

Bernalillo County Green Stormwater Infrastructure and Low Impact Development Standards



Parking lot median at office complex at 1925 Aspen Drive in Santa Fe
Design and installation by The RainCatcher

Arid LID Coalition

2014
Watershed-
based MS4
Permit

01 Practice Suspended Paving

Definition:
A general term for any technology that supports the weight of paving or concrete thereby creating void space and eliminating compaction.

Benefits:

- Structures allow greater soil volumes that are not compacted for greater tree growth
- On-site stormwater management
- Increased infiltration
- Minimized non-point source pollution

Considerations:

- Attention must be paid to existing underground utilities

Variations:

- Structural soil
- Slits cells
- Pedestal systems
- Paver grates

Can be used with:

- Stormwater tree trench
- Permeable paving



Image 1: Paver Grates, Arches Building in Albuquerque, NM

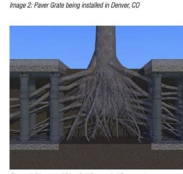


Image 3: Diagram of Slits Cell Suspended Pavement

2018 MRG GSI
Projects Booklet

National Pollutant Discharge Elimination System Manual

STORMWATER MANAGEMENT
GUIDELINES FOR CONSTRUCTION,
MS4, AND INDUSTRIAL ACTIVITIES

Revision 3.12/2020



2020 NMDOT GSI
Standards



2022 Pueblo
Alto & Mile Hi
Drainage Study,
Harvey Jones
Channel Demo
Project



CITY OF ALBUQUERQUE COUNCIL SERVICES
PUEBLO ALTO & MILE HI
NEIGHBORHOODS DRAINAGE STUDY
SUMMARY REPORT

JULY 2022



2017 Arid LID
Coalition
formed

2019
Interdisciplinary
Workshop

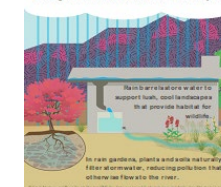


2021 GSI
Maintenance &
Residential
Rainwater
Harvesting
Trainings



Catch it if you can!

Three good reasons to harvest rainwater at your home



What You Can Do

- Create a rain garden
- Install a rain barrel
- Plant native plants
- Use organic mulch

Find out more at
bemoo.gov/rainwater



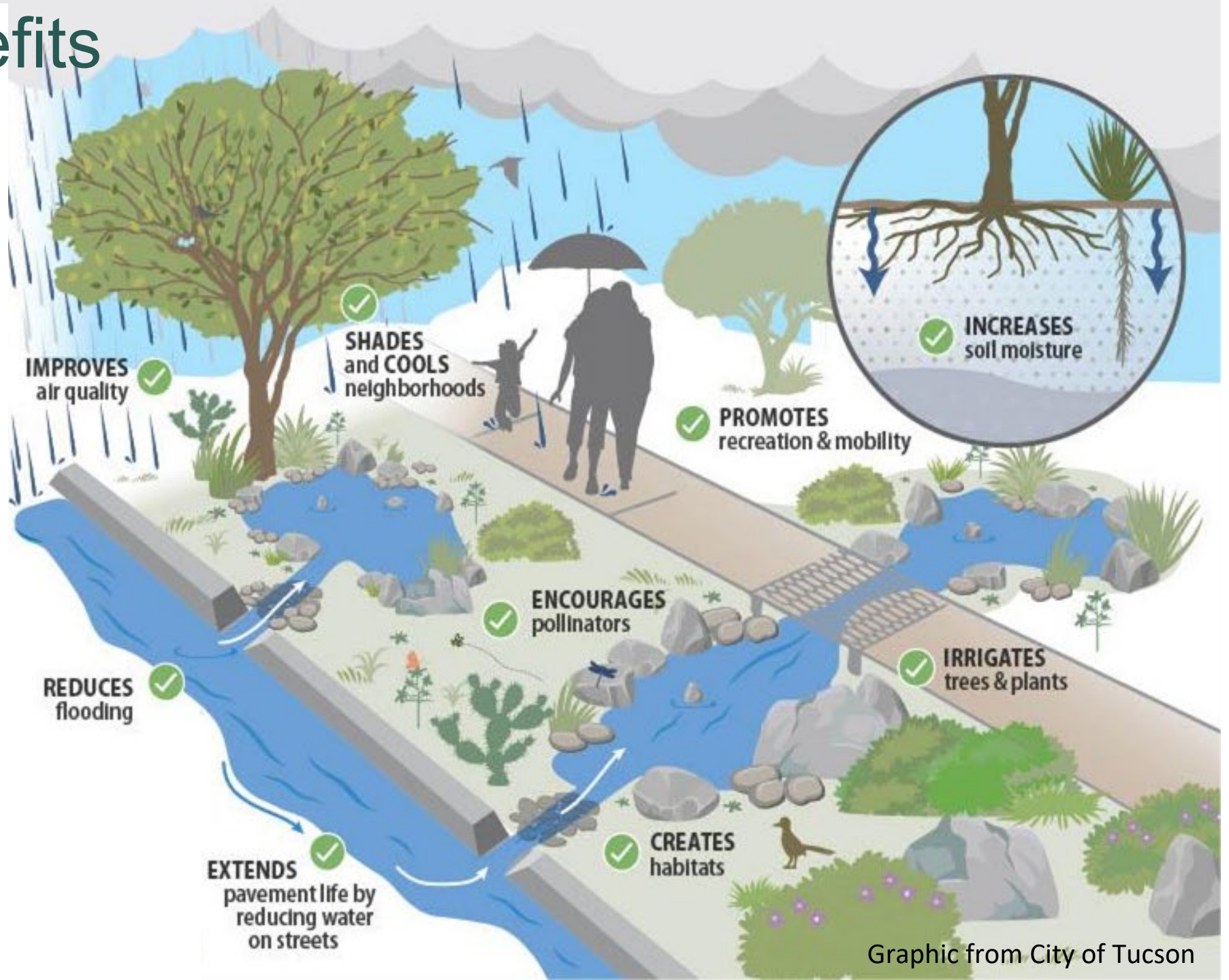
aridlidcoalition.org

The background image shows a natural setting with a gravel path leading through a wooded area. In the foreground, there is a large, dark, mulched area. The path is made of light-colored gravel and leads towards a line of trees. The text is overlaid on a semi-transparent white box with rounded corners.

Green Stormwater Infrastructure/Low Impact Development (GSI/LID) is a decentralized approach to stormwater management that captures and treats stormwater runoff as close to the source as possible by leveraging the ecological functions of living, natural systems.

