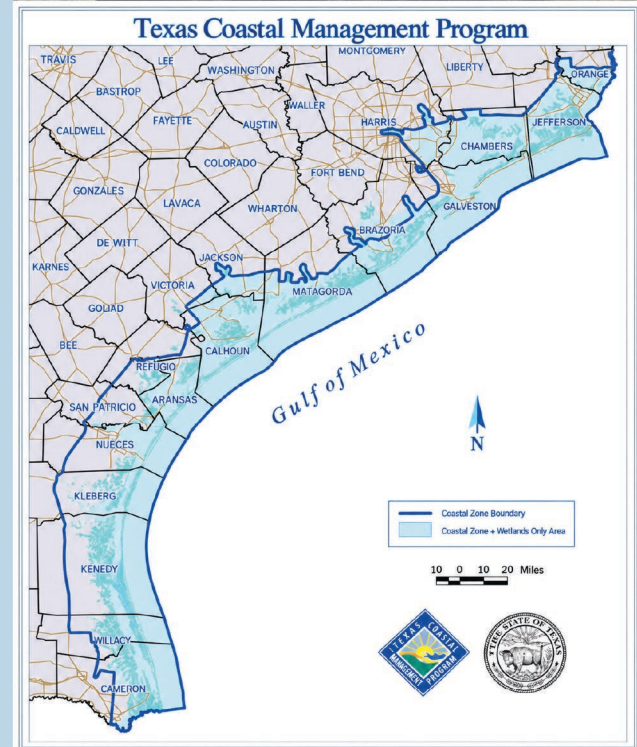




Clean Coast Texas

GREEN STORMWATER INFRASTRUCTURE: BENEFITS TO SMALL COASTAL CITIES OF TEXAS

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Introduction

As cities grow, so grows the amount of impervious surfaces – areas where water cannot soak into the ground. As a result, stormwater runoff into sewer systems and waterways increases. The increased accumulation of unfiltered stormwater runoff results in intensified flooding and reduced water quality. Further, increased frequency and greater severity of storm events are compounding the issue. Traditional stormwater infrastructure (e.g. pipes, tunnels, and drains), known as gray infrastructure, is inflexible to meet changing flood events and growing populations. Gray infrastructure can also adversely impact water quality, as water sluices off concrete surfaces, carrying the spilled contaminants (e.g. oil, animal waste, and anti-freeze) to waterways.

A cost-effective alternative to traditional methods is green stormwater infrastructure (GSI), sometimes called low impact development. GSI mimics nature by capturing rainwater at the location where it falls, slowing down runoff, and filtering it naturally. It also provides public benefits including improved water quality, increased biodiversity, and enhanced neighborhood aesthetics. Additionally, GSI boosts property value by increasing green spaces in the area. It is estimated that the addition of street trees, alone, can [increase property value](#) by up to [10%](#).

Role of Stormwater Ordinance

Stormwater runoff management is crucial to control flooding and water pollution. Such management can take place through ordinances and implementation of best management practices. Strategic consideration of water quality best management practices into ordinances can result in increased property value and reduced flooding events. Sustainable stormwater runoff management design practices in ordinances promote resilient development by incentivizing GSI strategies and preserving open space and natural areas.

Adoption of Green Stormwater Infrastructure

GSI can be adopted in new developments or retrofitted in existing developments by integrating it into existing features of the built environment, including streets, parking lots, and landscaped areas. Municipalities can implement GSI through mandatory ordinances, incentives to developers and landowners, or a combination of both approaches. Mandatory requirements such as increased setback size, landscaping, and required tree coverage can be used as the basis for incentives for developers. Such incentives could include credits to offset other impacts, lower construction costs based on using less hard materials such as concrete, allowing increased building size when green space is used, and expediting permits to encourage GSI use. A [multiple-city case study](#) shows that the cost of implementing GSI is very small on average when compared to the overall construction budget and can save communities in the long term with maintenance and upkeep.

