BMPs for Constrained Roadway Projects

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Agenda

- Goals
- Pollutants of Concern
- How Pollutants of Concern are Treated
- Design Constraints
- Evolution of Design
- Suite of Selected BMPs
- Lessons Learned

Goals

Directed by the Tollway to develop a suite of BMPs for future projects that would, to the extent practicable, minimize the impact on the environment through the implementation of a number of onsite Best Management Practices.

Any selected BMPs must be:

- Safe for the traveling public
- Sustainable
- Be capable of being maintained by Tollway maintenance personnel who are provided with additional training
- Provide a quantifiable net benefit

Pollutants of Concern

- Oils
- Total Suspended Solids (TSS)
- Metals
- Nutrients
- Chlorides

How Pollutants are Treated?

- Oils – Soil contact – Filtering – Capture
- TSS – Filter – Settling
- Metals – Filter – Settling
- Nutrients – Plant Nutrient Uptake

Infiltration provides an effective means of creating the physical movement of water to promote - Soil Contact, Filtering, Capture, Settling and Nutrient Uptake

But Jeff, what about the Chlorides?

- Well…..
- Based on data collected to date there has been a net decrease in chloride concentrations….but we don't know if this will be a temporary or permanent reduction.
- It is expected that the BMPs will provide an attenuation of chloride concentrations rather than a genuine reduction in chlorides

Design Constraints

- Narrow ROW
- No land acquisition for the purpose of BMPs
- Temporary Construction Easements would take as long to acquire as new land parcels
- Very flat ground
- Clay soils

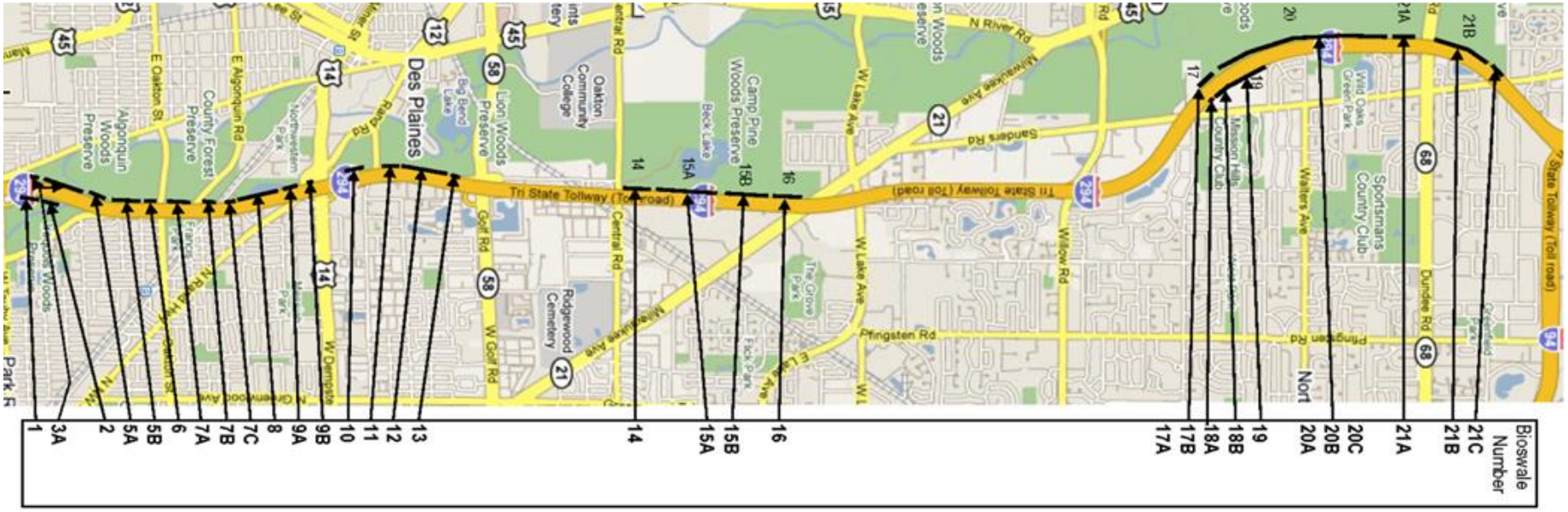
So…where do you do it?

- Given the limitations of the work space, the natural location is within the adjoining drainage swales and ditches.
- Miles of adjoining green space…
- Maximize the filtering and infiltration capabilities of the swales and ditches.
- Develop and install Bioswales

You have to start somewhere!

