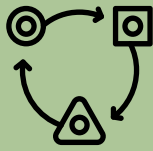




Resilience Recommendations



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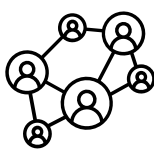
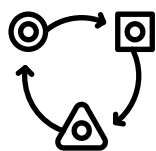
Overview

As part of the Rio Grande Valley Resilience and Sustainability Analysis, Alliance Transportation Group presents the following recommendations to improve regional resilience to environmental stressors and long-term sustainability.

Recommendations are organized into the following five guiding principles:

- *Adaptive Development*: Recommendations for building resilient infrastructure systems
- *Sustainable Future*: Recommendations that encourage regional and long-term sustainability
- *Connected Communities*: Recommendations involving public education and awareness
- *Collaborative Governance*: Recommendations to support regional coordination between governments
- *Just Choices*: Recommendations for making equitable decisions

Common recommendation themes are the need for natural systems such as green infrastructure and land preservation, investment in alternative transportation modes, effective communication, and protection for infrastructure and people. Strategies presented in this document are not exhaustive, but provide a starting place for implementing resilience projects.

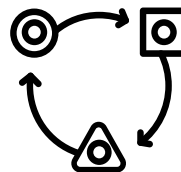


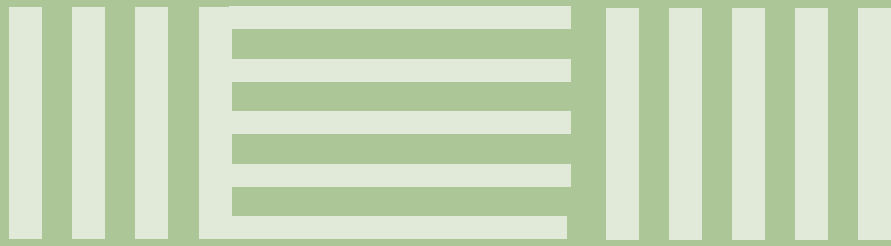
RGVMPO

Resilience and Sustainability Analysis

Adaptive Development Recommendations

Recommendations under this principle will be themed around building resilient infrastructure systems and overall development that factors in climate change and associated risks, planning for facilities that can be adapted for various uses, and planning that strengthens housing market resilience, especially for those communities most vulnerable to risk.





Coastal and Riverine Flooding

Flooding presents a challenge for communities and for the built environment. Low-lying areas of Cameron, Starr, and Hidalgo Counties are susceptible to riverine flooding during heavy rainfall events.

Additionally, low-lying areas of Cameron County are subject to repetitive coastal flooding. Natural systems, or green infrastructure, such as wetlands, bioswales, and rain gardens have been proven to be effective mitigation strategies when complemented with traditional grey drainage infrastructure.

Action Items

- Integrate wetlands restoration and creation into new and existing recreational trails and active transportation projects.
- Identify public right of ways and roadways where bioswales, rain gardens, or other green stormwater infrastructure could be constructed.
- Update development guidelines to encourage options for nature-based solutions like green infrastructure in private development.
- Assess the costs and benefits of implementing green infrastructure projects.



Coastal and Riverine Flooding: Green Infrastructure

Wetland Restoration & Preservation

One way to utilize green infrastructure is through the restoration of existing wetlands, which naturally manage flooding through their unique ability to absorb and store large amounts of water.

Wetlands located within floodplains next to rivers, streams, lakes, and ponds are known as riparian wetlands. These inland vegetated wetlands help to reduce flood risk by absorbing excess stormwater that grey infrastructure cannot manage and then slowly releasing it downstream. As a critical part of a comprehensive stormwater management strategy, these wetlands alleviate pressure on exhausted drainage pipes and inlets. Coastal wetlands, on the other hand, can be saltwater or freshwater and protect inland areas from coastal flooding and harsh wave action. With a natural system of wetlands intact, both the intensity and frequency of flooding events can be reduced. Beyond a decrease in flood risk, additional benefits of wetlands include their use as wildlife habitat and their ability to provide erosion control or streambank stabilization and improved water quality. Wetland restoration can be achieved by rehabilitating deteriorated wetlands to revive their natural characteristics and function; alternatively, wetlands can be constructed to mimic ecosystem and risk management functions. When planning the use of wetlands as critical components of a drainage system, research shows that the community benefits outweigh the cost, which can be cheaper to implement due to lower construction, operation, and maintenance costs. Moreover, wetland protection provides an opportunity to limit development in critical watersheds with open space and recreational opportunities.

Benefits:

- Improve flood and stormwater management
- Provide recreation opportunities
- Reduce urban heat
- Provide wildlife habitat
- Improve air quality and water quality



Leaders

Municipalities
(especially in
Cameron County),
Texas Parks and Wildlife
Department (TPWD)



Time Frame

Long-Term (5-10 years)



Funding

PROTECT Grant (FHWA),
Five Star and Urban
Waters Restoration Grant
(NFWF),
National Coastal
Resilience Fund (NFWF),
Coastal Zone
Management Habitat
Protection and
Restoration Grants
(NOAA),
Transformational Habitat
Restoration and
Coastal Resilience Grants
(NOAA)
Wetland Reserve
Easement Program
(NRCS)
North American Wetlands
Conservation Act Grants
(USFWS)



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation (TxDOT)



Time Frame

Short-Term (1-5 years)



Funding

PROTECT Grant (FHWA),
Texas Clean Water State
Revolving Fund,
Five Star and Urban
Waters Restoration Grant
Program (NFWF),
National Fish and Wildlife
Foundation America
The Beautiful Challenge,
Surface Transportation
Block Grant Alternatives
Set Aside (FHWA)

Coastal and Riverine Flooding:

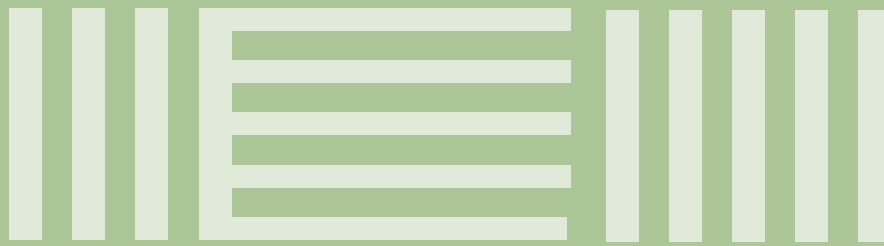
Green Infrastructure Bioswales and Rain Gardens

Green infrastructure for stormwater management can also be implemented in more intensely developed areas at a smaller scale. Bioswales and rain gardens are vegetated areas used to collect and filter stormwater runoff on roadways or private property, complementing traditional grey infrastructure. While bioswales and rain gardens function in similar ways, there are differences. Bioswales are landscaping features usually located in the public right of way along roadways that are designed to filter sediment and pollutants from runoff while slowing down the flow of runoff into streams. Rain gardens are landscape features with slightly depressed elevations that collect and absorb stormwater runoff, allowing for increased evaporation and percolation into the soil. Rain gardens may be located in yards or parks and are typically shallower and more simply designed than bioswales.

Several of the existing plans in the RGV region contain green infrastructure objectives. For example, the City of Hidalgo plans to utilize bioswales and other green infrastructure methods in capital projects to reduce the impacts from flood and heavy rainfall events. In Cameron County, the resacas act as reservoirs for stormwater. Brownsville's comprehensive plan includes bioswales among other methods as tools for resaca management. The continuation of these efforts in combination with other regional bioswale and rain garden projects can improve the collective resilience of the Lower Rio Grande Valley.

Benefits:

- Improve stormwater management
- Improve flood mitigation
- Enhance aesthetics
- Provide wildlife habitat
- Reduce urban heat
- Improve air quality and water quality



Case Study:

City of Houston's Green Stormwater Infrastructure Program

The City of Houston recently developed and adopted the Green Stormwater Infrastructure (GSI) Program to encourage development of green infrastructure on private property. The program started with a one-year study conducted by Houston's Chief Recovery Office, R.G. Miller Engineers, Asakura Robinson, Corona Environmental Consulting, and Neptune Street Advisors from 2018 to 2019. This study recommended the following four GSI sub-programs, in place since 2021, with the goal of making GSI the standard for property development in Houston.

1. **GSI Expedited Permitting Pilot Program:** Together with developers, the city will work to establish consolidated and expedited permitting guidelines and criteria for the review of GSI projects.
2. **GSI Awards and Recognition:** This program encourages GSI by acknowledging and promoting innovative and successful projects in Houston.
3. **GSI Tax Abatement Program:** Through this program, developers may apply for a tax abatement. Projects that align well with existing city goals and have large impacts are able to receive higher assistance.
4. **Integrated GSI Development Rules:** This effort seeks to combine and harmonize the development rules associated with parking, landscaping, drainage design, and related requirements so that developers can more easily implement GSI.
5. **The GSI Program was funded through the Houston Endowment as a response to extreme flooding from Hurricane Harvey in 2017.** With support from the GSI Program, increased green infrastructure like green roofs, rain gardens, bio-retention, permeable pavements, rainwater harvesting, bioswales, constructed wetlands, and rain gardens help Houston to better address future flood risk in the city.

Case Study:

Brownsville's Four Corners Detention Pond & Park Improvements

Plans for the Four Corners Detention Pond and Park Improvements project, also known as Southmost Waterplein Park, in Brownsville were approved in December of 2019. This 7-acre park will provide added drainage capacity to contain stormwater during rain events and help alleviate flooding in the surrounding neighborhoods. During dry periods the three detention pond areas can be used for recreational purposes with soccer fields, basketball courts, and water features. The park will connect to the Southmost Nature Trail so that residents can benefit fully from the park space and recreational opportunities. Additional stormwater management features such as a pump station and drainage culverts are also proposed.

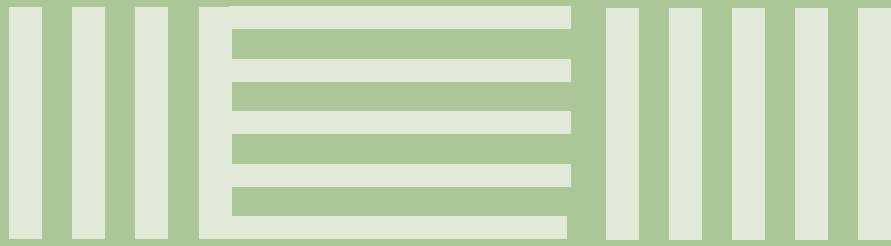


Coastal and Riverine Flooding:

Additional Strategies

Green infrastructure strategies can include many types of projects and have a broad range of environmental and societal benefits. In addition to the green infrastructure for flood management described above, some other green infrastructure projects include green roofs, tree planting, vegetated stream buffers, rainwater harvesting, etc.

