Guerrilla Green Infrastructure

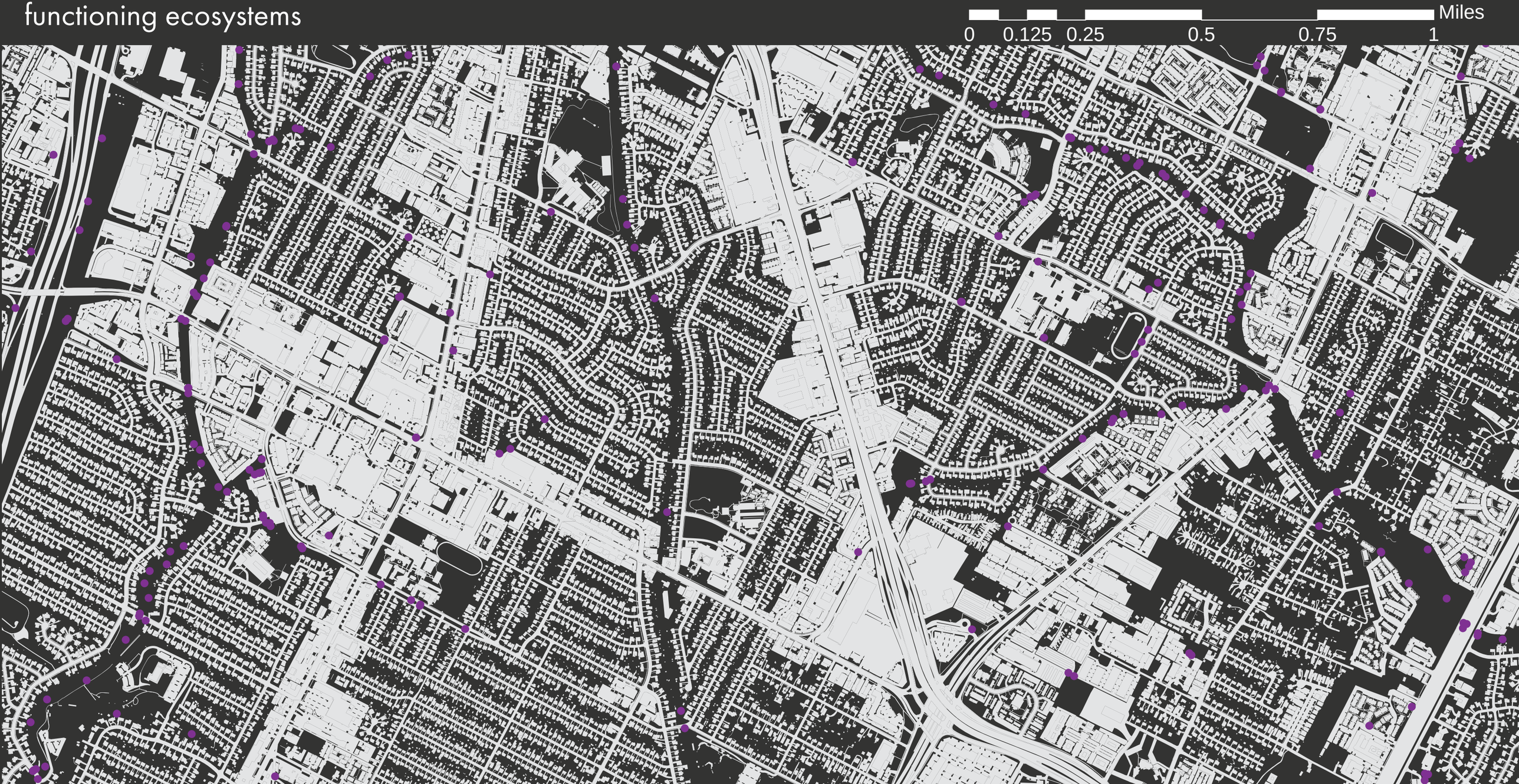
Tom Ludwig, MLA

DOTTIE JORDAN REC CENTER

Gray vs Green

Filling in the Gaps

Watersheds in urban areas are full of impervious surfaces that prevent infiltration and significantly alter the natural hydrology of an area. Guerrilla Green Infrastructure aims to capitalize on underutilized spaces and transform them into functioning ecosystems



What is Green Storm Water Infrastructure?

Green Infrastructure is a combination of engineering, ecology and landscape design to form living systems which provide ecological and environmental benefits by augmenting traditional urban infrastructure.

CRESTVIEW & WOODROW

Tools in our Tool belt | Biofiltration

The centerpiece of green infrastructure, biofiltration allows water quality treatment to be incorporated into the landscape. The key feature is a biological community of plants and organic soil microorganisms that remove pollutants through physical and biogeochemical filtration.

