Creating Value …

… Delivering Solutions

BMP Design and Construction Issues

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Baker

Presentation Overview

- Why LID BMPs
- Local Ordinances with BMP requirements
- Design Plans and Specifications
- Construction

LID BMPs

- ***Why LID BMPs***
- **Local Ordinances with BMP requirements**
- **Design Plans and Specifications**
- **Construction**

LID BMPs

Low Impact Development (LID) Best Management Practices (BMPs) are a way of controlling stormwater runoff volume and reducing pollutant loadings to receiving waters.

LID BMPs

- **Specifically, LID aims to:**
  - Preserve open space and minimize land disturbance
  - Protect Natural systems and processes
  - Reexamine the use and sizing of traditional site infrastructure
  - Incorporate natural site elements

LID BMPs

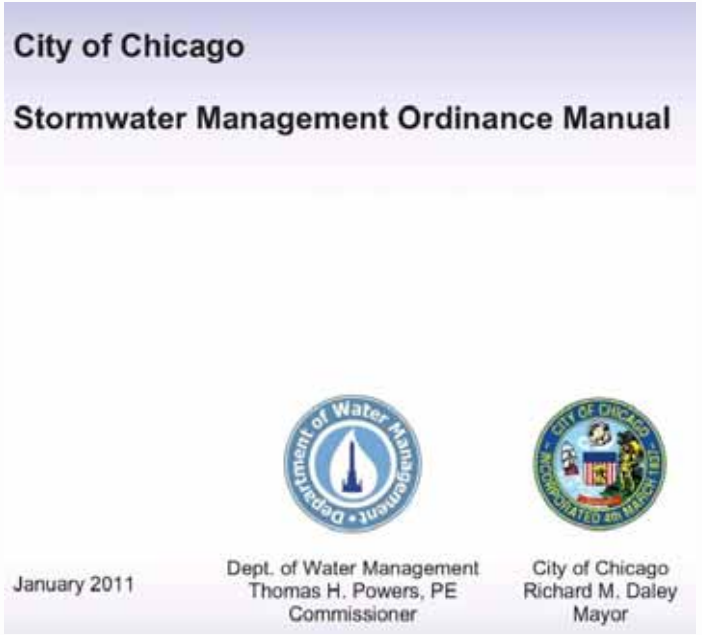
- **Types of BMPs**
  - Bioretention facilities
  - Grassy swales
  - Permeable pavements
  - Vegetated Roof Tops
  - Vegetated Filter Strips
  - Natural Landscaping and Stormwater Trees
  - Naturalized Detention Basins

Local Ordinances

- **Why LID BMPs**
- ***Local Ordinances with BMP requirements***
- **Design Plans and Specifications**
- **Construction**

Local Ordinances

- **Ordinances with BMP**
  - City of Chicago
  - Various Counties have included or are updating their ordinances to include BMP requirements due to stricter requirements from the EPA and National Research Council



City of Chicago

- **City of Chicago Stormwater Management Regulations and Ordinance Manual**
  - Developed a "Chicago's Water Agenda 2003" to encapsulate its goals for water management in the City
  - Steps to address stormwater management
    - Promoted green building design and best management practices
    - Prevented polluted stormwater from roadways from discharging directly into Lake Michigan and the Chicago and Calumet Rivers
    - Developed sewer inlet control systems called the "Rainblocker Program" to reduce combined sewer overflows and reduce basement flooding
    - Comply with the National Pollutant Discharge Elimination Systems (NPDES) Phase II requirements.

City of Chicago

- **City of Chicago Stormwater Management Ordinance Manual**
  - Created for developers, engineers and architects
  - Goals are to provide the technical tools and guidelines necessary to comply with the Stormwater Regulations and Chapter III of the Regulations for Sewer Construction and Stormwater Management
  - Includes Flow Rate Control, Volume Control, Erosion and Sediment Control and Operation and Maintenance Requirements Guidelines and Stormwater Tool Design Spreadsheet

City of Chicago

- **Stormwater Tool Design Spreadsheet**
  - Assists with the design of Rate and Volume Control including BMPs
  - Calculates maximum allowable release rate, required storage volume, designs BMPs, designs orifice sizes

