



NORTH CAROLINA

Department of Transportation



Advancing Nature-based Stormwater Strategies – Updates From the Roadways Working Group

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8/20/2021



ACTION PLAN FOR NATURE-BASED STORMWATER STRATEGIES:

*Promoting Natural Designs that Reduce Flooding
and Improve Water Quality In North Carolina*

MARCH 2021

The lovely aesthetics of River Bluffs in Castle Hayne, N.C. result from nature-based stormwater design being incorporated throughout the site. These stormwater measures help make it a walkable park-like neighborhood while preventing flooding and protecting water quality.

© RIVER BLUFFS DEVELOPMENT CORP.



Roadways

Roadways in North Carolina are either owned and operated by the N.C. Department of Transportation (NCDOT), a city government or private communities. Property dedicated for roads comprises one of the largest uses of land in the state, and these transportation facilities by their very nature must manage water to ensure public safety. Drainage systems for roads must provide for safety while being designed, constructed and installed across the mosaic of landscapes, land uses and soil types throughout the state. In addition to providing for the stormwater management requirements of the roads themselves, in many cases road drainage systems are also relied upon to provide drainage for surrounding land uses.

These characteristics of linear transportation corridors present unique challenges for managing stormwater and demand innovative and holistic solutions throughout the planning, design and construction process. In the context of roadways, nature-based stormwater solutions are sustainable planning, design, environmental management

This road includes curb cuts to guide runoff to a roadside infiltration system. Permeable paving on the bike path disconnects runoff and a living shoreline reduces erosion to protect infrastructure.

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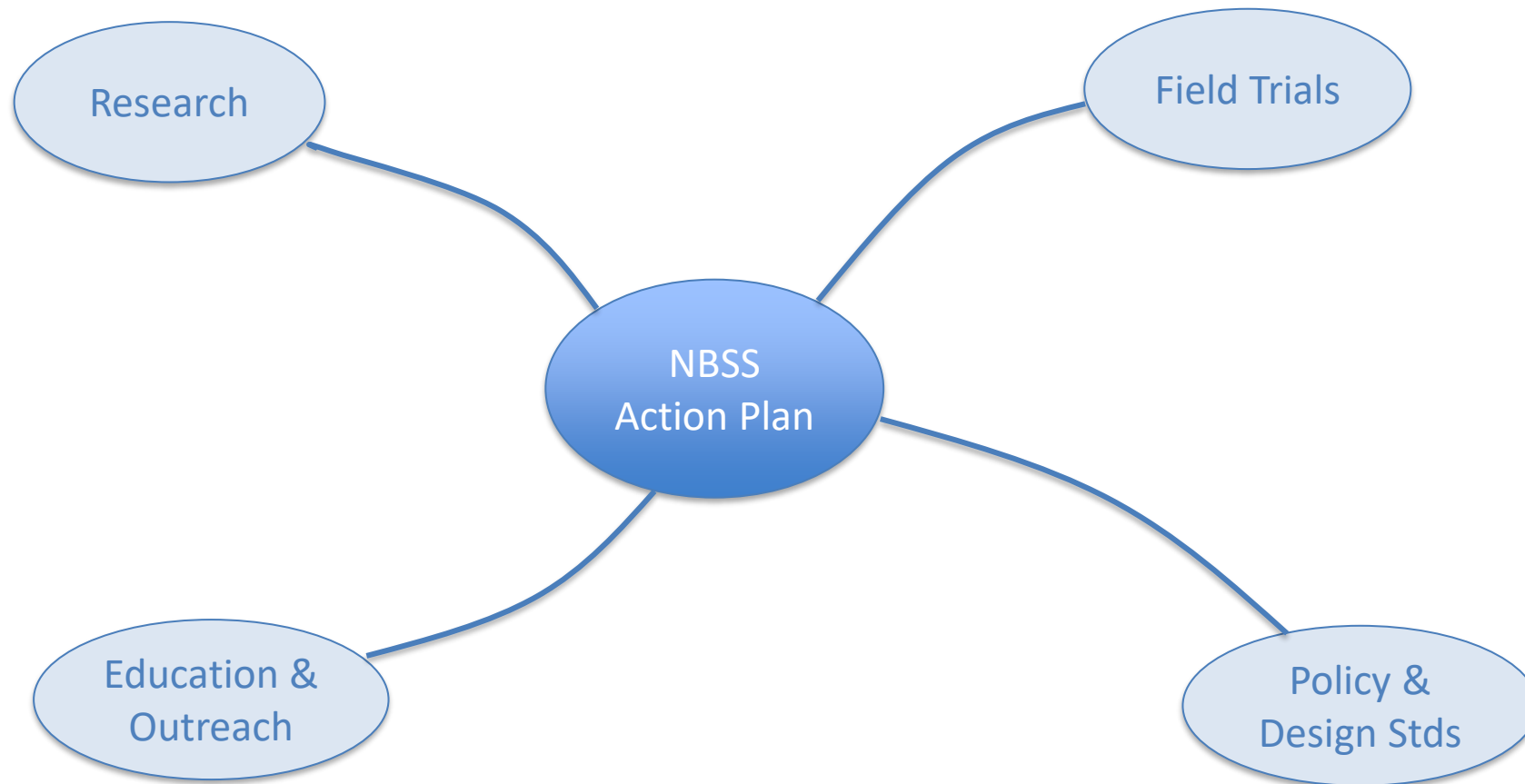
and engineering practices that weave natural features or processes into these disciplines. When applied broadly and where practicable, these strategies build more resilient transportation infrastructure.

