Piloting In-pipe Filters and Biofiltration Basins to Remove Bacteria from Stormwater in New Braunfels

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Nissim Gore-Datar, Arcadis

January 22nd, 2025

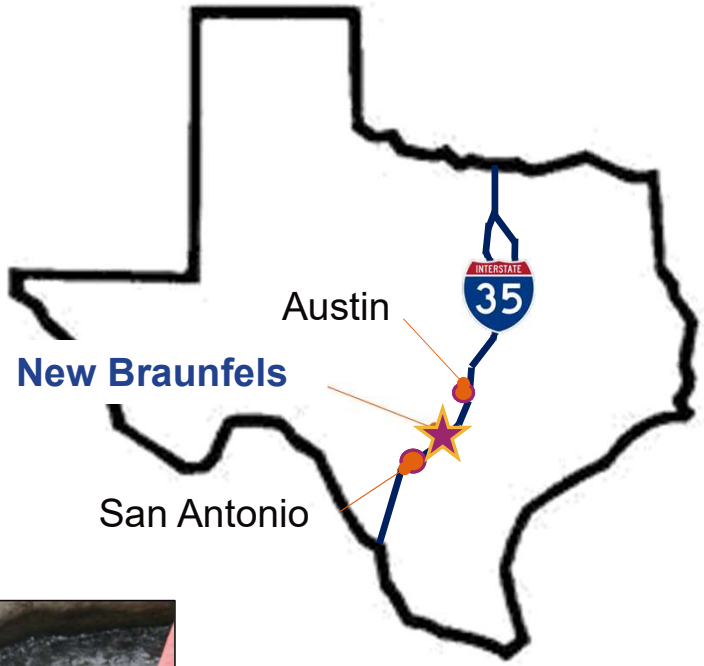
Agenda

TEXAS REGIONAL STORMWATER CONFERENCE

1. The Need for *E. coli* Removal BMPs in New Braunfels
2. Selection and Placement of BMPs
3. Design and Construction of BMPs
4. Key Takeaways

The City of New Braunfels

- **One of America's fastest-growing cities**
- **Current population: ~ 100,000**
- **A vibrant, water-loving community: tubing, swimming, fishing, kayaking, etc.**



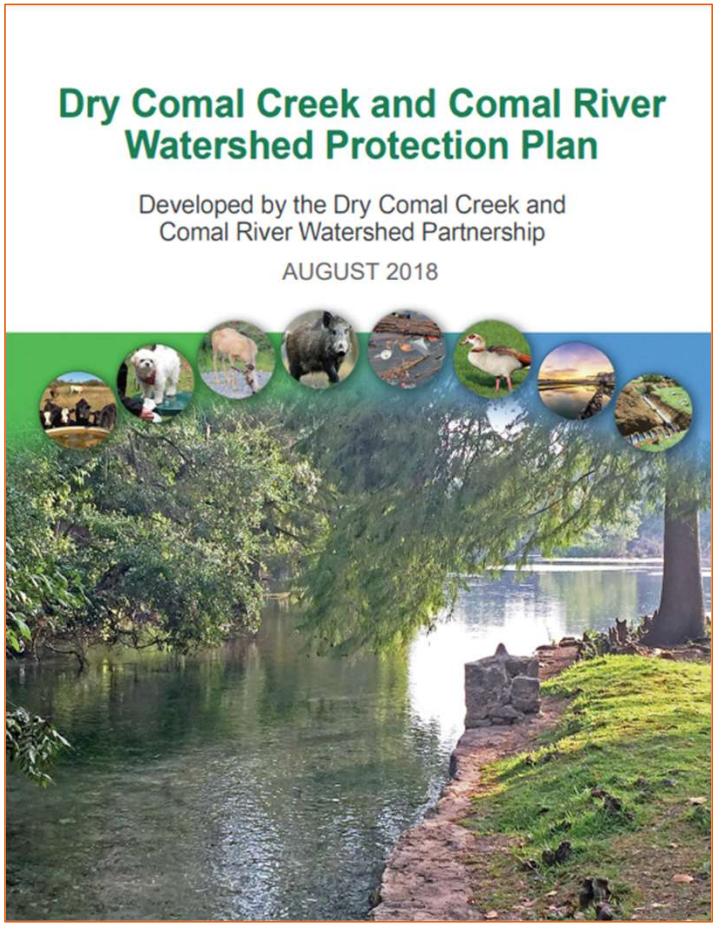
Dry Comal Creek and Comal River Watershed

- 83,160 acres
- Designated use: contact recreation
  - Popular water recreation destination
- Upstream of public drinking water supply
- Bacteria pollution – listed as 'impaired'
  - Dry Comal Creek – 2010
  - Comal River – 2016

The City's Watershed Protection Plan

- WPPs are stakeholder-driven watershed-based plans designed to prevent and manage nonpoint source (NPS) pollution.