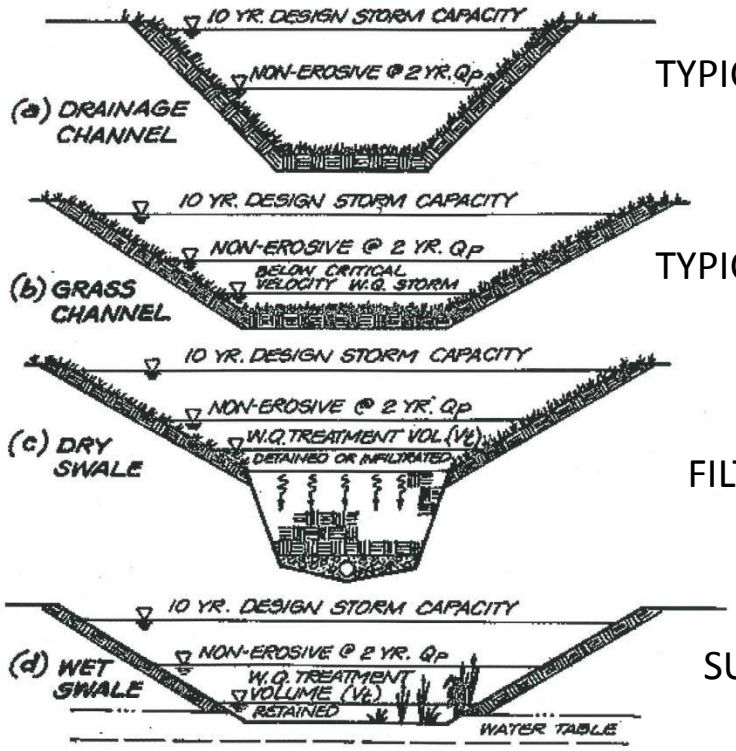
- The “Greening” of the Tollway began with the I-294 Bioswale Demonstration Project.
- I-294 was identified as the first location to test out the bioswales.
- In 2008, 2im Group was tasked with developing Bioswales to retrofit existing Tollway ditches.

Project Limits



TOTAL FEET OF BIOSWALES = 29,226 FT. OR 5.54 MILES

Bioswale Types



TYPICAL ROADWAY DITCH – CONVEYANCE, NO WATER QUALITY

TYPICAL HIGHWAY DITCH – CONVEYANCE, NO WATER QUALITY

FILTRATION/INFILTRATION – OPPORTUNITY

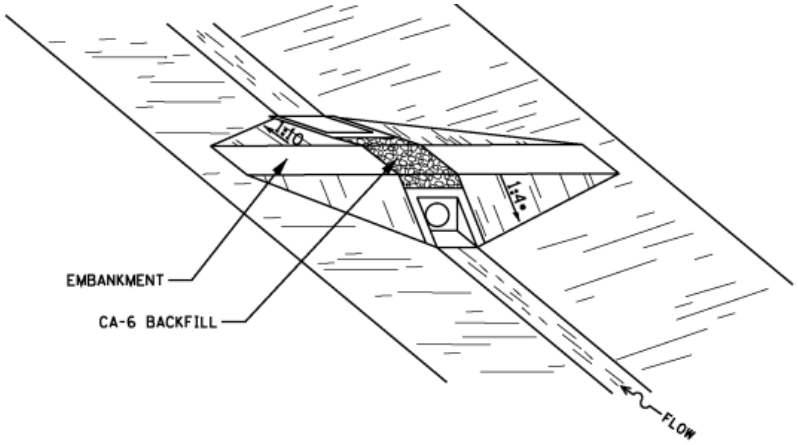
SUFACE DETENTION/VEGETATION – OPPORTUNITY

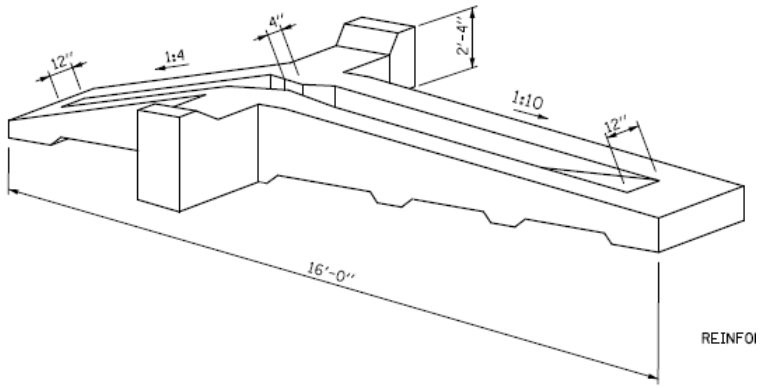
Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring, FHWA, MAY, 2002; Figure 17