1. **Develop educational and technical resources to improve the understanding of transportation planners, designers, roadside operations managers, and executive decision makers on the value of nature-based stormwater solutions tailored to transportation infrastructure.** These resources will need to be developed and adapted from other entities by NCDOT, consultants, researchers, NGOs and other governmental agencies.
 - a. Develop a guidance manual for transportation planners that illustrates effective incorporation of nature-based stormwater strategies into transportation planning and project development decision making processes.

Strategies Outlined in the Action Plan for Roadways

1. Develop educational and technical resources...
2. Complete a technical review of existing regulations and guidance...
3. Increase and prioritize the use of NBSS...
4. Engage transportation agencies as partners...

Roadways Update – Current Focus Areas



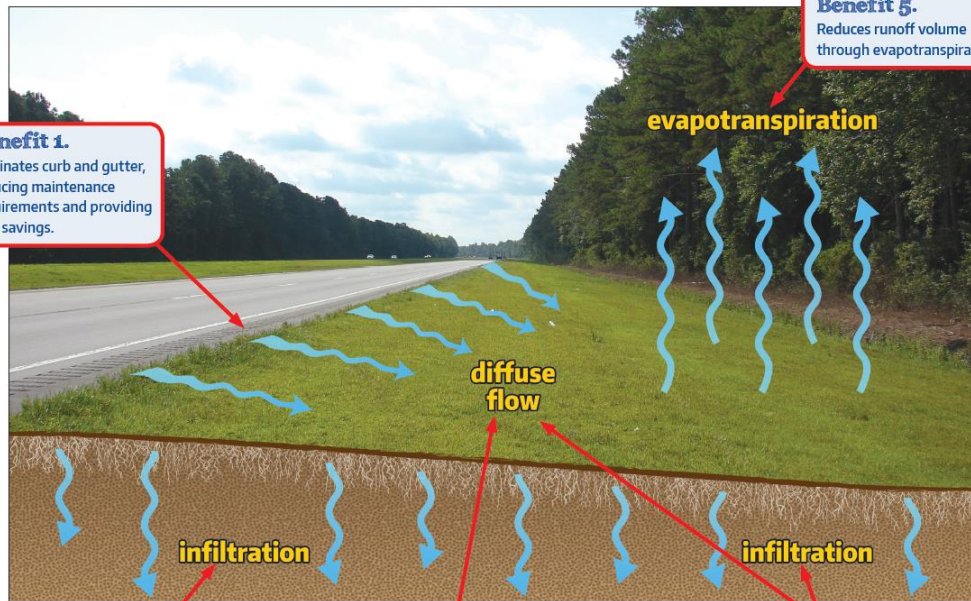
Research

Maximizing Shoulder Section Improves Water Quality



Benefit 1.

