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Tools and Techniques for Green Infrastructure

In 2010, the Jordan River Commission was created by interlocal agreement to implement the vision outlined in the *Blueprint Jordan River*. This visioning document highlights the endless opportunities for the Jordan River corridor to enrich quality of life in our region through education, recreation and economic development. The vision includes preservation of open space, completion of trails and recreational facilities, water quality improvements, river-oriented economic development, habitat restoration, and overall enhancement of the Jordan River corridor.

Over 3,000 people participated in the process to develop the *Blueprint Jordan River*, and the final document underscores the community's clear desire to enhance this unique resource. The vision has since been adopted by resolution by every local government along the river's length, and many stakeholders are actively working towards its river corridor enhancement and restoration.

The *Blueprint Jordan River* planning process clearly stated the community's desire to see green infrastructure implemented along the river. Eighty percent of survey respondents requested a green and recreation-based corridor as their preferred land use vision for the river corridor. Approximately 66 percent of respondents identified a preserved natural corridor would be the best long-term economic use of the river. A set of guiding principles encapsulate the plans commitment to green infrastructure, including establishing buffers between the river and the built environment, replacing structural water conveyance devices with alternatives that allow for flood management plus improvements for water quality, recreation, and habitat, reduce the use of hardscapes and impermeable surfaces in and near the corridor, and managing stormwater on site.

Approximately 37 miles of the Jordan River fall on the Clean Water Act's 303(d) List of Impaired Waters for *E. coli*, heavy metals, total dissolved solids, dissolved oxygen, temperature, and macroinvertebretes. Stormwater is a major cause of non-point source water pollution. When precipitation falls on our roofs, streets, and parking lots, the water cannot soak into the ground. Instead, runoff drains into the stormwater conveyance system on its way to the Jordan River. This carries with it trash, bacteria, heavy metals, and other pollutants. High flows and increased velocities from traditional engineering methods can cause erosion and flooding in downstream low-income communities along the river, damaging habitat, property, and infrastructure. In addition to the environmental benefits, green infrastructure will elevate quality of life, raise property values, attract tourism and recreation dollars, and incentivize new businesses to locate in the region.

The Jordan River Commission is supportive of all proposals and funding tools dedicated to helping implement this long-range, community-driven vision. We look forward to working with local governments to explore a variety of tools and techniques to assist in implementing green infrastructure along the 50-mile Jordan River corridor.

What is Green Infrastructure?

Green infrastructure is an approach to mimic a site's natural characteristics in managing precipitation events. Approaches work to infiltrate, evapo-transpire, capture, and reuse stormwater at its source This can replace traditional stormwater conveyance systems, which emphasizes the movement of stormwater through curbs, pipes, ditches, and ponds. Green infrastructure is often more cost-effective, sustainable, and environmentally-friendly, when compared to the traditional methods.

Benefits of Green Infrastructure

As communities along the Jordan River continue to develop and climate patterns shift, green infrastructure will be an important tool to replace single-purpose gray stormwater infrastructure, improving water quality while delivering other environmental, social, and economic benefits. The benefits of green infrastructure include:

1. Water Quality

Green infrastructure traps runoff, allowing the water to be soaked into the ground and preventing sediment from entering the Jordan River. Vegetation can retain excess nutrients prevalent in runoff, such as fertilizers from lawns. When concentrated downstream in the Jordan, nutrients can create toxic algal blooms. Sediment and suspended solids, such as leaf debris and other organic material, are trapped through green infrastructure.

2. Flooding

Green infrastructure can mitigate flooding by retaining, slowing, and reducing peak stormwater discharges in precipitation events. Traditional infrastructure pipes and culverts stormwater, increasing velocities and flows downstream along the Jordan River. By slowing down stormwater and decrease its supply, erosion and the flood risk can be reduced.

3. Water Supply

Through rainwater harvesting systems, precipitation can be used for outdoor irrigation to reduce reliance on potable water use. Green infrastructure can promote groundwater recharge. As climate change affects the drinking water system along the Wasatch Front, groundwater will become an importance source of potable water.

4. Private & Public Cost Savings

Green infrastructure can reduce the need for large capital costs in building and maintaining expensive traditional infrastructure projects. Rainwater harvesting can reduce landowner costs related to municipal water use. In turn, this will reduce the continued need for new and larger water treatment plants with a growing population along the Wasatch Front.

5. Air Quality

The increased use of green infrastructure can increase the urban forest canopy. This vegetation can soak up air pollutants, such as ozone and particulate matter. The canopy can also reduce air temperatures through shading, reducing energy use for air conditioning.

6. *Climate Resiliency*

As climate change puts stress on traditional infrastructure, green infrastructure is a flexible, sustainable, and more resilient solution for communities to mitigate the impacts of climate change.