Developers are motivated by higher property sale values and increased demand for construction with more natural aesthetics. A [study](#) found that property buyers will buy smaller lots if

surrounded by larger shared open space or are in proximity to such spaces. People are willing to pay more for green spaces as they [promote a sense of community and improve public physical and mental health](#). Further, GSI features like natural detention areas – areas which temporarily store stormwater and drain it gradually – can be used as [parks or sports recreation areas](#) improving neighboring property values while protecting neighborhoods from flooding. Unsurprisingly, people like to settle near lakes and ponds, which can be designed as retention areas, and pay a higher price for such properties. A [study](#) estimated that a retention pond in a neighborhood of Houston increased housing value by \$2,253 per property.

Evaluation of Select Small Coastal Cities in Texas

Ordinances of select Texas coastal cities were analyzed to understand and identify how they integrated GSI practices. The cities were selected based on their population size and proximity to the Coastal Bend: Rockport (pop. 10,070), Port Lavaca (pop. 11,557), Portland (pop. 20,383), and Victoria (pop. 65,534).¹ By choosing similarly sized, similarly located cities, this information establishes a baseline of practices to show that amending ordinances to require GSI practices does not deter new development. People buy a home in an area for its location and amenities available around it. By incorporating GSI, which provides open spaces and increases the aesthetic appeal of a location, developers can see growth in market value and an improved bottom line for the company.

The nature of GSI ordinances depends on factors such as the population size, municipal capacity to manage a program, economy, soil type, and amount of annual rainfall. Smaller communities encounter many obstacles including smaller staff having less capacity to regulate implementation, maintenance, and enforcement of GSI requirements. To overcome this issue, cities employ cost-friendly ordinances with low-effort implementation – best management practices such as permeable surfaces (which let water seep into the ground), tree planting and native landscaping, vegetative buffers, or redesigning areas like parking lots to allow stormwater to infiltrate rather than runoff. More complex programs include stormwater fee rebates, tax abatement, and expedited permitting, all of which may require a larger administrative system. Cost effective and simpler GSI adjustments allow a municipality to avoid financial issues or perceived bias in making monetary rebates. These inexpensive measures can also be limited to specific development zones, overlay districts, or new developments. Even retrofit applications of these features can take place during renovation or modification of existing developments. Further, incorporation of such features can be encouraged through non-monetary incentives to preserve existing vegetation and invest in more green spaces. Examples of incentives and mandatory provisions based on the evaluation of the selected cities are provided in Table A below.

¹ The population size is based on the 2020 Decennial Census conducted by the U.S. Census Bureau.

TABLE A: Enabling Provisions in Ordinances for Green Stormwater Infrastructure

No.	Activity	Details	Examples
1. Incentives			
a.	Additional Units	Land use approach that encourages clustering residential homes on smaller lots and preserving more open spaces, vegetation and permeable surfaces.	Portland encourages cluster development in single family and duplex residential zones. Developments having 40% conserved area are allowed 10% more units.
b.	Additional Building Height	An incentive for developers that exceed certain requirements such as increased setbacks, preserving open space, or adding GSI onsite.	Victoria allows a 1-ft height increase for each additional 1-ft setback. In industrial areas, the incentive is 1 foot in height for every 2 feet of added setback.
c.	Non-Monetary Conservation Credit	Developers/owners receive credits by conserving a certain amount of open space or preserve trees. Credits can be used to offset other landscaping requirements.	Victoria requires one tree every 800 sq ft of required landscaped area. It can be met by preserving existing trees, depending on the caliper: 3-inch caliper trees earn 1 credit toward landscaped areas while a tree with a 6-inch caliper earns 4 credits. Rockport applies a point system for landscaping. Landscaping plans must attain a certain point level to be approved, which can be achieved in part by preserving existing vegetation ² or adding vegetation.
2. Mandatory Provisions			
a.	Minimum Landscaping	A specific percentage of property remains vegetated, resulting in greater permeable areas.	Port Lavaca and Victoria require non-residential and multifamily developments to landscape a minimum of 10% of the total site. Victoria limits the use of non-vegetative permeable material to 25% in landscaping areas.

² Existing vegetation is eligible to earn points based on size. Points are calculated based on the equivalency to newly planted vegetation or trees under a landscape plan. Open spaces under tree canopies may be eligible to earn points, but plants considered invasive are not allowed.