Types of Green Infrastructure | Rain Gardens (Infiltration Basins)

Rain Gardens are shallow, landscaped depressions designed to collect and infiltrate storm water

Types of Green Infrastructure | Berms (Smiles)

Raised earth on slopes too steep for a rain garden can trap water and allow it to infiltrate into the ground

Types of Green Infrastructure | Swales

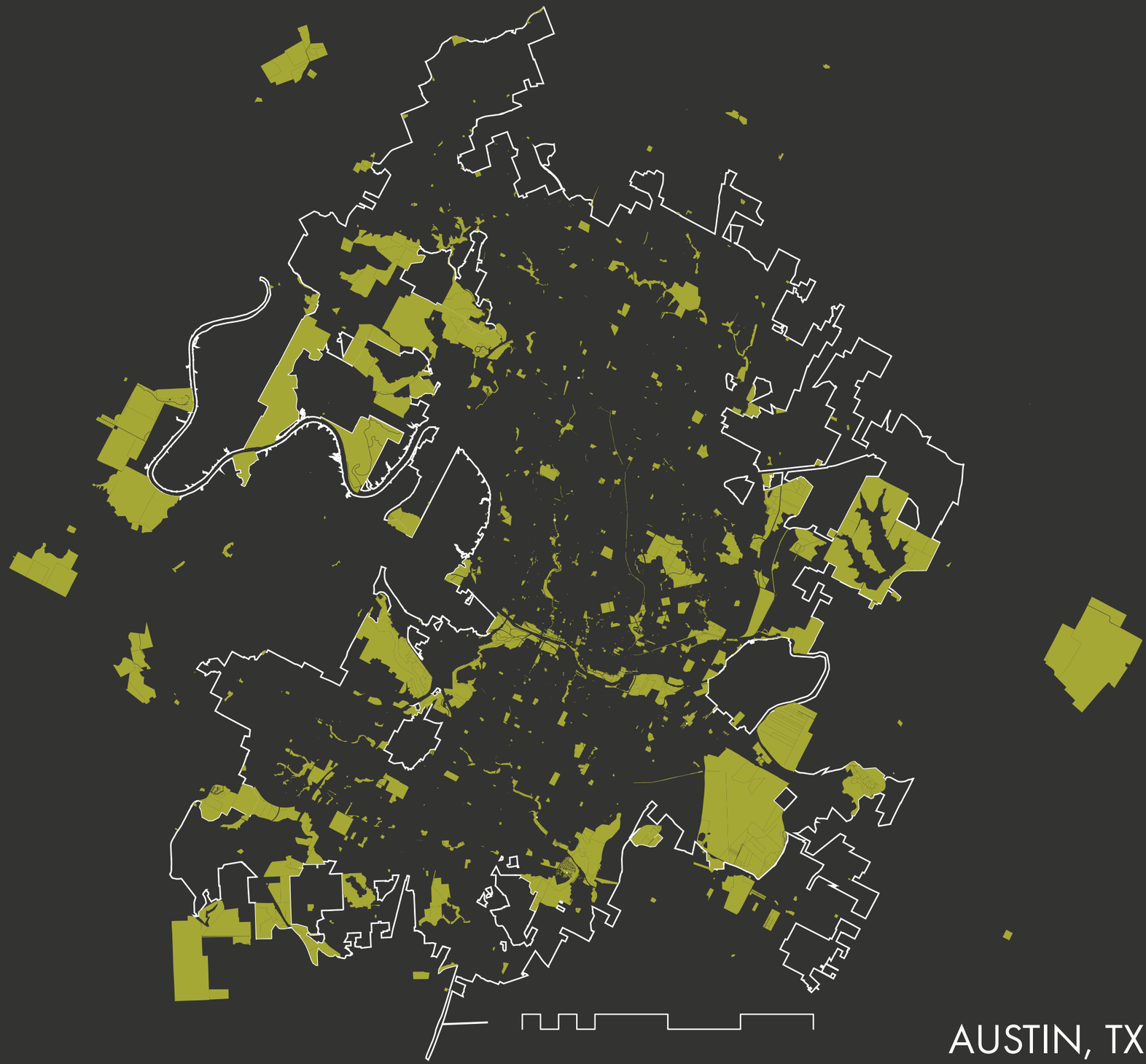
Depressed linear features that can collect, convey, infiltrate and treat storm water

NORTHWEST DISTRICT PARK

Types of Green Infrastructure | Vegetated Filter Strips

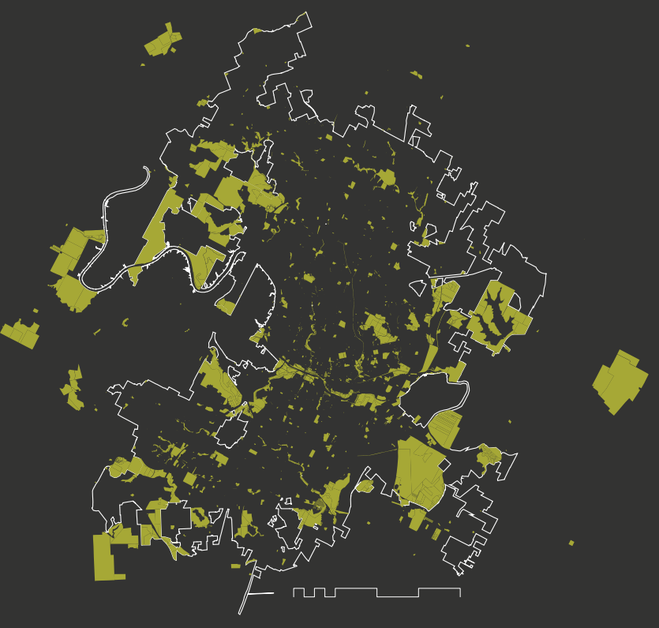
Linear bands of herbaceous vegetation that slow down sheet flow and force it through an herbaceous buffer