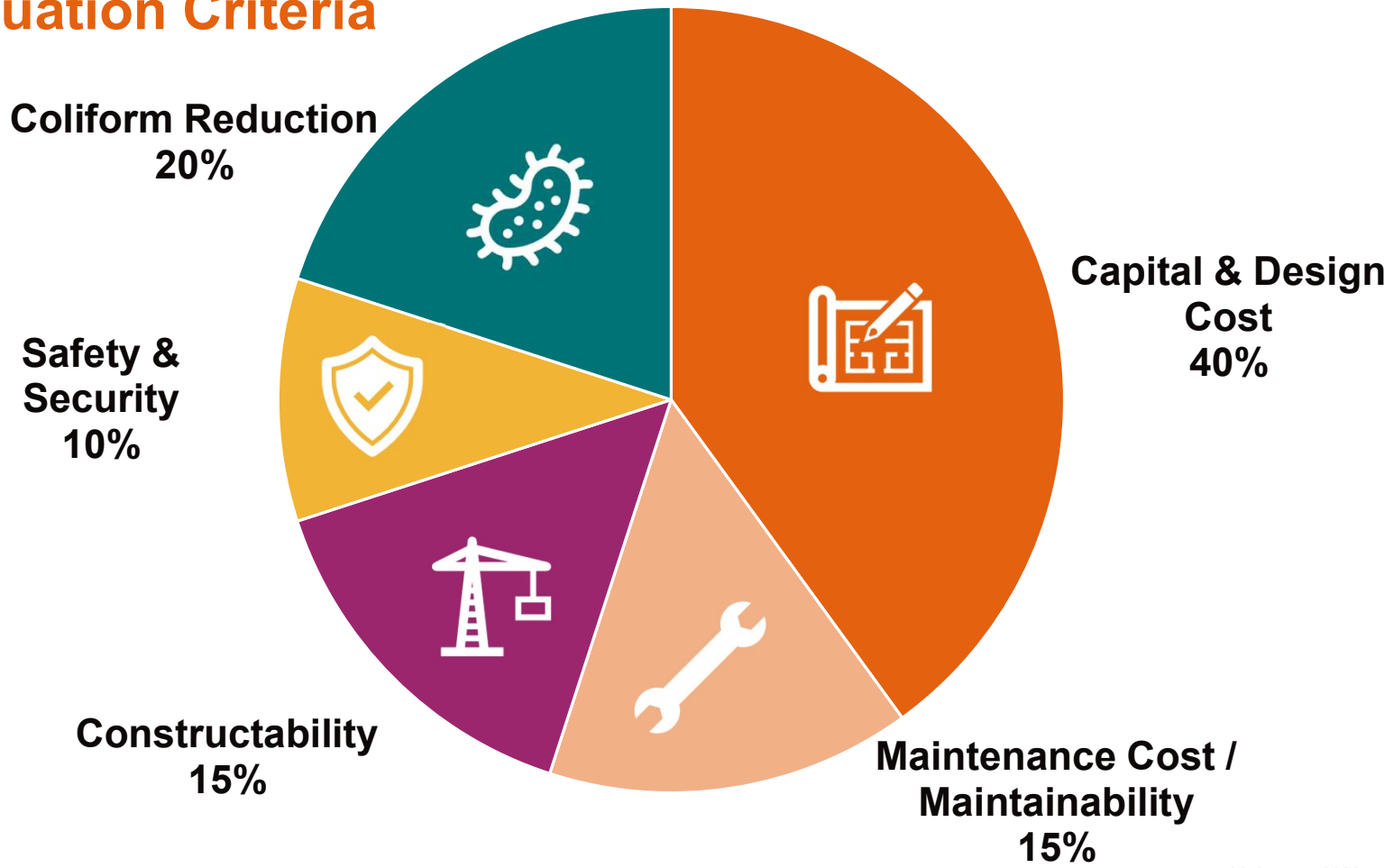
- The WPP and its implementation (including structural BMPs) are funded in part by the Nonpoint Source Program Grant under Section 319(h) of the Clean Water Act.



Watershed Protection Planning

- Develop a strategic plan
- Partner with agencies for funding and support
- Select, design & construct structural BMPs
- Monitor progress and adapt

BMP Evaluation Criteria



Approach to BMP Selection and Placement

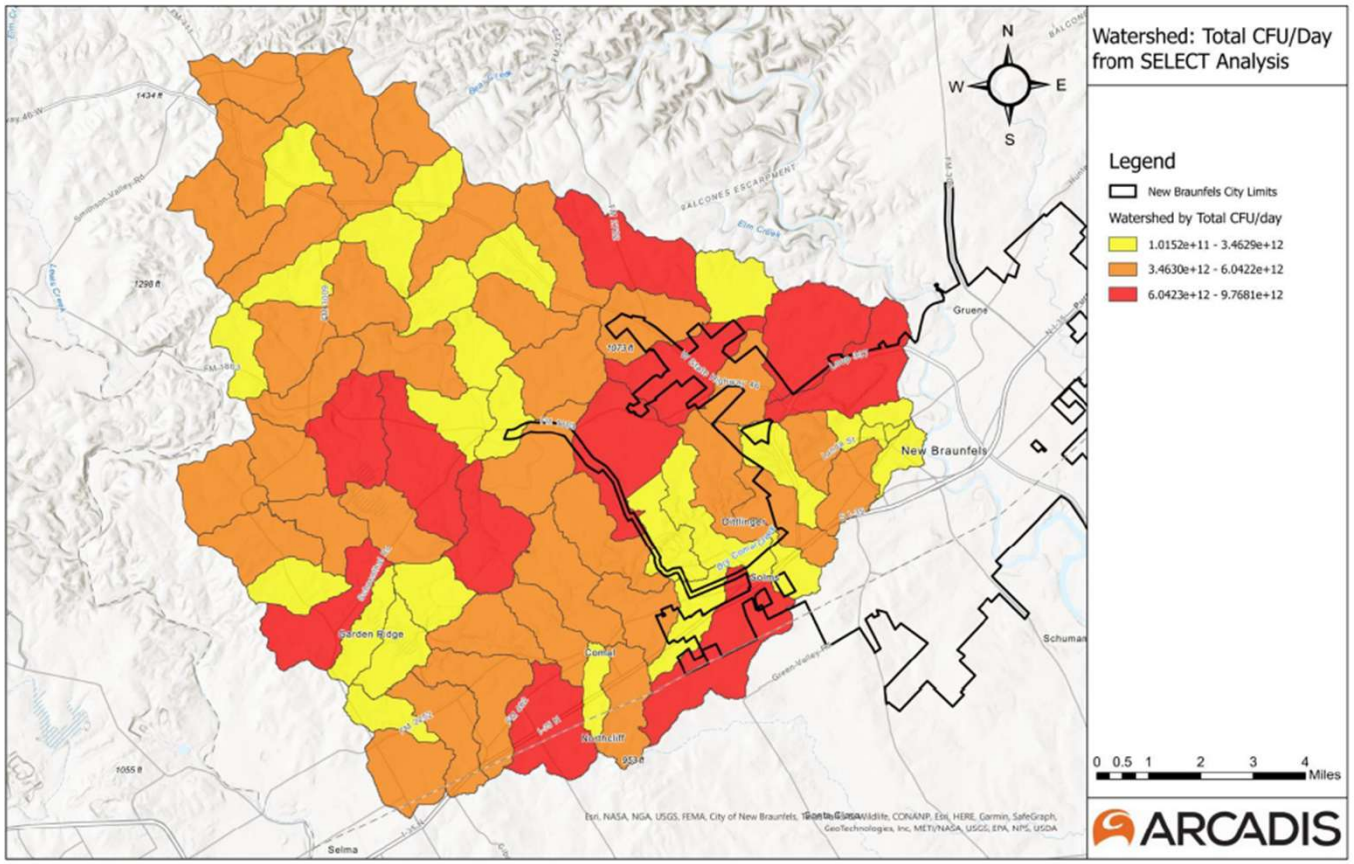
- Hydrologic Model
- Literature Review
- Water Quality Sampling
- Implementation Guidance

