that integrates conservation priorities, data, and plans, with input from and adoption by all conservation and natural resource stakeholders identified in Step 1 that addresses species, habitats, and relevant environmental issues and regulatory requirements agreed upon by the stakeholders (3, 4).*

### What Do I Do in Step 2?

- Identify the spatial data needed to create current (baseline) conditions.
- Prioritize ecological resources and issues to be addressed.
- Prepare data and resource sharing agreements to avoid, minimize, and conduct advance mitigation.
- Identify important data gaps.
- Define priority areas for conservation and mitigation.
- Stakeholders review team.



### What Is a Regional Environmental Framework?

Regional Ecological Framework is a spatial database of the priority resources in a pre-defined area and includes pre-identified priority areas to avoid or to invest in mitigation (ecological improvement) or restoration actions. The REF represents natural resources, the values of partners and stakeholders, and may include other concerns besides ecological resources such as cultural resources and environmental justice.

### Step 2: Outcomes

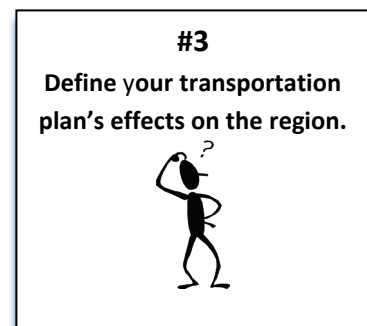
- A map that identifies resources of interest and areas for conservation and mitigation action.
- A thorough understanding of the region's natural resources.
- Data and information gap.
- An agreed upon set of conservation and mitigation goals.

### Step 3: Define Transportation and Infrastructure Scenarios

*Integrate existing, proposed, and forecasted development, transportation, and, optionally, other plans into one or more scenarios to assess cumulative effects on resources (3, 4).*

#### What Do I Do in Step 3?

MPOs prepare a long-range MTP for their planning regions to guide transportation development and address issues on safety, infrastructure condition, reliability, economic vitality, environmental sustainability, and project delivery. State DOTs also prepare a long-range statewide transportation plan to address these issues on a statewide basis. Step 3 should use these transportation plans (and other planning data) to define your transportation network's future. The future infrastructure scenarios are prepared by asking the question "What if?" For example, what if the region grows mostly along our coastal highway? How will that affect coastal resources? Or what if population growth continues or declines?



#### Step 3: Outcomes

- Future transportation system scenarios and possible impacts on resources.
- Areas and resources affected by transportation development.
- Cumulative effects on the region.
- Regional mitigation areas for the region.
- Aggregated mitigation needs to maximize ecological benefits.

#### REF Data Resources

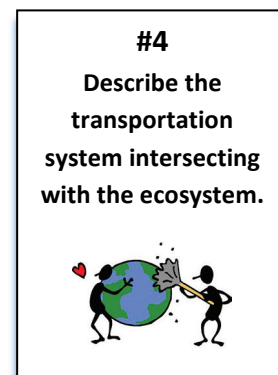
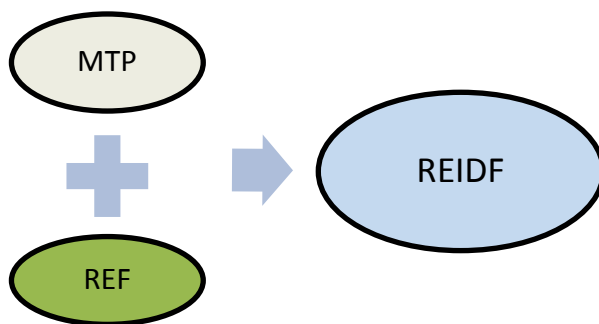
Natural resources databases and plans at state and federal resource agencies provide an abundance of data needed to build your REF. Examples include: state wildlife action plans, watershed protection plans, special area management plans, and coastal management plans. (See example REF and IEF from the Houston Galveston Area Council [HGAC] and the North Central Texas Council of Governments [NCTCOG] after Step 6.)

## Step 4: Create a Regional Ecosystem and Infrastructure Development Framework (REIDF)

*Integrate environmental conservation (REF) and transportation/infrastructure data and plans to support creation of an ecosystem and infrastructure development framework (REIDF). Assess effects of transportation/infrastructure on natural resource objectives. Identify preferred scenarios that meet both transportation/infrastructure and conservation goals by using the REIDF and predictive models of priority resources to analyze transportation scenarios in relation to natural resource conservation objectives (3, 4).*

### What Do I Do in Step 4?

Describe what would happen if you were to overlay (intersect) the transportation network and accompanying land uses onto your REF ecosystem. What does it look like now and in the future? This will be your REIDF.