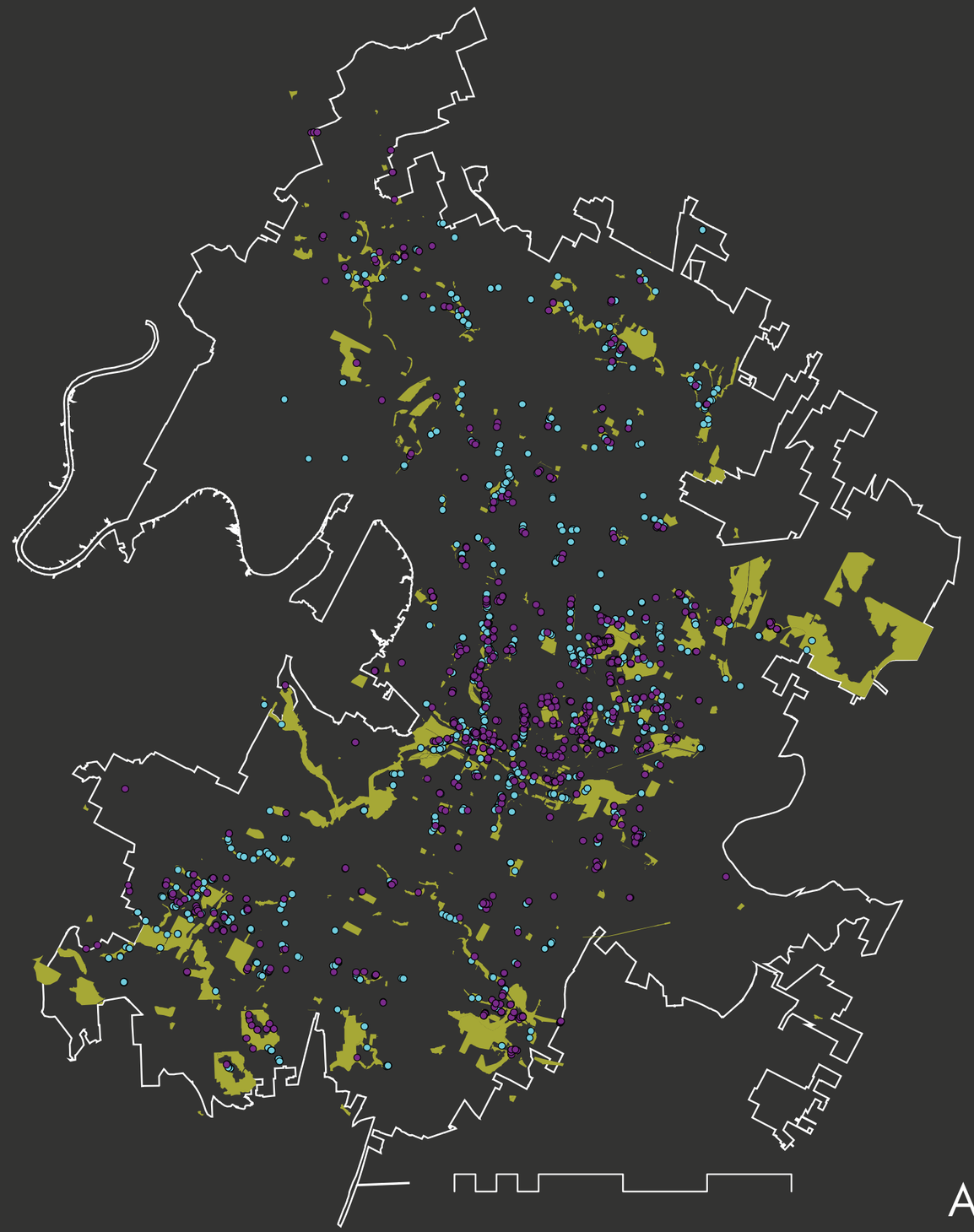
Filling in the Gaps Parkland



Finding the Water | Inlets and Outfalls

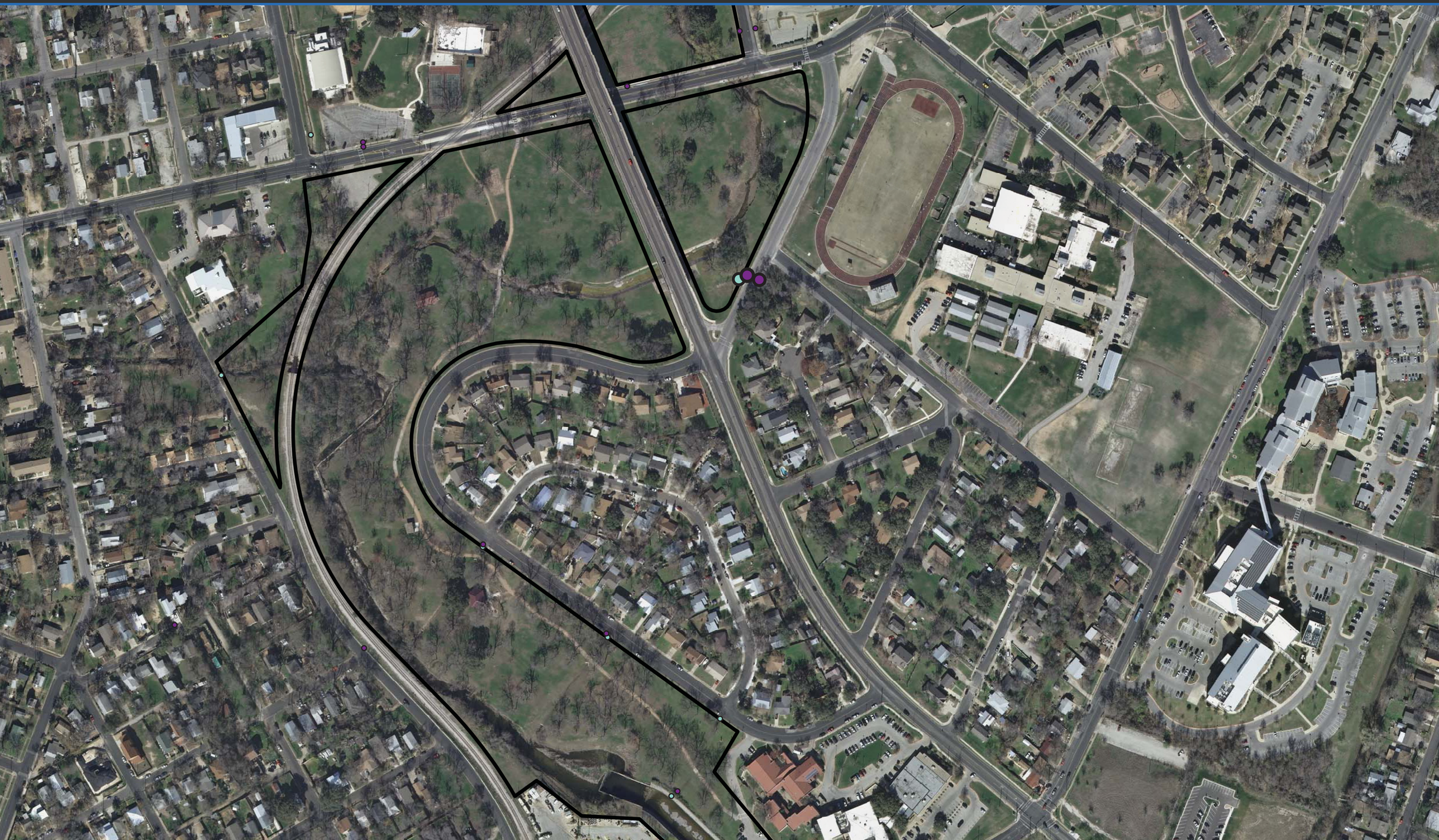
Filling in the Gaps Parkland





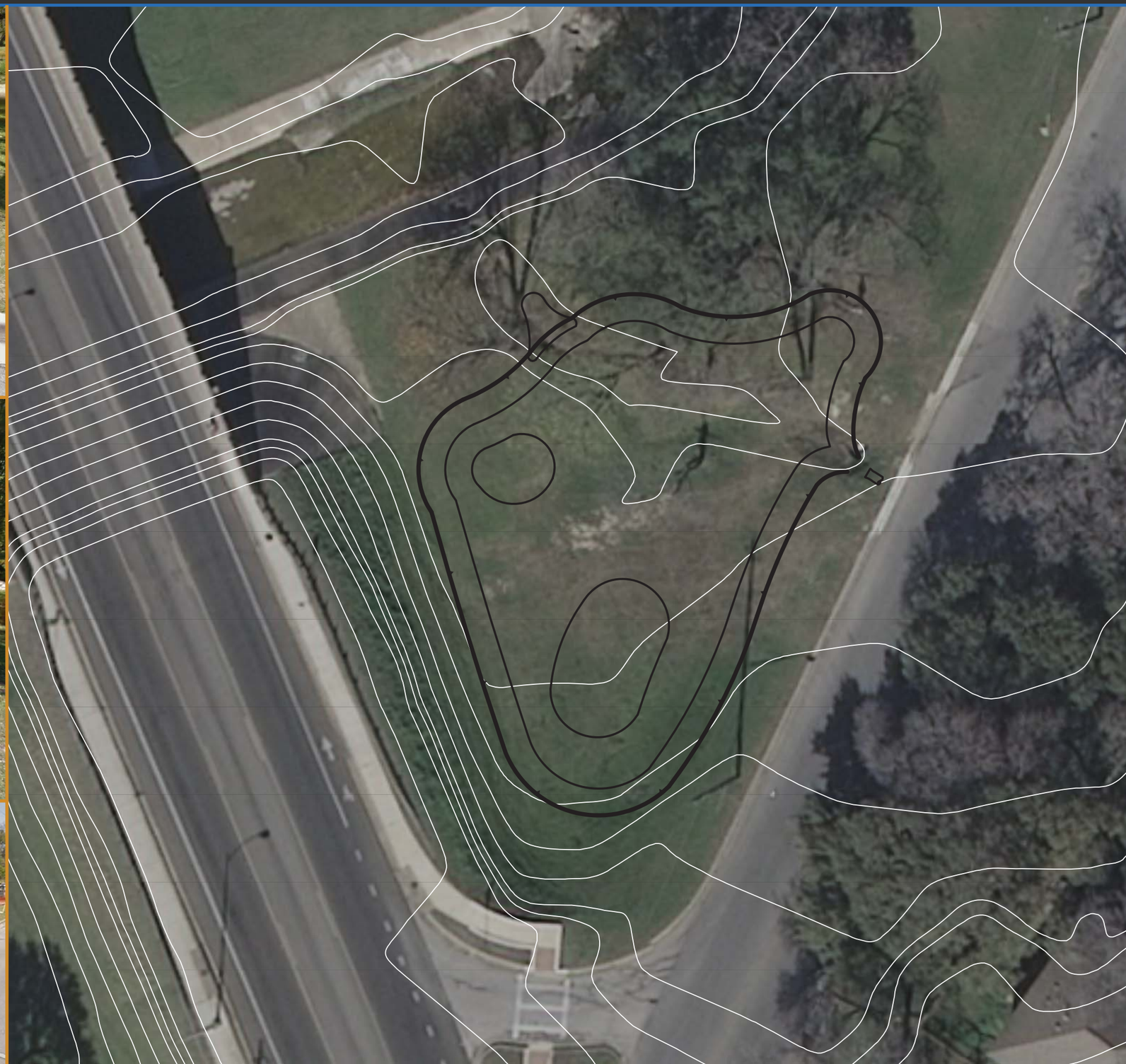
AUSTIN, TX

Locating Green Infrastructure



Finding the Drainage Area

Site Plan and Analysis



Finding the Water | Drainage Issues

Finding the Water | Drainage Issues

Prioritization | Which Projects are the Most Important?

Methods to quickly and efficiently score the feature in the field

Decide what is important to you

- Drainage area
- Impervious surfaces
- Infiltration potential

Score the variables

- Weight different categories
- Include pictures

Keep the scoring consistent