Eliminates curb and gutter, reducing maintenance requirements and providing cost savings.



Benefit 5.

Reduces runoff volume through evapotranspiration.

evapotranspiration

diffuse flow

infiltration

infiltration

Benefit 2.

Reduces runoff volume through infiltration.

Benefit 3.

Maintains runoff in a diffuse flow pattern, promoting sedimentation and filtration of pollutants through grass.

Benefit 4.

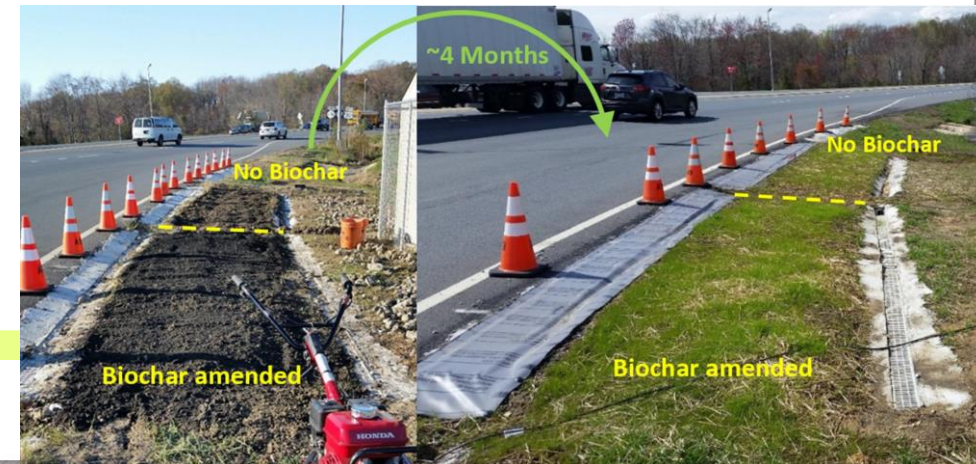
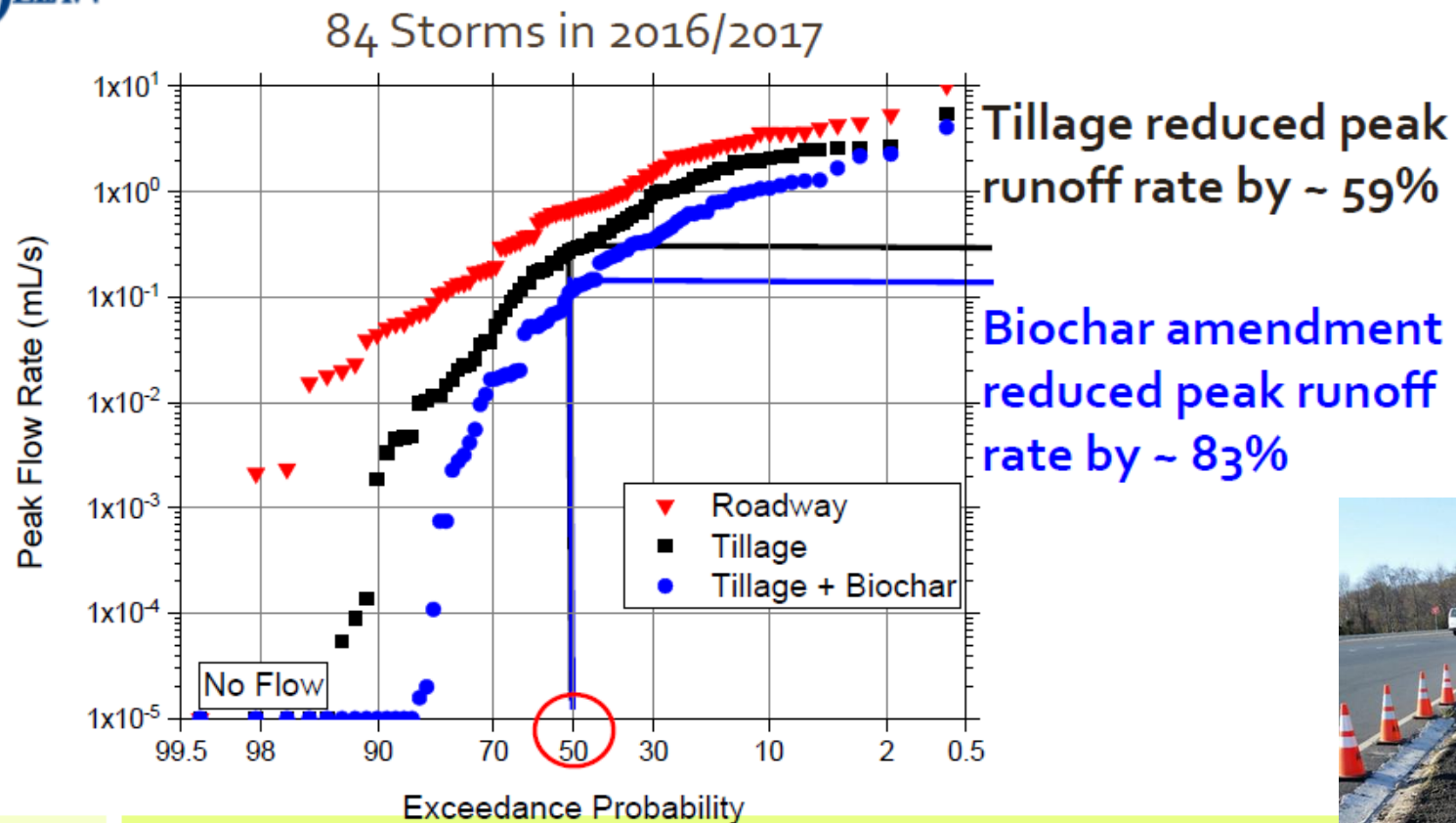
Improves water quality as runoff flows through vegetated areas and infiltrates into soil.

