North Central Texas Council of Governments

integrated Stormwater Management iSWM

Regional Impact

The health and viability of our region is dependent on the health and viability of our streams, soils, and water bodies. Without safe, clean, and reliable water, our social and ecological systems are negatively impacted.

When rainwater falls, it eventually finds its way into streams and water bodies. Where it ends up is determined by the contours of the land, and how clean it is depends on our treatment of the land between rainfall and water source.

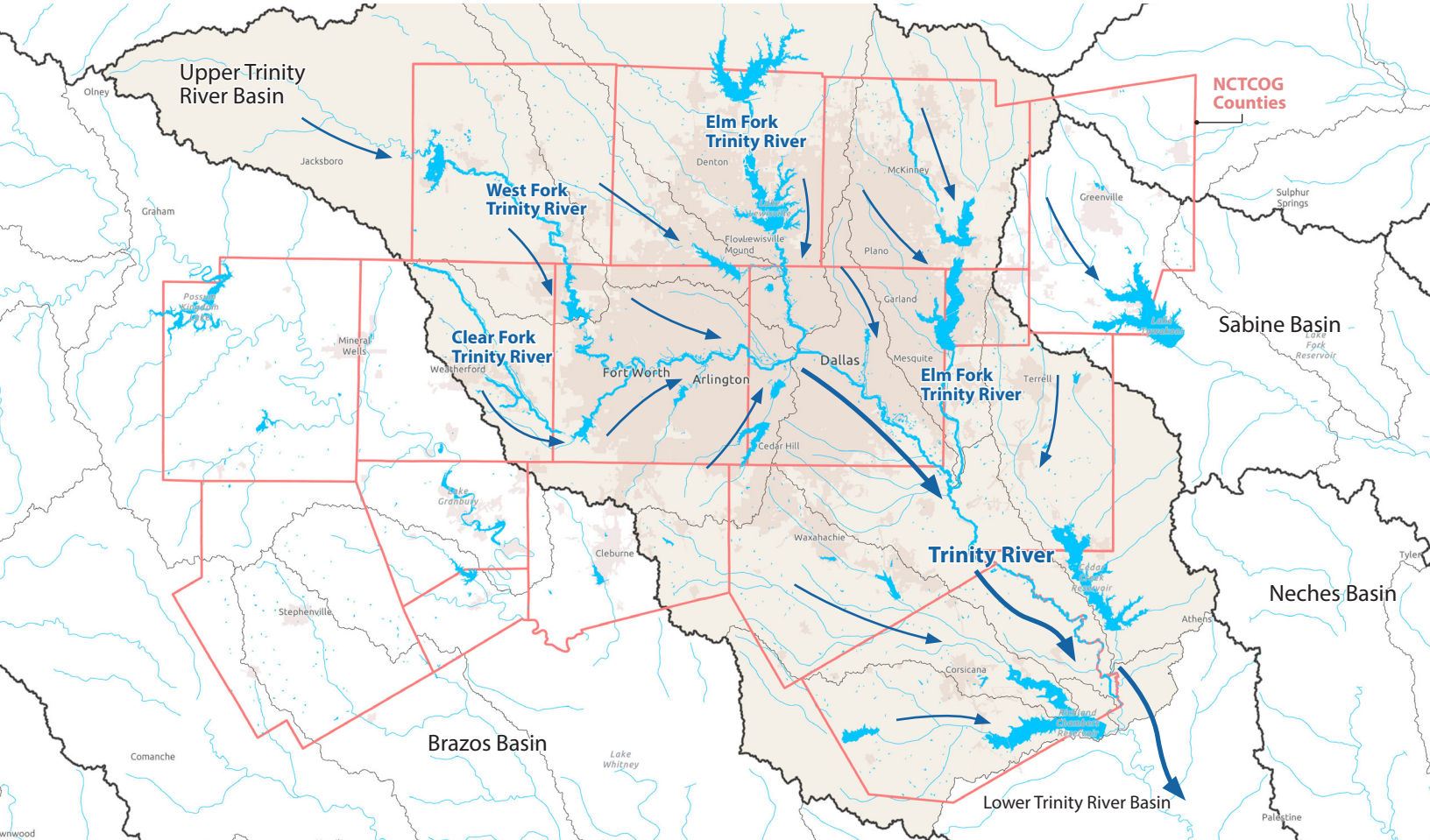
Crucially, watersheds span municipal boundaries. What happens upstream in our watershed does not just flow "away;" it has an impact downstream, with regional consequences.