Grey infrastructure strategies can also address the guiding principle of adaptive development. For example, stronger flood protection measures can be incorporated into the replacement or repairs of water and sewer facilities, roads, bridges, and tunnels. Another very effective way to prevent damage from flooding is to limit development in floodplains. Several existing city and regional plans include development regulations due to reduce flood hazards, like the City of San Benito's Comprehensive Plan.



Storm Surge and Sea Level Rise

Storm surge from hurricanes and long-term sea level rise add to the flood hazard in the LRGV region, especially in eastern Cameron County along the coast. Strong storm events can temporarily generate a rapid and significant increase of mean sea level. Storm surges of up to 20 feet or more can be produced from category 5 hurricanes, which has devastating impacts on communities, infrastructure, and buildings. Sea level rise due to climate change also threatens coastal areas in a more gradual and perpetual way.

The impacts of sea level rise are already evident, especially during high tide. High tide flooding, which causes disruptions and damage, is expected to increase in frequency. A higher sea level will also have the effect of raising base flood elevations, placing more areas at risk during hurricanes and severe weather events. As described above, natural systems can be used to increase protection from flood risk caused by storm surge and sea level rise.

Action Items

- Ensure that beach access roads and pathways do not cause harm to dune systems.
- Inform the public about the importance of dunes and how to protect them.
- Assess the roadway network and projected flood and sea level rise levels to evaluate the need for raising or enhancing protection of existing revetments.
- Ensure evacuation routes have adequate freeboard elevation, where applicable.



Storm Surge and Sea Level Rise:

Green Infrastructure Dune Restoration and Preservation

The preservation of dunes is one green infrastructure strategy for adaptive development. Coastal sand dunes act as a natural protective barrier that absorbs the impact of storm surges and waves. The entire dune system with vegetative cover must be intact to be effective. Restoration projects to enhance the stability of existing dunes can include planting native vegetation and constructing temporary sand fences to encourage sand accumulation. Dunes can also be constructed or repaired using imported beach sand where needed; natural materials like hay and seaweed can also be used to improve dune stabilization and decrease erosion from wind. Because of the delicate yet impactful nature, dune restoration projects should be protected from pedestrians and vehicles in order to preserve the natural function and habitat.

To accomplish this, wooden walkovers strategically placed near parking lots and roads allow for pedestrian beach access that limits damage to dunes. Access roads for vehicles should be designed and aligned in a manner that minimizes impact to the dune system. As a form of green infrastructure, dunes are the most efficient and cost-effective method of defense against storm surge and coastal erosion. Dune restoration and preservation also protect transportation infrastructure from the early impacts of sea level rise, as seen in the case study below of a section of California's Pacific Coast Highway.

South Padre Island's comprehensive plan already includes dune protection, beach nourishment, and erosion management to support a climate-resilient coastline. The preservation and restoration of dunes is a green infrastructure strategy for adaptive development that should continue to be pursued.

Benefits

- Improve flood mitigation
- Provide wildlife habitat
- Protect infrastructure
- Enhance aesthetics



Leaders

Municipalities,
RGVMPO



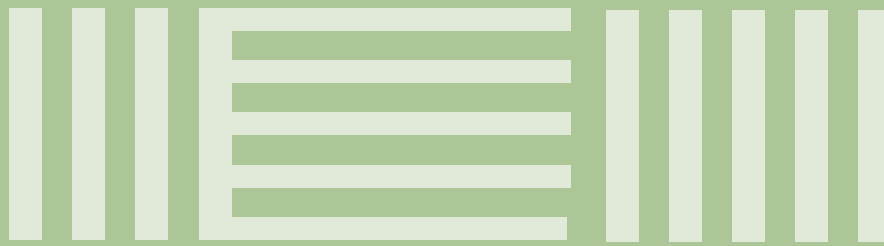
Time Frame

Short-Term and
Long Term (1-10 years)



Funding

National Coastal
Resilience Fund (NFWF),
PROTECT Grant (FHWA),
Coastal Zone
Management Habitat
Protection and
Restoration Grants
(NOAA)



Case Study: **Dune Restoration for California Highway Protection**

In Encinitas, California, a dune restoration project was implemented to protect a portion of the Pacific Coast Highway within Cardiff Beach State Park. This section of highway was consistently subject to flooding and erosion and previously utilized hard revetment structures for protection. After a study found that building additional revetments would increase the problem of erosion and limit access to the beach, the city selected to create dunes for a natural defense strategy. The project first conducted extensive storm surge and sea level rise modeling. Then, sand dunes were constructed on top of the existing revetment with imported sand, vegetation, and sand fences. In total, the project ended up being nearly 3,000 feet in length. A pedestrian pathway was also constructed to provide access to the beach and protect the dunes from pedestrian damage.

This project utilizes green infrastructure to provide highway protection and shoreline habitat, but it is not a permanent solution for addressing long-term sea-level rise. As stipulated in the project permit, if the dunes are repeatedly topped and unable to be maintained, other actions such as raising or relocating the highway may be necessary. Additionally, the dunes will be monitored for performance to inform other living shoreline projects on the West Coast.

Storm Surge and Sea Level Rise:

Elevating Roads & Structures



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation
(TxDOT)



Time Frame

Short-Term (1-5 years)



Funding

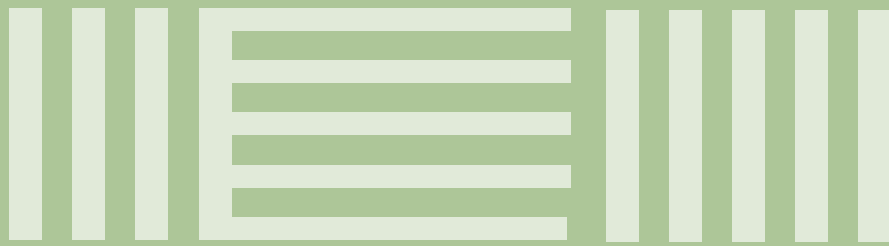
PROTECT Grant (Federal
Highway Administration)
Mega Grant (Department
of Transportation)
INFRA Grant (Department
of Transportation)
RAISE Grant (Department
of Transportation)

As sea levels continue to rise over time, increased tidal and storm surge flooding will have serious impacts on buildings, homes, roadways, and bridges. As a result, it may be necessary to adapt development and redevelopment to higher flood levels by raising roads and structural floor elevations. There are existing plans and projects in place that recognize the necessity of raising road elevations. The Hidalgo County Hazard Mitigation Plan, for example, contains projects to raise critical sections of county roads to build flood resilience. This strategy makes the built environment more resilient and decreases the risk of damage from flooding.

It is best practice to accommodate for additional elevation above the standard base flood elevation, or freeboard, when designing buildings and bridges. As sea level rises, freeboard heights will need to be adjusted to adequately prepare for an increase in risk over time. Roads and structures can be raised to accommodate future projections for flooding and sea levels. Where applicable, evacuation routes in particular should be raised so that egress is not hindered during flood or storm events. For roadways located in places where an increase in elevation is not feasible or where additional protection is needed, breakwater structures can be used to mitigate damage from erosion. However, it is important to consider possible trade-offs like ecosystem disruption when constructing hard coastal defense infrastructure.

Benefits

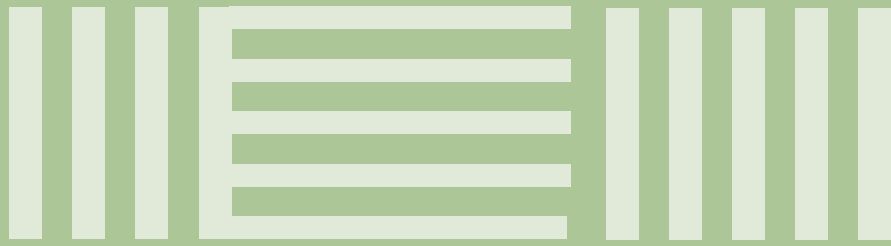
- Improve protection from damage
- Advance safety during emergencies
- Increase useful lifetime of infrastructure



Case Study: **Road Elevation in the Florida Keys**

Monroe County in the Florida Keys has worked to examine impacts of sea level rise on roadways and public infrastructure. Many roads in the county are at or near sea level, and routinely flood during king tides. This regularly causes disruption to traffic and drainage systems, mobility, water quality, and damage to roads and cars. To better understand this issue, LiDAR elevation data was collected and analyzed for the entire county. This data was then used to inform cost benefit analyses, policy recommendations, design criteria, and plans for road adaptation.

The final recommendations involve improving drainage systems and raising the roadways a minimum of 2 to 3 feet, depending on location. The communities in the Florida Keys are some of the most vulnerable to rising sea levels and impart valuable lessons on adaptive development.



Drought

Climate change exacerbates extreme weather events and sea level rise, as well as the frequency and duration of drought. The RGV depends on both surface water and groundwater for drinking and agriculture. When drought conditions persist for an extended period of time, there might not be sufficient water for household use, agriculture, recreation, or ecosystem habitats. Measures will need to be in place to promote water conservation during drought, but proactive measures are also beneficial.

Examples of proactive mitigation measures include replacing aging infrastructure with water conserving plumbing fixtures and creating water reuse systems. The Foresight McAllen 2007 comprehensive plan includes recommendations for innovative rain capture and reuse in capital project design. Water conservation measures such as these are just as important to the region now as they were when this plan was written.

Action Items

- Replace leaking or inefficient infrastructure and fixtures with new and efficient ones.
- Research and develop a water reuse system to maintain street trees and vegetation.



Drought:

Replacing Aging Infrastructure

On a system wide scale, aging water infrastructure can leak and waste significant amounts of precious water resources. Leaky pipes and water mains can be replaced to conserve water and also save money. On a smaller scale, old plumbing fixtures use more water than newer low flow varieties. For example, old inefficient residential toilets from around 1990 or before can use 3.5 to 6 gallons of water per flush, while newer ones use 1.6 gallons or less. In the tri-county Rio Grande Valley area, around 25% of homes were constructed in 1980 or earlier. Since toilet flushing makes up a large source of water usage in homes and offices, installing low flow fixtures can greatly reduce water usage and contribute to water conservation efforts.