Soil Improvement to Enhance Infiltration



Research

Biochar Impact on Infiltration 2016-2017 (1-1.5 y)



Slide Credit: Dr. Paul Imhoff, University of Delaware

Field Trials

- NBSS Action Plan for Falls Lake
 - NBSS retrofit opportunities
 - Carbon Footprint evaluation
 - Construction materials
 - Construction activities
 - Maintenance activities
 - Sequestration by vegetation and soils



Field Trials

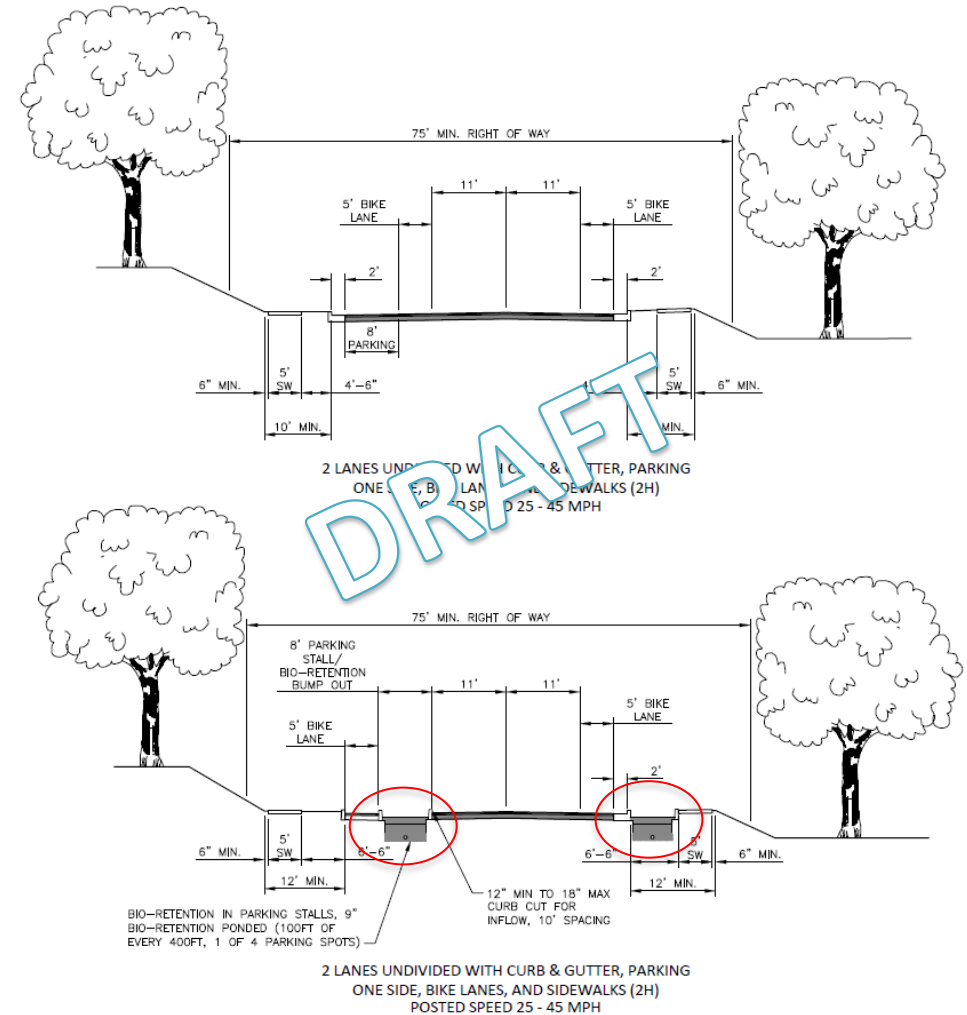
- Evaluation Procedure for Implementation Opportunities for NBSS within NCDOT Remnant Properties



Remnant Property ID #:		Date:	
Data Collected By:	County:	Division:	
Acreage:	Remnant Class:	Status:	
Brief Site Description:			
Step 1: Compile all available mapping data within the vicinity of the proposed site			
Check the following sources for available GIS data:			
<input type="checkbox"/> NCDOT GIS Data:	Download available data from NCDOT GIS website (Roads, railroads, county boundaries, structures). https://connect.ncdot.gov/resources/gis/Pages/GIS-Data-Layers.aspx		
<input type="checkbox"/> NC Onemap Data:	Search NC Onemap for data such as parcel boundaries, orthoimagery, and contours. http://www.nconemap.com/		
<input type="checkbox"/> NC Spatial Data:	Download LIDAR and DEM files from NC's spatial data download site. https://sdd.nc.gov/		
<input type="checkbox"/> ESRI Online Data:	Download data from ArcGIS online services (USGS Quad maps, topography, soil data, imagery, etc).		
<input type="checkbox"/> Stream Stats Data:	Get detailed drainage area data and download shapefile. https://streamstats.usgs.gov/ss/		