GSI/LID Benefits

- reduces flooding
- reduces erosion, promotes sediment capture
- filters/removes pollutants
- improves water quality
- irrigates plants/trees, shading and cooling neighborhoods
- improves air quality, reduces urban heat island effect
- creates habitat and encourages pollinators
- promotes recreation
- provides traffic calming
- addresses EJ issues

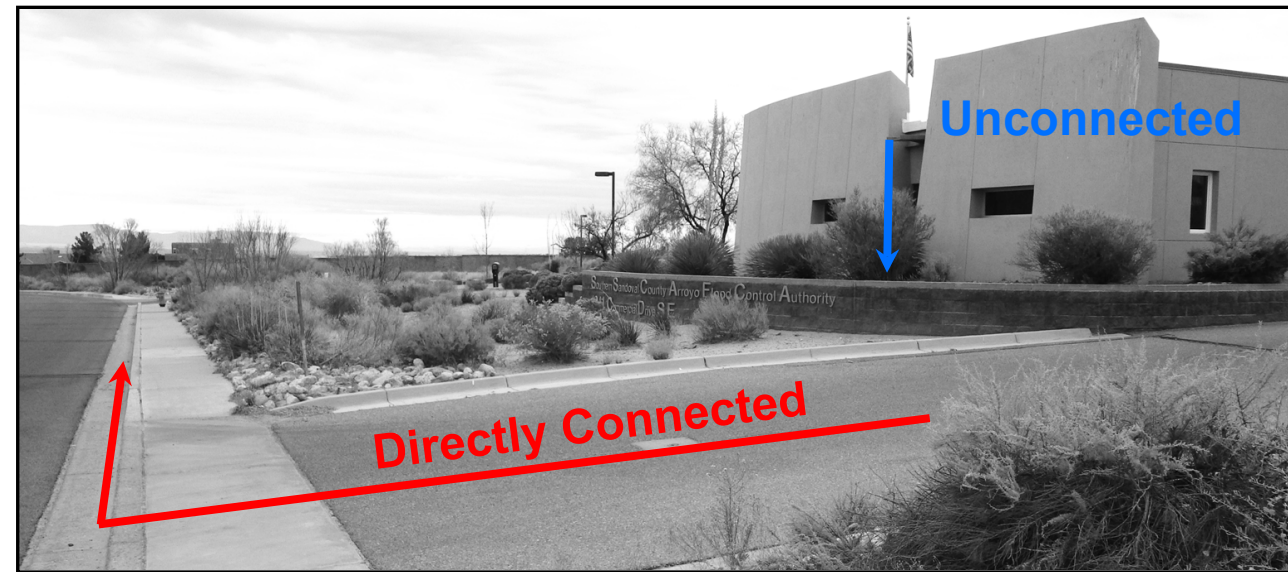
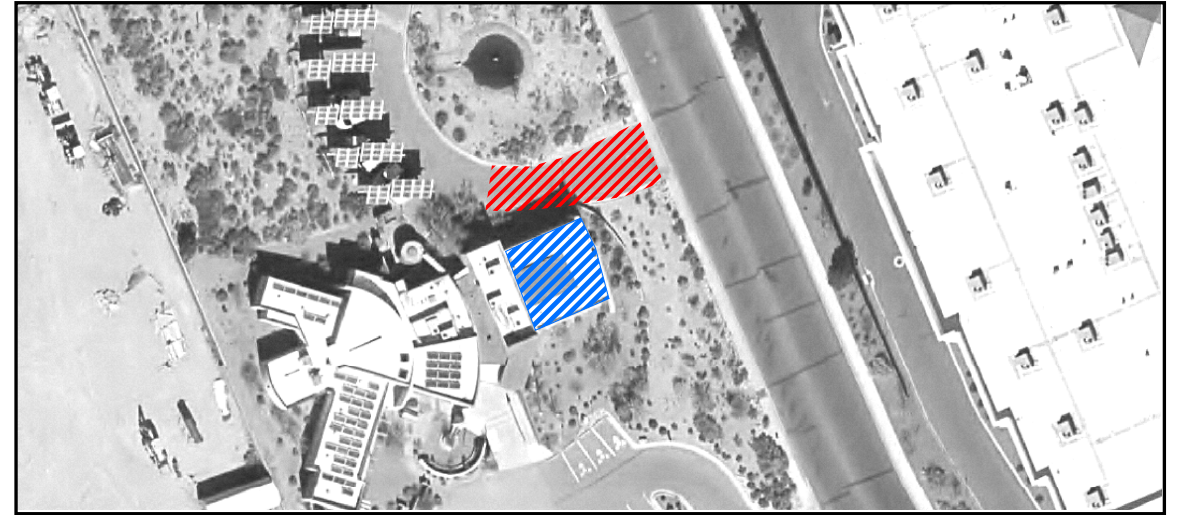


Directly Connected Impervious Area (DCIA)

- Portion of impervious area with direct connection to the stormwater drainage system (MS4)
- Higher peak flows, greater volume, greater frequency
- Greater transport of pollutants (reduced water quality)