### Step 4 Outcomes

The outcome of creating the REIDF should be a representation of what the region will look like in the future scenario. The representation should use maps, graphics, and supporting data to communicate the potential and cumulative impacts on natural resources. Additionally, this step should include agreement among stakeholders on:

- The priority resources to be avoided.
- The resources where impacts should be minimized.
- Locations for conservation areas.
- Locations for restoration areas.
- Identified and quantified regional mitigation needs and demands.

## Step 5: Implement Agreements, Permits, Crediting Strategies, Programmatic Mitigation, and Prioritize Ecological Actions

*In this condensed IEF guide, Step 5 includes four sub-steps that implement the IEF framework:*

- *Establish and prioritize ecological actions.*
- *Develop crediting strategy.*
- *Develop programmatic consultation, biological opinion, or permit.*
- *Deliver conservation and transportation projects.*

### What Do I Do in Step 5?

Step 5 puts it all together; it encompasses an ongoing process of reaching consensus and preparing agreements that enable the IEF to be effective. The ultimate goal is to accomplish all of the sub-steps described above. This could take years to accomplish, but many of the sub-steps may already be in place in the form of existing memorandums of understanding and programmatic agreements with various resource agencies. This can also be the step in which to use pilot projects to test crediting strategies.

### Step 5 Outcomes

- A regional conservation, restoration, recovery, and mitigation strategy, with quantitative and qualitative valuation of mitigation sites.
- Conservation and mitigation preferences and priorities.
- Measures and metrics to track progress toward regional ecosystem goals and objectives.
- Agreement on resource management roles and methods.

**#5**  
**Stakeholder**  
**agreements that**  
**preserve both**  
**ecosystem and**  
**transportation**  
**system.**





## Step 6: Monitor and Update the REF and REIDF

Maintain a current REF that reflects the most recent distribution and knowledge of natural resources, conservation priorities, and mitigation opportunity areas that can support periodic updates to scenarios, and regional cumulative effects assessments (3,4).

### What Do I Do in Step 6?

Step 6 involves measuring, monitoring, and updating the REIDF.

### IEF and REF Examples

There are several examples of where the IEF has been deployed as a pilot program. SHRP2 funded four pilot projects in California, Colorado, Oregon, and West Virginia to test the IEF. The results of these pilot projects are in *An Ecological Approach to Integrating Conservation and Highway Planning, Volumes 1 and 2* (2).

In Texas, similar efforts are underway at NCTCOG and HGAC.

### North Central Texas Council of Governments

The North Texas REF consists of 10 Vital Ecosystem Information Layers focused on three central ecological parameters: Green Infrastructure, Water Quality and Flooding, and Ecosystem Value. The REF provides a foundation for using the watershed approach when considering the conservation and ecosystem based priorities during development of infrastructure projects (Figure 3). See the NCTCOG REF website: [http://www.nctcog.org/traces/Reg\\_Ecosystem\\_Framework.asp](http://www.nctcog.org/traces/Reg_Ecosystem_Framework.asp).