Hydrologic Model Methodology

- Utilized the existing subwatersheds and stream and tributaries shapefiles in ArcGIS
- Data on property parcels, city limits, elevations and stormwater infrastructure pulled from New Braunfels Open Data site
- Only stormwater outfalls within city limits and >24” were considered
- Outfalls were field verified and their accessibility and possible impacts to installation/construction were documented

SELECT Model for Potential BMP Locations

Spatially Explicit Load Enrichment Calculation Tool



Literature Review

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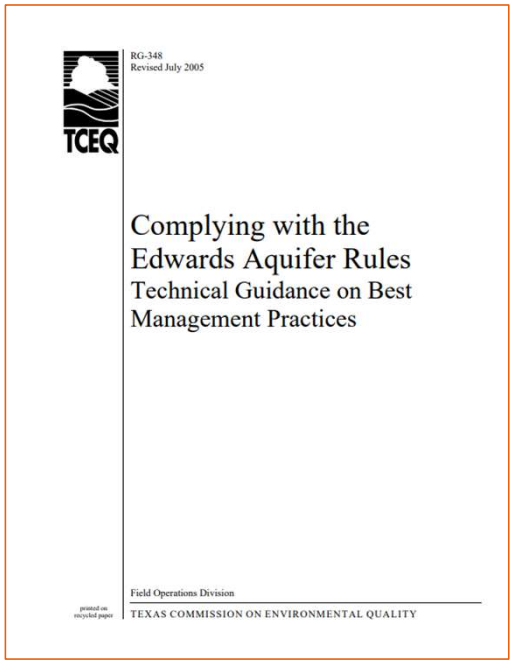


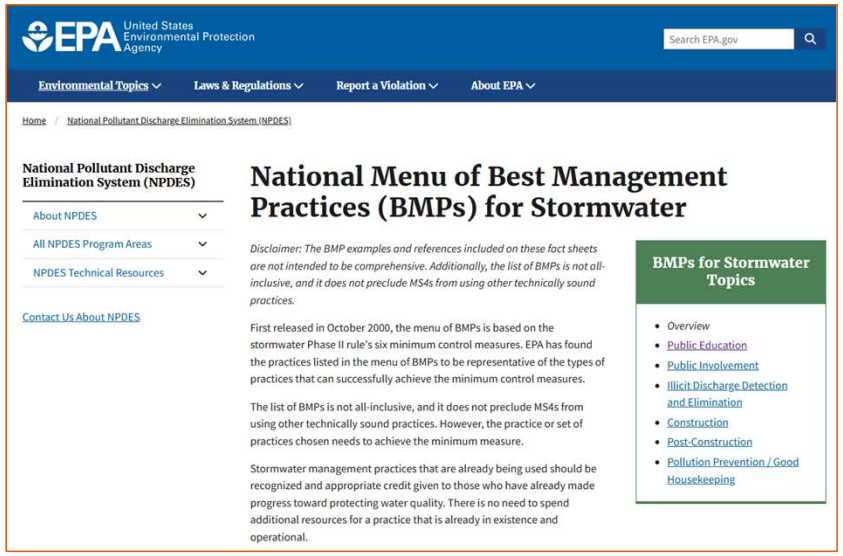
RG-348
Revised July 2005

TCEQ

Complying with the Edwards Aquifer Rules
Technical Guidance on Best Management Practices

Field Operations Division

TEXAS COMMISSION ON ENVIRONMENTAL QUALITY



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National Menu of Best Management Practices (BMPs) for Stormwater

Disclaimer: The BMP examples and references included on these fact sheets are not intended to be comprehensive. Additionally, the list of BMPs is not all-inclusive, and it does not preclude MS4s from using other technically sound practices.

First released in October 2000, the menu of BMPs is based on the stormwater Phase II rule's six minimum control measures. EPA has found the practices listed in the menu of BMPs to be representative of the types of practices that can successfully achieve the minimum control measures.

The list of BMPs is not all-inclusive, and it does not preclude MS4s from using other technically sound practices. However, the practice or set of practices chosen needs to achieve the minimum measure.

Stormwater management practices that are already being used should be recognized and appropriate credit given to those who have already made progress toward protecting water quality. There is no need to spend additional resources for a practice that is already in existence and operational.