It is therefore critical that action to protect and restore the health and safety of our water resources be coordinated at the regional level. The threats posed by degraded water quality, as well as the benefits provided by maintaining healthy water resources, are both regional in scale.

The regional impact of impaired waterways due to development is not abstract. Large amounts of impervious surface, such as pavement and buildings, lead to degraded water quality, air pollution, intensified heat waves, increased frequency and intensity of flooding, groundwater depletion, biodiversity loss, and higher carbon emissions. Streams and lakes become off-limits to recreation, instead of priceless quality-of-life amenities.

Each of these impacts carry price tags for municipalities, residents, and businesses that only rise as problems worsen. With an additional 3.5 million people expected to move to the region by 2045, the stress on our water resources will only compound with intensified development.

The good news is that when employed systemwide, green stormwater infrastructure offers a way to sustainably absorb population growth, improve the health and stability of the overall region, and generate places that are more human-friendly and economically vibrant. An integrated stormwater management system does much more than "green" our stormwater infrastructure. It is a multifunctional good: an economic asset, a boost to cost-effectiveness and water resource reliability, a climate mitigation strategy, a recreational outlet, and a life-support system.



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Cost Savings

Not only does green stormwater management contribute to beautification, recreational opportunities, and a healthier natural environment; it can bring significant cost savings for local governments (and ultimately, businesses and residents) over the long term as well. Green stormwater infrastructure has been found, through many research studies and municipal programs, to be both less costly and more cost-effective (that is, providing greater value in benefits for relatively lower costs) over the long term than equivalent grey infrastructure.

Construction & installation costs

Construction and installation of green stormwater infrastructure at sufficient scale may be 15 to 80 less expensive than conventional stormwater infrastructure, according to U.S. EPA.

Other reduced costs associated with GSI can include reduced land acquisition costs and reduced off-site costs imposed on others.

Maintenance intensity

While GSI methods may require more frequent maintenance than conventional stormwater infrastructure, they are much less intensive and expensive than maintaining high-cost built systems.

Widespread use of GSI can reduce overall runoff volume, thereby lowering costs (such as construction and maintenance of pipes and outfalls) associated with pumping runoff to a treatment plant or discharge area.

Flood damage

The integrated stormwater approach reduces peak runoff flow by infiltrating and retaining stormwater to mitigate downstream flood damage. The more stormwater that is allowed to infiltrate (or be harvested for reuse) upstream close to the source, the less the impact downstream will be. Therefore, targeted applications dispersed throughout the community add up to protect from serious damage, on top of the added social benefits of having neighborhood green space.

Energy costs

Energy costs can be lowered with green infrastructure applications.

- Green roofs add insulation that saves money on heating and cooling costs, and can even extend a typical roof's lifespan two to three times.
- Trees have a moderating effect on the local climate through shading, windbreak, and evapotranspiration.
- GSI helps lessen the urban heat island effect by replacing heat-trapping pavement with biomass, reducing the energy needs for air conditioning in summer.
- GSI that harvests and reuses rainwater can lower water and energy costs.
- Onsite reuse and infiltration reduce the amount of water that needs to be conveyed offsite.

Runoff

GSI reduces pollutant and thermal loads in stormwater runoff. Plants and soil provide pollutant filtration and groundwater recharge, reducing the need for costly pipe maintenance and water treatment. This also helps maintain more consistent stream flows and can moderate temperature fluctuations, which are a costly threat to aquatic habitats.

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Public Health

Well-integrated green infrastructure can be a positive contributor to public health. Improved air and water quality, moderated climates, reduced stress levels from exposure to greenery and the noise reduction provided by vegetation, and increased opportunities for recreation all have an impact on long-term illness and cost to health services and the public.

Impervious surface reduction

In urbanized settings, impervious surface poses a threat to water and air quality, and it worsens the urban heat island effect. Green infrastructure reverses the trend, making urban environments safer and healthier.