<input type="checkbox"/> Connect NCDOT Atlas Data:	Utilize NCDOT's Atlas screening tool to get data on the site by drawing project area, choosing layers, and downloading shapefile. https://gis27.services.ncdot.gov/GIS/TransScreen/Screening/home		
<input type="checkbox"/> NC 811 Utilities Data:	Obtain information on utilities within the site with NC 811. www.nc811.org		
<input type="checkbox"/> County GIS Data:	Most counties have GIS data available for download (shapefiles such as parcel lines, county topography, utilities, easements, soils).		
<input type="checkbox"/> Stream Classification:	Find the classification of nearby water bodies and the corresponding rules and regulations. https://deq.nc.gov/about/divisions/water-resources/planning/classification-standards/classifications		
Step 2: Use compiled mapping data to create base map for site			
At a minimum the base map should include:			
<input type="checkbox"/> Parcel Lines	<input type="checkbox"/> Topography within site and for drainage area	<input type="checkbox"/> Most recent aerial photography	<input type="checkbox"/> Estimated drainage area
Step 3: Use base map to assess potential NBSS retrofit site			
At a minimum the following should be estimated for the site:			
<input type="checkbox"/> Estimate average slope of site	<input type="checkbox"/> Estimate landuse and impervious area	<input type="checkbox"/> Estimate potential runoff from NCDOT roads/facilities	<input type="checkbox"/> Identify potential NBSS locations