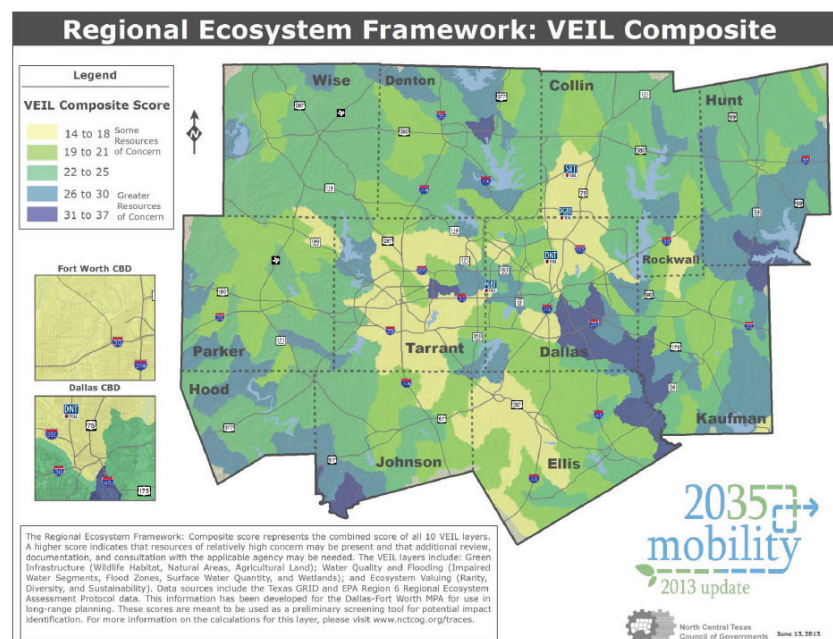
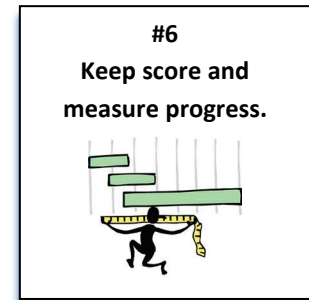
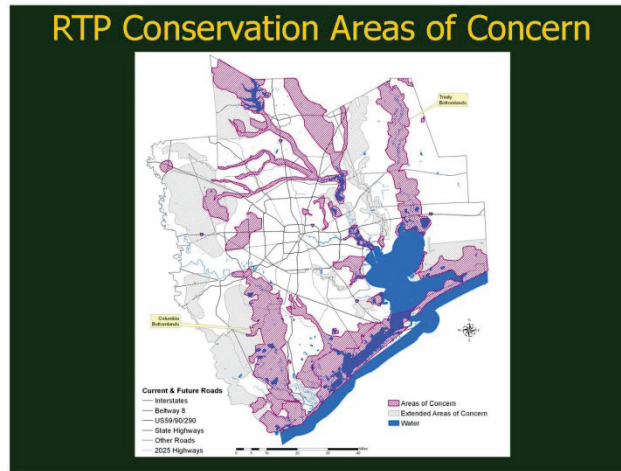
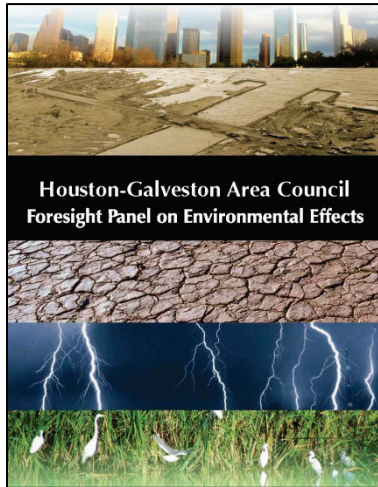


Figure 3. NCTCOG Regional Ecological Framework.

## Houston-Galveston Area Council

HGAC developed the Regional Decision-Support System. HGAC organized an Eco-Logical Advisory Committee to guide in the development of the tool and included federal and state environmental resource agencies and other conservation organizations. The Geographic Information System (GIS) database is accessible both in-house and publicly through an online portal. The tool has over 12,000 mapped features that transportation planners can use to evaluate the potential impacts of proposed projects. See <http://www.h-gac.com/community/environmental-stewardship/eco-logical/>.



**Figure 4.** HGAC Publications Supporting Regional Environmental Framework.

## CHAPTER 4 Things You Can Do

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### Scaling IEF

You can scale the IEF to a project, or a resource, or both. You can also scale the IEF to a small region, corridor, or for a particular species across the state. It may be easier to begin the IEF process by using one of the individual steps for a particular project or corridor.

For example, scaling **Step 1** to a **project level** can be made using an in-house project team consisting of planners, environmental specialist, design engineers, and resource agency representatives. Districts can use opportunities such as the design concept conference and planning meetings to accomplish this step. Completing scoping documents are an excellent way to begin this step. Scaling Step 1 on a **regional level** may be accomplished using MPO technical committees.

### Use Existing Transportation Plans

TxDOT's Statewide Long-Range Transportation 2035 Plan and ongoing updates to the statewide plan include priority corridors and strategies for mitigation, and potential areas for mitigation. MPO's MTPs also contain priority projects, priority corridors, environmental frameworks, and GIS data needed to support the framework.