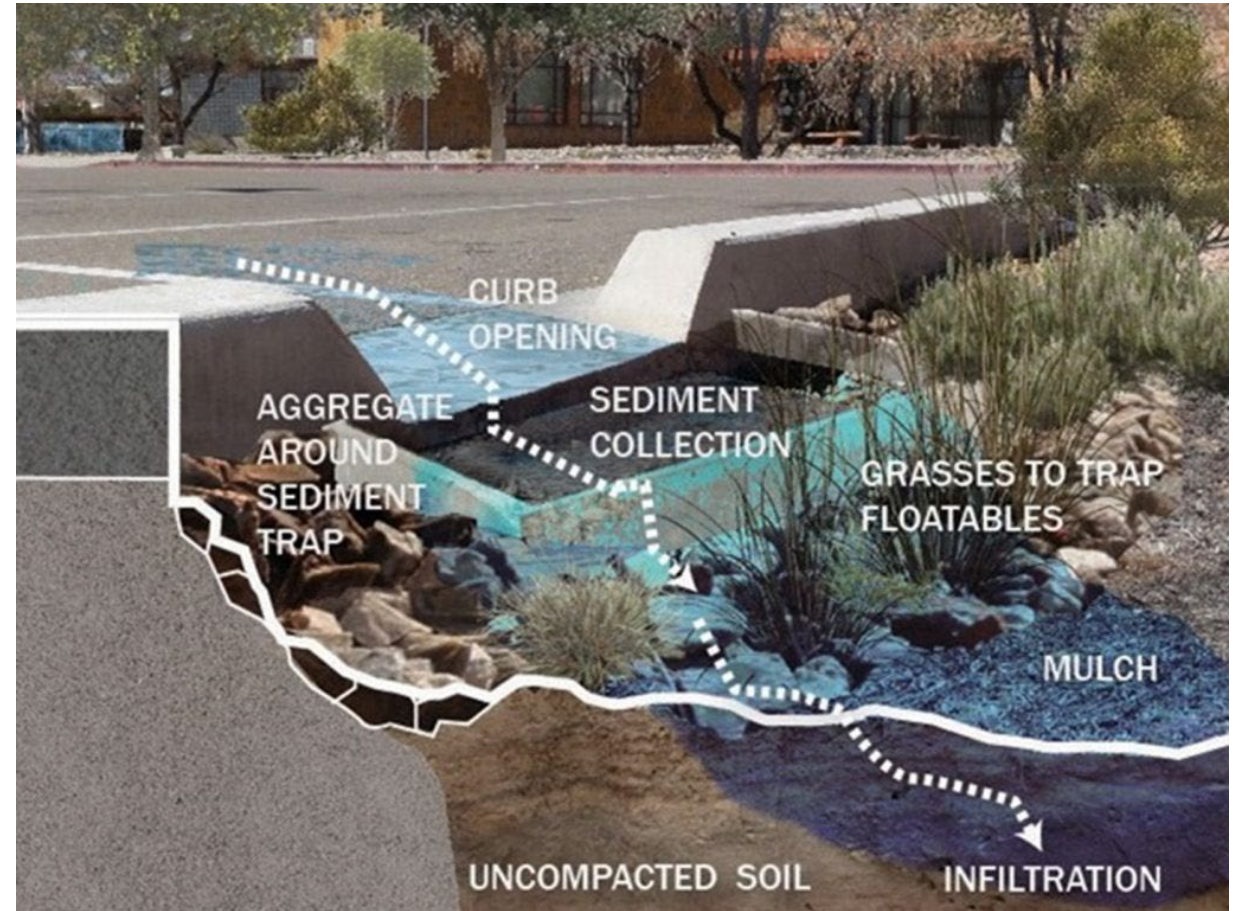
GSI/LID reduces DCIA

- Parking lots, rooftops drain to landscaped areas
- Isolated impervious areas that drain to a pervious area



GSI/LID Standards Purpose

- Enhance public understanding and increase application of GSI/LID
- Advance best practices in stormwater management & pollution reduction
- Meet Federal MS4 Permit requirements



GSI/LID Standards Overview

- Locations to use GSI/LID
 - Benefits of GSI/LID
 - Regulatory context
 - Stormwater quality design storm & volume
 - Best Management Practices – 9 highlighted in document
 - Design & construction
 - Maintenance
 - Mulch & plant selection
- 

GSI/LID Standards - Drainage

- Grading and Drainage:
 - Calculation for the Stormwater Quality Volume (SWQV)

$$SWQV = a[(R_C * Area_C) + (R_D * Area_D)]$$

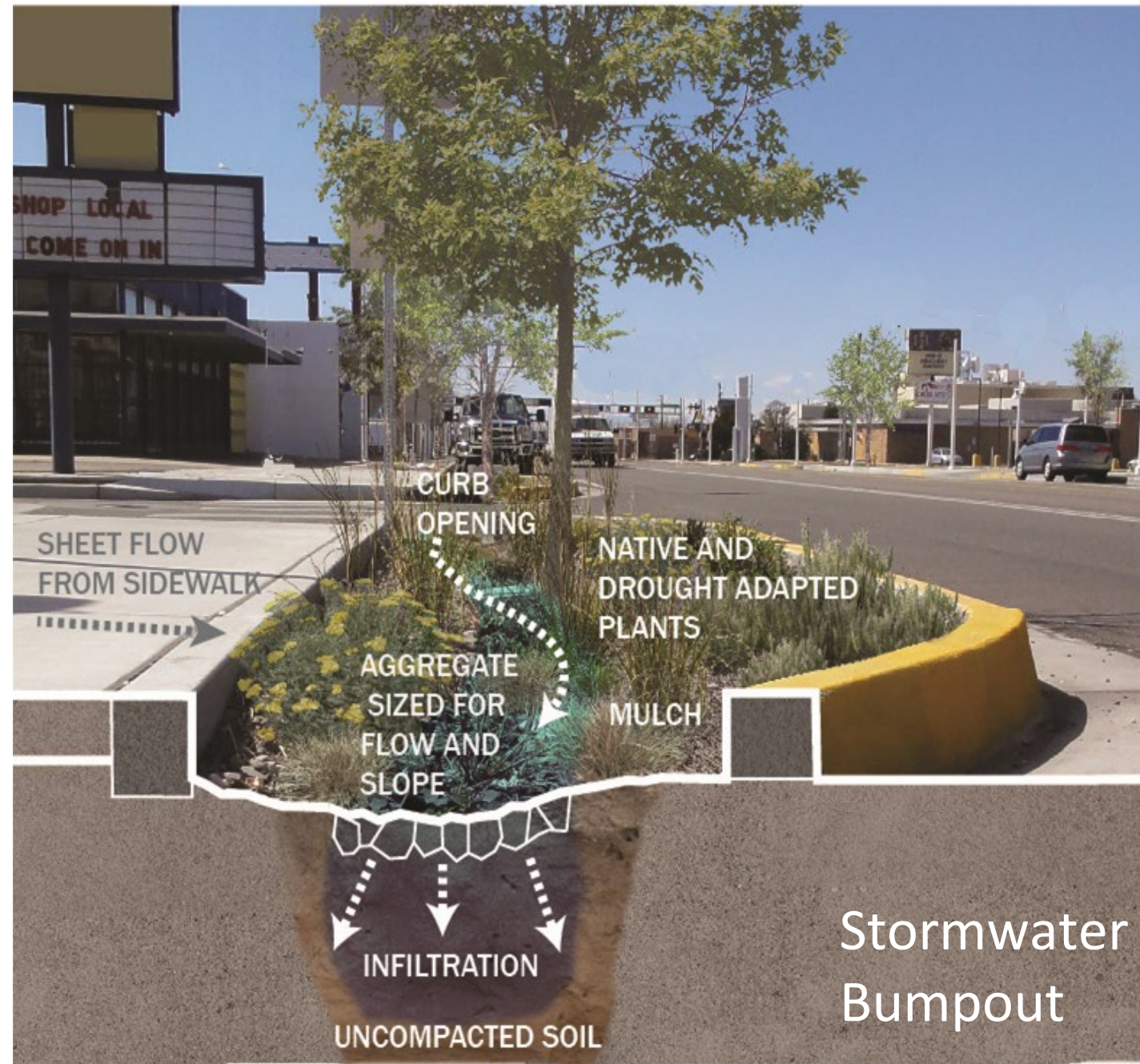
- All applicants must submit the post-construction GSI evaluation form