BMPs for Stormwater Topics

- *Overview*
- Public Education
- Public Involvement
- Illicit Discharge Detection and Elimination
- Construction
- Post-Construction
- Pollution Prevention / Good Housekeeping

GEORGIA
STORMWATER MANAGEMENT MANUAL
2016 EDITION

Slide 11

NG1 Talk about how limited the list of BMPs that remove E coli is. That is why we did a pilot.
Gore-Datar, Nissim, 2026-01-08T21:08:16.037

NG1 0 Why we ruled out larger wetland type BMPs due to space constraints in a built-up town like New Braunfels
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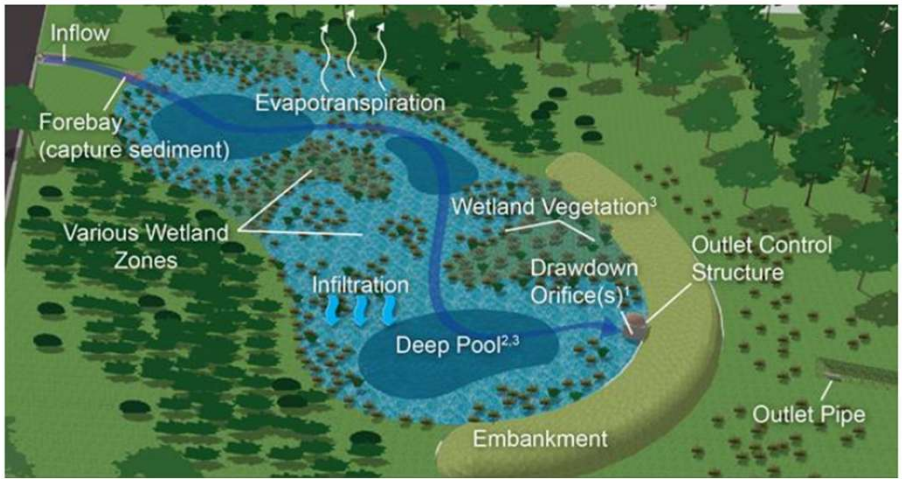
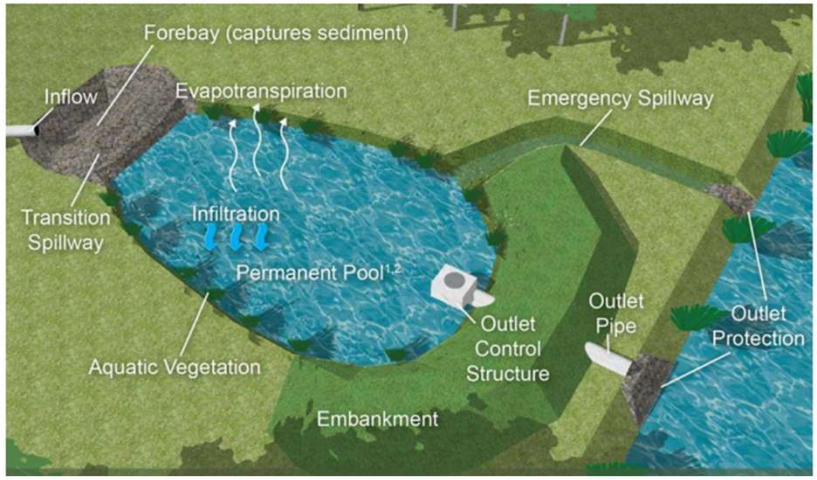
Natural Treatment BMPs: Large-Scale

Stormwater Wetland



Detention Pond



70% – 85% Fecal Coliform Removal 70%

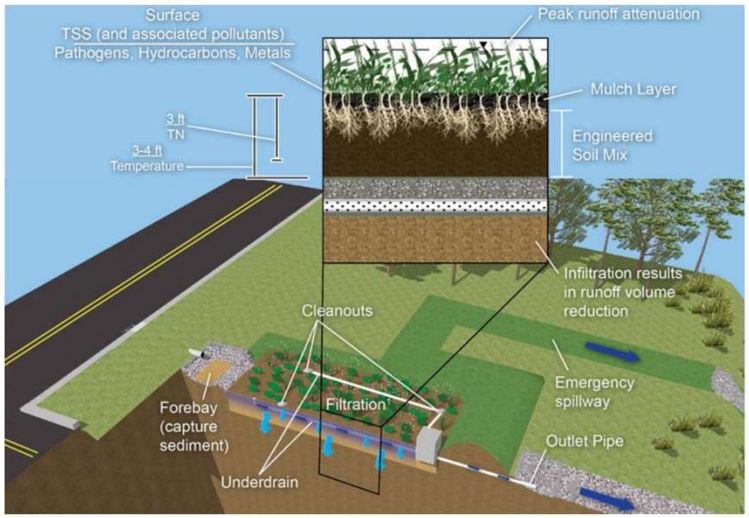
Source: Stormwater Design Guide, Georgia Dept. of Transportation, 2024

Natural Treatment BMPs: Large-Scale

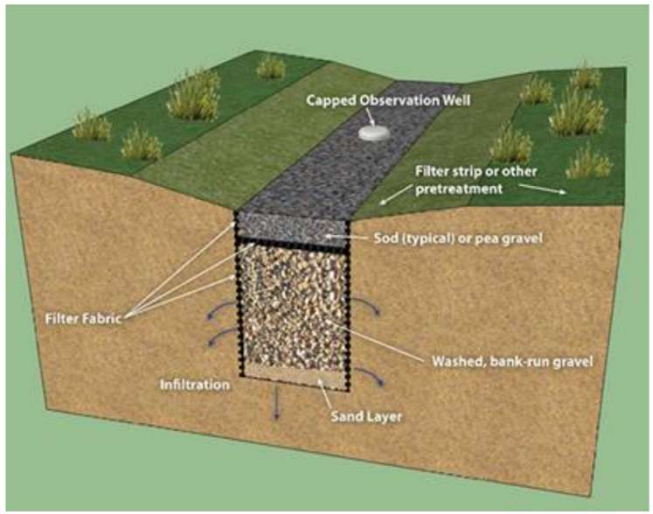
Criteria	Stormwater Ponds	Stormwater Wetlands
Capital and Design Cost	moderate	high
Maintenance Cost / Maintainability	moderate	low
Constructability	moderate	low
Safety and Security	moderate	moderate
Coliform Reduction	moderate	high
Total Score	moderate	low