- Consistency in who judges the projects

If scores are close, go with the community that would benefit the most

- Pick under served communities first

GSI Priority Index Sheet

Date: Grow Zone:
Time: EII Score: _____
Initials: Feature # (mark on aerial): _____

Type of Drainage Issue (Circle all that apply)

Concentrated Overland Flow | Curb Jump | Sheet Flow | Slope Erosion
Rill Formation | Bank Erosion | Infiltration | Other:

Description:

Size of Drainage Area:

% Impervious Cover:

Scoring: 1 = Low 2 3 4 5 = Medium 6 7 8 9 10 = High

Metric	Score	Picture #	Description
1. Current Soil Erosion			
2. Soil Erosion Potential			
3. Non-Point Source Pollution			
4. Nutrient/Bacteria Load			
5. Lack of Infiltration			
6. Soil Degradation			
7. Impact on Habitat			
8. Contribution to Flooding			
9. Impact on Water Quality			
10. Impact on Existing Infrastructure			
Total Score		/100	

GSI Solution Proposal (Circle all that apply)

Raingarden | Flow Control | Curb Cut | Vegetated Swale/Basin
Smiles (berms) | Establish Vegetation | Stabilize Bank | Other:

Description:

Metric	Score	
1. Impact on Soil Erosion		Sketch:
2. Contaminant Removal		
3. Nutrient/Bacteria Treatment		
4. Infiltration Rate Potential		
5. Soil Stabilization		
6. Wildlife Habitat Quality		
7. Flood Reduction Potential		
8. Impact on Water Quality		
9. PARD/Stakeholder Interest		
10. Efficiency - Construction		
Total Score		/100
Priority Score		/200

Final Comments:

Case Study | Dottie Jordan Recreation Center

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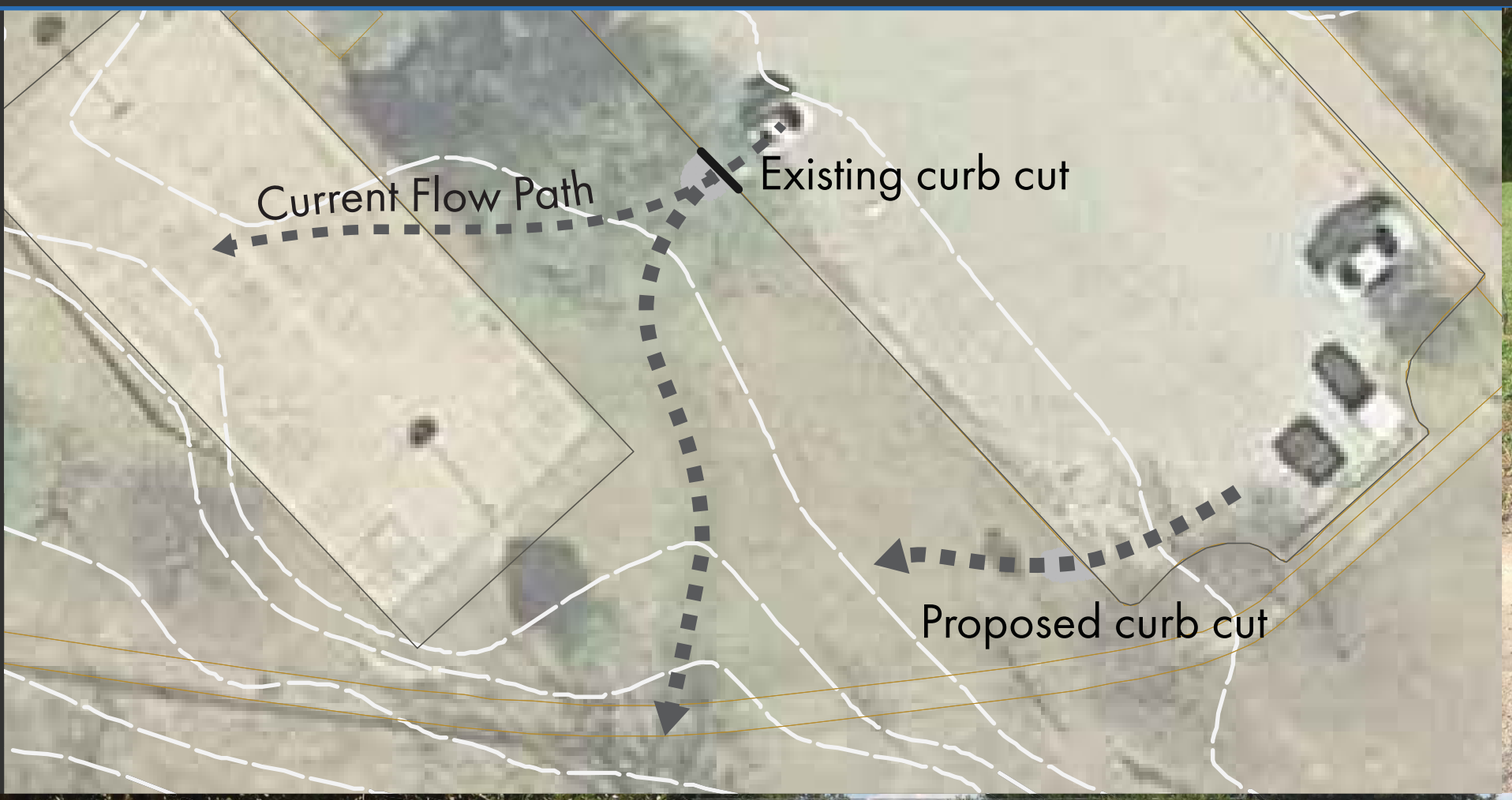


Percolation Tests

1. FIND A SUITABLE LOCATION

Identify where the deepest part of the rain garden will be located

2. DIG A HOLE

Dig the hole to the desired depth of your rain garden. If the rain garden is adjacent to a curb cut, make sure to account for the height of the curb

3. FILL THE HOLE WITH WATER TWICE

Fill the hole once and allow it to drain. Then fill the hole again and measure the rate of infiltration for 2 hours. If the water drops by 2/3 an inch over that time the area is suitable for a 1’ deep rain garden.

Modeling Infiltration and Cost Effectiveness | Adams Papa

DRAINAGE AREA CHARACTERISTICS

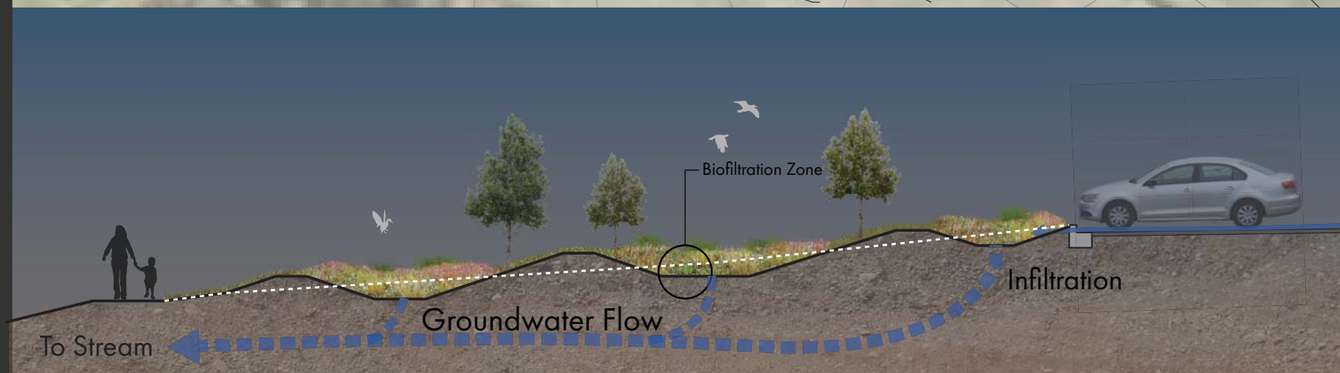
Drainage Area (acres) DA	**0.50**
Source of Rv and Concentration Data	CRWR
Impervious Cover IC (%)	**95%**
Runoff Coefficient Rv	0.861