Benefits:

- Increase water conservation and efficiency
- Save on water bills



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation (TxDOT)



Time Frame

Long Term (7-10 Years)



Funding

WaterSMART Grants,
Texas PACE Program

Drought: Creating Water Re-use Systems



Leaders

Municipalities



Time Frame

Short-Term (1-5 years)



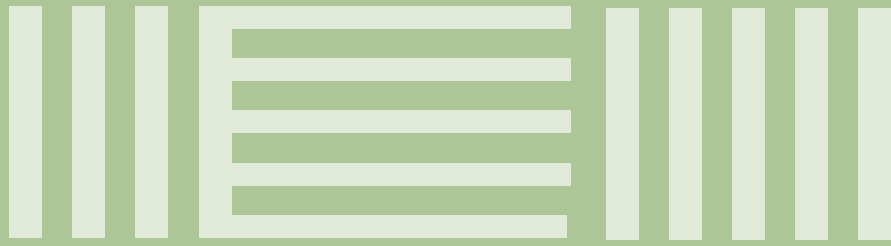
Funding

Texas Clean Water State
Revolving Fund

Water reuse, also referred to as “purple pipe” systems, recycle used greywater. Greywater is wastewater generated from domestic sources that is relatively clean and has not come into contact with fecal matter. Water used for washing hands or showering can be reused for landscape watering without needing to be treated at wastewater treatment plants. A greywater reuse system collects this used water and supplies it to yards or other vegetated areas and can be implemented at an individual building scale or for a group of buildings. Moreover, maintenance of street trees and vegetation does not need to add to overall water demand and can instead be supplied with recycled water.

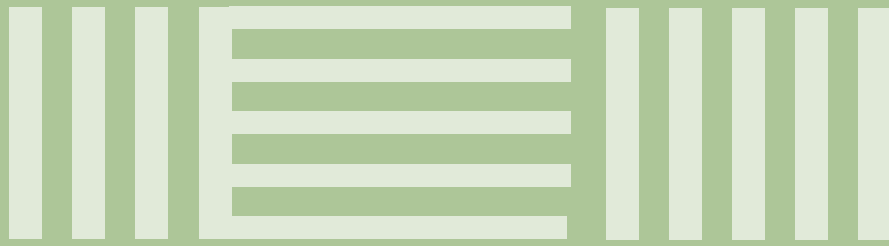
Benefits:

- Increase water conservation
- Support efficient vegetation maintenance



Case Study: **Austin Reclaimed Water System**

The city of Austin promotes water reuse systems that collect greywater, rainwater, and air conditioning condensate as sources for non-potable water uses. These systems can be on-site reuse or connected to a larger water reuse system within the service area. The city requires new developments within 250 feet of the system to connect to it. For customers that wish to use this cheaper recycled water for irrigation, there is also a reclaimed water bulk facility for hauling trucks. By using recycled water for landscaping or toilet flushing purposes, the overall demand for fresh treated water in the city has decreased.



Extreme Heat

Extreme heat poses a significant risk to the LRGV region. Hidalgo, Cameron, and Starr Counties commonly experience extreme heat events with temperatures soaring to 114° Fahrenheit. Urban areas, especially areas lacking tree canopy coverage, experience Urban Heat Island (UHI) effect, exacerbating these already intense events. Solutions exist to help mitigate these events, such as expanding tree canopy and eliminating parking minimums.

Action Items

- Develop a plan to implement green infrastructure, shade structures, and cool pavement or roofing material where necessary, prioritizing spaces for vulnerable populations.
- Encourage preventative and awareness measures to reduce heat illnesses.
- Continue to increase tree coverage on public and private property.
- Expand tree canopy and vegetation on major transit and pedestrian corridors.
- Establish a network of cooling centers.

Extreme Heat:

Eliminate Parking Minimums



Leaders

Municipalities



Time Frame

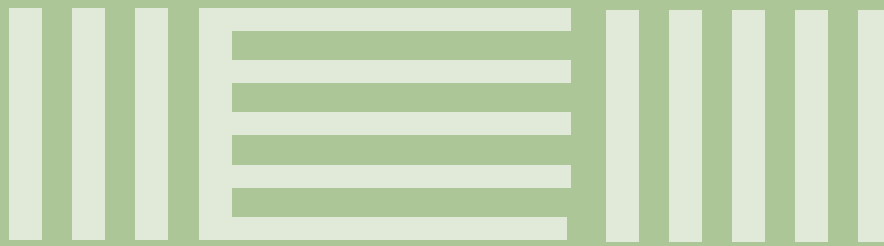
Short-Term (1-5 years)

Green infrastructure is arguably the most effective way to reduce temperatures in urban areas. In addition to the solutions outlined above, other effective tactics are green roofs and facades, variation in building and tree heights for ventilation, evaporative cooling, promoting blue and green spaces, education on extreme heat dangers, establishing a network of cooling centers during extreme heat events, piloting cool pavement, and shading critical areas. Where it is not possible or effective to plant trees, shade structures and canopies can be constructed to provide respite from the heat.

An excellent existing consideration for extreme heat is in Cameron County's Hazard Mitigation Plan. A proposed action in this plan is to provide free bus transportation to cooling centers during extreme heat events, among other heat related precautions.

Benefits:

- Reduce Urban Heat Island effect
- Improve water quality
- Enhance aesthetics



Case Study: Phoenix Cool Corridors Program

The City of Phoenix has adopted green corridors in their action against extreme heat. Originally laid out in their 2010 Tree and Shade Master Plan, the City worked to establish green corridors called “Connected Oasis” in the downtown area to create a “unique urban environment.” Since then, it has been renamed the Cool Corridors Program and was approved by the council to receive \$1.5 million to plant 200 trees per mile for a total of 1,800 new trees. These cool corridors are approximately one-mile-long walkways or pathways. The goal shade coverage for the cool corridors is 60% shade coverage as measured during the hottest times of the day, but all corridors must at least meet a minimum of 30%. The city has developed a ranking system to identify the most heat-vulnerable areas.

The four variables used are the following:

- A. City of Phoenix Heat Vulnerability Index scores for census tracts adjacent to corridors
- B. Percent of housing units in census tracts adjacent to corridors with no cars
- C. Number of estimated daily pedestrian trips along each corridor based on simulation data
- D. Current shade coverage and land surface temperature

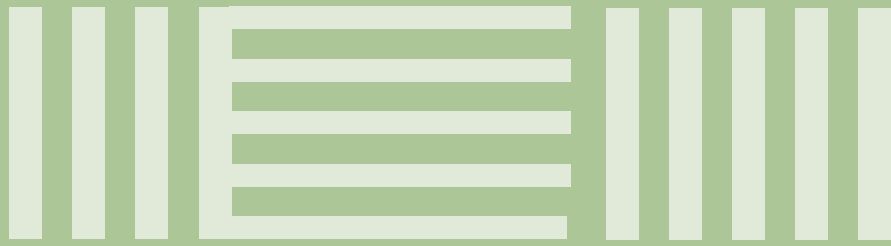
Combining those variables with public engagement and the existing master plans in a scoring system allows the city to identify areas with the greatest need for cool corridors. Phoenix has also laid out an evaluation system that includes “the status of tree planting along prioritized corridors, the types of community engagement activities completed, feedback received therein, and health of trees planted as part of the cool corridors program.” Phoenix plans to create 100 cool corridors by 2030.

Extreme Heat:

Additional Strategies

Green infrastructure is arguably the most effective way to reduce temperatures in urban areas. In addition to the solutions outlined above, other effective tactics are green roofs and facades, variation in building and tree heights for ventilation, evaporative cooling, promoting blue and green spaces, education on extreme heat dangers, establishing a network of cooling centers during extreme heat events, piloting cool pavement, and shading critical areas. Where it is not possible or effective to plant trees, shade structures and canopies can be constructed to provide respite from the heat.

An excellent existing consideration for extreme heat is in Cameron County's Hazard Mitigation Plan. A proposed action in this plan is to provide free bus transportation to cooling centers during extreme heat events, among other heat related precautions.



Wildfires

Wildfire risk is only increasing with the rise in temperatures and drier conditions. Communities are particularly at risk in the Wildland-Urban Interface (WUI), where buildings meet with wildland vegetation. Because there are few ways to prevent wildfires, damage mitigation is vital. Communities can use tactics like fire breaks, which prevent vegetation within a certain distance of homes, or encourage or require buildings to be built with non-combustible materials such as stone, stucco, and brick.

Action Items

- Avoid closed access design for neighborhoods
- Require fire resistant materials and landscaping practices in high risk areas
- Make sure emergency management and evacuation strategies are up to date



Wildfire Risk Zones: Fire Breaks and Limiting Development

As cities build further and further out, issues arise with structures in WUI zones. As more of these structures are built in WUI zones, the risk of damage increases. Communities can avoid this in two ways. The first method is to limit development altogether in wildfire risk zones. The fewer structures in risk zones the less likely they will be damaged. This is especially necessary for high-risk zones with steep slopes. If communities choose to allow development in WUI zones, doing so wisely can help mitigate the risk.

Fire breaks are buffer zones between a structure and vegetation. They help reduce the possible spread of wildfire to a structure. This is done by clearing a zone two to three times as wide as the height of the nearest surface vegetation. This usually is anywhere between two to fifteen feet wide. As the hardscape for active transportation requires a similar amount of space, fire breaks can be used in conjunction with facilities like trails and pathways. It is important to note that while this method can help stop the direct spread of a fire, embers may float above the fire break and catch structures on fire. This is why limiting any development in high-risk zones should be the priority.