Natural Treatment BMPs: Small-Scale

Bioretention Basin



Infiltration Trench



90% Fecal Coliform Removal 100%

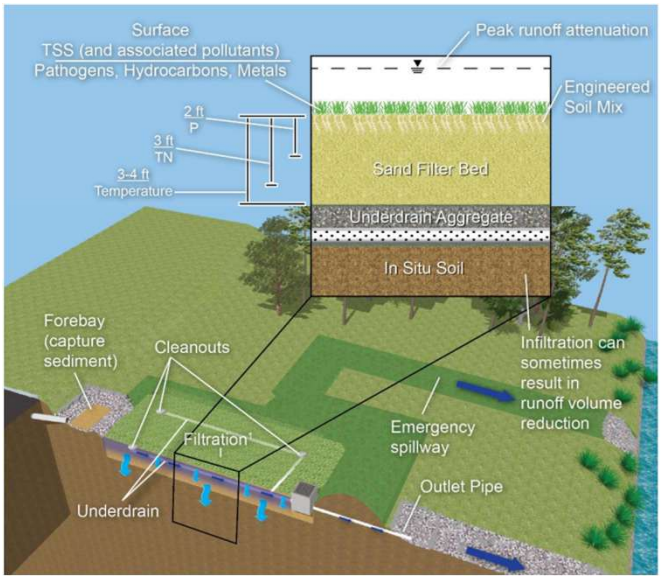
Source: Stormwater Design Guide, Georgia Dept. of Transportation, 2024

Natural Treatment BMPs: Small-Scale

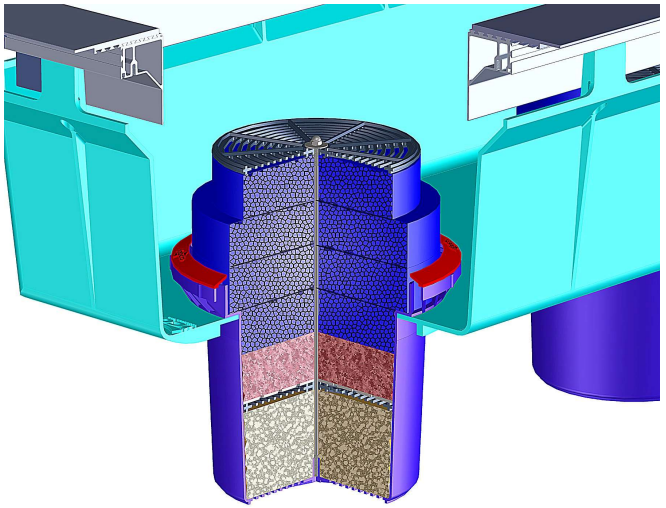
Criteria	Bioretention Basins	Infiltration Trenches
Capital and Design Cost	high	moderate
Maintenance Cost	moderate	high
Constructability	high	high
Safety and Security	high	high
Coliform Reduction	high	moderate
Total Score	moderate	moderate