<https://www.bernco.gov/GSI>

Coefficient/Variable	Description	Quantity
a	Factor to convert rainfall depth from inches to feet	$1/12$ (feet/inch)
R_C	Rainfall depth for Land Treatment C. This factor is different for New Development and Redevelopment.	New Development: $R_C = 0.520 \text{ inches}$ Redevelopment: $R_C = 0.410 \text{ inches}$
$Area_C$	Surface area of Land Treatment C	Total Land Treatment C area (ft ²) based on project design
R_D	Rainfall depth for Land Treatment D. This factor is the 90 th percentile depth for New Development and 80 th percentile depth for Redevelopment.	New Development: $R_D = 0.615 \text{ inches}$ Redevelopment: $R_D = 0.48 \text{ inches}$
$Area_D$	Surface area of Land Treatment D	Total Land Treatment D area (ft ²) based on project design

Recommended Best Management Practices

1. Stormwater harvesting basin
2. Bioswale
3. Stormwater bumpout
4. Depressed median
5. Infiltration trench
6. Curb cut
7. Check dam
8. Outlet control structure
9. Permeable pavement





DEPRESSED MEDIAN



A linear or curvilinear shallow depression located in the roadway median designed to improve water quality by conveying, slowing, and treating runoff; allows pollutants to settle out and promotes infiltration.

DEPRESSED MEDIAN

DESIGN CONSIDERATIONS

- Consider depth to the groundwater table & bedrock – refer to Section 6, General Design Principles.
- Recommended max. longitudinal slope of 5% to minimize potential for erosive flow velocities.
- Recommend infiltration rate greater than 0.5-inch/hr. An underdrain may be required if the infiltration rate is less than 0.5-inch/hr.
- To maximize infiltration, do not compact bottom during or after construction & ensure that the bottom is scarified per the standard drawing.
- Size & place erosion protection as needed for design storm velocity & slope stabilization.
- Consider a sediment trap at concentrated inflows.
- Place plants according to elevation zone & inundation zone. Do not place plants where inlet(s) or outlet will be impacted.
- Include an irrigation system for plant establishment.
- Select plants that allow for vehicle clearances & sight triangles.
- Utilize the AASHTO Roadside Design Guide when placing & designing depressed medians adjacent to travel ways.

MAINTENANCE

- Inspect after storms > 0.25-inches, recommend inspections minimum of twice per year.
- Remove debris, trash & accumulated sediment. The accumulated sediment should be removed if it inhibits vegetation or reduces the median capacity.
- Check for & repair erosions issues.
- Add & redistribute organic mulch as needed.
- Prune & replace plants as needed. Prune plants to maintain vehicle clearances & sight triangles.
- Leave organic debris in place to biodegrade.
- Remove invasive species.

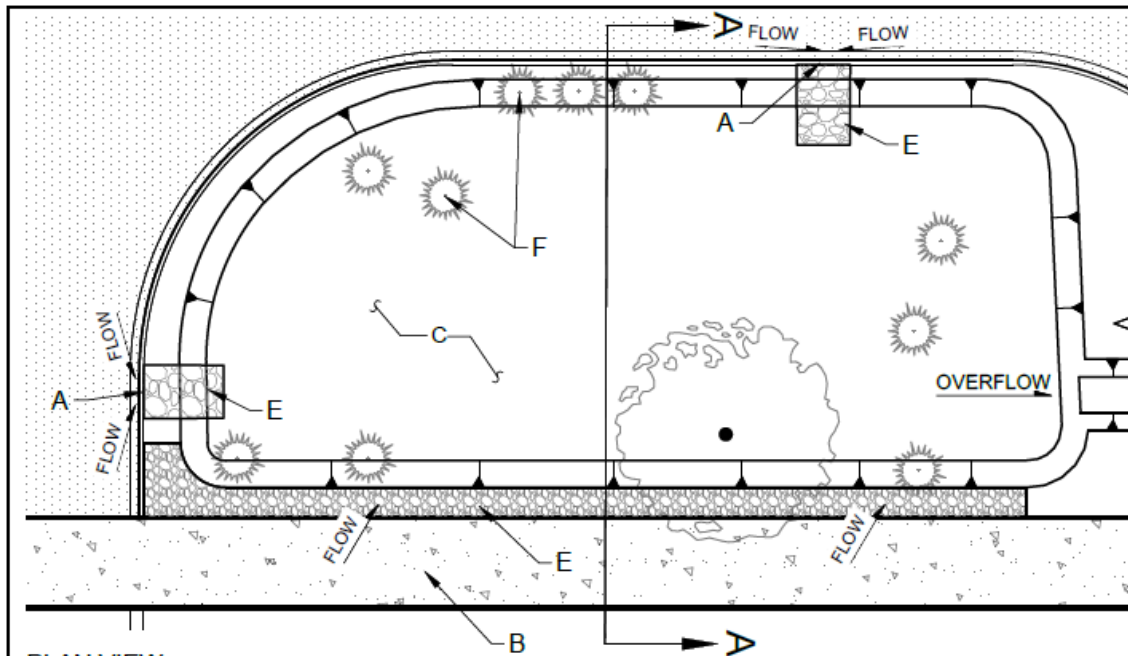


WHERE TO USE

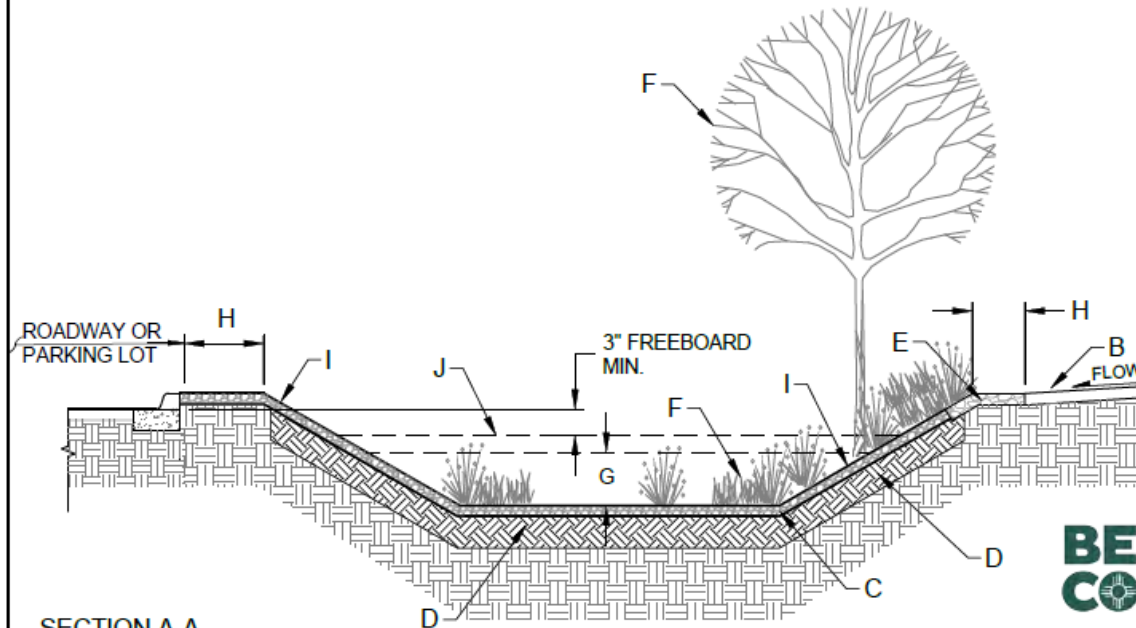
✓	Urban Type Road
✓	Rural Type Road
✓	Streetside
✓	Parking
✓	Residential Development
✓	Commercial/Institutional Development

