ARIZONA WATER CONSERVATION FACTSHEET

Green Stormwater Infrastructure (GSI)

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THE UNIVERSITY OF ARIZONA COOPERATIVE EXTENSION
WATER RESOURCES RESEARCH CENTER
wrrc.arizona.edu/conserve

Stone Dip Pocket Park

The Town of Superior is located in Pinal County, Arizona, whose watershed is defined by the Apache Leap escarpment towards the east and the volcanic Picketpost Mountain to the southwest. This biogeographically diverse town has a rich past with historically naturally flowing water through Queen Creek, the major drainage area of the surrounding region. The elevation ranges from 2,400 feet near Boyce Thompson Arboretum to 5,630 feet near King's Crown peak, creating elevation-driven biotic communities.[1] The landscape hosts Upper Sonoran desert scrub in the lower regions and oak-juniper woodlands at higher elevations. Additionally, Queen Creek supports riparian zones that increase the biodiversity of an arid/semi-arid ecological zone.

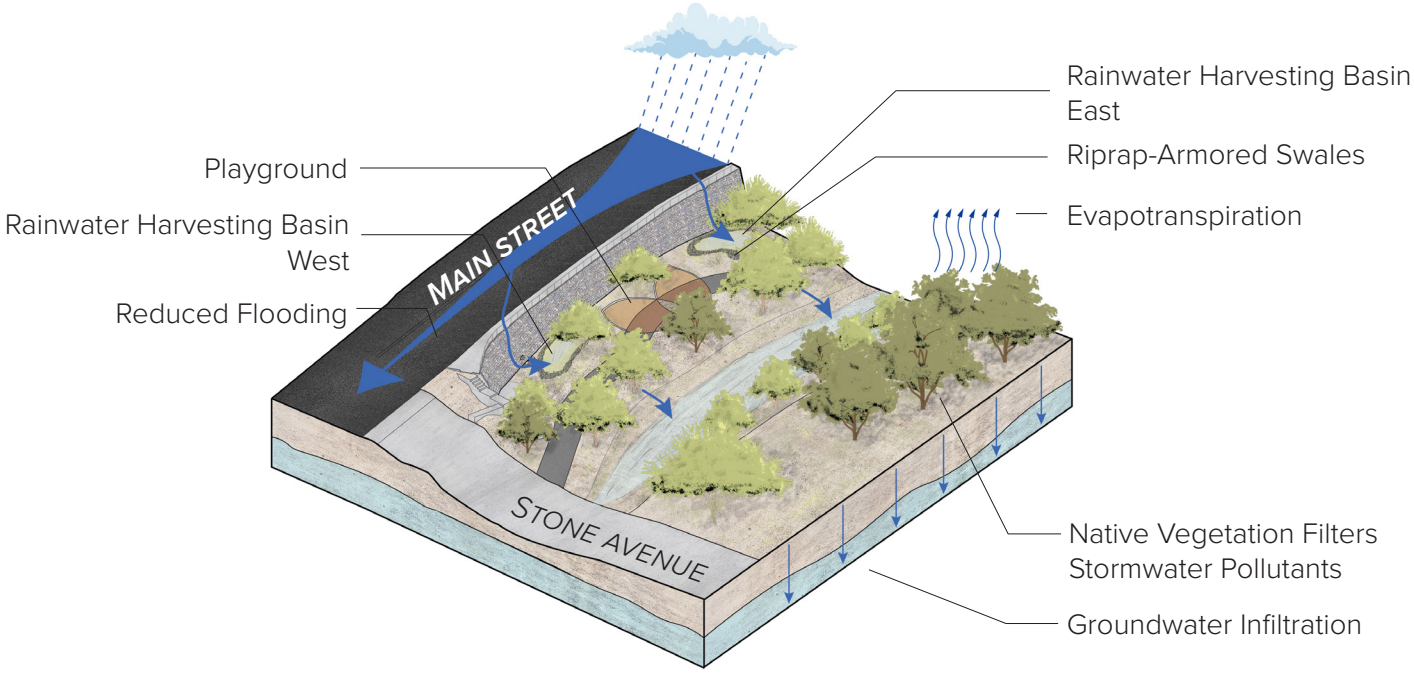


Figure 1. Stone Dip Pocket Park green stormwater infrastructure features.