Benefits:

- Allow for active transportation development
- Protect from wildfire



Leaders

Municipalities,
RGVMPO



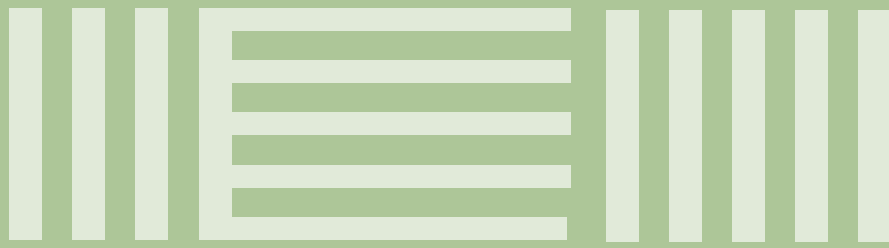
Time Frame

Short-Term (1-5 years)



Funding

Pre-Disaster Mitigation
Grant Program (FEMA),
PROTECT Grant (FHWA)



Case Study: **Santa Fe, New Mexico Overlay District**

Santa Fe, New Mexico, is no stranger to the dangers of wildfires. After experiencing several destructive wildfires, the city set out to create a new overlay district in a part of Santa Fe that has the highest risk: the escarpment. Steep slopes and foothills around Santa Fe characterize this area; moreover, regulatory protections were drafted to protect the beautiful views of the foothills, protect the watersheds, and reduce wildfire risk. New development in this district must go through a more “rigorous set of building and site standards to mitigate risks of wildfire.” The city lists standards such as “density and location, building materials and construction, vegetation management, emergency vehicle access, water supply, and fire protection.”

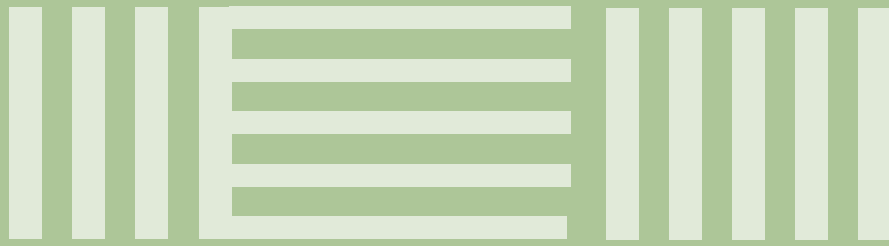
The City of Santa Fe cites two helpful lessons when developing a wildfire protection plan. First, collaboration between different departments, especially the fire and planning departments, is necessary. Second is the ability to balance multiple objectives. The city primarily set out to adopt an overlay district to protect district aesthetics, but over time adapted the plan to be more about wildfire risk reduction. Balancing multiple objectives allows for the program to have more community and stakeholder buy-in.

Wildfires:

Additional Strategies

Prevention and mitigation are critical when dealing with wildfire risk. Aside from the solutions mentioned above, education on preventing wildfires, multiple routes for evacuation, and clear emergency and evacuation plans are critical to risk mitigation. Measures already included in Cameron, Hidalgo and Starr County's Hazard Mitigation Plans can help to address wildfire adaptation and mitigation.

For example, programs to routinely trim tree limbs near power lines helps to maintain road access for evacuation and to reduce the chances for trees to ignite from faulty power line equipment.



Corrosion

The corrosion of metal is an issue for maintenance and longevity of infrastructure. Concrete reinforced with steel is susceptible to cracking and breaking when the rebar inside begins to corrode and rust. This corrosion process occurs when metal is exposed to water, salts from deicing material or seawater, oxygen, chlorine, or some soils. Estimates show that the corrosion of bridges costs the nation over \$13 billion annually. Corrosion is a natural process, but it can be slowed using several different methods of corrosion protection. If water and chemicals are prevented from permeating the concrete, the eventual corrosion of the rebar can be delayed.

The type of corrosion protection measure that is appropriate should be determined on a case-by-case basis, especially in coastal areas. With effective drainage and regular inspections and repair, the lifespan of existing roads and bridges can be prolonged. Pipelines and other metal equipment or structures are also at risk of corrosion from contact with the soil or atmosphere. These metal structures can benefit from corrosion protection measures that delay the corrosion process. Corrosion protection measures are more expensive to implement initially, but over time will save on the cost of maintenance and repair.

Action Items

- Inspect and catalog the state of corrosion for all bridges.
- Identify corroded structures and create repair or retrofit plans.
- Conduct testing to understand the corrosivity of the soil.
- Establish guidelines to implement corrosion protection measures for new projects.



Corrosion:

Decrease the Permeability of Concrete

Low permeability of concrete can prevent corrosion from impacting substances and reacting with the reinforcing steel. This can be achieved by increasing the concrete cover and base thickness, using high performance concrete, decking, or by coating the concrete with sealants.

Benefits:

- Reduce corrosion
- Save on maintenance and repair costs
- Increase useful lifespan of infrastructure



Leaders

Municipalities,
RGMPO



Time Frame

Long-term (7-10 Years)



Funding

Bridge Investment
Program (FHWA)



Leaders

Municipalities,
RGVMPO, TxDOT



Time Frame

Long-term (7-10 Years)



Funding

INFRA Grant (DOT)

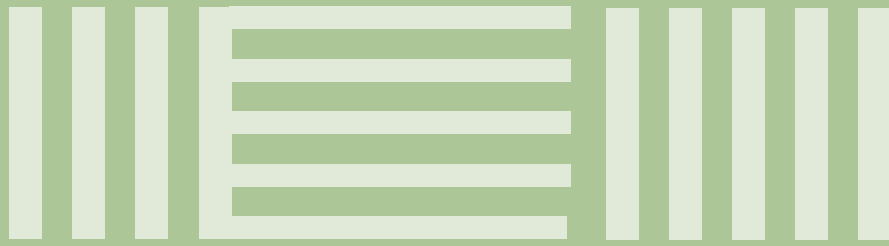
Corrosion:

Protect Reinforcing Steel (Rebar)

Rebar can be coated with epoxy to protect from oxidation. Duplex coating is one example, which uses both a metallic coat and an organic coat over the steel substrate. This type of coating extends the life of the steel. Additionally, there are types of steel that are more resistant to corrosion than traditionally used rebar: stainless reinforcing steel, low carbon/chromium reinforcing steel (LCCR), continuously galvanized reinforcing (CGR), hot dipped galvanized reinforcing (HDG), and glass fiber reinforced polymer bars (GFRP). These types of reinforced steel are more expensive, but they provide resistance to corrosion and increase durability of structures in environments with more corrosive substances present.

Benefits:

- Reduce corrosion
- Save on maintenance and repair costs
- Increase useful lifespan of infrastructure



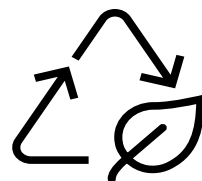
Case Study: **Cathodic Protection of Howard Frankland and Crescent Beach Bridges in Florida**

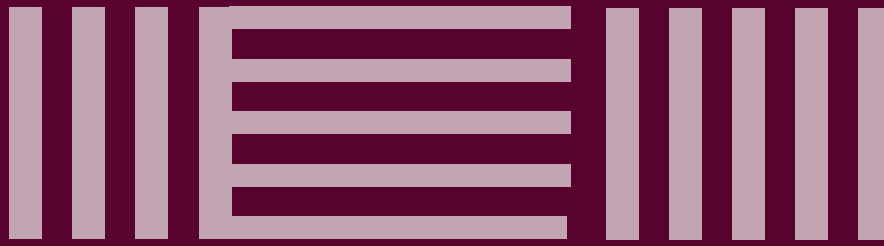
The Howard Frankland Bridge in Tampa and the Crescent Beach Bridge in Crescent Beach, Florida were not built with corrosion-resistant materials when they were constructed in 1960 and 1975, respectively. Both bridges experienced significant damage until the 1980s, when they were retrofitted with cathodic protection systems. This project involved removing unsound concrete, cleaning exposed reinforcement surfaces, and installing cathodic protection features and pile jackets or pier caps. The cathodic method of protection successfully interrupted the corrosion process occurring within the structures. The service life of these bridges was extended by more than 40 years and cost around \$47 million in 2021 dollars, which is a fraction of what a total replacement would cost. For comparison, the Howard Frankland Bridge is expected to be replaced due to capacity needs at a cost of around \$865 million.



Sustainable Future Recommendations

Mitigation measures under this principle are themed around adaptations that encourage regional sustainability such as reducing vehicle emissions through investment in sustainable transportation options and encouraging the use of cleaner, renewable energy generation and fuels. Actions under this theme can be focused on the environmental, economic, or social aspects of sustainability.





Land Conservation

Less than 2% of the land in Texas is protected for conservation and park purposes. Land conservation has been identified as one of the most necessary tools to combat the negative impacts of climate change. These lands help provide refuge to species facing declining populations and protects current biodiversity. Protected lands also help lower temperatures, decrease greenhouse gases, and, when on the coast, can act as a buffer against flooding and hurricanes. Given their irreplaceable benefits, protected lands must be a part of any resiliency plan.

Action Items

- Prioritize protected lands expansion in areas with high biodiversity and environmental importance.
- Work with parks and local schools to promote outdoor education programs.
- Enforce strict penalties for illegal activities, such as dumping, in protected areas.
- Connecting existing protected areas through wildlife corridors.
- Leverage existing ecotourism destinations to promote sustainable tourism that will help financially support the protected lands.
- Consider fare-free transportation to conservation attractions to promote sustainable tourism.
- Implement noise and light pollution ordinances to protect migration paths.



Land Conservation: Preserve and Expand

Land conservation can provide numerous benefits to achieving sustainability goals. Communities can work on preserving existing protected lands to reap these benefits. Moreover, these protected lands should also be expanded. This is especially true for areas along coastlines. These areas are the first defense against flooding from hurricanes that hit the area. Roots from native plants in these protected lands can absorb water better than developing the area with impervious cover.

Expanding existing protected lands and working to connect existing lands with bioswales and other hydrologic connection projects better help protect the biodiversity of the area. Connection of protected lands allow species (and water) to move freely without concern for their safety. Adding additional protected lands, with a focus on freshwater sources, also helps protect valuable resources from pollution.