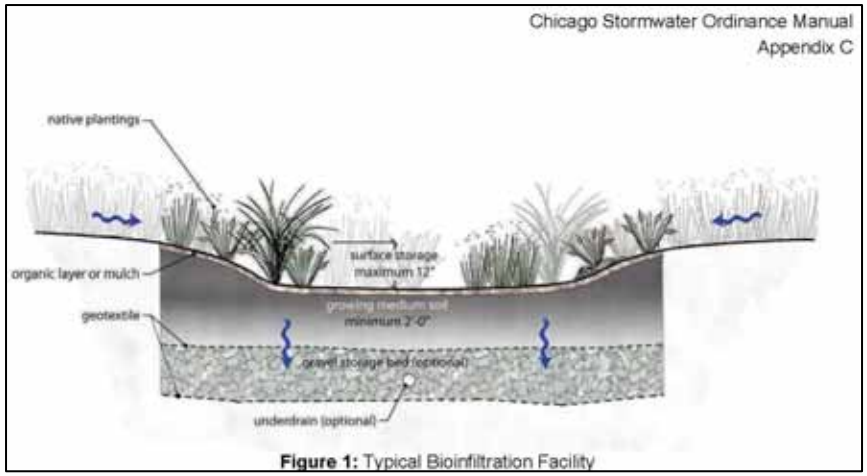


Figure 1: Typical Bioinfiltration Facility

City of Chicago
Department of Water Management

Stormwater Spreadsheet Tool

INDEX OF SPREADSHEETS

Required>>	☐	COVER
Required>>	☐	INDEX
	☐	0.0 RELEASE RATE
Required>>	☐	1.0 RATE CONTROL
	☐	1.1 Dry Weather Flow
	☐	1.2 BMPs-Rate Control Credit
	☐	1.3 Orifice Sizing Calculation
Required>>	☐	2.0 VOLUME CONTROL
	☐	2.1 BMP Volume Summary
	☐	2.1.1 Bioinfiltration
	☐	2.1.2 Drainage Swales
	☐	2.1.3 Green Roof
	☐	2.1.4 Infiltration Vault
	☐	2.1.5 Trees
	☐	2.1.6 Permeable Pavement
	☐	2.1.7.1 Roof Runoff BMPs - Planter Boxes
	☐	2.1.7.2 Roof Runoff BMPs - Rain Barrels / Cisterns
	☐	2.1.8 Filter Strips
	☐	2.1.9 Oversized Detention