Superior receives an average of 18.70 inches of rain annually and can accumulate up to 4 inches of precipitation during extreme storms such as summer monsoons or Pacific originating hurricanes in the fall.[2] These periods of heavy rain and the town's vertical topography put much of Superior along Queen Creek at a 10% annual risk from flash flooding that can cause property damage of ($350,000 annualized per year) to homes, businesses, and roads.[3]

Stone Dip Pocket Park serves as an interactive space that reflects water restoration, natural beauty, and an engaged community. Situated on the corner of Main Street and South Stone Avenue and set directly next to Queen Creek, the park addresses flooding, water infiltration, soil and vegetation restoration through Green Stormwater Infrastructure (GSI). GSI features divert water runoff from Main Street, to enter Stone Dip Pocket Park during rain events. Rain Collection Gardens and Bioswales capture runoff, allowing water to naturally infiltrate the soil during storms and promote water recharge. Water is filtered by rainwater harvesting basins filled with mulch and native arid-adapted plants (Figure 1).

Thanks to the generous donation of the site by David Korak and family, along with funding from the Water Infrastructure Finance Authority of Arizona Water Conservation Grant Fund, the Town of Superior has the opportunity to implement green infrastructure strategies such as GSI and promote water infiltration to the community's groundwater. Moreover, Stone Dip Pocket Park aligns with Pinal County's Drought response plan to implement voluntary reduction in water use throughout the county. Through signage in the park and demonstration workshops, the park will provide a platform for community members to educate visitors on drought-related shortages, reliance on non-renewable supplies, and groundwater depletion.

To increase public awareness about the multiple benefits of water conservation for human and environmental systems, Stone Dip Pocket Park is a community showcase that:

- Creates shaded outdoor space with attractive landscape features
- Uses native and desert adapted plants
- Demonstrates sustainable irrigation practices
- Encourages water infiltration to groundwater near Queen Creek
- Provides a space for public education
- Demonstrates landscaping water conservation techniques

Green Stormwater Infrastructure

The process of urban development typically involves deforestation, an increase in impervious surfaces, and an alteration of water flow and temperature. This creates a hydrological phenomenon called "urban stream runoff," causing a decrease in water quality and increase in flooding. Urbanization also causes the "heat island effect," an increase in temperature within developed areas, affecting precipitation patterns and adding stress to the natural environment.[4] Additionally, some communities like the Town of Superior, have altered surface flows due to historic and ongoing copper mining operations. Arizona produces approximately 65% of the United States' copper, with 27 major mines producing more than 23 million pounds of copper per year.[5] Green Stormwater Infrastructure is a low-impact development method of construction that can help mitigate urbanization and mining impacts.

Water runoff typically travels down roads and other impervious surfaces towards grey infrastructure, which includes drains and sewer systems. In larger cities (not the case for Superior), water runoff can be diverted to wastewater treatment plants so that water can later be used for irrigation. Nationally public works professionals are realizing the disadvantages of grey infrastructure and its inability to process large quantities of water without vast resources, making it vulnerable during times of heavy precipitation.[6] As studies show that rainfall intensity is increasing, urban areas will begin to face more damage and water pollution if urban landscapes do not change. Utilizing Green Stormwater Infrastructure as an alternative, water is instead diverted to bioretention systems that allow water to seep into the soil.

The benefits of Green Stormwater Infrastructure include:

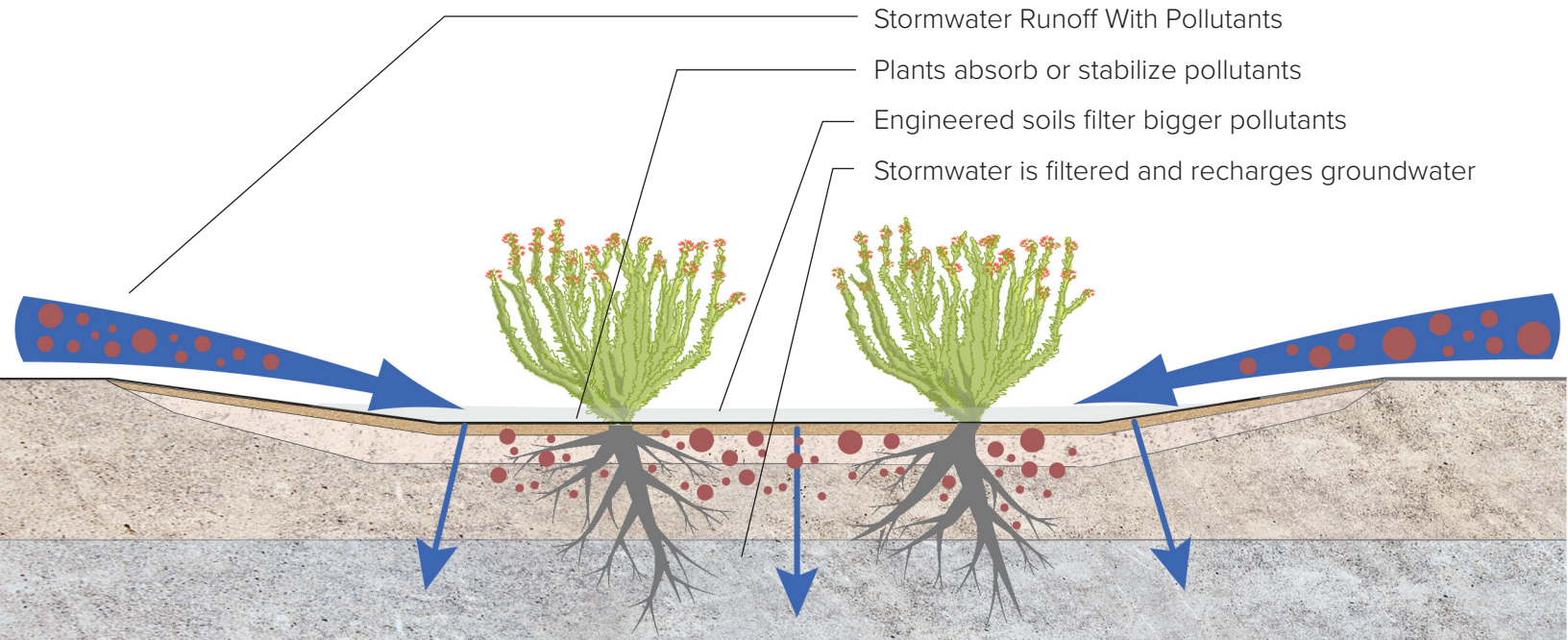
- Decreasing water on streets
- Encouraging pollinators
- Increasing soil moisture
- Lowering neighborhood temperature
- Providing sustainable water for plants
- Reducing flooding
- Reducing water pollutants
- Reducing dust in the air

Water Infiltration and Recharge

Long-term drought continues to persist across Arizona and temperatures have increased by 2.5° F in the past two decades. Monsoon precipitation has become highly variable but mountain regions will experience heavier rainfall events.[7] This causes changes to natural systems such as increased evapotranspiration and streamflow decline, adding stress to groundwater supplies. Groundwater, a vital water resource for many areas in Arizona, is found in aquifers at varying depths. Statewide 40% or more of the annual water supply comes from groundwater. Due to multiple factors such as drought from climate change, irrigation and municipal pumping, some basins have declining groundwater that is in need of recharge enhancement.[8] In the case of Superior, these impacts can be seen at Queen Creek, which once flowed through town as a perennial creek. Today, Queen Creek is an ephemeral creek due to geologic fracturing in the upper watershed. This is due in part from 1900's historic mining efforts, current mining dewatering, lack of infiltration, and drought conditions.

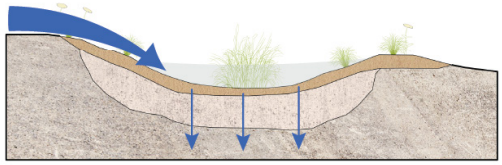
As the occurrence of extreme weather events increases, towns in Arizona, view stormwater as an episodic source of water that can increase groundwater recharge. Using Green Stormwater Infrastructure to divert stormwater into permeable surfaces promotes soil infiltration, the downward entry of water into soil that filters water biologically, physically, and chemically.[9] For example, ammonia, a positively charged nitrogen formed chemical and is usually naturally filtered through the soil's negative charge. By introducing specific soils into bioretention swales and rain gardens, contaminants can be filtered before water reaches native soils and water sources.