			Rockport requires the lesser of 5 sq ft per linear foot of street frontage or 15% of the defined street yard to be landscaped.
b.	Native and Drought Resistant Plants	Native plants tend to be drought resistant and have deep roots to absorb rain, prevent erosion, and filter pollutants. Such plants are generally hardy and require less water and maintenance.	Portland and Rockport require native and drought-tolerant plants in landscaping.
c.	Vegetated Buffer Areas	Natural or planted strip of vegetation between development zones or areas with special use help reduce runoff velocity, trap sediments, and filter pollutants.	Portland requires at least a 10-ft buffer with vegetation between differently zoned areas, buffers around parking lots, and buffers around manufactured home developments. Port Lavaca requires buffers around telecom towers and manufactured housing. Victoria requires buffers around parking lots, drives, and access easements abutting the street right of way.
d.	Trees	Trees filter pollutants, and provide uncompacted soil for increased runoff absorption. Minimum quantities, caliper, height, and species requirements ensure increased tree cover.	Port Lavaca and Victoria require one tree per 800 sq ft, with a 5-sq-ft landscaped area around it. Port Lavaca also requires trees planted on both sides of streets in non-residential and multifamily areas. Portland's tree requirements only apply to residential property and vary based on type of property.
e.	Vegetated Setbacks	Use of open, unpaved spaces that naturally absorb, filter, and manage rainwater.	Victoria has varying setback requirements for different zones ranging from 15-ft to 50-ft front setbacks, 5-ft to 25-ft rear setbacks, and 5-ft to 10-ft side setbacks. At least 70% of the required landscaping for the empty

			spaces of the building site should be in the setback adjacent to the streets. In contrast, Portland requires that front and side yards of all residential homes must be completely covered with sod or permanent vegetation. Port Lavaca and Rockport's setback requirements are similar but 20% smaller than Victoria's.
f.	Parking Lot Landscaping	Landscaped areas in parking lots should connect to hard surfaces to collect runoff to help offset localized flooding.	Portland requires landscaping for lots having more than 10 parking spaces, but has no requirement for water flow connection from hard surfaces to the landscaped areas or curb cuts. In contrast, Victoria and Rockport require landscaping in lots having at least 35 and 20 parking spaces, respectively. They require the parking lots to allow stormwater runoff to drain into the landscaped area. Rockport also requires all parts of a parking lot to be within 64 ft from the trunk of a tree unless otherwise approved. It has additional landscaping requirements for parking areas between property lines and the wall line of the building. These parking spaces are designed so the stormwater can drain into the landscaped areas.

Federal Incentives

A federal program, the Federal Emergency Management Agency (FEMA) Community Rating System (CRS), encourages communities to implement practices that exceed the statutory requirements under the National Flood Insurance Program (NFIP). Residents, rather than developers, receive the benefits. Communities earn points by using GSI practices, and the points allow their residents significant flood insurance premium discounts. Municipal GSI requirements can lower NFIP premiums by up to 45%. Rockport, for example, participates in FEMA CRS, and

has a rating of 7 based on its tree-preservation and open space incentives. This has resulted in a 15% discount on NFIP premiums for its residents. GSI activities which count towards the FEMA CRS points are provided in Table B below.

TABLE B: GSI Eligible for FEMA CRS Points

No.	GSI Feature	Description	CRS Points
1.	Open Space Preservation	Less development on flood prone areas can enhance the natural functioning of floodplains. Points are earned for open space preservation, natural flood control, water quality protection, and habitat preservation. Open space must be preserved in perpetuity. This can be achieved through subdivision design, cluster development, transfer of development rights, and planned unit development.	Maximum Score: 1,450 points for open space. Additional Score: 350 points for protection of natural floodplain.
2.	Natural Channel and Shoreline Protection	Preservation or restoration of stream, riverine, and coastal shorelines allow natural flood management processes to function. The credit is based on the fraction of protected shoreline in the community.	Maximum Score: 120 points.
3.	Stormwater Management Regulation	Regulations that require peak flows and runoff volumes after development to be no greater than before development are eligible for points.	Maximum Score: 380 points. 50% credit for control of runoff volumes. Adoption of Low Impact Development/Green Infrastructure for all development: 25 points. Measures to improve water quality: 25 points.
4.	Watershed Master Plan	A qualifying watershed master plan must be evaluated every five years. It plans for development to manage peak flow and volume of waterbody(s). Points are awarded based on plans that identify existing natural runoff features, prohibit modification of natural channels,	Maximum Score: 315 points.

		require soft materials for channel improvements, and have a dedicated source of funding.	
5.	Natural Floodplain Functions Plan	Communities that adopt plans to protect natural functions within the floodplain are eligible for points. Examples include open space corridors, connected wetlands, or habitat conservation plans.	Maximum Score: 100 points.