Benefits:

- Provide wildlife habitat
- Reduce Urban Heat Island effect
- Improve stormwater management
- Improve air quality and water quality
- Enhance natural beauty



Leaders

Municipalities,
Texas Parks and Wildlife
Department



Time Frame

Long Term (5-10 Years)



Funding

Wildlife Crossings Pilot Program (FHWA)
Local Parks Grants
(Texas Parks and Wildlife)
National Coastal Resilience Fund (NFWF)
Texas Farm and Ranch Lands Conservation Program (Texas Parks and Wildlife)
Conservation Innovation Grants (USDA)



Leaders

Municipalities,
RGMPO,
Texas Parks and Wildlife
Department (TPWD)



Time Frame

Short-Term (1-5 years)



Funding

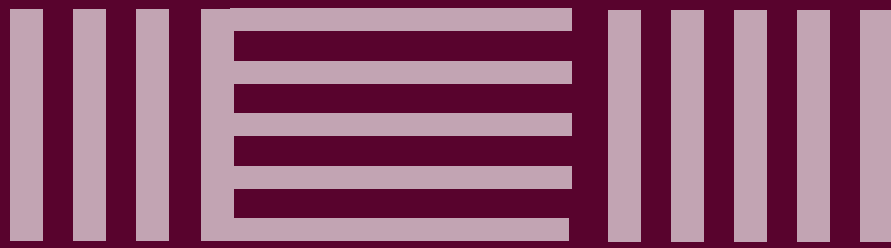
Local Parks Grants
(Texas GLO)
Philanthropic grant
programs

Land Protection: Promote Outdoor Education and Sustainable Tourism

An effective strategy for promoting protected lands and sustainability is through outdoor education and promotion of sustainable tourism. Outdoor education can be a fun and informative way to engage students and citizens in general on the importance of sustainability. The National Butterfly Center, South Padre Island Birding and Nature Center, and the Santa Ana Wildlife Refuge are among several places in the region that currently take visitors on nature walks or host volunteering events. This helps residents of all ages to learn more about their local environment and the different types of organisms living there. Promoting sustainable tourism is also an important tool to enhance land conservation activities. Aside from the economic benefits, sustainable tourism allows people to see firsthand the importance of these areas and can help financially sustain their continued protection. Putting safeguards in place, like limited development and tour guide requirements, helps ensure that this increased tourism does not negatively affect the protected land.

Benefits:

- Improve environmental awareness
- Promote economic activity from tourism



Safety

Safety is a pillar of community resilience. Ensuring communities can move about safely and without fear is paramount to building a resilient community. Safety comes in several forms. Communities face the adverse effects of extreme weather, public health, and traffic deaths. Taking a proactive approach to these situations allows communities to be better prepared to meet these challenges when they arise.

Action Items

- Implement traffic calming measures, such as speed bumps, raised sidewalks, road diets, reduced speed limits, and traffic circles in areas identified as crashes hotspots.
- Construct more pedestrian-friendly infrastructure, such as sidewalks and walking/ biking trails.
- Create public health campaigns focused on better health outcomes.
- Designate local government buildings as resilience hubs for people to go to during emergencies.



Safety:

Vision Zero Implementation

Vision Zero is a strategy to eliminate traffic fatalities and serious injuries by taking a system-wide approach to safety. The traditional approach to safety has been that traffic deaths are “inevitable,” and the way to solve it is by perfecting human behavior and promoting individual responsibility. So far, this strategy has not worked, with the number of traffic deaths getting higher. Vision Zero offers a different approach. This approach views traffic deaths as preventable and accounts for human failure. The goal is to map out the area by traffic fatalities and severe injuries and change the system’s design to make it much safer. This usually involves redesigning high-crash streets to reduce vehicle speed. It also involves redesigning intersections, corridors, and streets using a Complete Streets approach to encourage people to travel by other modes of transportation beyond the motor vehicle.

Benefits:

- Advance safety for pedestrians, bicyclists, drivers, and passengers
- Encourage alternative transportation modes



Leaders

Municipalities,
RGVMPO, TxDOT



Time Frame

Short-Term (1-5 years)



Funding

RAISE Grant (DOT)
Safe Streets for All
Program (DOT)
Neighborhood Access
Grant Program (FHWA)
Surface Transportation
Block Grant Alternatives
Set Aside (FHWA)
Protect Grant (FHWA)
Traffic Safety Grants
(TxDOT)

Promoting Alternatives:

Walkability

Walking just thirty minutes a day can have tremendous benefits to a person's health, including losing body fat, reducing stress, preventing or managing heart disease, high blood pressure, type 2 diabetes, and so many more. As great as walking is for someone, few people will walk without safe places to do so. A walkability approach to transportation has a core principle that destinations should be accessible by foot. This involves building more densely and creating the appropriate infrastructure, such as sidewalks, to reach those destinations. A model with growing interest from cities and communities around the world is a "15-Minute City" approach. The basic concept of this approach is that most daily necessities should be within a 15-minute walk or bike from a residence. A helpful way to pilot this is by closing a popular street in the city to cars for a morning. This is done every Sunday morning in Merida, Mexico, on the famous Paseo de Montejo. The boulevard is shut off to cars for a few hours. Families come out and enjoy riding their bikes through the town safely, encouraging public support for more 'bici rutas' or bicycle lanes. Much like Vision Zero, it is a goal to aspire to.

By building-in exercise into people's daily lives, they can live healthier lives and are much more resilient to public health emergencies.

Benefits:

- Encourage alternative transportation modes
- Support physical and mental health



Leaders

Municipalities



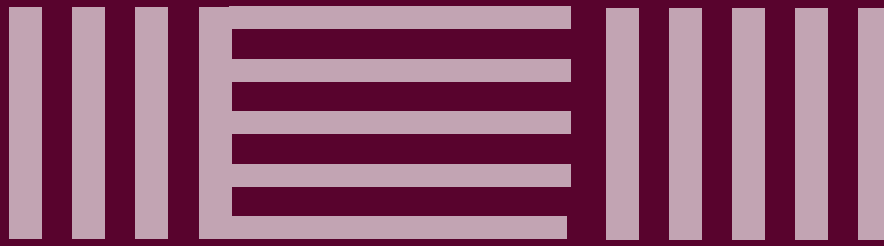
Time Frame

Short-Term (1-5 years)



Funding

Urban & Community Forestry Inflation Reduction Act Grants (USFS), Five Star and Urban Waters Restoration Grant Program (NFWF), PROTECT Grant (FHWA)



Housing

Sustainability and housing are greatly linked; houses provide the primary protection to individuals from natural disasters. Ensuring that homes are sustainable and resilient is critical to a fully comprehensive plan for mitigation of risk.

Action Items

- Encourage gentle density for residential development and allow for more varied housing options.
- Revise local zoning ordinances to reduce minimum lot size requirements, expand multifamily zoned areas, and allow for accessory dwelling units (ADUs).
- Provide educational programs about weatherization.
- Encourage rainwater harvesting to encourage conserving water.
- Adopt and enforce building codes that promote climate resilience and sustainability.
- Establish a loan or grant program for retrofitting existing buildings to be more energy efficient.
- Reduce regulatory hurdles for homeowners and business owners who want to install solar panels or other sustainable devices.
- Implement energy efficiency standards for new buildings.

Housing:

Preservation of Existing Buildings and Build New Sustainable and Resilient Structures

Housing in the United States accounts for 20% of greenhouse gas emissions or the equivalent of the sixth largest emitter on Earth. Looking at how to make housing more sustainable and resilient can drastically help. First, preserving existing buildings is often the most sustainable approach. Keeping existing buildings eliminates the emissions that would be produced from the transportation of materials and construction of a new building. Also, “old” does not always mean unsustainable, as several of these buildings were designed with sustainable features that reflected the local climate. Weatherization is also an option to preserve and improve existing homes that need better climate adaptation. Particularly relevant to the LRGV region is the fact that weatherized homes that are efficient and well insulated are able to stay cooler during a heat wave with power outages. Preservation and retrofitting are effective and cost-efficient strategies that avoid delays due to new construction and permitting times and also avoid displacement. When this is not an option, new buildings should be required to be efficient. It is necessary that these new buildings are designed to be sustainable and resilient so that they are durable in the face of extreme climate. Policies on certain energy and water efficiency standards can help buildings be more sustainable. Policies on foundation and roofing construction are some examples of policies that help improve resilience.

Benefits:

- Reduce impacts of extreme heat
- Increase water conservation



Leaders

Municipalities



Time Frame

Short-Term (1-5 years)



Funding

Urban & Community Forestry Inflation Reduction Act Grants (USFS), Five Star and Urban Waters Restoration Grant Program (NFWF), PROTECT Grant (FHWA)



Leaders

Municipalities,
RGVMPO, Counties,
Federal Reserve of Dallas



Time Frame

Long-Term (5-10 years)



Funding

Grid Resilience Utility and
Industry Grants (DOE),
Energy Improvements in
Rural or Remote Areas (DOE)
Green and Resilient Retrofit
Program (HUD),
HUD Community Block
Grant Colonias set aside
Texas Bootstrap Loan Pro-
gram (TDHCA),
Section 108 Loan Guarantee
Program (HUD)

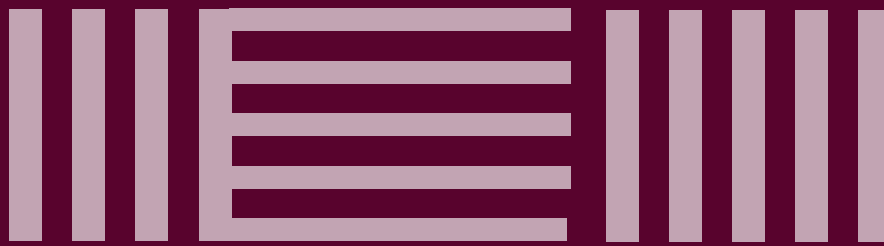
Housing: Improving Infrastructure in the Colonias

“The Texas Office of the Secretary of State defines a colonia as a residential area along the Texas–Mexico border that may lack some of the most basic living necessities such as potable water, septic or sewer systems, electricity, paved roads or safe and sanitary housing.” These areas lie outside of city limits and thus do not receive much of the basic infrastructure that is needed. These areas are some of the most vulnerable areas to extreme weather events. Cities should work to support these communities by incorporating them or providing grants and assistance to state and federal funds for infrastructure improvement projects. This has already been done in several colonias in the Rio Grande Valley, who now have access to street lighting and drainage systems.

Benefits:

- Advance safety and equity





Air Quality

Good air quality is important for the sustainability of current and future residents of the LRRGV. Moreover, poor air quality disproportionately impacts people of color and low-income communities due to proximity to pollution sources like highways. Extended exposure to polluted air can cause serious health consequences for the cardiovascular and respiratory systems. The elderly, children, and those with preexisting conditions like asthma are especially vulnerable to the negative health impacts of poor air quality. One effective way to improve air quality is to decrease emissions from vehicles. The transportation sector accounts for approximately 45 percent of nitrogen oxides (NO_x) in the United States. While national vehicle emissions standards help to reduce the amount of criteria pollutants in the air, transportation electrification eliminates pollution from tailpipes. When combined with renewable energy sources like solar and wind power, the electrification of transportation improves air quality even further.