Engineered Filter BMPs

Sand Filter



In-pipe/Cartridge-based Filter



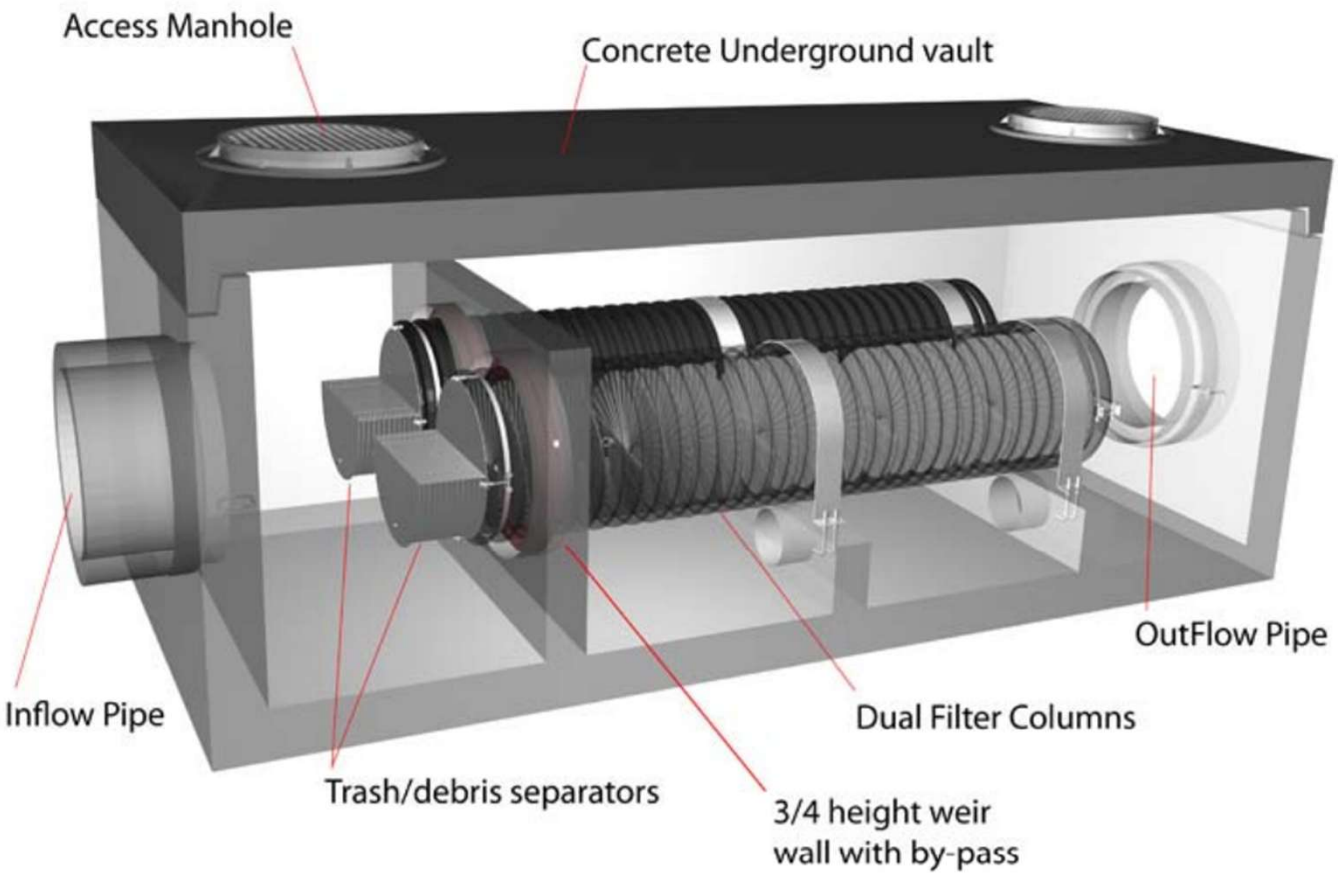
40% Fecal Coliform Removal 70% – 99%

Sources: Stormwater Design Guide, Georgia Dept. of Transportation, 2024; Fabco

Engineered Filter BMPs

Criteria	Sand Filters	Proprietary Filters
Capital and Design Cost	high	moderate
Maintenance Cost	moderate	moderate
Constructability	moderate	high
Safety and Security	moderate	high
Coliform Reduction	low	high[1]
Total Score	low	high

Selected Filtration BMP: Fabco Helix



Filtration and Bacteria Removal Process

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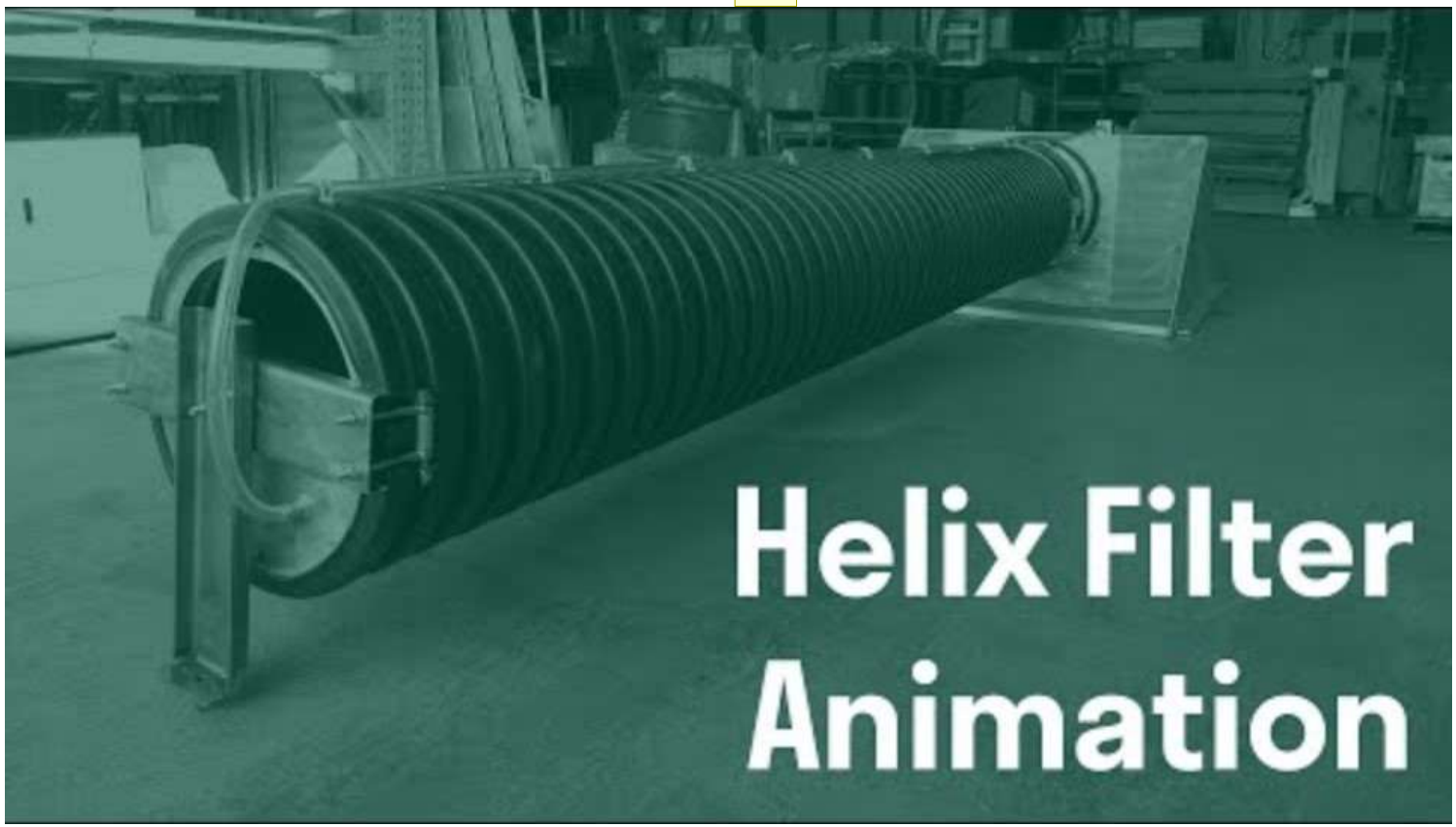