Additional Incentives

The following section provides examples of how larger cities in Texas have offered incentives for developers that integrate GSI into their developments. Their municipal governments have more capacity to address the more complicated regulatory functions needed for some incentives. This report discusses some of those practices.

North Central Texas Council of Governments (NCTCOG)

NCTCOG is a voluntary association of governments which provides regional planning, economic development, and social services. It serves 16 counties³ of North Central Texas, centered around Dallas (pop. 1,304,379) and Forth Worth (pop. 918,915). The NCTCOG has developed a program – the Integrated Stormwater Management (iSWM) program – to inform member governments on stormwater management and encourage adoption of GSI. The program includes the iSWM Criteria Manual for Site Development and Construction to assist in selecting sites with stormwater runoff in mind, and a Technical Manual.

NCTCOG suggests its members adopt best management practices through a point-based system. A minimum number of points are needed to meet the iSWM requirements for water quality. Additional points qualify for development incentives. The design practices are categorized into four categories: conservation of natural features and resources, lower impact site design techniques, reduction in impervious cover, and use of natural features for stormwater management. Design practices under each category are identified in Table C.

Development incentives can be monetary or non-monetary and are listed below. Monetary incentives can be burdensome for small cities as the incentives may require significant financial investment not just in the awards but in the personnel required to manage the programs. Non-monetary incentives can be cost effective for a municipality while attractive to developers.

³ The 16 counties and their 2020 census populations are: Navarro County (52,624), Ellis County (192,455), Johnson County (179,927), Somervell County (9,205), Erath County (42,545), Palo Pinto County (28,409), Hood County (61,598), Parker County (148,222), Tarrant County (2,110,640), Dallas County (2,613,539), Kaufman County (145,310), Rockwall County (107,819), Hunt County (99,956), Collin County (1,064,465), Denton County (906,422) and Wise County (68,632).

Monetary Incentives

- Waiver or reduction of fees.
- Waiver of maintenance or public maintenance.
- Stormwater user fee credits or discounts.
- Rebates, local grants, or reverse auctions.
- Low interest loans, subsidies, tax credits, or financing of special green projects.
- Awards and recognition programs.
- Local government public-private partnerships.

Non-Monetary Incentives

- Narrower pavement width for minor arterials.
- Use of vegetated swales in lieu of curbs and gutters for eligible developments.
- Reduced right of way requirements, i.e. sidewalk/utility easements.
- Increased density in buildable area, floor area ratios, or additional units in buildable area.
- Expedited review and inspections of plans.
- Reduction in other requirements.

TABLE C: Site Design Practices Provided under NCTCOG iSWM

No.	Activity	Detail	Maximum Points
1. Conservation of Natural Features and Resources			
a.	Preservation of Undisturbed Natural Areas	Undisturbed forested and vegetated areas, floodplains, stream corridors, and wetlands help preserve the original hydrology and avoid the impact that land compaction and alteration have on stormwater runoff and pollutants.	8
b.	Preserve Riparian Buffers	A continuous vegetated buffer that is uninterrupted by impervious areas allows stormwater to slow down and infiltrate before flowing into a stream.	8
c.	Avoid Floodplains	Development in floodplains can reduce their ability to convey and absorb stormwater, potentially causing safety problems or significant damage.	8
d.	Avoid Steep Slopes	Steep slopes can increase the velocity of the runoff and do not allow absorption, resulting in erosion and pooled stormwater at the end of the slope rather than infiltration.	3
e.	Minimize Siting on Porous Soils	Porous Soils have high infiltration rates and aid in reducing runoff volumes. Development should be limited in such areas.	3