7. *Habitat & Wildlife*

Green infrastructure can provide vital habitat for the wildlife along the Wasatch Front. Large-scale parks and open space can provide connectivity for wildlife movement and small-scale rain gardens and green roofs can provide habitat for insects, pollinators, and birds. By reducing erosion and sedimentation, green infrastructure also directly improves habitat along the Jordan River.

8. *Green Jobs*

Jobs can be created to meet the increasing demand for green infrastructure in its construction and maintenance. As new training and certification programs emerge, low-skill workers from low-income communities along the Wasatch Front can get jobs bettering their communities.

9. *Recreation*

Green infrastructure corridors can become new spaces to put mixed-use trails for active transportation and recreation. Additional, bird and wildlife watching can become new activities for nature-starved urban families and children to experience nature without leaving the city.

10. *Health Benefits*

Nature is an important physical and mental necessary for residents in an urban environment. Green infrastructure brings nature closest to where people live, work, and play. Through increased recreation and active transportation opportunities, green infrastructure encourages outdoor physical activities. Increase vegetation and tree canopy coverage can reduce air pollutants and reduce respiratory ailments, leading to decreased hospital admissions, workday absences, and premature death.

11. *Property Values/ Economic Development*

Green infrastructure can beautify neglected or degraded portions of cities, increasing surrounding property values to benefit both developers and homeowners. These areas can also promote economic development as business owners located near green spaces and popular spaces in cities.

Types of Green Infrastructure

1. *Rainwater Harvesting & Downspout Disconnection*

During precipitation events, roofs become a large surface area with the potential to collect and trap rainwater. Rooftop drainage pipes can be redirected into cisterns, gardens, or other permeable areas to store and/or infiltrate the water into the soil. They can significantly slow and reduce the amount of water flowing into the stormwater system and reduce dependence on municipal water use for the outdoors.

2. *Bioswales, Rain Gardens, & Planter Boxes*

Bioswales, rain gardens, and planter boxes are important tools in varying sizes to retain and treat stormwater as it soaks into the ground or moves into the stormwater systems. They are attractive, vegetated bioretention basins to mimic the natural hydrology of the site and provide green, nature space in urban environments. They can also provide key habitat for insects, pollinators, and the wildlife that depends on these species, such as neotropical migratory birds along the Jordan River.

3. Permeable Pavement & Green Streets

Permeable pavement and green streets work to catch, treat, and infiltration precipitation where it falls. a good example of a practice that catches water where it falls. This can be particularly cost effective when land values are high. This technique can also mitigate icy roads as precipitation is soaked into the ground, rather than trapped on the road surface. Green streets can combine green infrastructure techniques, such as bioswales, rain gardens, and planter boxes, with permeable pavement. Additional benefits include mitigating the urban heat island effect and creating a better pedestrian sphere and walkable environment.

4. Green Roofs

Green roofs are covered with a growing media and vegetation to trap, filter, and sometimes store precipitation. This technique is useful to reduce stormwater management costs for large industrial and office buildings. It also can be cost-effective in dense urban areas with high land values. Green roofs can provide habitat for insects, pollinators, and birds, as well as reduce energy costs related to cooling and heating buildings.

5. Urban Tree Canopy

Increase tree canopy can provide habitat and mitigate the urban heat island effect, while providing vital habitat for neotropical birds and the other wildlife of the Jordan River corridor. Trees soak up stormwater through their leaves and roots, reducing the runoff into the Jordan River. Tree planting events are a good opportunity to involve residents, businesses, and community in the restoration of the Jordan River.

6. Land Conservation

Increase open space and river buffers help to mitigate flooding, promoting stormwater recharge, filter pollutants, and create vital riparian habitat. These areas can provide passive and active recreation opportunities for Wasatch Front residents.

7. Stream Restoration & Daylighting

According to the Center for Watershed Protection, headwaters and stream restoration is the most cost-effective way to improve water quality. Many urban waterways, including those that feed the Jordan River, have been channelized or even buried. This has led to increased erosion, sedimentation, and other water quality concerns. By restoring and uncovering these streams, water quality impairments can be improved, floods can be mitigated, and many additional social and environmental benefits follow.

Planning & Policy Tools

1. General

It is important for communities to define the goals of implementing green infrastructure along the Jordan River. These goals will help stakeholders develop infrastructure to achieve compliance with established standards. A set of metrics will help measure and quantify the impacts of green infrastructure in achieving goals. It is important to then modify the goals and standards to achieve the best result for the community.

2. Water Quality

Section 303 of the Clean Water Act authorizes the establishment of designated uses for a particular water source. Primarily, the Jordan River is protected for recreation, such as boating and fishing, and

aquatic wildlife, including cold water species, warm water species, and waterfowl in different stretches. Antidegradation policies can require a review of proposed discharges into the Jordan River and suggest the use of green infrastructure to mitigate any impacts.

