# Subsurface Gravel Wetlands

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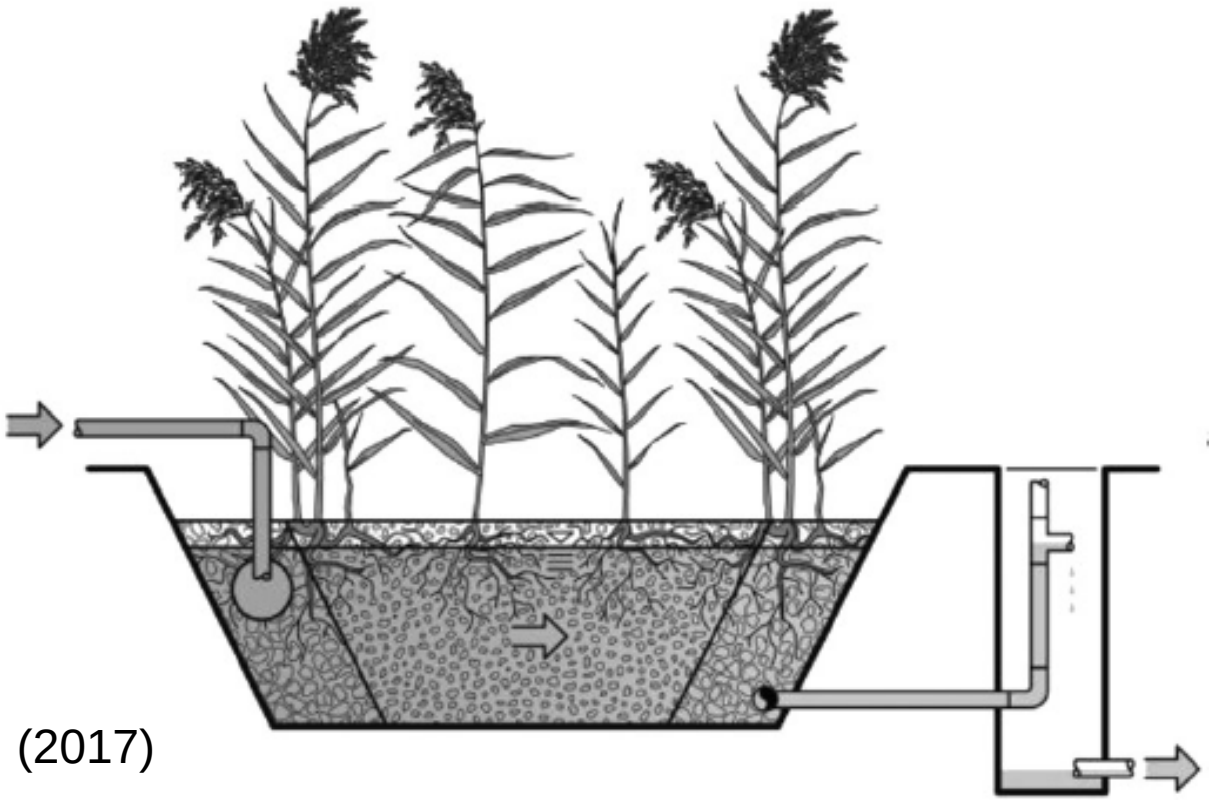
January 2020 NSAB Meeting