2. Lower Impact Site Design			
a.	Fit Design to the Terrain	Avoiding mass grading by considering the landscape's natural topography, soils, and drainage paths at the design phase. This avoids erosion and new stormwater flood paths.	4
b.	Locate Development in Less Sensitive Areas	Strategically planning development to avoid sensitive areas allows the natural drainage to function.	4
c.	Reduce Limits of Clearing and Grading	Limits on the area that can be graded or cleared during construction minimizes the environmental footprint of development and encourages GSI such as tree retention.	6
d.	Use Open Space Development	The technique shifts the focus from conventional gray infrastructure like pipes and concrete culverts to natural and eco-friendly methods to water capture.	8
e.	Creative Design	Use of bioswales, rain gardens, and permeable pavers increases the aesthetic appeal of a property and support infiltration of stormwater into the ground.	8
3. Reduction of Impervious Cover			
a.	Reduce Roadway Length and Width	Right-sizing streets decrease stormwater runoff volume, reducing the need for costly, large scale gray infrastructure and allows integration of GSI.	4
b.	Reduce Building Footprint	Building upward or clustering the development decreases ground coverage, and uses landscaping to capture, filter, and absorb rainfall on site.	4
c.	Reduce Parking Footprint	Minimizing impervious surfaces in parking lots reduces urban heat and filters pollutants. Right-sizing parking lots and replacing asphalt with nature-based materials can promote groundwater recharge and reduce runoff.	5
d.	Reduce Impervious Setbacks and Frontage	Vegetated setbacks can reduce runoff. Limiting impervious surfaces of setbacks and frontage by requiring vegetation promotes retention of stormwater and greater infiltration.	4
e.	Use Fewer or Alternative Cul-de-Sacs	Impervious cover can be reduced by replacing traditional cul-de-sacs with alternative turnarounds (like	3

		hammerheads or loop roads) or using vegetated center islands.	
f.	Create Parking Lot Stormwater Islands	Landscaped depressions designed to collect, filter, and infiltrate runoff can replace traditional raised concrete medians to mitigate flooding and filter pollutants. This can also reduce irrigation needs.	5
4. Utilization of Natural Features of Stormwater Management			
a.	Use Buffers and Undisturbed Areas	Undisturbed natural features such as unfilled floodplains, stand of trees, established vegetation, wetlands, ponds, creeks, gullies, and other natural features retain stormwater and reduce flooding.	4
b.	Use Natural Drainageways Instead of Storm Sewers	Rather than funneling rainwater off concrete and into underground pipes, using vegetated swales and depressed green spaces to slow, filter, and absorb stormwater naturally.	4
c.	Use Vegetated Swales Instead of Curbs and Gutters	Instead of conventional concrete curb and gutter systems, vegetated swales slow stormwater runoff, reduce peak discharge rates, and naturally filter out pollutants like heavy metals and sediments.	3
d.	Drain Rooftop Runoff to Permeable Areas	Directing rooftop runoff onto permeable areas allows water to sink into the soil, filter out pollutants, and recharge local groundwater aquifers.	4

Cities in the Lower Rio Grande Valley (LRGV)

The Lower Rio Grande Valley (LRGV) has coastal cities with varying population sizes and similar soil composition to other Texas coastal areas. This can make it a useful comparison for small coastal communities. The LRGV task force helps cities develop management plans and manuals and provides training on ways to incorporate best management practices. Some cities give incentives for GSI adoption in the following ways:

- McAllen (pop. 142,210): The city uses a scoring system for multifamily, mixed use, and non-residential design to grant incentives to developers in the form of additional height, increased impervious cover, and additional dwelling unit per acre. Points are earned for maintaining and enhancing the natural environment, promoting conservation, low-impact development best practices, and enhancing building characteristics by incorporating green roofs.
- Edinburg (pop. 100,243): Density bonuses are provided to developers of single-family residential units to use cluster developments to allow greater open spaces. Also, the city

intends to create areas such as tree-lined streets and open spaces for recreation and stormwater management.

- **Brownsville (pop. 186,738):** The city provides score-based development incentives (similar to the NCTCOG iSWM) for single-family and duplex residential properties. Eligible techniques and practices include use of permeable surfaces for driveways, parking, and sidewalks, maintaining the natural environment, and using rainwater harvesting systems.