Policy & Design Standards

- Evaluate possible changes/options to NCDOT typical sections for various urban and rural roadway types



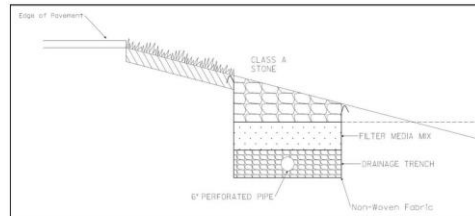
Policy & Design Standards

- BMP Toolbox update
 - National review of practices and design standards
 - Add new BMPs to the Toolbox
 - Create on demand video-based training



Bio-Embankments

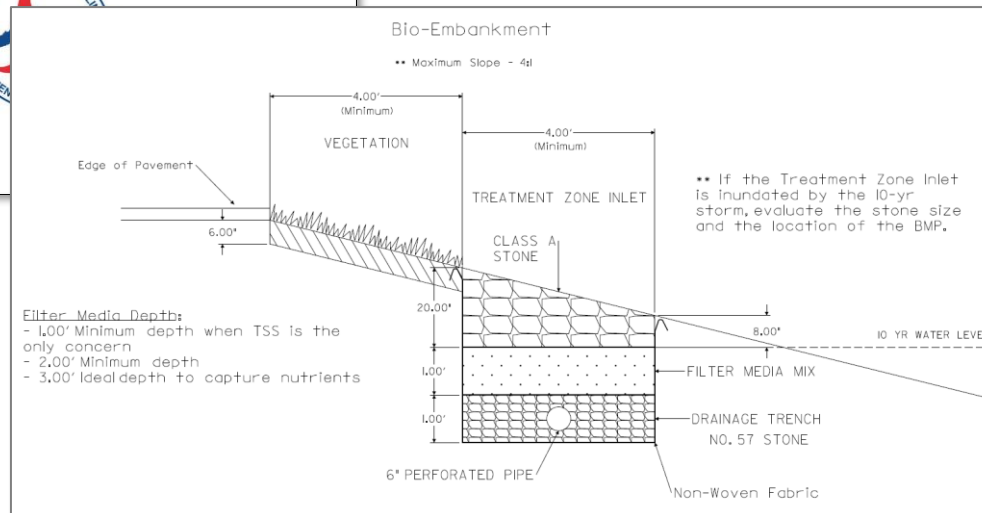
BIO-EMBANKMENTS



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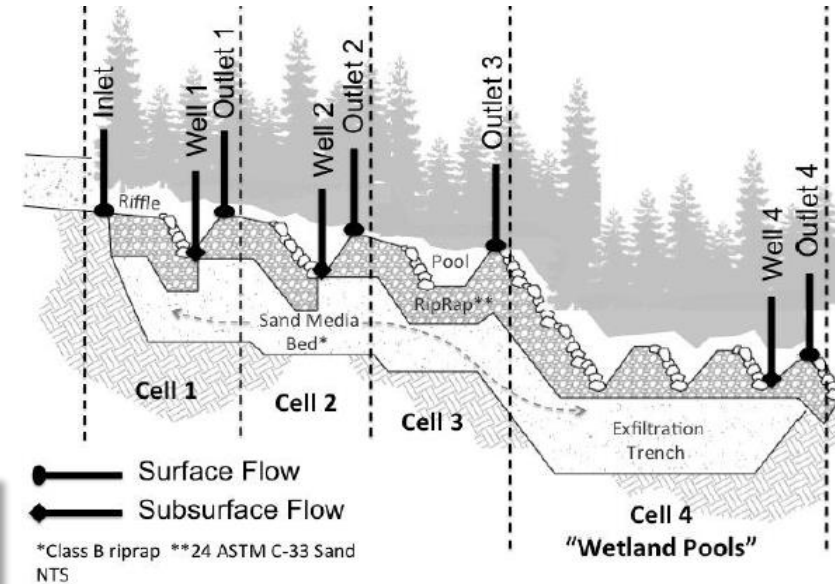
July 2017