Action Items

- Promote EV charging for multifamily, commercial, office, and institutional spaces.
- Identify key destinations as potential locations for public level 2 and DC fast charging.
- Consider streamlining permitting and electrical plan review processes, upsizing the electrical requirements for future EV growth, requiring EV chargers at commercial and multifamily properties, and requiring single-family homes to be EV charger ready.
- Commit to electrifying transit buses, school buses, and city fleet vehicles.
- Identify potential sites for public charging stations.
- Invest in transit.



Air Quality: Electric Vehicles

The electrification of vehicles reduces emissions of criteria pollutants like particulate matter, nitrogen oxides, carbon monoxide, and carbon dioxide. There are many models of light duty electric vehicles (EVs) available today that are increasingly cost competitive with traditional internal combustion engine passenger and fleet vehicles. Other types of vehicles, like medium and heavy-duty trucks and buses are also becoming more widely available. Traditional heavy-duty vehicles produce more pollution than light duty vehicles and tend to be concentrated along freight networks. Air pollution from bottlenecks at the border would be reduced if more vehicles were electric or zero emission. Transit buses and school buses should be prioritized for electrification since they produce air pollution, heat, and noise while serving vulnerable populations. Communities can begin now thinking about possible locations for chargers so when funding becomes more widely available, communities can request them. The Infrastructure Investment and Jobs Act and the Inflation Reduction Act both have several funding provisions available to support vehicle electrification, since it is a key part to a sustainable future with cleaner air.

Benefits:

- Improve air quality
- Realize health benefits
- Lower noise pollution
- Reduce CO2 emissions



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation (TXDOT)



Time Frame

Med-Long Term
(2-10 years)



Funding

Low or No Emission
Vehicle Program (DOT)
Low- and No- Emission
Grants (FTA)
Clean School Bus
Program (EPA)
National Electric Vehicle
Infrastructure
Program (TxDOT)



Leaders

Municipalities



Time Frame

Short-Term (1-5 years)



Funding

Local Parks Grants
(Texas GLO)
Philanthropic grant
programs

Air Quality: Transportation Alternatives

A simple way to reduce emissions and improve air quality is to reduce the number of private vehicles on the road. Transit and active transportation methods like walking and bicycling limit the amount of pollution emitted into the air per person for each trip. Investing in transit and sidewalks will enable mode shifts to occur away from highly polluting single occupant vehicles. There are four transit agencies that operate in the area: Valley Metro, Brownsville Metro, Metro McAllen, and Island Metro. Transit service can be improved to better serve transit dependent persons and also increase the share of population that utilizes public transportation by choice.

Benefits:

- Improve air quality and water quality
- Reduce noise pollution

Air Quality: Green Infrastructure (Pollution Reduction)

Green infrastructure that involves vegetation like street trees, wetlands, and green roofs helps to directly remove pollutants from the air through surface deposition and biochemical processes of plants. The benefits of vegetation on city scale ambient air quality are complex, but a reduction of pollutant exposure at a local or site-specific scale is appreciable. Roadside vegetation is able to act as a barrier to reduce concentration of pollutants downwind. Special attention should be given to the types of plants used for air quality purposes so that pollution capture can be functional, since certain plants are better at absorbing and blocking airborne pollutants than others. Vegetation planted along stressful roadway environments needs to be properly maintained so that it can survive to filter pollutants from the air. In addition, green infrastructure that provides shade and lowers temperatures can help to decrease energy demand for air conditioning in buildings and cars, which in turn can decrease the overall production of pollutants.

Benefits:

- Enhance aesthetics
- Provide wildlife habitat
- Reduce urban heat
- Improve air quality and water quality
- Allow for carbon capture



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation (TXDOT),
Non-profit Organizations



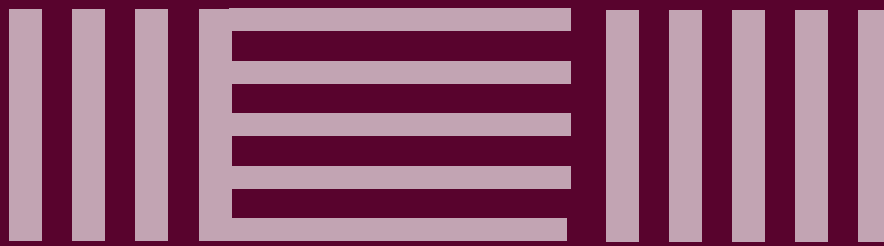
Time Frame

Short-Long
Term (1-5 years)



Funding

Low- and No-Emission
Grants (FTA)



Water Quality

Satisfactory water quality is necessary for a sustainable future because all forms of life depend on water. In the LRGV region, access to clean water allows for drinking water, wildlife habitat, agriculture and irrigation, and water recreation, among other activities. Everyday activities and existing infrastructure can have negative impacts on water quality by contributing to nonpoint source contamination. For example, stormwater runoff from roadways and parking lots increases pollutants in waterways. Cars leak fluids and oils that decrease water quality and harm wildlife when washed from impervious surfaces and deposited into streams and water bodies. Some strategies to help improve water quality are to manage stormwater runoff, decrease the number of vehicles driving on roads, keep vehicles maintained so that they do not leak hazardous materials, and implement green infrastructure along roadways to filter pollution in runoff. Projects that improve runoff water quality are applicable everywhere in the region due to the cumulative character of watersheds.

Action Items

- Conduct public education about how proper vehicle maintenance reduces pollution into waterways.
- Implement green streets design programs.
- Identify and reallocate available space within the right-of-way that can be used to improve water quality and stormwater management.
- Support development strategies that encourage walkability and transit ridership.
- Encourage car sharing and carpool programs.



Water Quality: Green Streets



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Med Term
(2-7 years)



Funding

PROTECT Grant (FHWA)
Texas Clean Water State
Revolving Fund
(Texas Water
Development Board)

Green infrastructure can absorb and filter stormwater runoff before it is discharged into waterways. Plants and soils retain water that is expelled from hard and impervious surfaces like roads and highways. Pollutants in the water are then filtered through plants and soil, where solid particulates and sediment can settle out and other pollutants can be absorbed by slowly passing through plant root systems. The green streets approach incorporates design, vegetation, and materials that slow the movement of stormwater runoff so that it can be naturally filtered before emptying into drainage systems or surface waters. The bioretention feature of green streets from the use of green infrastructure like rain gardens and bioswales can remove up to 90% of pollutants while also recharging groundwater supply. When implemented at a large scale, green streets can improve the health of the entire watershed.

Benefits:

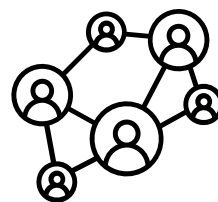
- Improve water quality and air quality
- Calm traffic
- Reduce urban heat
- Enhance aesthetics
- Advance safety

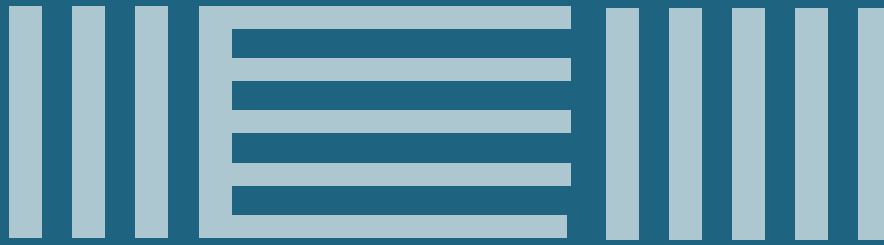
RGVMP

Resilience and Sustainability Analysis

Connected Communities Recommendations

Actions under this principle are themed around public involvement and education and serve to encourage active and ongoing communication to the community about sustainability, resiliency, and the role everyone can play in achieving goals, as well as to encourage communication with external partners about the importance of resiliency planning and value of the region to the nation's economy.





Public Education

Public education on important topics helps to bring communities together, especially in times of extreme weather or disaster events. Public education should engage all groups of people, regardless of factors like age, race, or educational background. The public needs to be aware of the actions they can take to reduce their risk during floods, fires, extreme weather, and extreme temperatures. Some general key factors of public awareness campaigns as described by the Global Disaster Preparedness Center are that people need to be stimulated to seek information, learn lessons from stories, and seek consensus from multiple sources. Additionally, public awareness campaigns can take the form of many different methods and can be tailored to accommodate particular groups or communities. Social media, publications, events, and trainings are all tools for public education. Utilizing multiple intervention strategies with consistent and intriguing messaging across different community settings is an effective way to administer community-wide public education. Other public awareness campaigns about sustainability and resilience are also important. Public education can cover topics like air quality, water quality, preserved lands, and water or energy conservation.

Collective action towards environmental, social, and economic sustainability and resiliency must first begin with a broad public understanding. Connected communities that learn together can act together in the interest of regional sustainability. Current and future generations will reap both environmental and health benefits from ongoing community wide awareness of sustainability goals and initiatives. Regardless of the topic of an educational or awareness campaign, information should flow both ways. Planners and decision makers can learn about public concerns related to the environmental stressors and natural hazards. This feedback can then be used to improve emergency response and sustainability efforts.

Action Items

- Create public outreach campaigns for public education on various natural hazards.
- Create educational programs for sustainability, climate change, and environmental awareness.
- Utilize existing public involvement activities to offer information about initiatives.
- Support social networks using public and community spaces and events.
- Use language that is easy to understand when explaining concepts to the public and make all material available in both Spanish and English.

Education:

Natural Hazards

Public education about natural disasters and extreme events enables communities to mitigate negative impacts. Residents need to be aware of the dangers of frequent and well-known hazards, like hurricanes and flooding, as well as the less frequent or unexpectedly dangerous hazards like wildfires and extreme cold or heat. Extreme heat events are one of the deadliest weather-related hazard in the nation. Informing people of how to protect themselves and their neighbors contributes to overall region wide resilience from these types of events. Hazard maps help people to understand their vulnerability and provide a starting point for targeted communication of public education on natural hazards. Some key educational points for natural hazards are listed below:

Wildfire:

- Risk of wildfire ignition from people (campfires, burning leaves, cigarettes, sparks from trailer chains, etc.)
- How to protect homes by creating a defensible buffer zone free of combustible materials
- How to stay away from smoke (stay indoors, close doors and windows, etc.)