Slide 19

NG1 Add slides with case study from Fabco’s site of how it works elsewhere

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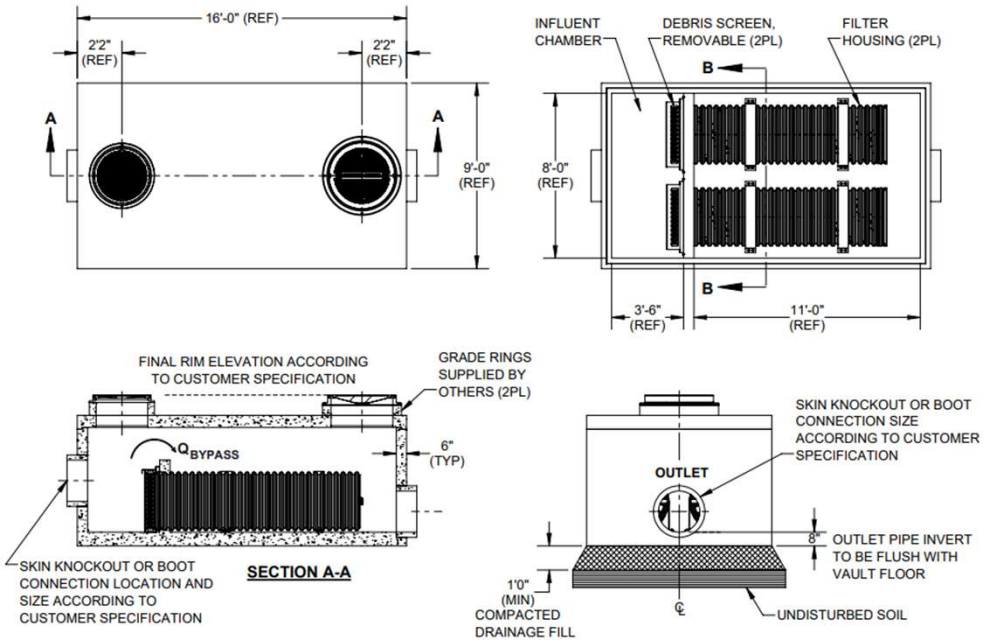
Site-specific Considerations

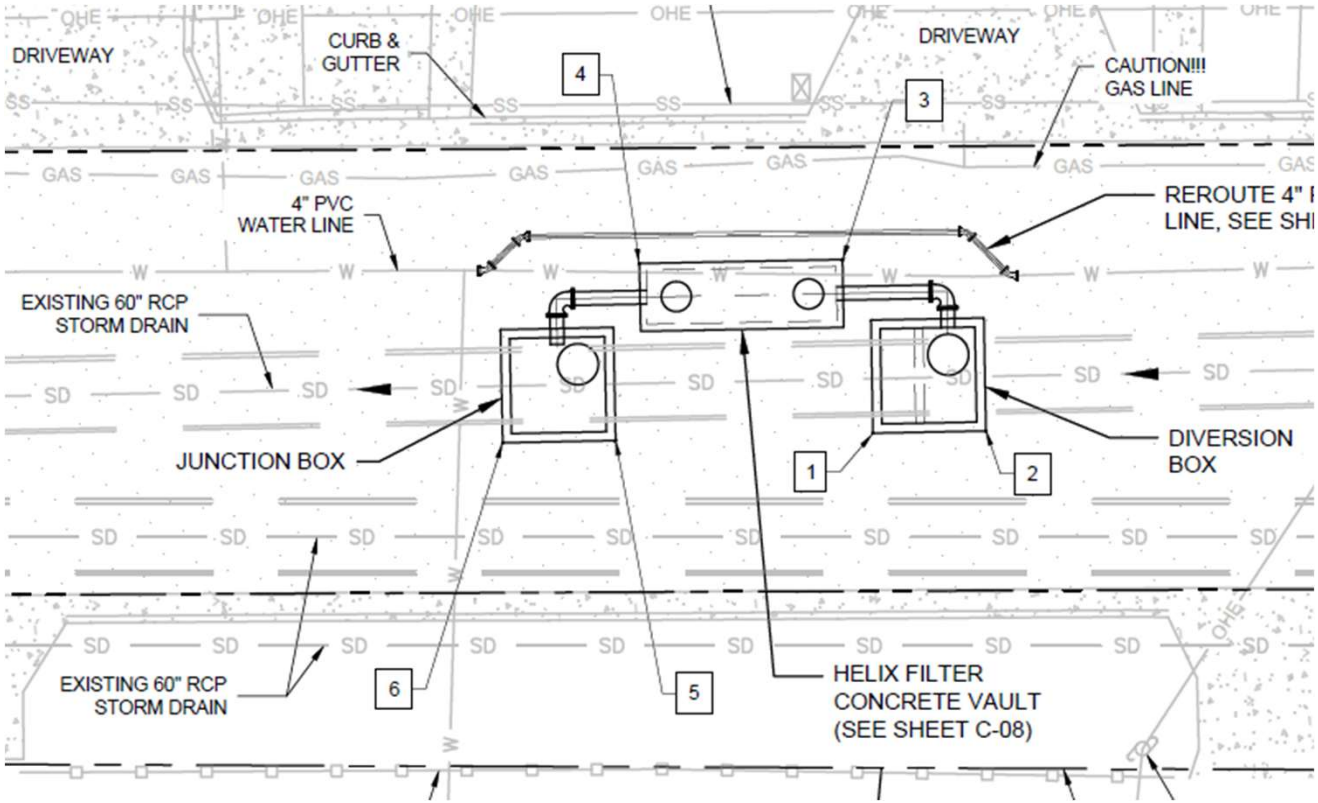
- Upstream of an active surface water quality monitoring station along the Dry Comal Creek
- Existing 60-inch storm drainpipe
- Railway easement nearby
- Water line in right-of-way