Biofiltration Conveyance - BFC

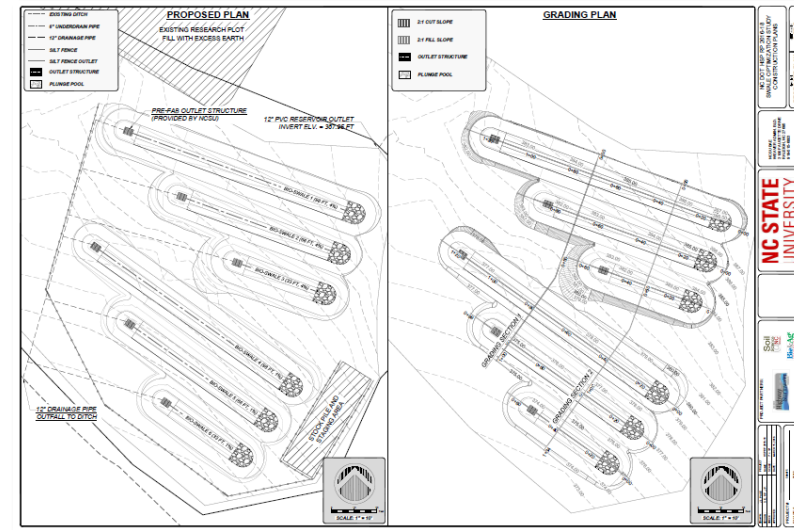


- Biofiltration Conveyance - BFC



- BFC constructed with Armorflex Concrete Mattress instead of rip-rap

Bioswale & Swale Design/Optimization



Education & Outreach

VISUALIZING ROADSIDES AS TRANSPORTATION ASSETS

WSDOT owns and maintains approximately 100,000 acres of unpaved land. As part of the agency's overall Transportation Asset Management Plan, WSDOT has classified and mapped roadside land use areas as shown on this poster. This geographic inventory of six specific roadside land use types provides the basis for budgeting, planning, tracking, monitoring, and evaluating maintenance actions, and for measuring agency performance.