Extreme temperatures:

- How to stay cool and cooling center locations
- Heat related illness signs, treatments, and when to get medical help (heat stroke, heat exhaustion, heat cramps, sunburn, and heat rash)
- Know to check on neighbors
- For cold: dripping pipes and carbon monoxide poisoning danger

Flooding:

- Clear storm drains, secure debris in yards
- Elevate homes in risk areas
- When driving, “turn around don’t drown”

General emergency planning:

- Know primary and alternative evacuation routes.
- Know how to take action to protect yourself, family, and neighbors.
- Preparedness kits: water, nonperishable food, medications, etc.
- Store important documents and valuables so they won’t be damaged.
- Sign up for local emergency messages.



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Resilient Communities
Program (Texas GLO)



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Five Star and Urban
Waters Restoration Grant
Program (NFWF),
Local Parks Grants
(Texas Parks and Wildlife),
National Environmental
Foundations Programs
(NEEF),
Environmental Literacy
Program Grants (NOAA)

Education: The Environment and Sustainability

Awareness of natural hazards and how to respond to them is crucial for community health and safety during emergencies. Public education on sustainability and the environment is also important for community wellbeing. Exposure to poor air quality, for example, can have serious health implications for those with preexisting health conditions, children, and the elderly. Water quality and water conservation are important to maintaining adequate drinking water and recreational activities in the water. Active transportation options are not only environmentally friendly, but also have added physical and mental health benefits. Day to day activities of individuals, informed by an understanding of environmental and personal considerations, contribute to the overall success of sustainability goals and initiatives. Some key environmental and sustainability related educational topics are listed below:

Air quality

- Air quality benefits of electric vehicles, transit, active transportation, and green infrastructure
- Poor air quality impacts on health and what to do on days with poor air quality.

Water quality

- How proper vehicle maintenance decreases pollution into water bodies
- How to properly dispose of hazardous materials
- Which bodies of water are safe for recreational activities
- Why water quality is important for wildlife habitat
- Physical and mental health benefits of walking and biking
- Sustainability of public transportation

Water Conservation

- Low flow plumbing fixtures like toilets and showerheads
- Checking for water leaks and drips
- Greywater reuse systems and rain capture

Climate Change

- Sea level rise projections and impacts
- Think long term for planning the future

Community Connectedness: Evacuation Routes

For communities to maintain connectedness even in the midst of natural disasters, evacuation routes must be well planned, maintained, and communicated. There are 12 major evacuation routes in the three LRGV counties. These routes need to be wide enough to manage mass evacuation loads and be in good working condition so that people and emergency personnel can utilize them safely. To ensure traffic flow, the roadways that make up evacuation routes should be free of possible debris like tree limbs and clear of floodwater inundation. Proactive public education on evacuation zones, routes, and procedures can help to improve evacuation efficiency. Transit dependent and other vulnerable populations will need to have special consideration when it comes to evacuation planning and outreach. As previously mentioned, existing plans such as the county Hazard Mitigation Plans outline routine tree trimming maintenance in the public-right-of-way. This is essential for egress during an emergency. Additionally, evacuation route access is a major concern for many cities in the region.

South Padre Island, for example, is connected to the mainland by a single causeway. The city's most recent comprehensive plan explains the need for a proposed second causeway in order to improve community connection and mobility during evacuations. Some local comprehensive plans consider the importance of subdivision regulations or design to ensure adequate emergency access and integration into evacuation networks. Efforts to consider and prepare for evacuations should continue throughout the LRGV area to increase resiliency before emergencies take place.

Action Items:

- Create a transit plan for the evacuation of vulnerable populations.
- Communicate evacuation plans and procedures.
- Evaluate the conditions and maintenance procedures of evacuation routes.
- Avoid closed access design for neighborhoods.



Leaders

Municipalities,
RGVMPO,
Texas Department of
Transportation (TxDOT)



Time Frame

Short-Term (1-5 years)



Funding

PROTECT Grant (FHWA)

Community Connectedness: Information & Communications Technology (ICT)



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



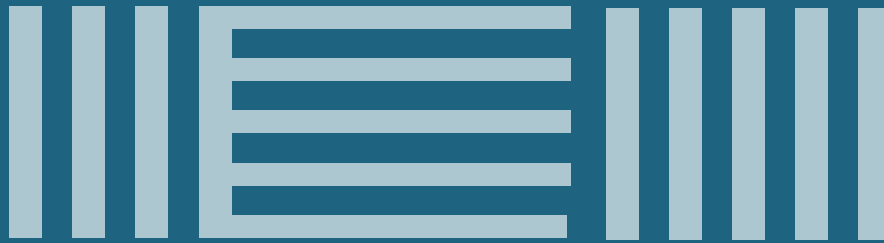
Funding

Five Star and Urban
Waters Restoration Grant
Program (NFWF),
Local Parks Grants
(Texas Parks and Wildlife),
National Environmental
Foundations Programs
(NEEF),
Environmental Literacy
Program Grants (NOAA)

The Covid-19 pandemic showed the importance of digital connection. Supporting Information and Communications Technology (ICT) is critical for staying connected during emergencies. Supporting ICT can ensure that communication is maintained between agencies and the public. As the Rio Grande Valley is experiencing rapid growth, a unique opportunity exists to create sustainable and resilient ICT. Local governments can also work to add more monitoring and early warning systems to alert residents of threats as they happen.

Action Items

- Support targeted hardening of infrastructure to protect the public health, safety, and environment.
- Support decentralized energy distribution.
- Establish robust cybersecurity protocols to protect sensitive data from ransomware and other cybersecurity threats.
- Create and maintain an open data portal to help communities develop solutions.
- Guarantee redundancies and diversification in the local energy grid.
- Apply for digital inclusion grants to help expand internet access.



Case Study: **Donna ISD Wi-Fi Towers During Pandemic**

During the beginning of the pandemic, schools were forced to move to online learning, but a reliable internet connection was not guaranteed for every student. Donna Independent School District (ISD) approved a proposal to construct 12 new Wi-Fi communication towers in more rural and underinvested areas of Donna. These towers provided free Wi-Fi to students within one mile of the tower and created an internet connection for much of the 52% of students who did not have one before. These Wi-Fi towers helped Donna become more resilient by establishing essential communication infrastructure.

RGVMPO

Resilience and Sustainability Analysis

Collaborative Governance Recommendations

Actions under this principle are themed around regional governance and include items such as data sharing agreements and cooperative endeavor agreements to meet regional goals.





Communication

Internal and external communication is essential for short term disaster events and for ongoing environmental condition monitoring such as air quality. Communication between governmental agencies and jurisdictions must be frequent and well established so that in turn, communication with the public is consistent and clear. At critical times such as a regional emergency, conflicting information from different agencies can hinder the public's ability to get out of harm's way.

For this reason, cities, counties, and agencies within the LRGV should establish systems and regularly practice delivering aligned communication. With effective communication in place, the region can be more resilient to stressors of all types. Moreover, solid communication helps to unify the region and make it more competitive for funding from grant opportunities, which can in turn be used to mitigate and adapt to climate change.

Action Items

- Develop local resilience plans.
- Establish and enable regional data sharing practices.
- Continue to strengthen coordination between governments in the region and work towards common goals together.
- Communicate with the public frequently and consistently.



Communication: Interjurisdictional

Each jurisdiction, whether at the municipal or regional level, plays a role in contributing to region wide communication. This is best performed if the individual silos within agencies are surmounted so that information flows freely.

Some strategies to improve interjurisdictional communication are listed below:

- Identify relevant contacts and network with counterparts in different departments and agencies.
- Identify existing plans or policies that would benefit from interjurisdictional communication.
- Regularly meet together with regional authorities (virtually and in person).
- Frequently share ideas and information within the region.

Benefits:

- Improve regional sustainability and resiliency
- Build public trust



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Building Resilient Infrastructure and Communities Grant (FEMA),
Inflation Reduction Act Environmental and Climate Justice Program (EPA),
Cultural and Community Resilience Program (National Endowment for the Humanities),
Our Town Creative Placemaking Grant (National Endowment for the Arts)

Communication: With the Public



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Building Resilient
Infrastructure and
Communities Grant (FEMA),
Inflation Reduction Act
Environmental and Climate
Justice Program (EPA),
Cultural and Community
Resilience Program
(National Endowment for the
Humanities),
Our Town Creative
Placemaking Grant
(National Endowment for the
Arts)

Communication with the public needs to be consistent across all sources and methods of dispersion. This helps to build public trust in the associated governmental agencies. Some tools for public outreach are listed below. Of course, the subject matter determines which method is most appropriate, with nonurgent messages allowing for more flexibility and creativity.

- Social media platforms
- Websites
- Radio and TV Public Service Announcements
- Brochure or pamphlet handouts and mailouts
- Dynamic Message Signs on roadways
- Storytelling
- Small and large presentations
- Events or activities
- Press conferences
- Newspaper advertisements
- Signs and billboards
- Emergency alert email or text messaging system

Benefits:

- Improve regional sustainability and resiliency
- Build public trust

Communication:

Routine Resilience Discussions

Interjurisdictional communication and collaboration also sets the RGV up to achieve sustainability goals. Existing regional agencies, such as the RGVMPPO, can help to facilitate sustainability and resilience discussions. Since resilience and sustainability involve such a broad range of concerns from housing and transportation to the economy and the environment- they should be incorporated into all areas of planning and policymaking. Additionally, sustainability and resilience in the LRGV can be continually improved. This means that efforts to mitigate and adapt to stressors should be ongoing and not impeded by progress or the lack of it. While it may be necessary to create new collaborative efforts in the future, the existing projects should first be used to enhance sustainability and resiliency in the region.

Benefits:

- Improve regional sustainability and resiliency
- Build on existing projects



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Building Resilient
Infrastructure and
Communities Grant (FEMA),
Inflation Reduction Act
Environmental and Climate
Justice Program (EPA),
Cultural and Community
Resilience Program
(National Endowment for the
Humanities),
Our Town Creative
Placemaking Grant
(National Endowment for the
Arts)

Communication:

Establishing and Enabling Regional Data Practices



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)

To have consistent messaging to the public and to work effectively together, agencies need to have a unified source of information. Data sharing is necessary to enable collaboration within the region. It is especially important that current data and maps relating to hazards are widely available so that decisions can be well informed.

