A GREEN INFRASTRUCTURE CASE STUDY
RESIDENTIAL SUBDIVISION IN MONTGOMERY TOWNSHIP, NJ

Presented by
Brian R. Perry, PE, CME, LEED AP

Prepared by
Christine E. Yeatman, PE

Van Note-Harvey Associates, Inc.
103 College Road East, Princeton, NJ 08540
(609) 987-2323 | www.vannoteharvey.com
ENGINEERS | PLANNERS | ENVIRONMENTAL CONSULTANTS | SURVEYORS
ABSTRACT

Many of us already know that Green Infrastructure (GI) refers to the use of landscape elements to improve the urban environment. This includes vegetated green spaces, preserved and planted forests as well as innovative sustainability measures such as green roofs, permeable pavers, rain gardens, and bio-swales. While GI is gaining in popularity around the country and taking its foothold in newer regulations, some common misconceptions and barriers prevent its wider application.

This presentation focuses on a residential development in Montgomery Township, New Jersey that was designed and approved with GI measures over 15 years ago. Specifically, a mix of 218 single-family and duplex units were designed and developed over a 138-acre parcel, preserving over 30% of it and incorporating GI measures, including preservation of wooded areas, bioretention basins, water quality swales, rooftop disconnections, porous asphalt, and forested retention, throughout. The implementation of GI measures into the design of this residential development was somewhat progressive then, but was also proactive towards the adoption of impending stormwater management rules in the State of New Jersey at the time. Those stormwater management rules would enhance the then stormwater management criteria to include incorporation of non-structural stormwater management measures to the greatest extent practicable. The term “non-structural” for site design has generally evolved into the broader, bigger picture view of GI in the community or watershed.

In this presentation, we will delve into the stormwater regulations in place at the time the development was designed and approved, the rules that were subsequently adopted, the current trends in GI design and how this particular site has “held up” and thrived with respect to same.
**PRE-DEVELOPED SITE**

- Project planning/design began in 2001 on a 138-acre site
- Existing site consisted of:
  - A select number of small buildings including barns/residence
  - Agricultural fields
  - Woodlands
- Located adjacent to Bedens Brook
SITE DEVELOPMENT PLAN

- Site design began in 2003
- Received site plan approval in 2005
- Developed a mix of 218 age restricted single-family and duplex units as well as affordable housing units.
- 38.3 acres of impervious surfaces
STORMWATER REGULATIONS

• 2003 requirements vs. 2004 NJAC 7:8 (New Jersey Stormwater Management Regulations) not yet adopted requirements

• Design was progressive relative to the current standards at that time as non-structural/green infrastructure was not a requirement

• Provided groundwater recharge through the various stormwater management techniques incorporated into the design, despite not being required

• Per municipal requirements at the time, non point source pollution loading assessment included for:
  • Total Suspended Solids (TSS) - 78.8% removal efficiency provided
  • Total Nitrogen (TN) - 54.5% removal efficiency provided
  • Total Phosphorous (TP) - 65.2% removal efficiency provided
  • Oil/ Grease - 65.6% removal efficiency provided
STORMWATER MANAGEMENT OVERVIEW

- Preserved Woods
  - 41.4 acres (30% of site)
- Bioretention Basins (3) and Extended Detention Basin (1)
  - 4.8 acre total footprint
- Rain Gardens
  - 1 acre total footprint
- Water Quality Swales
  - 6,245 LF
  - 18.5 acres Drainage Area
- Porous Asphalt (walking trails)
- Forested Retention
  - 0.5 acre footprint
- Rooftop Disconnections
  - Approximately 70%

Stormwater management accounts for over 15% of the site. In total, green infrastructure features account for over 45% of the entire development.
PRESERVED WOODS

Pre-Developed Site

Developed Site
(Approx. 75% of site woods preserved)
Preserved Woods

- Preservation of natural woods was an important part of the design
- Maintaining 30% of overall site area as wooded area provides:
  - Environmental benefits
  - Costs associated with tree removal/planting of new trees
  - Provides natural “screening” of the site
  - Minimize stormwater runoff from development

Limits of Preserved Woods
Limits of Preserved Woods
**Bioretention Basins**

- Bioretention basins designed to capture runoff from the site to meet peak rate reductions, treat runoff, and provide groundwater recharge.

- Basins designed to be aesthetically pleasing and integrated with the surrounding site.
Bioretention Basins

Plantings designed to withstand larger storm events

Limits of Preserved Woods
Water Quality Swales

- 6,245 LF of water quality swales incorporated into design
- Capture runoff from approximately 18.5 acres of the site
- Designed for 80% TSS removal
**Water Quality Swales**

- **Magenta – Drainage Limits**
- **Blue – Swales**
Porous Asphalt Trails

- Reduce impervious surface and minimize runoff by allowing infiltration of surface runoff into the walk/stone bed
- Preserved trees with walk alignment
- Allow runoff to infiltrate to the roots of adjacent trees
FORESTED RETENTION

- Preserved trees
- Allow runoff to be temporarily detained within retention area
- Overflow structure provided for any runoff not infiltrated

Forested Retention Area
Rooftop Disconnections

- Many roofs discharge stormwater to grade via roof leaders/splash blocks
- Where feasible, runoff sheet flows over lawn to bioretention swales or storm structures
SITE PROGRESSION - 2006

- Existing site, prior to development
- Road overlay shown for future development
SITE PROGRESSION - 2008

- Start of construction on western portion of the site
- Note tree preservation
Site Progression - 2010

- Continued construction of single family homes
- East side not yet constructed
SITE PROGRESSION - 2013

- Work continues on west side of the site
- Work begins on east
SITE PROGRESSION - 2015

- Continued construction progress
• Continued construction progress
• Note, additional development is planned and has progressed since the original approval.

• Additional development will include:
  • Parking lot will be constructed of porous asphalt pavement
  • Grass swale conveying runoff to a downstream inlet.