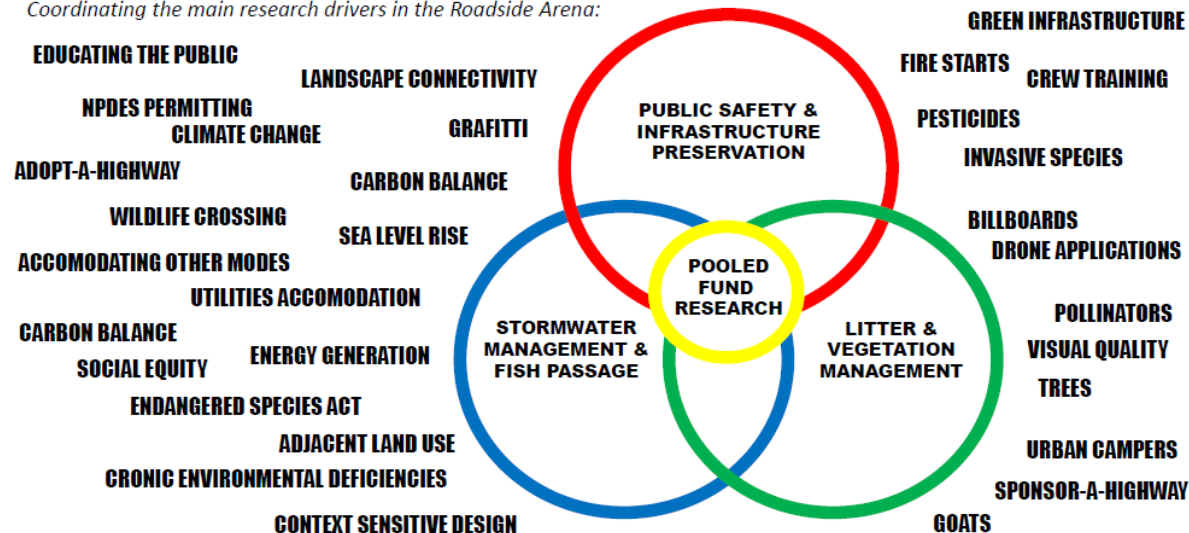
Education & Outreach

- National level coordination via the Transportation Research Board
- Goal: Develop an online information portal

PROBLEM NUMBER: 2022-F-01

Tools and Technology for Roadside Landscape Asset Management

Coordinating the main research drivers in the Roadside Arena:

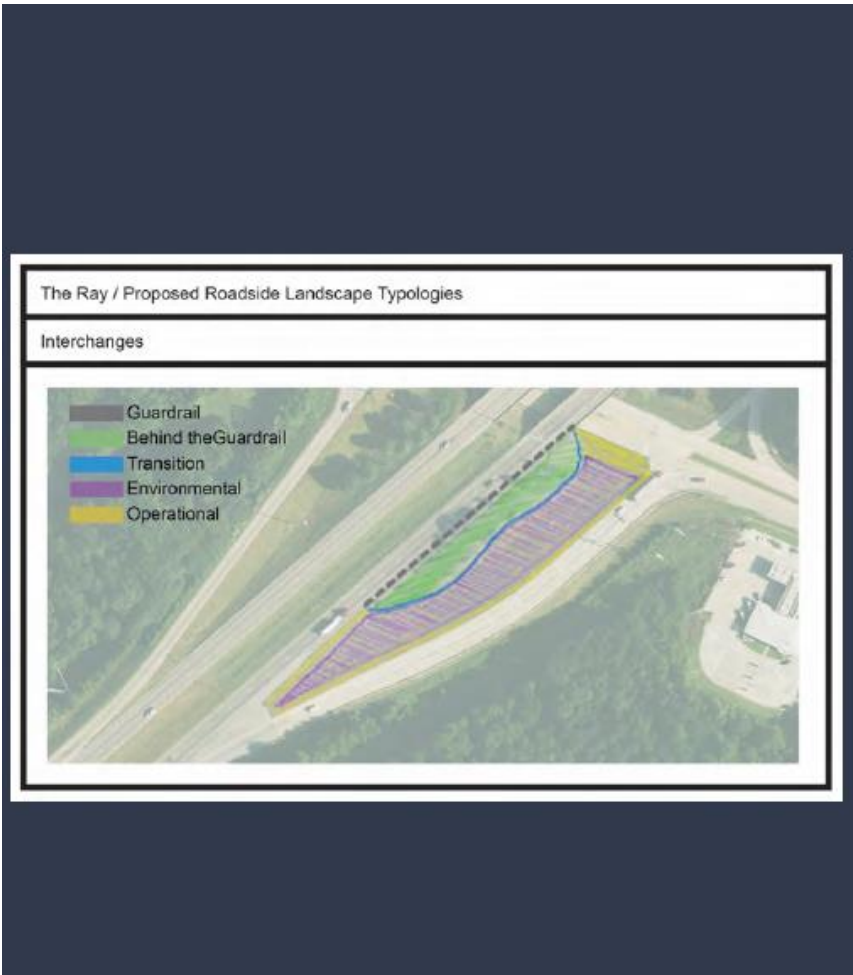


Slide credit: Ray Willard, WSDOT

Education & Outreach



Education & Outreach



Interchanges

Zone B / Environmental Zone

Possible planting strategies include but are not limited to:

- Pollinator meadows
- Native plant seed production
- Canola or other biodiesel crops
- Plantings for carbon sequestration
- Crops for hay or other productive fiber production goals
- Roadside solar (outside of the designed clear zone with safety fencing)

Slide credit: Matthew Quirey, Research Fellow, The Ray

Thank You!