FUNCTIONS WITH

 CURB OPENING	 STORMWATER BASIN	 BIOSWALE
 CHECK DAM	 OUTLET CONTROL STRUCTURE	



PLAN VIEW



SECTION A-A

GENERAL NOTES:

1. SEE TECHNICAL GUIDANCE SHEET FOR DESIGN GUIDANCE AND CONSIDERATIONS.
2. OVERFLOW REQUIRED & SHALL BE SIZED FOR 100-YEAR PEAK DISCHARGE OR DESIGN REPORT SHALL DEMONSTRATE BASIN RETAINS 100-YEAR, 24-HOUR CONTRIBUTING RUNOFF.
3. NO PLANTINGS IMPACTING FLOW CAPACITY SHALL BE PLACED AT CONCENTRATED FLOW INLETS OR OVERFLOW.
4. TREES AND SHRUBS SHOULD BE LOCATED IN ACCORDANCE WITH INUNDATION ZONE AND ELEVATION ZONE. SEE BERNALILLO COUNTY GSI PLANT LIST FOR GUIDANCE.
5. MULCH TYPE AND LOCATION PER PROJECT PLANS SHALL BE INFORMED BY EVALUATION OF HYDRAULIC CONDITIONS AND MAY BE USED FOR EROSION PREVENTION, SLOPE STABILIZATION, OR DESIGN PREFERENCE. ORGANIC MULCH MAY BE USED WHERE DESIGN VELOCITY IS LESS THAN 1 FPS.
6. AVOID COMPACTION OF BASIN BOTTOM DURING AND AFTER CONSTRUCTION TO MAINTAIN INFILTRATION RATE

CONSTRUCTION NOTES:

- A. CURB OPENING PER COUNTY STD DWG GSI-01.
- B. SIDEWALK, PATH, OR OTHER HARDSCAPE DRAINING TO BASIN.
- C. ORGANIC OR INORGANIC MULCH PER PROJECT PLANS. PLANS SHALL SPECIFY MULCH TYPE, THICKNESS, AND LOCATION.
- D. SCARIFY SUBGRADE TO DEPTH OF 12", MIN.
- E. EROSION PROTECTION AT FLOW INLET. TYPE & DIMENSIONS PER PROJECT PLANS. COMPACT SUBGRADE BELOW EROSION PROTECTION TO 95% OF MAX DENSITY.
- F. PLANTS PER PROJECT PLANS.
- G. 9" MAXIMUM PONDING DEPTH & DEPTH FOR CALCULATING STORMWATER QUALITY VOLUME (SWQV). MEASURED FROM BASIN BOTTOM TO OVERFLOW ELEVATION.
- H. 2' STEP OUT WHEN BASIN ALONG ROADWAY. 1' SETBACK ALONG OTHER PEDESTRIAN ROUTES.
- I. 3H:IV SIDE SLOPE OR FLATTER TYP.
- J. WATER SURFACE AT 100-YEAR OVERFLOW DEPTH. FREEBOARD MEASURED FROM OVERFLOW WATER SURFACE TO TOP OF BASIN OR LOWEST INFLOW ELEVATION (WHICHEVER IS LOWEST).