Factors Considered for Preliminary Design

- Contributing drainage area
- Size of BMP footprint
- Stormwater runoff flow rate
- BMP outlet size



Designing Diversion Structures



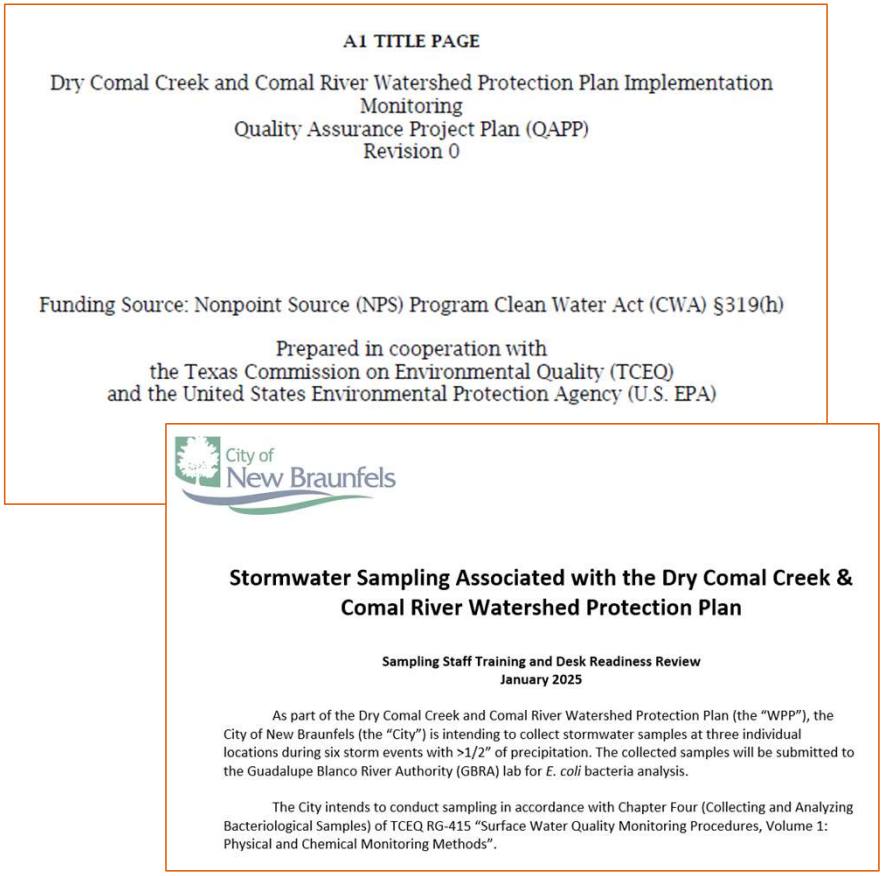
Implementation Timeline

Months	Implementation Activity
0 – 6	Identify pilot BMP type and location
6 – 12	Select stormwater consultant and execute design contract
13 – 18	Draft pilot BMP design plans
19 – 24	Finalize pilot BMP design plans & execute construction contract
25 – 36	Complete construction & as-built design plans
37 – 48	Complete initial inspection and maintenance events; conduct effectiveness sampling

Monitoring Challenge: ‘Qualifying Rain Events’

- TCEQ definition:
  - >2 hrs. long
  - >0.5 in. rainfall (New Braunfels Airport rain gauge)
  - During working hours on working days

- The ongoing drought has limited the number of opportunities to collect samples



A1 TITLE PAGE

Dry Comal Creek and Comal River Watershed Protection Plan Implementation Monitoring
Quality Assurance Project Plan (QAPP)
Revision 0

Funding Source: Nonpoint Source (NPS) Program Clean Water Act (CWA) §319(h)

Prepared in cooperation with
the Texas Commission on Environmental Quality (TCEQ)
and the United States Environmental Protection Agency (U.S. EPA)

City of New Braunfels

Stormwater Sampling Associated with the Dry Comal Creek & Comal River Watershed Protection Plan

Sampling Staff Training and Desk Readiness Review
January 2025

As part of the Dry Comal Creek and Comal River Watershed Protection Plan (the “WPP”), the City of New Braunfels (the “City”) is intending to collect stormwater samples at three individual locations during six storm events with >1/2” of precipitation. The collected samples will be submitted to the Guadalupe Blanco River Authority (GBRA) lab for *E. coli* bacteria analysis.

The City intends to conduct sampling in accordance with Chapter Four (Collecting and Analyzing Bacteriological Samples) of TCEQ RG-415 “Surface Water Quality Monitoring Procedures, Volume 1: Physical and Chemical Monitoring Methods”.

Key Takeaways

- Federal funding can be utilized to develop & implement a WPP
- Literature reviews, hydrologic modeling and water quality sampling can help shortlist BMPs and locations
- Structural BMP options for *E. coli* reduction are limited, and performance data are sparse
- Pilot testing can help fill data gaps and assess suitability
- Site-specific construction challenges and drought-driven monitoring challenges can hinder implementation

Thank you for attending!

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