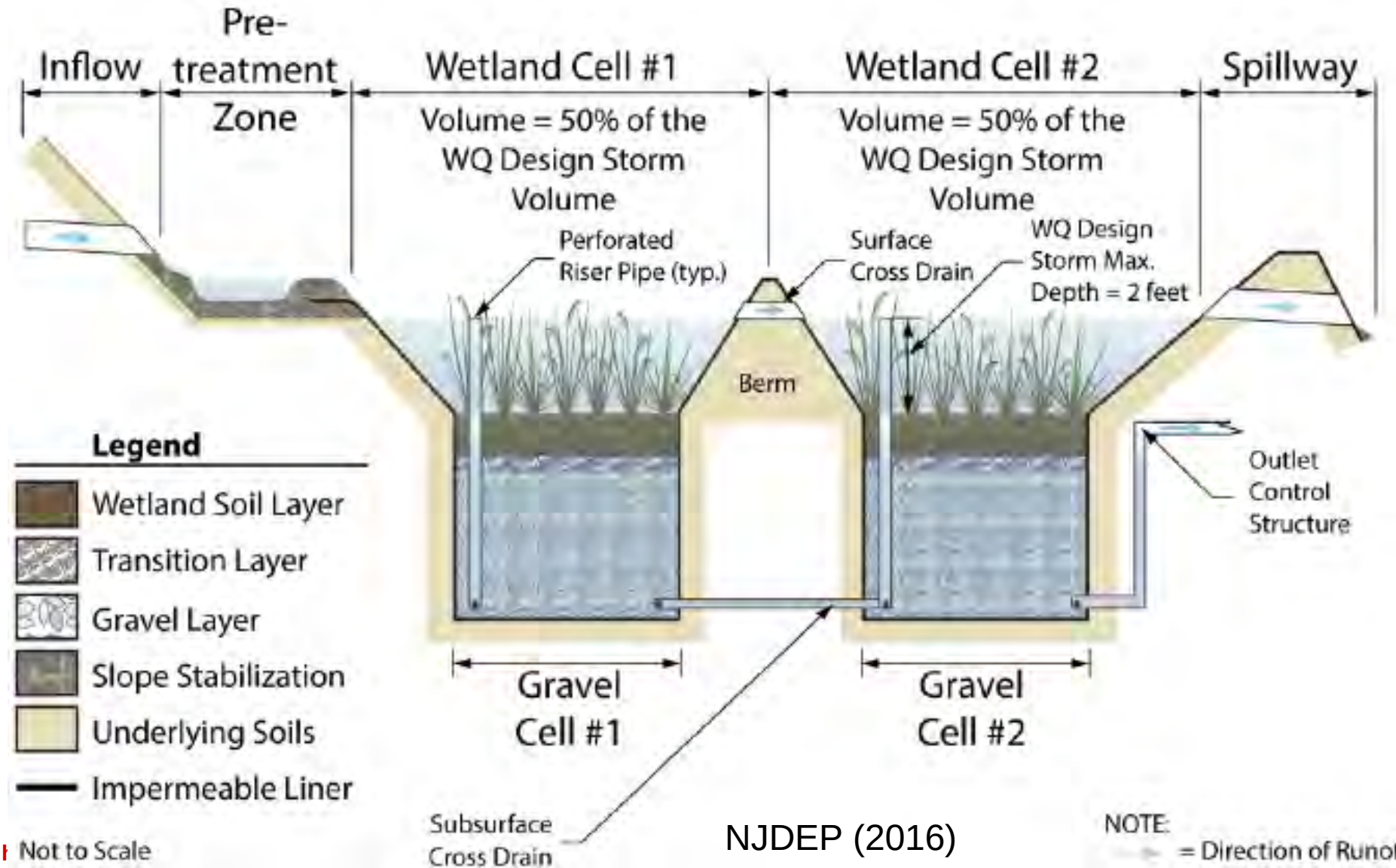
# What are Subsurface Gravel Wetlands?

- Structural option for wastewater or stormwater treatment
- Treatment provided using horizontal flow through saturated gravel bed



Dotro et al. (2017)

# What are Subsurface Gravel Wetlands?




NJDEP (2016)

# Gravel Wetlands vs. Stormwater Wetlands

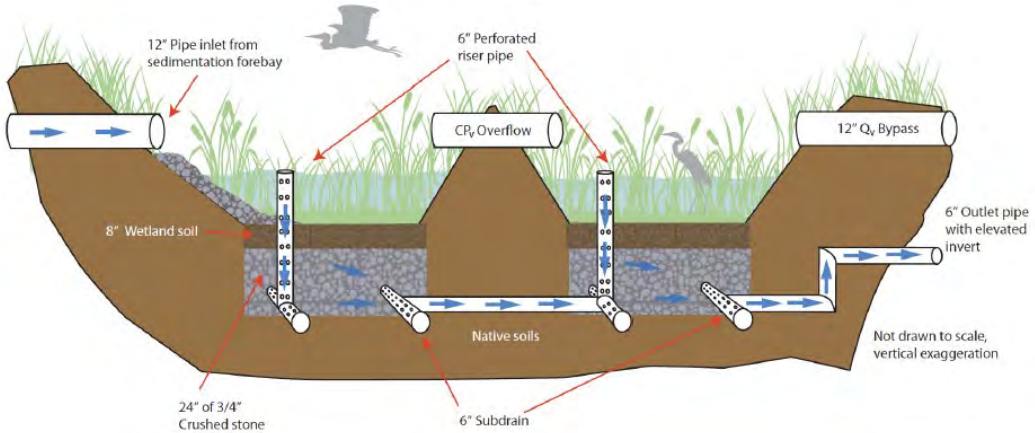
- Stormwater wetlands:
  - Constantly ponded water
  - Varying topography
  - Plant specific zones
- Gravel wetlands:
  - Temporarily pond water
  - Saturated gravel layer
  - Little variation in topography