- Research shows that water quality becomes degraded when an area's impervious surface exceeds 10 percent.
- GSI helps manage pollution from runoff in a less costly and more cost-effective manner, while allowing cities to minimize impervious surface and boost vegetation.

Urban heat

Buildings, rooftops, and pavement absorb heat from solar radiation and release it continuously, so that air temperatures are elevated day and night. In summer, heat waves are exacerbated, causing stroke and even death among more vulnerable individuals. More people die yearly from heat waves than any other extreme weather event.

High air temperatures can accelerate smog and ozone formation, which can damage the lungs, trigger asthma attacks, and lead to the development of asthma in children.

- Studies show even small temperature reductions a positive impact on human health in urban environments.
- Vegetation cools the surrounding air through evapotranspiration. Shade from trees keeps surface temperatures lower; on a 100-degree day, unshaded blacktop can reach 160 degrees.
- Vegetation cleans the air, removing air pollutants such as nitrogen dioxide, sulfur dioxide, ozone, and even particulate matter. These pollutants contribute to and worsen respiratory diseases.

- Several cities have studied the impact of GSI components and found millions of dollars in avoided medical expenses due to air pollutant removal.

Recreation opportunities

Integrated green infrastructure can readily be designed to accommodate recreation. Parks with fields, linear greenways, and urban forests are all activity assets that improve quality of life and public health if they are easily accessible to residents.

Many individuals have difficulty incorporating regular exercise into their routine in part because of a lack of outdoor recreational opportunities nearby. Providing high quality green space for exercise can result in avoided medical expenses in addition to cost-effective water treatment.

Repeated studies have shown significant health benefits linked to living near urban green space. These links include:

- Reduced all-cause mortality—and especially related to strokes, cardiovascular and respiratory diseases, and heat waves—and increased lifespan
- Improved mental health and cognitive function—including lower levels of depression, anxiety and stress
- Reduced prevalence of obesity and type-2 diabetes
- Improved immune system function

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Climate

Green infrastructure is vital to both mitigating and adapting to the worst effects of climate chaos, which intensify weather patterns and threaten local resources and human health.

Heat

Investing in large-scale, high-quality GSI can produce a kind of natural air conditioning for urban area, which suffer from heat island effects due to extensive pavement, which absorbs heat more readily than any natural landscape.

- The microclimate control benefits—due to both shade and evaporative cooling—from trees and green space can be significant in developed areas, and can contribute lower energy use for heating and cooling for residents and businesses.
- Street trees cool and clean the air and cools pavement that would otherwise be absorbing direct sunlight and radiating heat day and night.
- Reducing urban air temperatures also decreases smog; a 1-degree temperature decrease can make the air 3 percent less smoggy.

Flooding

Heavy downpours have increased in both frequency and intensity over the past half century, and this trend is predicted to continue as global temperatures rise. Cities of all sizes are perpetually at risk for extreme flooding, as the average 100-year floodplain is expected to grow by 45% by the end of this century.

- At a large scale, integrated stormwater management reduces stormwater runoff and preserves floodplain, helping protect surrounding areas from localized and river flooding.
- Restoring and preserving natural stormwater flow reverses the trend of pushing the worst effects downstream.

Drought

Climate change is stressing fragile local water supplies as drought intensifies. When it does rain, impervious surfaces carry this scarce resource away, discharging directly into water bodies and storm drains. Worsening heat also contributes to large increases in evapotransipration.

- Rain gardens, green streets, and other GSI types let rainwater soak into the ground, replenishing local groundwater and storing it for when it is most needed.
- At a smaller scale, rainwater can be harvested for reuse, saving the need for water brought in from offsite for irrigation or potable uses. As much as 75 percent of the rain that falls on a rooftop can be captured and reused.
- Steady groundwater supplies are necessary for drinking water and irrigation; they also provide essential baseflow for rivers and help maintain water levels in wetlands and lakes.

Carbon

Extensive green infrastructure networks can provide carbon storage and sequestration through soil and biomass. The greatest contributors are intact natural systems such as grasslands, woodlands, and wetland networks, but even smaller installed applications provide significant benefits over grey infrastructure.

- One study found significant carbon footprint mitigation from bioretention basins (70%), green roofs (68%), and vegetated swales (45%).