Some strategies for data sharing are listed below:

- Share data and information from this plan across the RGV jurisdictions and agencies.
- Share ideas relating to regional environmental, social, and economic goals.
- Develop standards for metadata.
- Establish responsibilities and data management for collective data access.
- Create a regional database with resources, local GIS data, and points of contacts.

Benefits:

- Improve regional sustainability and resiliency
- Improve work efficiency and accuracy

Collaborative Governance: Develop Local Resilience Plans

Regional resilience is the ultimate objective so that people in all communities within the LRGV can successfully face climate, economic, and other stressors. In order to work towards this end, it would be beneficial for each locality to have a dedicated resilience plan. Since each community has a unique combination of threats and opportunities, closely examining resilience at a local scale could help guide investment to resilience related projects. Local knowledge and specialization contributes to overall regional improvement when local governments collaborate.

Benefits:

- Improve regional sustainability and resiliency

Action Items:

- Develop local resilience plans.
- Establish and enable regional data sharing practices.
- Continue to strengthen coordination between governments in the region and work towards common goals together.
- Communicate with the public frequently and consistently.



Leaders

Municipalities,
RGVMPO



Time Frame

Short-Term (1-5 years)



Funding

Building Resilient
Infrastructure and
Communities Grant
(FEMA)

RGVMPO

Resilience and Sustainability Analysis

Just Choices Recommendations

Actions under this principle are themed around making equitable decisions that encourage development without displacement.



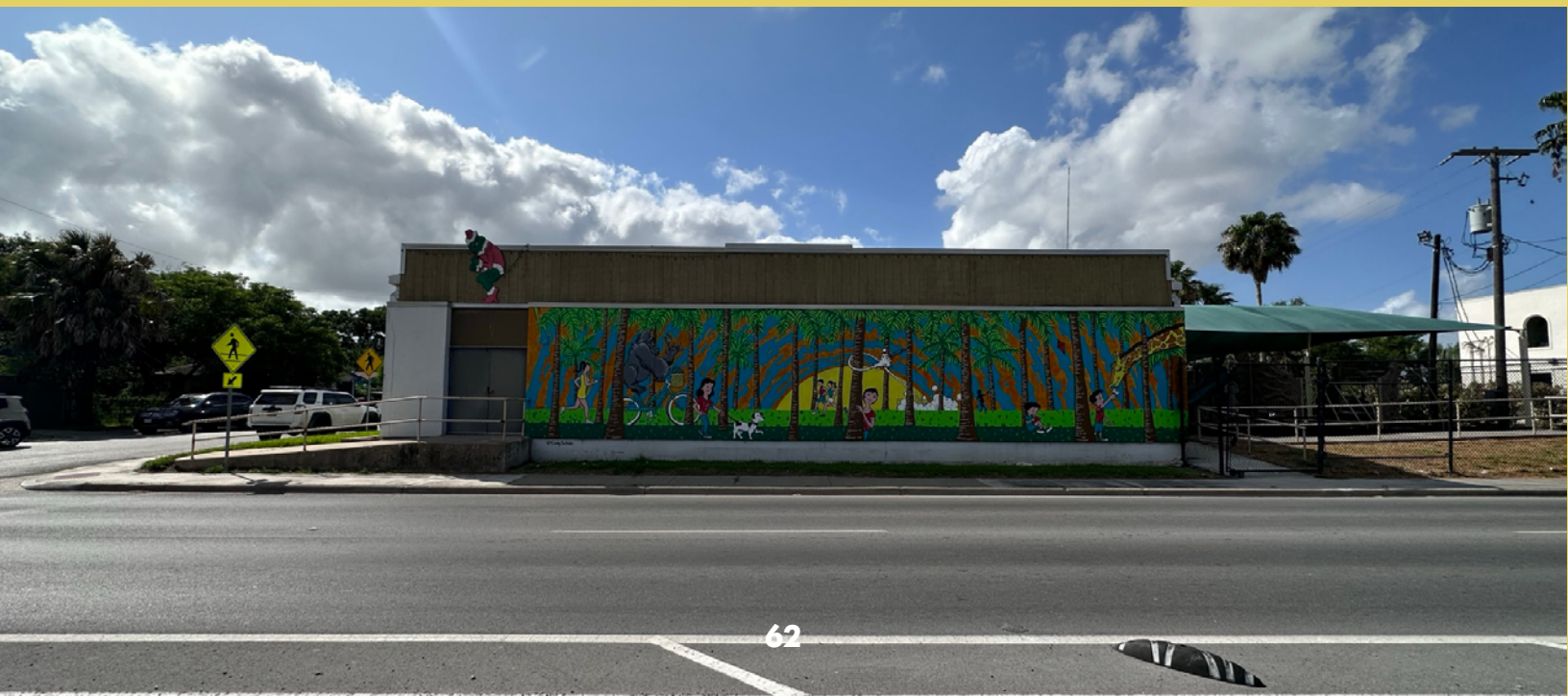


Equitable Decision-making

Generations of transportation, housing, and economic policy rooted in bias have left legacies of disinvestment and unjust outcomes for poor communities and communities of color. Now, many of the same vulnerable communities in the Lower Rio Grande Valley face disproportionate impacts from extreme weather events. Planners today more deeply understand the injustices that have taken place and are committed to proactively addressing these disparate impacts. But the status quo is deeply entrenched in our society and built environment, so agencies and officials are encouraged to consider equity in all decision making processes to improve the quality of life for all residents.

Action Items

- Invest resilience money equitably by targeting investments in disadvantaged areas.
- Use the resilience priority investment tool to make decisions.
- Expand transportation access to serve “transit deserts” in underserved communities.
- Provide business continuity education for small and disadvantaged businesses.
- Continue using multilingual outreach programs.
- Define and state clear equity goals in new plans.
- Create measurable indicators for equity in transportation and resiliency plans.
- Collect data to establish a benchmark of outcomes for vulnerable populations.
- Oversample vulnerable populations to ensure the most feedback possible in surveys.
- Consider anti-displacement policies to mitigate displacement by new projects.
- Conduct accessibility audits on transportation providers.



Equitable Decision Making: Understand Marginalized Communities and Their Needs

The first step to ensuring actions are done equitably is to understand those already disadvantaged. This should include various groups from income, race, people with disabilities, and other marginalized groups. The American Planning Association (APA) offers some advice on identifying marginalized populations, like avoiding aggregating marginalized communities since all have different experiences. Agencies should map out these communities and other high-priority areas to understand where underserved communities are. This can be done by either using a dot-density or heat map. Once underserved communities have been defined and identified, work to understand each of these communities' specific needs and concerns through authentic public engagement. Successful public engagement of underserved communities ensures that agencies work in the best interests of the community they serve.

Public engagement must employ several methods in various places, including and beyond those required. The Transportation Research Board (TRB) advises that effective equity analysis in regional transportation planning processes must also include an assessment of environmental health, safety conditions, and gaps in transit access and mobility. This means looking at emissions, crash rates, mode preferences, access to transit, and access to destinations using transit. Agencies who engage in understanding marginalized communities and their needs can feel confident that they are working to solve some of the most pressing challenges facing these communities.



Leaders

Municipalities,
RGVMPO



Time Frame

Short to Med-Term
(1-7 Years)



Funding

RAISE Grant
Department of
Transportation (DOT)

Equitable Decision Making: Prioritizing and Evaluating Activities for Equitable Outcomes



Leaders

Municipalities,
RGMPO



Time Frame

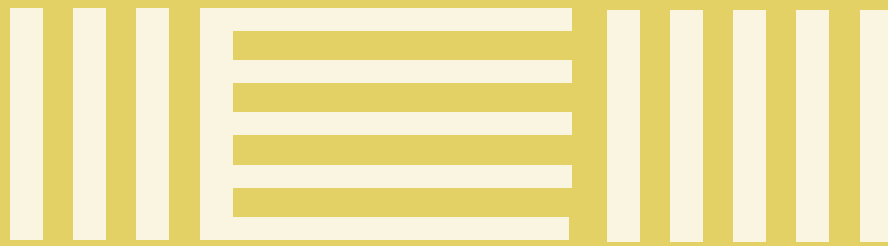
Short to Med-term
(1-5 Years)

After identifying marginalized groups and understanding their needs, agencies can begin to prioritize and evaluate activities for equitable outcomes. When a new project comes up, agencies should use multiple equity-oriented criteria that include the specific needs of disaggregated marginalized populations. When determining what criteria to use, TRB recommends that agencies inventory their current indicators and determine if equity indicators are missing and how to orient current indicators to more meaningfully advance equity. Project maps that are overlaid onto underserved communities should go beyond the legal requirement and “stratify the data into modal categories, and/or calculate relative per capita spending levels.”

The APA advises that all projects should apply equity-related criteria that are given higher weights to equity criteria than they currently do, to ensure that projects are advancing equity.

After creating equity-based criteria for agency activities, it is critical to follow up on those activities with proper evaluation to determine if outcomes are equitable. Collect and analyze data on current conditions to use as a benchmark to compare to after activities to determine if outcomes are more equitable. Agencies can use statistical significance measures to screen for disparities.

An example of this can be a location quotient (LQ) which is a formula that “compare the concentration of underserved persons in an affected geographic area to see if the demographics of the affected population closely resemble the demographic makeup of the regional population.” While these quantitative tools can help determine equitable outcomes, agencies should also continue to engage in authentic public engagement with underserved communities to ensure that outcomes are truly equitable.



Case Study: **NORPC's Use of Data for Transportation Equity**

As part of the Greater New Orleans 2048 Metropolitan Transportation Plan (MTP), the New Orleans Regional Planning Commission (NORPC) has developed and utilized equity indicators as part of their evaluation process for new transportation plans. This scorecard makes up about 25 points out of the 150 points and every project must have a minimum of 15 points to advance. A deduction of 10 points may take place if there are negative impacts on vulnerable communities.

This scorecard is broken down into the following categories:

1. New mobility options to communities of need,
2. Traffic calming in areas of need,
3. New transportation amenities for a community of need,
4. project development with consultation of "potentially impacted residents",
5. another method for achieving greater transportation equity.

Using data from the US Census Bureau, ACS, and Louisiana Department of Social Services, NORPC can identify vulnerable populations and locations to conduct targeted outreach of populations for effective public engagement. NORPC's equity-minded approach to new transportation plans helps advance equity in a way not previously done.