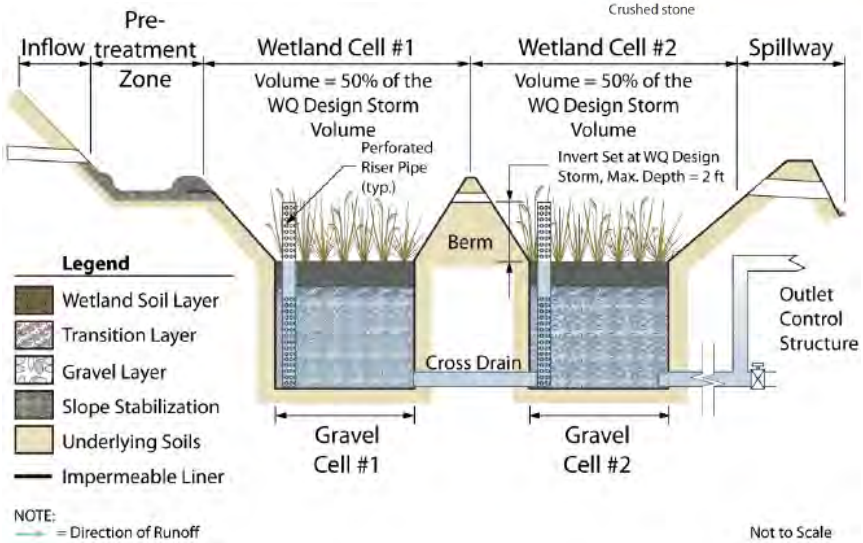
# Gravel Wetlands vs. Stormwater Wetlands

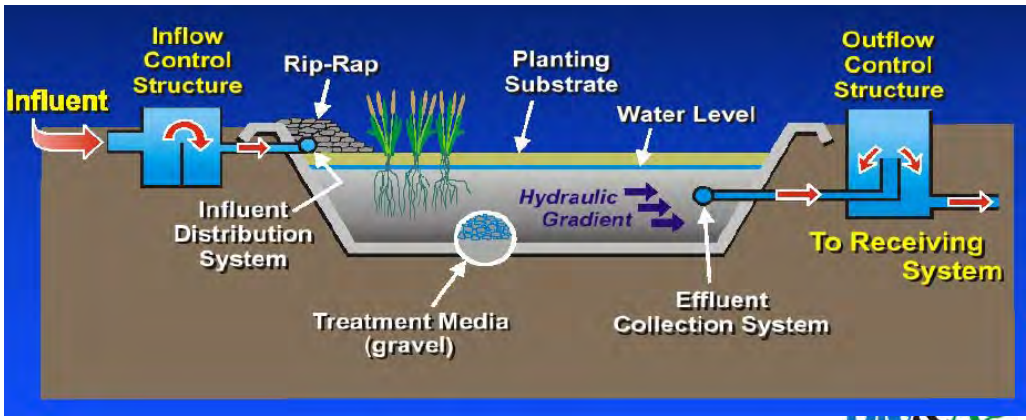
- NC stormwater wetlands (Hathaway and Hunt 2010; Line et al. 2008; Mallin et al. 2012):
  - TN removal: 39 to 59%
  - TP removal: 27 to 68%
  - TSS removal: 58 to 83%
- Gravel wetlands:
  - Wastewater: up to 96% TN and 71% TP removal (Van de Moortel et al. 2009); < 20 mg/L effluent TSS (Reed and Brown 1995)
  - Stormwater: 54% TP and 99% TSS removal (Roseen et al. 2009)