REVISIONS		COUNTY OF BERNALILLO	
		STORMWATER HARVESTING BASIN	
		GSI-02	JULY 2022

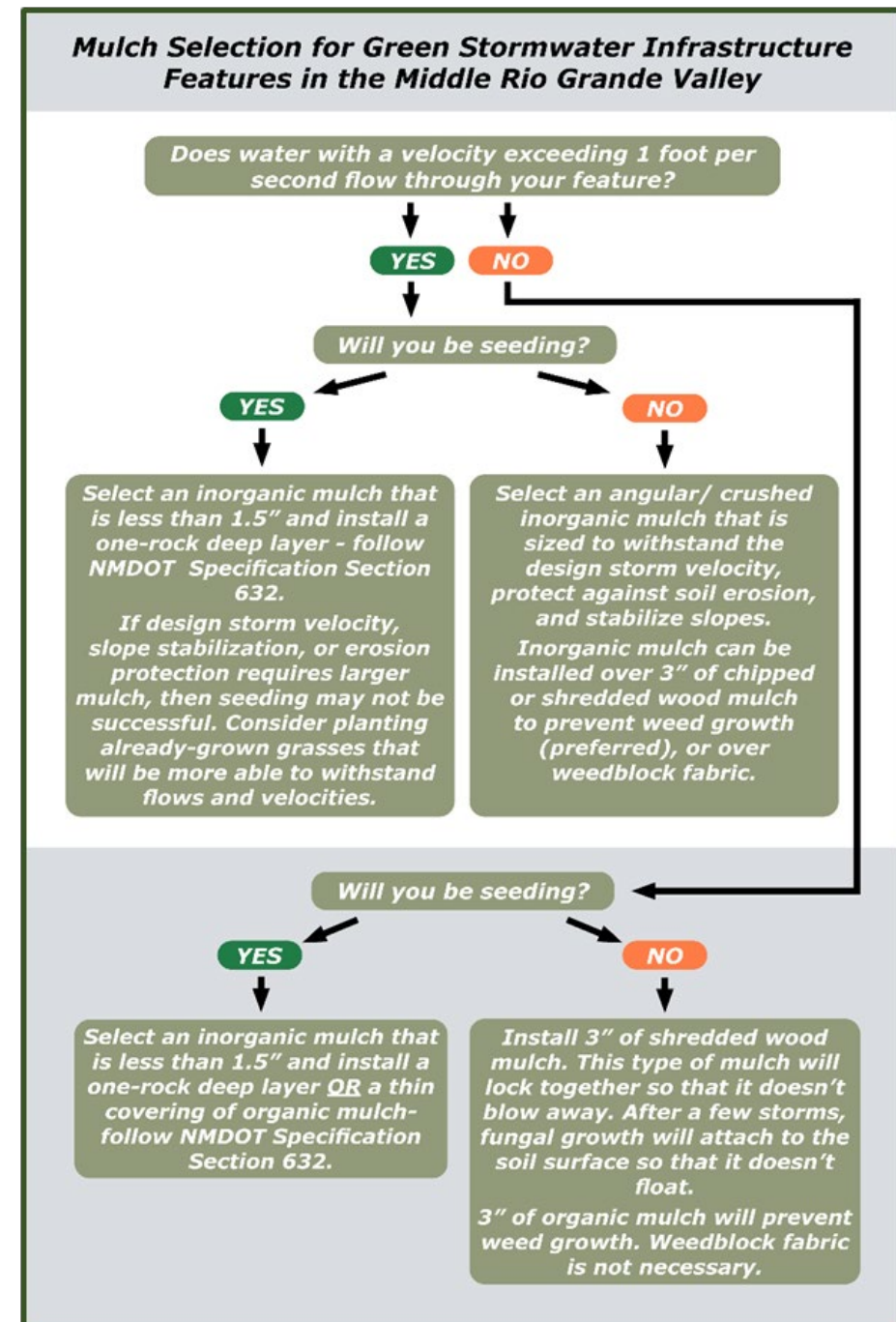
Required Design Data for GSI/LID BMPs

Table 3: Typical Design Data Required for GSI/LID BMPs

BMP	Standard Drawing Number	GSI/LID Standard Drawing	Typical GSI/LID BMP Design Data Required on Project Plans
 CURB OPENING	GSI-01	Curb Opening	• Curb opening length (L) – recommend 2-ft. minimum. • Identify if sediment trap is required. • Sediment trap dimensions, if required. • Riprap rundown/erosion protection dimensions, stone size, and riprap thickness. • Elevation of flowline at curb opening and elevation at bottom of sediment trap or adjacent BMP. • Gutter transition, if different from County Standard Drawing 2207.
 STORMWATER BASIN	GSI-02	Stormwater Harvesting Basin	• Erosion protection type and dimensions; if riprap, provide stone size and riprap thickness. • Ponding depth for SWQV – recommend 9-in. maximum. • Water surface elevation at 100-year overflow depth. • Freeboard measurement – recommend 3-in. minimum. • Mulch type, thickness, and location.
 STORMWATER BUMPOUT	GSI-03	Stormwater Bumpout	• Bump out radius – recommend 10-ft. minimum. • Bumpout dimensions. • Riprap/erosion protection dimensions, stone size, and riprap thickness. • Design storm velocity. • Ponding depth for SWQV – recommend 9-in. maximum. • Mulch type, thickness, and location.
 BIOSWALE	GSI-04	Bioswale	• Design storm velocity; if velocity is greater than 3 fps, check dam(s) required. • Freeboard measurement – recommend 3-in. minimum. • Erosion protection type and dimensions; if riprap, provide stone size and riprap thickness. • Mulch type, thickness, and location.

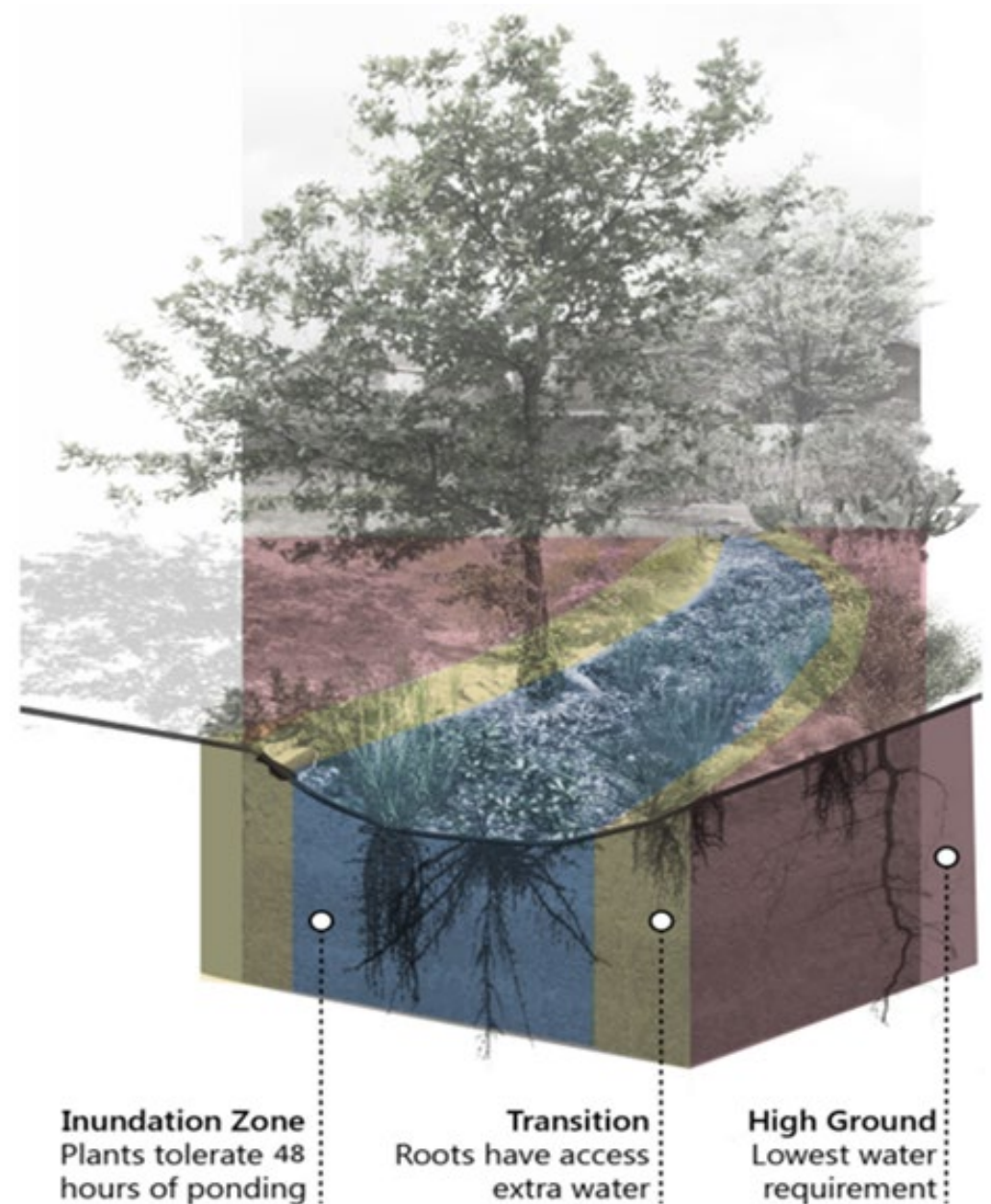
Mulch

- Mulch can be organic (plant material) or inorganic (gravel, crushed rock).
- Organic mulch provides pollutant treatment and helps develop healthy soil microbiomes.
- Inorganic mulch provides less runoff treatment, stores and releases heat, appropriate for higher velocity flow.
- Preferred mulch: shredded, partially composted, woody mulch, min. 3" depth