### Compare the Estimated Cost of Avoidance versus Mitigation

Compensatory mitigation occurs when impacts are unavoidable. In some cases, the compensatory mitigation costs can be significant. Figures 5 and 6 present mitigation purchase data from TxDOT's Right-of Way Information System (ROWIS) from 2003–2013. The cost and quantity of mitigation parcels and fees are increasing. Stream mitigation costs can range from \$100 to \$1000 per linear foot depending on the impacts and restoration costs. In some cases, it may be less expensive to avoid impacts rather than to mitigate or compensate for impacts. Compare the cost to see if it is less expensive to avoid a wetland or stream by bridging over the stream rather than using a box culvert and incurring costs from impacts and permitting. The extra cost to design and build a bridge to avoid wetlands or stream may be less than the cost of mitigation, permitting, and resulting project delays.

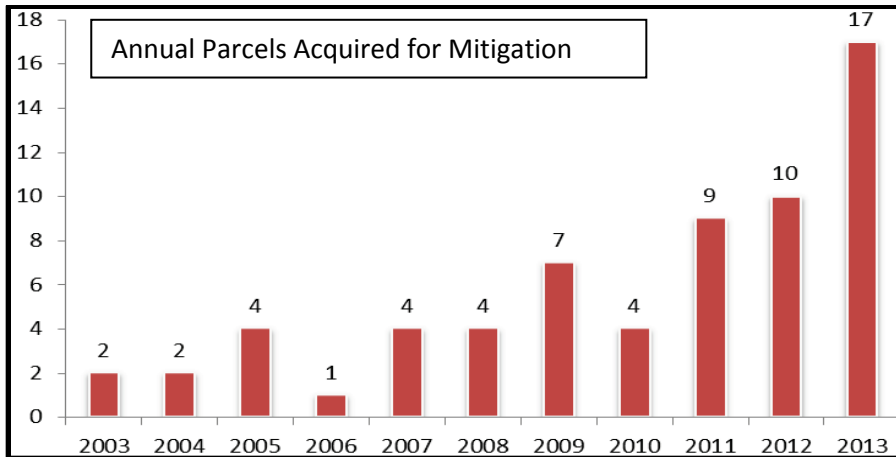


Figure 5. Annual Parcel Acquired by TxDOT.

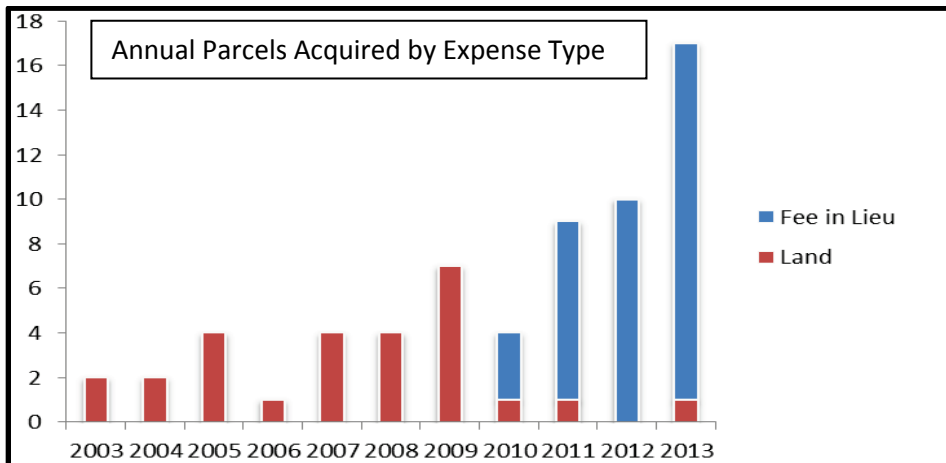


Figure 6. Annual Parcels Acquired by Expense Type.

### Track Project Mitigation Cost

Tracking project-level mitigation costs can provide the data and evidence needed to help prioritize mitigation decisions for future projects. ROWIS tracks the mitigation purchases as if they are parcels of land. By statutory law, the remedy of environmental impact is considered a right-of-way acquisition cost. The ROW Division sets up the mitigation as a parcel in ROWIS coded with an “m” for mitigation or “w” for wetland. However, ROWIS does not capture mitigation costs that are part of construction costs, or ongoing maintenance at the district. Mitigation cost tracking at the district can provide the financial information needed to prioritize the next project mitigation decision to avoid or mitigate.

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