# Current Design Guidance

- Gravel wetlands approved SCM in: MD, NH, NJ, and TN



# Current Design Guidance- NH

- Pioneer of gravel wetlands for stormwater treatment
- Guidance (UNHSC 2016):
  - Saturated gravel within 4 to 8 in of soil surface
  - Minimum of: 8 in wetland soil, 3 in intermediate aggregate, 24 in gravel layers
  - Geotextile fabric if in-situ conductivity > 0.03 ft/day
  - Size primary orifice for 24 to 30 hr storage in gravel layer
  - Two cell system where length of each cell is ≥ 15 ft and holds 50% of WQV
  - Pre-treatment basin or forebay that is well-drained

# Current Design Guidance- MD

- Recommends following UNHSC (2016) design manual
- Guidance (MDE 2012):
  - Appropriate for HSG C or D soils or sites with high groundwater table
  - Must use impermeable liner for HSG A or B soils
  - Wetland soil specifications:

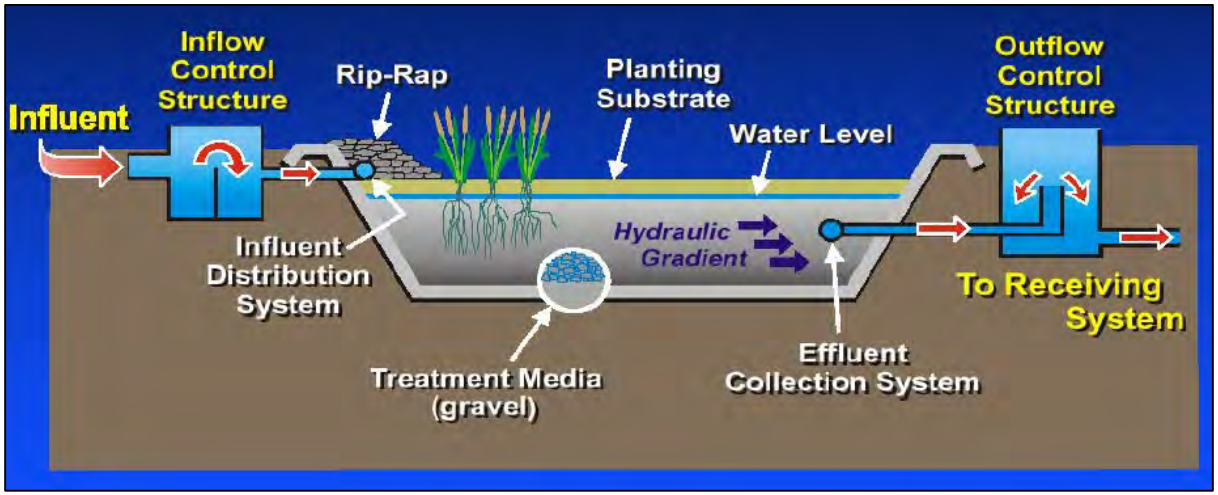
| US Standard Sieve Size in/mm | Percent Passing | Percent Passing Testing Tolerances |
|---|---|---|
| 0.5/12.5 | 100 | ± 10.0 |
| #10/2.00 | 90 - 75 | ± 5.0 |
| #100/0.15 | 40-50 | ± 5.0 |
| #200/0.075 | 25-50 | ± 5.0 |

# Current Design Guidance- NJ

- Guidance (NJDEP 2016):
  - Minimum 85% vegetation density
  - Forebay sized to hold minimum 10% WQV and drain within 9 hrs
  - Maximum ponded water at soil surface is 2 ft and drains within 72 hrs
  - Similar depths of soil and aggregate as UNHSC (2016)
  - At least 1 ft separation from SHWT

# Current Design Guidance- TN

- Guidance (Knox County 2018):
  - Drainage area ≤ 5 ac with ≥ 50% impervious cover
  - SHWT separation ≥ 2 ft
  - Pre-treatment required and accounts for WQV storage
  - Minimum of 20 ft wide easement for maintenance



# Current Design Guidance Synopsis

- General consensus:
  - Pre-treatment is necessary
  - Permeable in-situ soils should be avoided
  - Saturation within 4 to 8 in of wetland soil surface
  - Temporarily (≤ 72 hrs) pond water at surface
  - Drainage pipes incorporated into cell(s) to encourage infiltration into gravel layer
  - At least 8 in soil, 3 in intermediate aggregate, 2 ft gravel