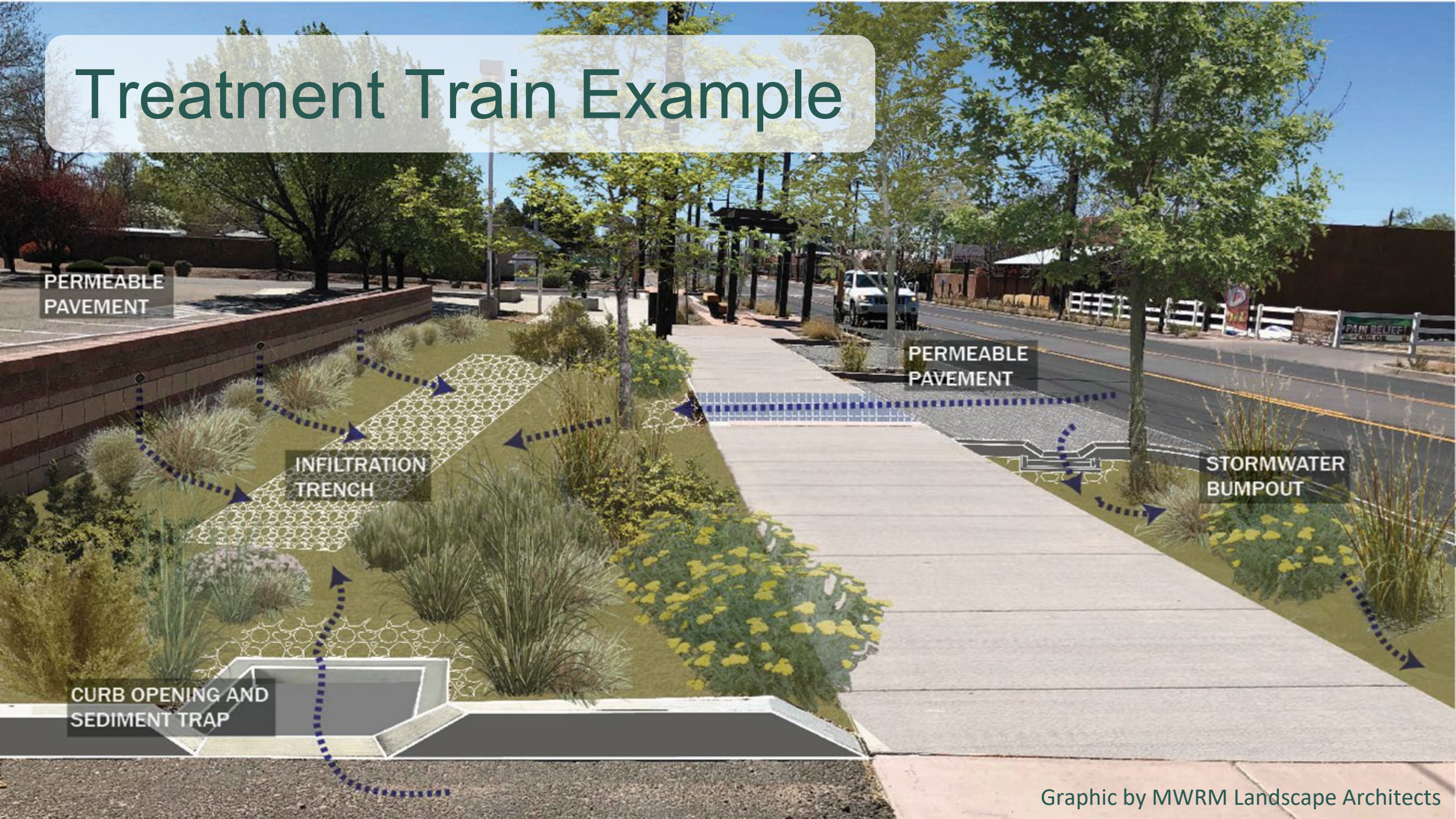
Plants

- GSI Plant List provides recommended plants that can survive without irrigation in a GSI/LID BMP after establishment.
- Considers biome, elevation, and infiltration zone
- Includes trees, shrubs, perennials, and grasses
- bernco.gov/plantlist