3. Total Maximum Daily Loads

Approximately 37 miles of the Jordan River are designated on the Clean Water Act's 303(d) List of Impaired Waters. Salt Lake County developed the 2015 Salt Lake County Integrated Watershed Plan to guide restoration of the Jordan River and the other impaired waterways of Salt Lake County. This document lays out the Total Maximum Daily Load of the Jordan River and strategies to mitigate water quality impairments, of which green infrastructure is a major component.

4. MS4 Permits

Municipal Separate Stormwater Sewer System communities along the Jordan River are required to obtain a National Pollutant Discharge Elimination System Permit and develop a stormwater management program. Green infrastructure can be an integral component to reduce the amount of stormwater discharge into the Jordan River. MS4 permits can require or incentivize green infrastructure through performance standards, impervious surface restrictions, stormwater credits, and other techniques.

Online Tools & Resources

1. Green Infrastructure Wizard

GIWiz is an interactive web application that connects communities to EPA Green Infrastructure tools and resources, where users can produce customized reports.

2. Watershed Management Optimization Support Tool

WMOST is a software application designed to facilitate integrated water resources management across wet and dry climate regions. The tool allows water resource managers and planners to screen a wide range of practices, including traditional grey infrastructure, green infrastructure, and other low impact development practices, across a watershed or jurisdiction for cost-effectiveness and economic sustainability.

3. Visualizing Ecosystems for Land Management Assessment

VELMA is a computer software model that regional planners and land managers can use to quantify the effectiveness of natural and engineered green infrastructure management practices for reducing nonpoint sources of nutrients and contaminants in streams, estuaries, and ground water. These include riparian buffers, cover crops, and constructed wetlands.

4. Storm Water Management Model

SWMM is a dynamic hydrology-hydraulic-water quality simulation model used throughout the world for stormwater runoff reduction planning, analysis, and design of combined sewers and other drainage systems. It allows users to represent combinations of green infrastructure practices to determine their effectiveness in managing runoff. SWMM was developed to help support local, state, and national stormwater management objectives to reduce runoff through infiltration and retention.

5. National Stormwater Calculator

SWC is a desktop application that estimates the annual amount of stormwater runoff from a specific location in the United States (including Puerto Rico), based on local soil conditions, land cover, and

historic rainfall records. It is used to inform site developers on how well they can meet a desired stormwater retention target with and without the use of green infrastructure. It also allows users to consider how runoff may vary based both on historical weather and potential future climate. SWC was mentioned in President Obama's Climate Action Plan and is now a resource for LEED Project Credit 16 (Rainwater Management) certification by the U.S. Green Building Council for projects that are designed to reduce runoff volume and improve water quality of a site.

6. *Other Online Tools*
   - *Bioretention, Permeable Pavement, Green Roof, and Rainwater Harvesting Models* – North Carolina State Cooperative Extension
   - *Delaware Urban Runoff Management Model (DURMM)* – Delaware Department of Natural Resources & Environmental Control
   - *Green LTCP-EZ* – Environmental Protection Agency
   - *Green Save Calculator* – Green Roofs for a Healthy Cities
   - *Green Values National Stormwater Management Calculator* – Center for Neighborhood Technology
   - *Hydrologic Modeling System* –Army Corps of Engineers
   - *Hydrological Simulation Program – Fortran* –Geological Survey
   - *i-Tree* – US Forest Service
   - *Low Impact Development Quicksheet* – Milwaukee Metropolitan Sewerage District
   - *Long-Term Hydrologic Impact Assessment Model* – Local Government Environmental Assistance Network
   - *Program for Predicting Polluting Particle Passage through Pits, Puddles, and Ponds* – William Walker
   - RECARGA - University of Wisconsin – University of Wisconsin Madison College of Engineering
   - *Site Evaluation Tool* – Tetra Tech
   - *Source Loading and Management Model* – PV & Associates
   - *Stormulator* – State Water Resources Control Board, University of Carolina Davis Extension, and the California Sea Grant Program
   - *Watershed Treatment Model* – Center for Watershed Protection
   - *WinTR-55* – Natural Resources Conservation Service

Available Grants & Programs

1. *Federal Grant & Financial Assistance Programs*
   - Department of Agriculture – National Urban and Community Forestry Program
   - Environmental Protection Agency – Clean Water Act Nonpoint Source Grant (Section 319)
   - Environmental Protection Agency – Clean Water State Revolving Fund
   - Department of Housing & Urban Development – Community Development Block Grant Program
   - Fish & Wildlife Service – Neotropical Migratory Bird Conservation Act Grants
   - Fish & Wildlife Service – North American Wetlands Conservation Act Grants

2. *State & Local Grant & Financial Assistance Programs*
   - Municipal – Capital Improvement Programs

3. *Private Grant & Financial Assistance Programs*
   - National Fish & Wildlife Foundation – 5-Star & Urban Waters Grant Program
   - Surdna Foundation – Urban Water Management Grants
   - Institute for Sustainable Communities – Partnership for Resilient Communities