Bioswale Design

- Depending on the slope of the swale you may need to slow the water down to promote infiltration and filtration.
- Use ditch checks to pond water +/-8” deep
- Slopes between 1% - 2%

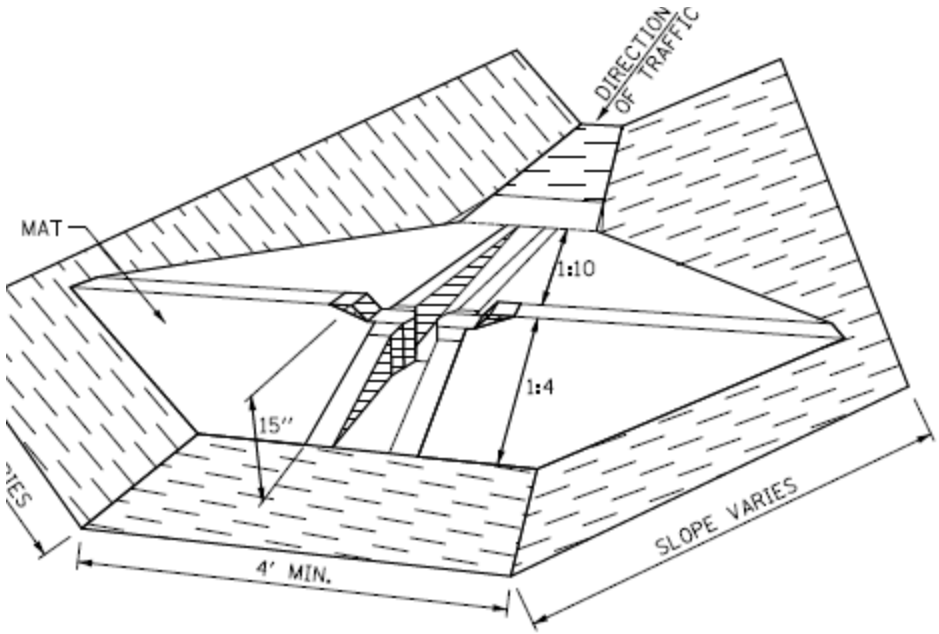
Bioswale Evolution





Original Design used a ditch check with a pipe to control flow.
But pipes are prone to clogging.

A completely new unique design was developed for I-90, that still slows down the flow to promote infiltration but is less likely to clog



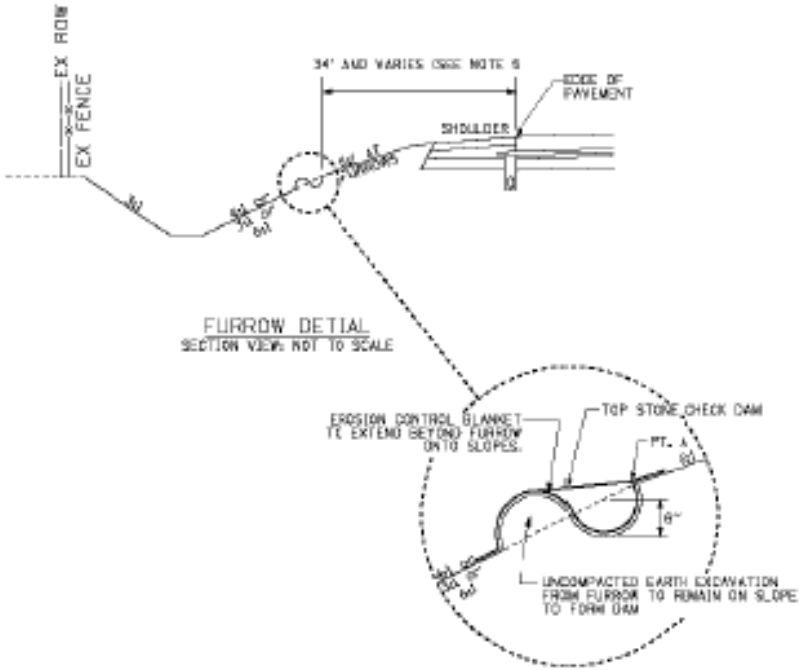
We still haven’t used all the green space!!!!!