Design Plans and Specifications

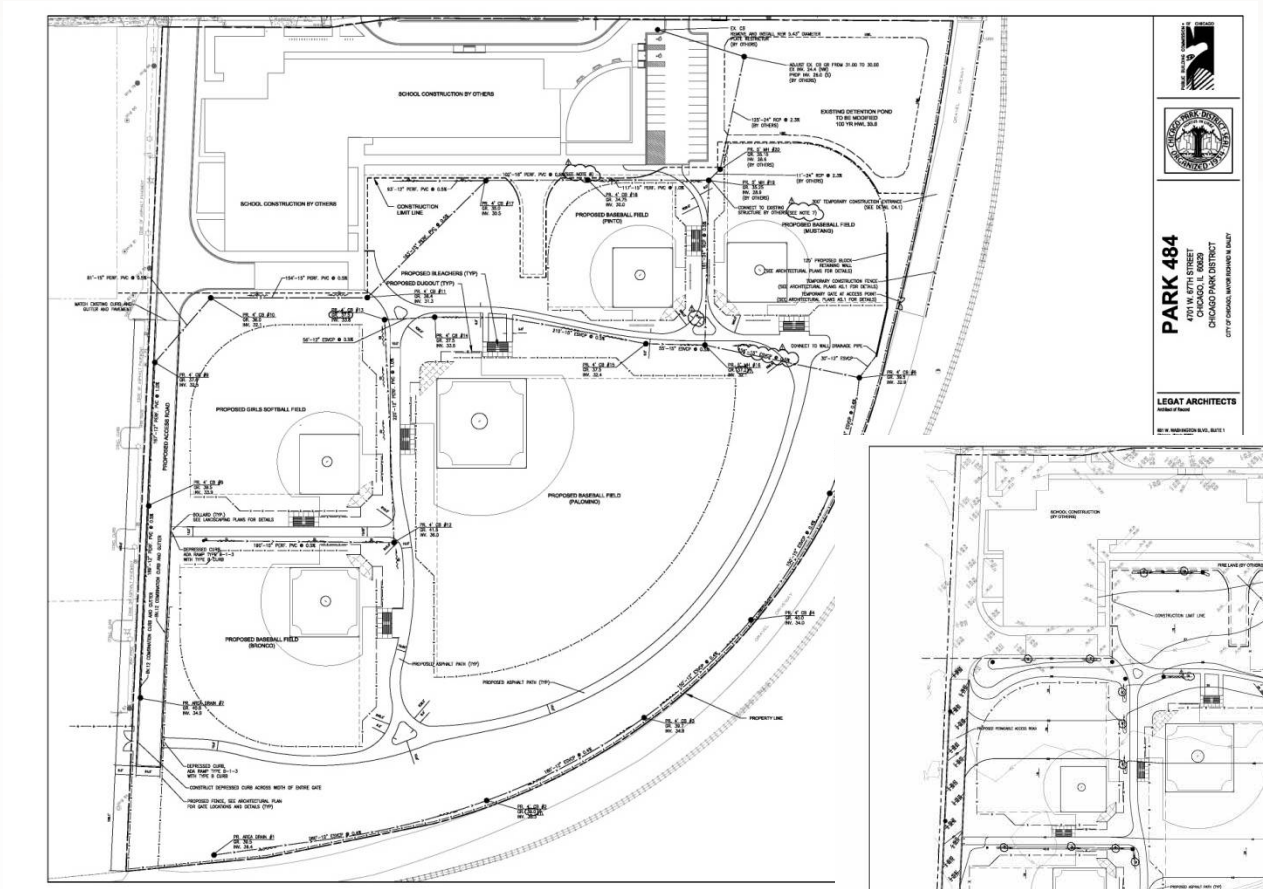
- Why LID BMPs
- Local Ordinances with BMP requirements
- *Design Plans and Specifications*
- Construction

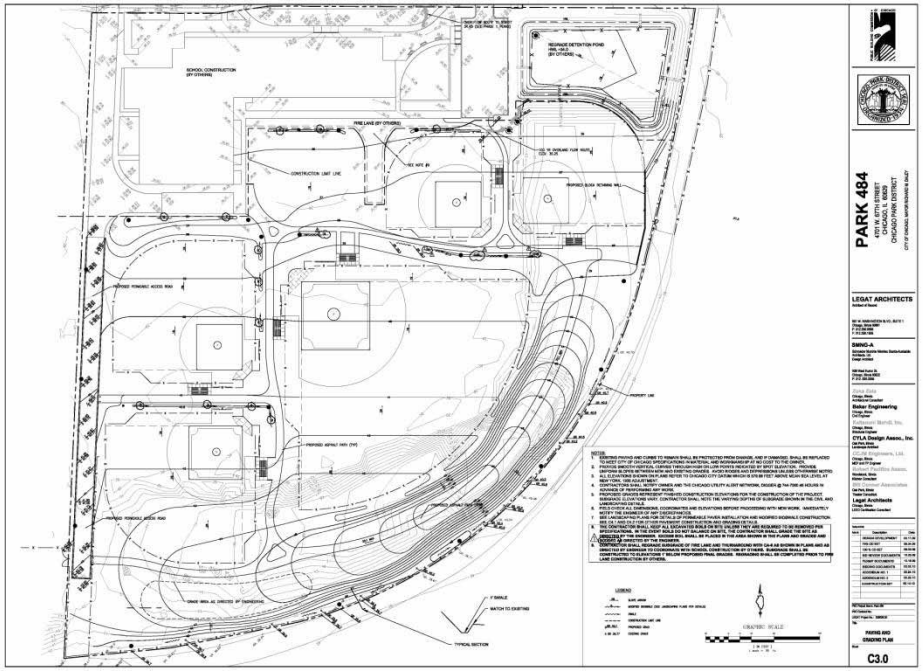
Design Plans and Specifications

- **3 important items**
  - Design Plan Sheets
  - Details, details, details
  - Specifications