# Greensboro Gravel Wetland

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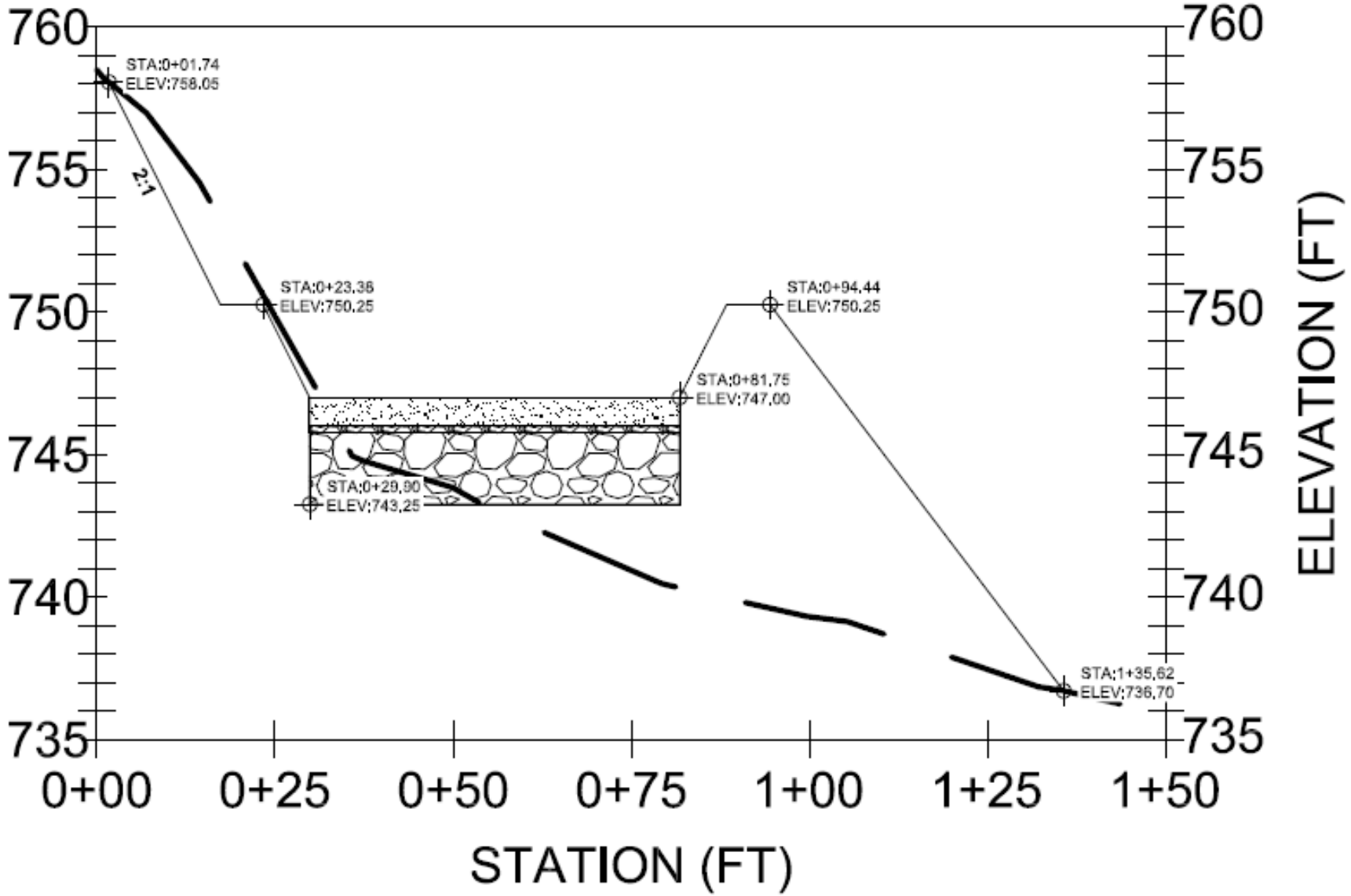
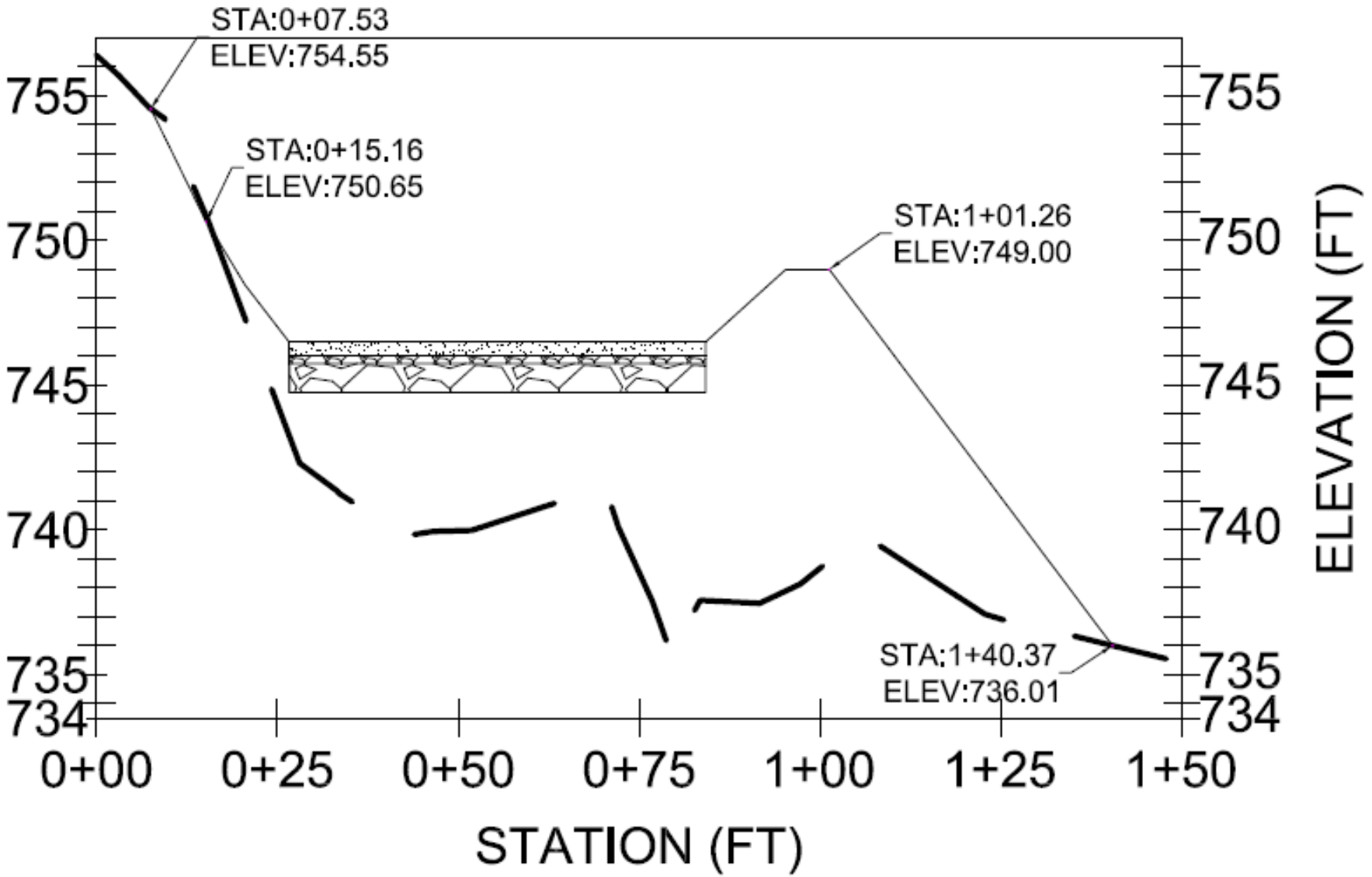


# Greensboro Gravel Wetland



# Next Steps

- Monitor Greensboro gravel wetland through August 2020
- Begin monitoring Raleigh gravel wetland Fall 2020
- Finalize design guidance and EMCs December 2021

# Questions?

cleanwater MANAGEMENT TRUST FUND

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GREENSBORO NORTH CAROLINA

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