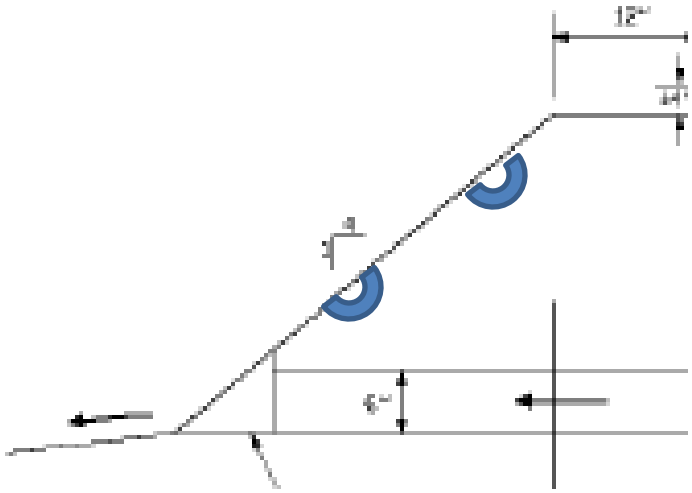
- The shoulder of the highway isn’t all ditch
- There is still room for more BMPs

Furrows

- On embankments, water generally flows down the slope very quickly before reaching the ditch line.
- Install slope breaks – Furrows on contour across the embankments to:
  - Slow down the flow
  - Promote sheet flow
  - Capture sediment
  - And promote additional infiltration

Furrows


EX ROW
EX FENCE
SHOULDER
EDGE OF PAVEMENT
FURROW DETIAL
SECTION VIEW: NOT TO SCALE
EROSION CONTROL BLANKET TO EXTEND BEYOND FURROW ONTO SLOPES.
TOP STONE CHECK DAM
UNCOMPACTED EARTH EXCAVATION FROM FURROW TO REMAIN ON SLOPE TO FORM DAM


12"
6"

Call now and we can double your order.

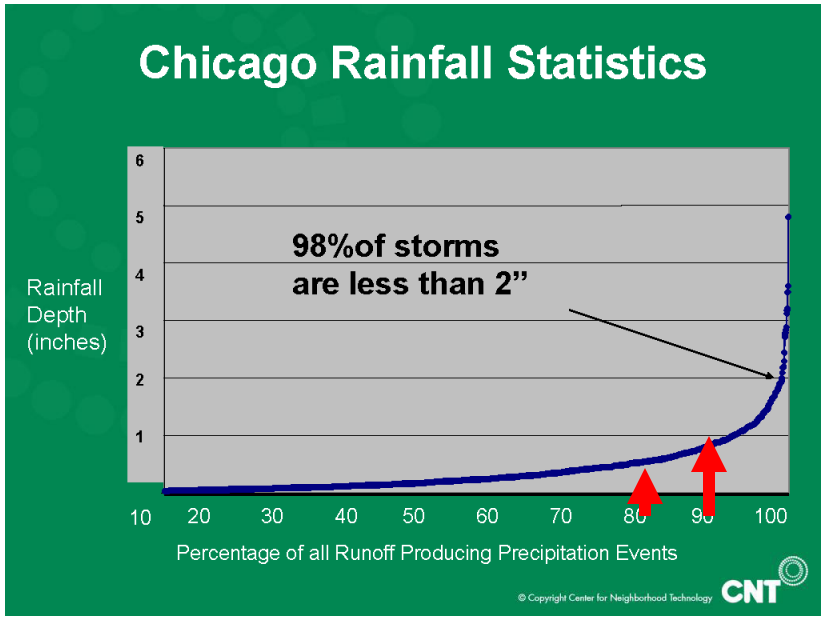
- We have covered the embankments and ditch lines with BMPs – what else can we do?
- Provide additional stormwater capture
- Capturing a water quality volume provides a quantifiable reduction in discharge and pollutants from the ROW.