GSI Incentives in Ordinances

Irrespective of whether installation of GSI is mandatory or incentivized, cities can achieve higher standards through the adoption of ordinances. Mandates for GSI installations offer benefits for developers and property owners in the form of economic, recreational, aesthetic, and environmental value. Hence, it is essential that ordinances address GSI in a clear and explicit manner. Examples of language used by similarly situated municipalities' ordinances are provided in Table D below.

TABLE D: GSI Related Sample Language for Ordinances

No.	Activity	Sample Language
1.	Design Infrastructure to Withstand Severe Storms	All structures intended to address stormwater runoff, to include swales, detention/retention ponds, and storm sewers, shall be constructed to a 100-year, 24-hour storm standard. The post-development peak runoff rate of a lot should not exceed the pre-development peak runoff rate.
2.	Reducing Tree Requirements where Parking Lots Use Permeable Surfaces and/or Shared Parking Lots	(1) Islands, medians, and peninsulas between parking spaces must be landscaped with native and drought resistant plants. Material used for creating pathways must be permeable such as brick, pavers, or permeable asphalt. The parking spaces must slope in a manner to allow stormwater to drain into landscaped islands, medians, or peninsulas. Where curbs surround those areas, curb cuts shall be used to ensure stormwater runoff drains into the landscaped areas. (2) Each interior planting island shall contain canopy or understory trees of at least one and one-half aggregate caliper inches (ACI) per every 152-sq ft. (3) The total ACI requirements for canopy and understory trees may be reduced by 5% when: a. At least 30% of the total required parking is subject to shared parking agreement; or b. At least 20% of the parking surface is permeable.

3.	Additional Building Height for Increased Setback	(1) A developer may increase the height of the building beyond the maximum permitted height, by increasing the setback above the minimum requirement. The additional permitted heights are as follows: a. For all uses, 1-ft additional height per foot of additional setback. b. For industrial uses, 1-ft additional height per 2 ft of additional setback. (2) The setback must be vegetated and, to the extent practicable, incorporate stormwater design practices to minimize runoff.
4.	Increased Building Size for Low Impact Development Stormwater Management	(1) Single family and duplex dwellings which incorporate low impact development stormwater management may be eligible to receive developmental incentives such as 10-ft maximum height increase, additional 10 ft of building coverage, and 10% reduction in minimum lot size and 10% increase in maximum dwelling units. (2) Eligible low impact development include: a. Use of permeable paving for all driveways, sidewalks, and other paved surfaces, including brick or paver units, exposed aggregate, or improved permeable surface (excluding dirt, grass, or gravel). b. Altering the topography and elevation by no more than 4 ft for at least 80% of the subject property. c. Preserving at least 35% of the subject property unaltered in its natural state.
5.	Retention of Natural Temporary Detention/Retention Areas to Manage Stormwater	(1) Any construction in an area which functions as a natural temporary detention/retention of stormwater runoff shall be approved only upon verification by the city of plans to offset the stormwater storage lost by construction. Those plans shall: a. provide for an area in the immediate vicinity that will store an equivalent amount of stormwater; or b. where such stormwater offset is impracticable, increase the capacity of the onsite detention/retention facility. (2) This provision does not supersede any restrictions applicable in special flood hazard areas or other specifically designated flood zones.
6.	Non-issuance of Building Permit to Ensure Adequate	Where more than 30% of the total site of a multi-family development is covered by impervious surfaces/structures, the building inspector may refuse to issue a building permit after physical inspection of the lot and construction, if such

	Stormwater Drainage	construction would alter the flow of stormwater from pre-construction flow rates and patterns.
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Conclusion

GSI can be an opportunity for smaller coastal cities to manage stormwater runoff, increase property values, enhance the appeal of an area, mitigate flooding risk, and encourage development. Coastal cities in Texas can adopt cost effective best practices used by other smaller cities. Cost effective approaches like conserving natural areas, landscaping, and planting native species can improve drainage and water quality. Meanwhile, developers can be encouraged to adopt GSI through monetary and non-monetary incentives. Smaller cities can explore federal funding opportunities such as the CRS under FEMA to reduce their burden while also providing benefits to its residents.

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