BMP CHARACTERISTICS

Water Quality Volume (in.)	0.29
Pretreatent Design	NONE
Maximum Ponding Depth (ft.)	1
Depth of Soil Media (ft.)	1.5
Infiltration Rate of underlying soil (in/hr)	**0.35**
Assumed Effective Porosity of Soil Media (unitless)	0.3
Filtration Area required (cu.ft.)	359
Est. Treatment Rate (cfh)	10
Est. Drawdown Time (hr)	**50**
Average Annual Runoff Capture Efficiency RCE (%)	**42%**
Avg. Annual Runoff Volume Captured and Infiltrated (in.)	**11.27**

COST AND COST EFFECTIVENESS

Total Eng/Design/Construction Cost	$19,392
Annual O&M	$100
Assumed BMP Life (yr)	25
Total Annualized Cost	$876
Avg. Annual TSS Load Removed (lb/yr)	218
Cost Effectiveness ($ per lb. TSS removed)	**$4.01**
Cost Effectiveness ($ per cu.ft. infiltration)	**$0.04**



Stakeholder Meetings

Engage the community through a workshop and explain what exactly you are doing to their park.

Come Prepared

- Bring a presentation and easily digestible literature
- Establish yourself early as an expert

Don’t Sugarcoat the project

- Low maintenance
- Low impact

Listen to their input

- The community knows the park better than you do

Construction | The Devil is in the Details

Construction altering the hydrology of a site must be monitored constantly. Elevations and precise grading are critical in order to get the desired effect.

Planting Strategies

Plant selection depends on the type of GI feature and the goals of the project. The vegetation must be able to tolerate wide variations in moisture, from very dry to inundated with water. Roadside ditch flowers such as Rock Tickseed can add color while also providing resources for local wildlife.

Big Muhly Grass
Muhlenbergia lindheimeri

Meadow Sedge
Carex perdentata

Zexmenia
Wedelia texana

Rock Tickseed
Coreopsis

Bald Cypress
Taxodium distichum

Inland Sea Oats
Chasmanthium latifolium

Fall Aster
Symphyotrichum oblongifolium

Possumhaw Holly
Ilex decidua

Management | “Maintenance”

Work with local stakeholders and decide whether or not they are willing to make these features look “nice”. Otherwise, leave them to do their intended job by developing their own ecosystems

BLUNN CREEK RAIN GARDEN

WHY GREEN STORMWATER INFRASTRUCTURE?

Green Stormwater Infrastructure (GSI) consists of rain gardens, bioswales and berms that capture urban runoff and allow it to be filtered by plants and slowly released into the soil to become groundwater, a process called infiltration.

POLLUTION:
As rain water flows off impervious surfaces such as parking lots, streets and buildings it collects pollutants from cars, garbage, and asphalt. If left untreated this water can be very harful to stream ecosystems, especially to plant and animal life. GSI captures harmful pollutants and filters them through plants and the soil which cleans the water.

NUTRIENTS:
Urban runoff is full of harmful nutrients from pet waste and lawn fertilizers which can cause large algae blooms downstream. Unlike traditional grey storm sewers, GSI contains plant material which soaks up excess nutrients before they can damage the stream system.

FLOODING & EROSION:
Impervious surfaces in urban environments quickly direct water into streams, increasing peak flows which causes severe flooding and erosion. When used as water control features, Green Stormwater Infrastructure captures urban runoff and allows it to infiltrate into the ground where it is slowly released into river systems over time.

COMMON INVASIVE SPECIES
FOUND IN CENTRAL TEXAS

Johnson Grass
Sorghum halapense
This perennial grass grows to ~6' in height and has a white stripe down the center of the leaf blade. Often confused with gama grass, Johnson grass leaf blades feel smooth to the touch.

Giant Cane (Giant Reed Grass)
Arundo donax
Another exotic perennial grass, Arundo grows 20' high on thick woody canes. The alternate parallel veined leaves are 2-3' long at the base and taper to a point. 1-2' plume like flowers appear in late summer.

Heavenly Bamboo
Nandina domestica
An erect evergreen shrub, Nandia can grow up to 8' high. The glossy, dark green bipinnnately compound leaves closely resemble bamboo and turn red in the fall. Red berries form in early winter.