Infiltration Zones in GSI/LID BMPs

Treatment Train Example



Maintenance for GSI in Arid Climates

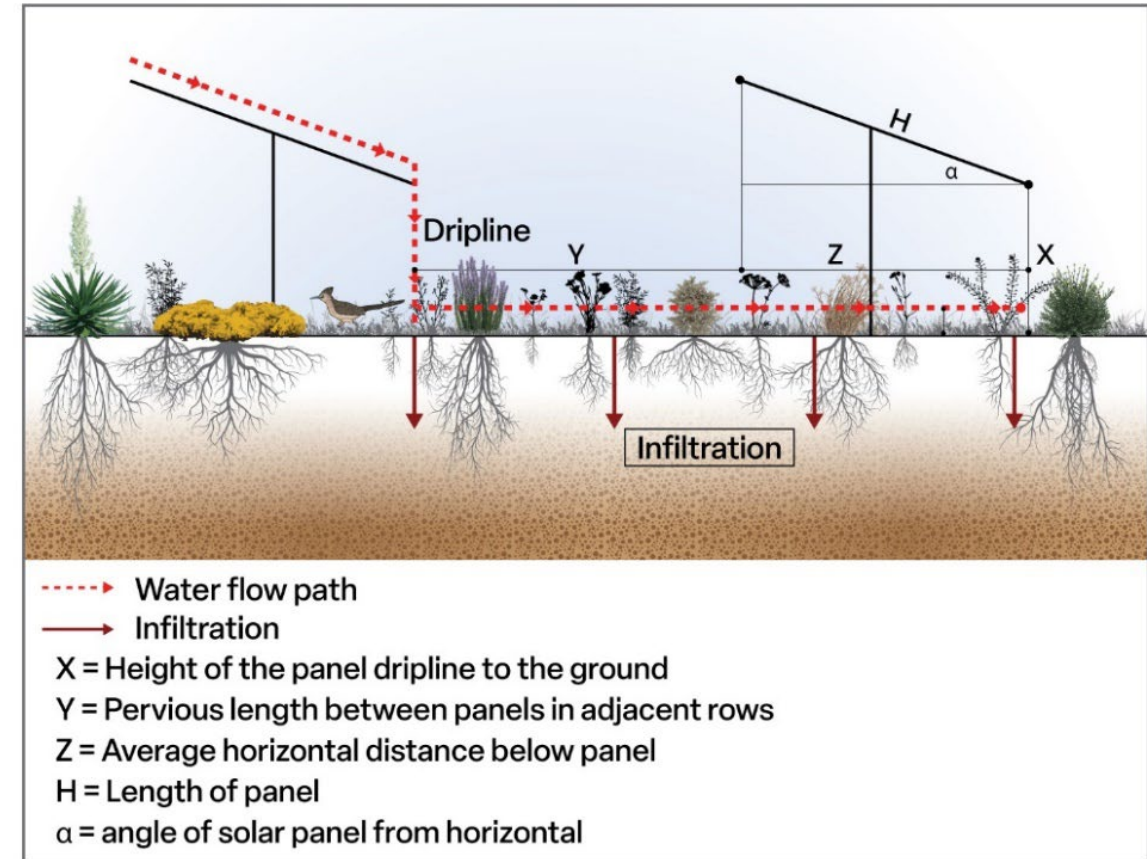
- Developed through the Arid LID Coalition
 - www.Bernco.gov/GSI
- Maintenance Manual – 6 modules
 - GSI Introduction
 - Permeable Pavement
 - Stormwater Harvesting Basins
 - Infiltration Conveyance
 - Plant Identification and Maintenance
 - Mulch Maintenance
- Training videos
- In-person trainings



Stormwater Mgmt in Solar Array Installations

- Stormwater Management Guidance in Large Scale Ground-Mounted Solar Arrays
 - Slopes
 - Soil conditions, erosion
 - Vegetation
 - Calculating stormwater quality volume
 - Hydrologic analysis
 - Rainfall losses

<https://www.bernco.gov/blog/2023/05/11/new-guidance-for-stormwater-management-in-solar-array-facilities/>



Acknowledgements - GSI/LID Standards

BERNALILLO COUNTY

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Web links:

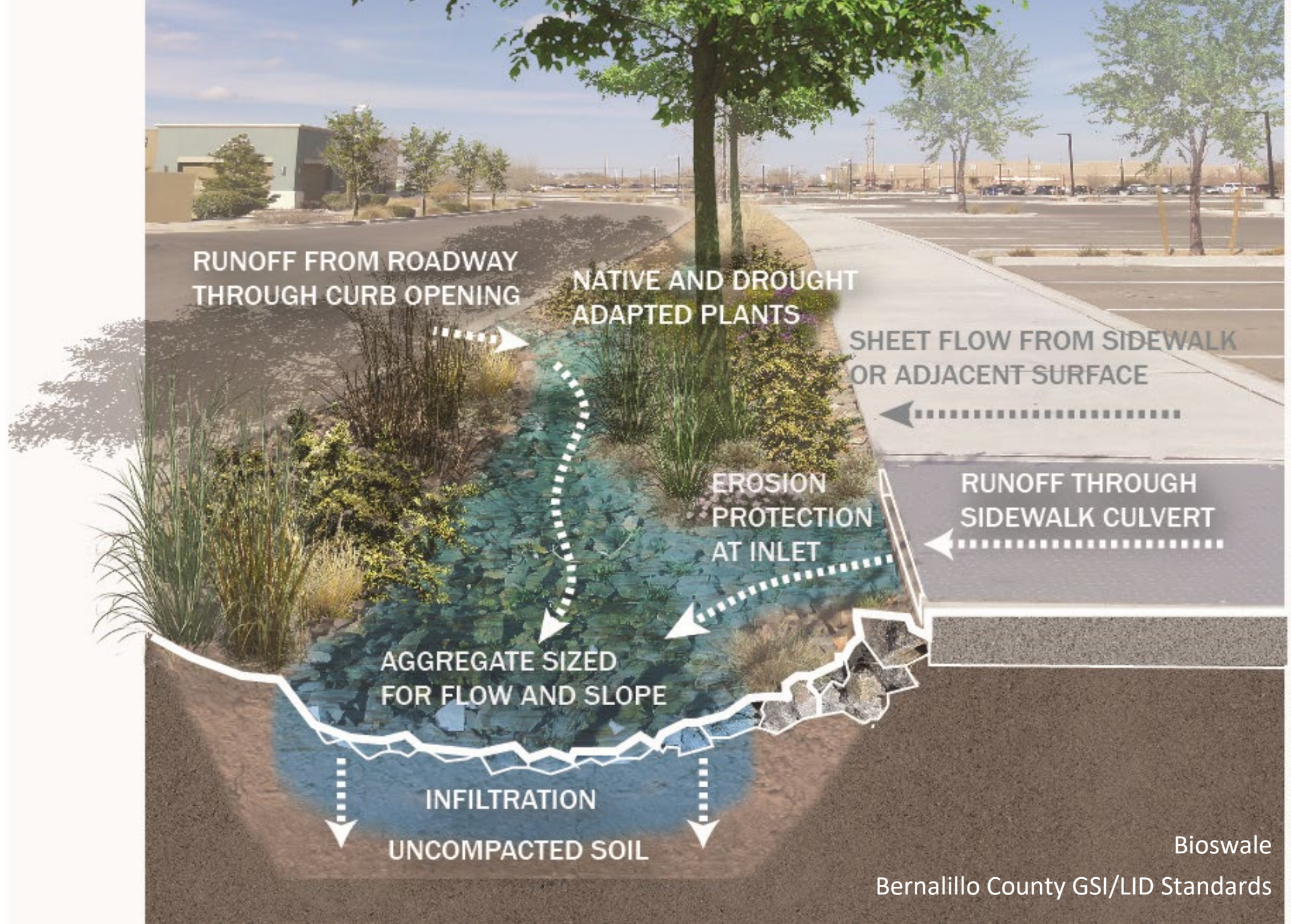
www.Bernco.gov/GSI

www.Bernco.gov/public-works/development-review/tech-standards/



Additional Slides





Locations for GSI BMPs

- Medians
- Landscape/buffer zones
- Parking areas
- Site development



2nd Street Trail



Roadway Types



Las Estancias Shopping Center



Why GSI/LID?