The addition of specific vegetation in rain gardens provides an opportunity to clean stormwater pollutants through phytoremediation. Phytoremediation is a low-cost method of treating pollutants found in soil and groundwater that utilizes plants to either remove or stabilize heavy metals and other toxic elements. With phytoremediation, it is important to use native plants to help perpetuate a healthy ecosystem. In the case of Stone Dip Pocket Park, plants such as Desert globemallow (*Sphaeralcea ambigua)*, or Brittlebush (*Encelia farinosa)*, are native to the Sonoran Desert and stabilize pollutants accumulated from mining and impermeable surfaces at the roots, preventing further transport.[10] [11]
A co-benefit to increasing soil infiltration and promoting water recharge is the development of high-quality riparian ecosystems, important habitat that supports plants and wildlife.

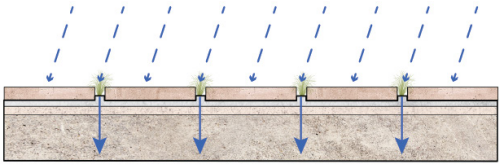


Green Stormwater Infrastructure Components

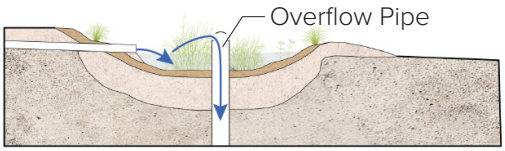
- **Rainwater Harvesting Basins** – These are shallow depressions in the ground that capture rain, improve soil infiltration, and promote groundwater recharge. They are typically sized to support rainfall capture calculated from potential stormwater run-off in the watershed.


Rainwater Harvesting Basin

- **Permeable Paving** - The use of porous concrete or an alternative method of paving that allows rainwater to travel through the pavement, thereby providing water to the surrounding landscape.

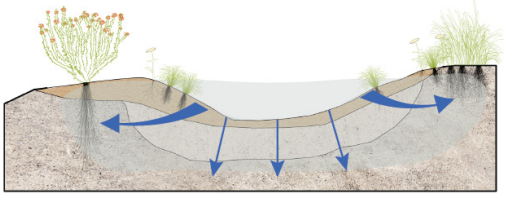

Permeable Paving

- **Rain Gardens** – Used as the bridge between street runoff and natural landscapes, also known as bioretention systems, flow-through planters, and pervious strips, they are designed to promote water recharge, soil infiltration, and channel clean water downstream.

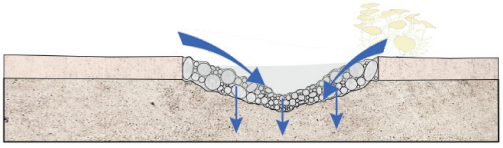


Rain Garden

- **Passive Irrigation** – Passive irrigation reduces flooding by leading rainwater into landscaped areas and tree pits, which then irrigates the vegetation. Passive irrigation is one of the simplest methods of implementing GSI into local designs.


Passive Irrigation

- **Rock Check Dam in a Swale** – Small structures made of rocks or other materials that reduce erosion by reducing water flow. Check dams also double as sediment traps, which collect particles and protect drainage systems. A swale is a shallow channel to help slow water.


Rock Check Dam in a Swale

Getting Started

Green Stormwater Infrastructure is not just for public spaces. It can also be implemented in private residences to create a greater impact for local communities. By incorporating GSI strategies at home, neighborhoods begin to reduce temperatures, use less water for irrigation, and encourage native pollinators. Simple rain gardens and bioswales are a great start to rainwater harvesting in your own backyard.

Please follow the blue WRRC or the green Superior Sustainability Elevated QR code links below to find additional resources and references used for the creation of this factsheet or **wrrc.arizona.edu/conserve**.

Preparation of this Factsheet was funded by the Town of Superior, the Water Infrastructure Finance Authority of Arizona Water Conservation Grant Fund, and by the Technology and Research Initiative Fund (TRIF)/Water, Environment, and Energy Solutions Initiative, administered by the University of Arizona Office of Research and Partnerships.

Additional Resources and References
wrrc.arizona.edu/conserve

WATER INFRASTRUCTURE FINANCE AUTHORITY OF ARIZONA