Stormwater Quantity

- Water Quality Volume:
  - Rainfall from 80% of annual events
  - Rainfall from 90% of annual events
  - 2-year 24-hour event

80% = 0.6 in

90% = 0.9 in



Water Quality Volume

- I-90 reconstruction and the new Elgin O'Hare Western Access projects are the first to incorporate a Water Quality Volume into their designs.
- I-90 is capturing the first 0.75 inches of rainfall and retaining it onsite. A ¾ inch event translates into approximately 88% of all rain events recorded at O'Hare

Water Quality Volume

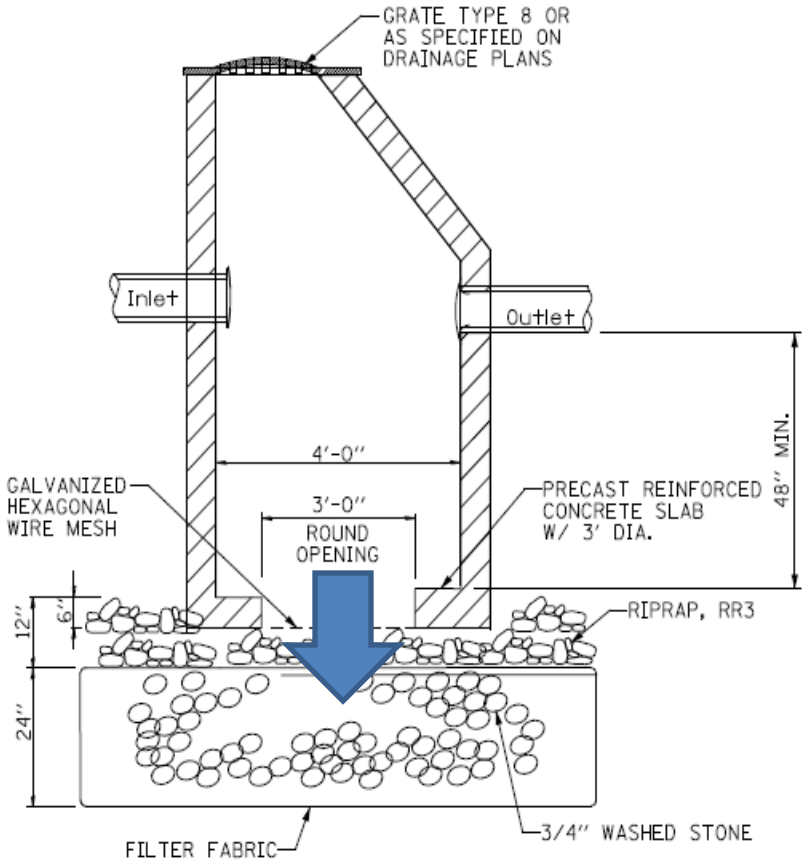
- The Elgin O'Hare Western Access project will capture the first 1.25 inches of rainfall which correlates to 98% of all rain events recorded at O'Hare.
- Theoretically, there would be zero discharge from the sites with lesser events meaning zero discharge on the surface of pollutants.

Water Quality Volume – Where are we putting it.

- In the bioswale sub-base
  - As surface ponding
- Within detention ponds
  - Vaults
  - Stone sub-base
    - Interesting Story – Elgin O'Hare Western Access
      - Wildlife deterrents
      - No surface water beyond 48 hours
      - Need effective storage that will not attract wildlife…

But wait there's more!!!

- There is still room left to fit in more BMPs
- Manholes below embankments can be made leaky.
- Manholes are designed with leaky bottoms to promote additional infiltration when clear of pavement.



INFILTRATION CATCH BASIN DETAIL

Vegetation

- Typically we use Salt Tolerant grass from shoulder to ROW fence
- NOW:
  - Salt Tolerant (Class 2E) for the first 20’ beyond edge of shoulder
  - Low Profile Prairie (Class 4F) all other upland areas
  - Bioswale Seed Mixture 1 adjacent to waters

    Little Blue Stem Side-oats grama

    Prairie Dropseed Indian grass

Other design initiatives

- Placing underdrain outlets at least 100’ upstream of Waters/Wetlands
- Using Floc Logs at underdrain outlets adjacent to Waters/Wetlands to minimize fines entering waterways
- Using Shock Logs (when required) to rebalance pH levels due to recycled concrete in sub-base

Lessons Learned

(…or why this matters for non-Tollway projects)

- Proper application of BMPs really does require multi-disciplinary cooperation
- Education, education, education…
- Follow-up on design. What works, what doesn't and why?

- Questions?