Chinese Tallow Tree
Triadica sebifera
Tallow is a deciduous tree which can be identified by its heart shaped alternate leaves. The leaves will also release a white milky sap when cut. It flowers in the fall with long yellow spike-like branches.

Large Leaf Privet
Ligustrum sp.
This fast growing evergreen can quickly dominate an entire area through seeds and root sprouts. It can be distinguished due to its opposite, glossy dark green leaves with a pale under-surface and translucent margins. Small white flowers bloom in the spring, giving way to clusters of blue berries which resemble grapes.

For more invasive species information visit http://www.austintexas.gov/invasive

NON-REGULATORY

GREEN STORMWATER INFRASTRUCTURE

MAINTENANCE CHECKLIST

MAINTENANCE CHECKLIST

GSI FEATURE _____

DATE _____ POND # _____

YES

- ☐ Is the inlet structure free of obstruction?
  - ☐ No, it is not free of obstruction and requires maintenance.

  Description: _____

- ☐ Is the outlet structure free of obstruction?
  - ☐ No, it is not free of obstruction and requires maintenance.

  Description: _____

- ☐ Is >50% of the feature vegetated?
  - ☐ No, less than half of the feature is vegetated

  Description: _____

- ☐ Is the feature free of standing water?
  - ☐ No, the feature has standing water for more than 3 days.

  Description: _____

- ☐ Is there more than 75% native species cover?
  - ☐ No, the feature is not more than 75% native species.

  Description: _____

- ☐ Is the feature free of erosion and scouring?
  - ☐ No, there is significant erosion and scouring occurring.

  Description: _____

For useful tips and solutions, visit http://www.austintexas.gov/sites/default/files/files/Watershed/stormwater/GSI-Maintenance-Manual.pdf

OBSTRUCTED INLET/OUTLET STRUCTURE

WHAT TO LOOK FOR:

- Plants and sediment blocking inlet/outlet
- Buildup of sediment on pavement
- Water pooling in front of inlet

PROPERLY FUNCTIONING INLET/OUTLET

WHAT TO LOOK FOR:

- Splash pad is 3-4" below pavement and clear of vegetation and debris
- Water has clear path from street through curb
- No cracks or falures in the curb or street

VEGETATION MAINTENANCE

VEGETATION CHARACTERISTICS:

- These are not maintained landscapes, they are functioning ecosystems.
- If vegetation doesn't impede function and has more than 75% native species cover, it will not require maintenance.
- There is no mulching, pruning or mowing required in non-regulatory Green Stormwater Infrastructure.

Questions and Comments

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Austin, TX

Education:

The Ohio State University — Columbus, OH
Master of Landscape Architecture, City Planning Minor — May, 2014
Course Highlights: Ecological Restoration and Rehabilitation, Wildlife Habitat Design, Low Impact Development
Cumulative GPA: 3.765

Allegheny College — Meadville, PA
Bachelor of Environmental Science, Psychology Minor — May, 2010
Course Highlights: Stream Ecology, Environmental Geology, Methods in Environmental Research
Cumulative GPA: 3.602
Honors: 2-time Alden Scholar Award Winner, Graduated Cum Laude

Experience:

City of Austin - Watershed Protection Department — Austin, TX
Environmental Scientist Associate — May - Present, 2014
- Project design, development and implementation of green stormwater infrastructure in Austin City Parks
- Fieldwork in water quality monitoring, stream rehabilitation and riparian habitat restoration

Enviroscience Inc — Stow, OH
Restoration Ecologist — June - Sept, 2013
- Restoration of degraded streams, pastures, brownfields and urban developments
- Graphic design for proposals and client presentations
- Fieldwork including construction oversight, planting, survey, monitoring and invasive species removal

Stantec Consulting Services Inc — Columbus, OH
Intern, Landscape Architecture / Environmental Services — June-August, 2012
- Landscape design and construction documentation
- Field Survey Crew - monitoring, site survey, delineations, permitting

Cleveland Botanical Gardens — Cleveland, OH
Intern, Horticulture — April-August, 2011
- Horticulture duties, plant identification, exhibit design and construction

URS Corporation — Cleveland, OH
Intern, Water Resources — June-December, 2010
- Generated Environmental Assessments, delineations and NEPA documentation
- Section 404 and 401, NPDES permitting

Other Work:

Graduate Teaching Assistant: The Ohio State University — Columbus, OH
Student Teacher - Workshop I, II & III, Visualizing Landscape — Aug 2012 - May 2014
- Teaching graphic design and technical documentation, landscape construction details, topography and grading, and plant selection to graduate and undergraduate students

City of Bay Village Service Department — Bay Village, OH
Seasonal Laborer - Park Management — June-August '07-2009

Activities:

OSU Student Organic Farm — Columbus, OH
General Labor — March 2012 - May 2014
- Organic agriculture and farm design

Varsity Soccer — Meadville, PA
Athlete — August 2006 - May 2010
- Four-year varsity letter winner, NSCAA All Region Scholar Athlete

References Available Upon Request