Design Plans and Specifications

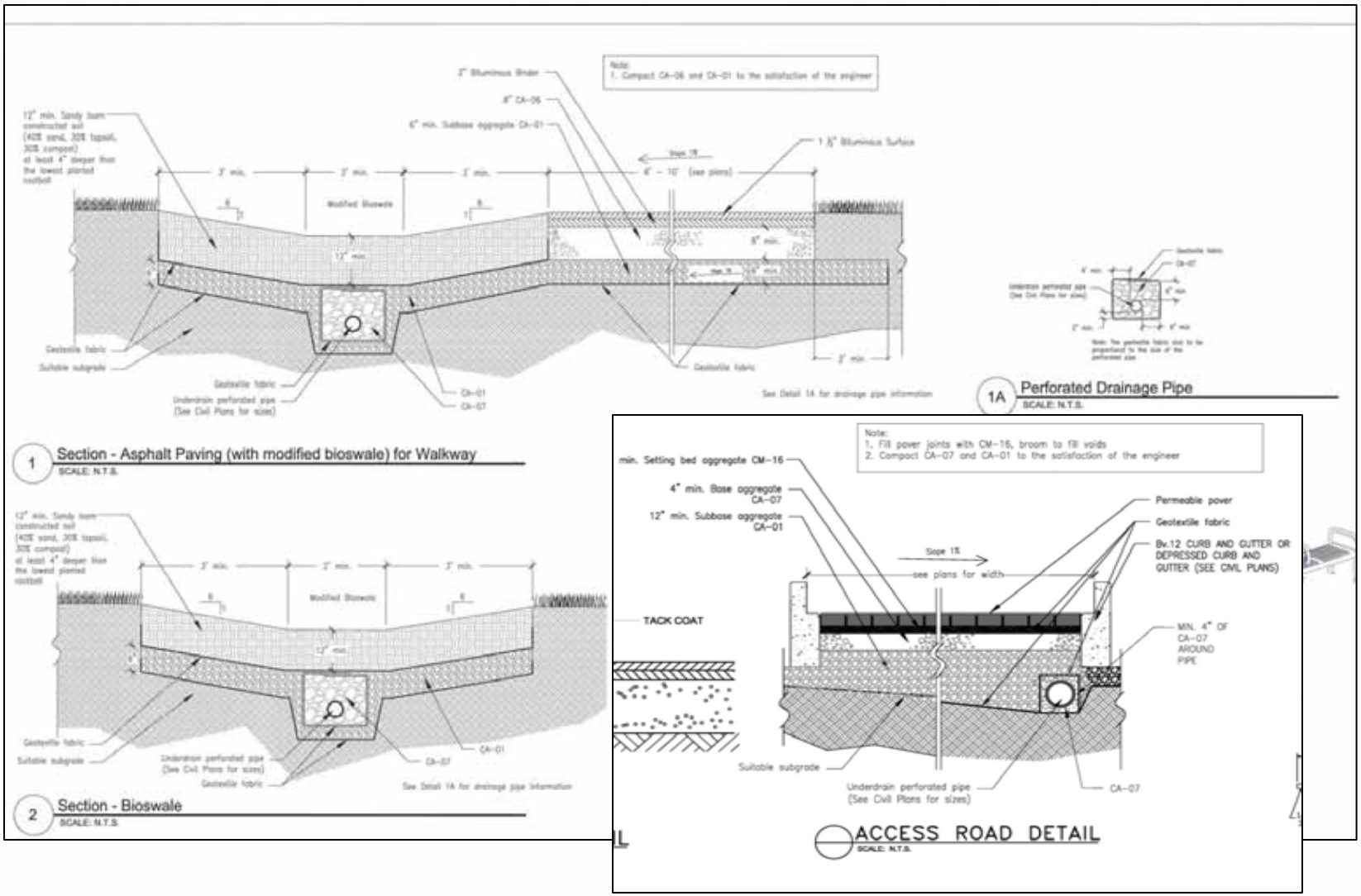
- **Design Plan Sheets**





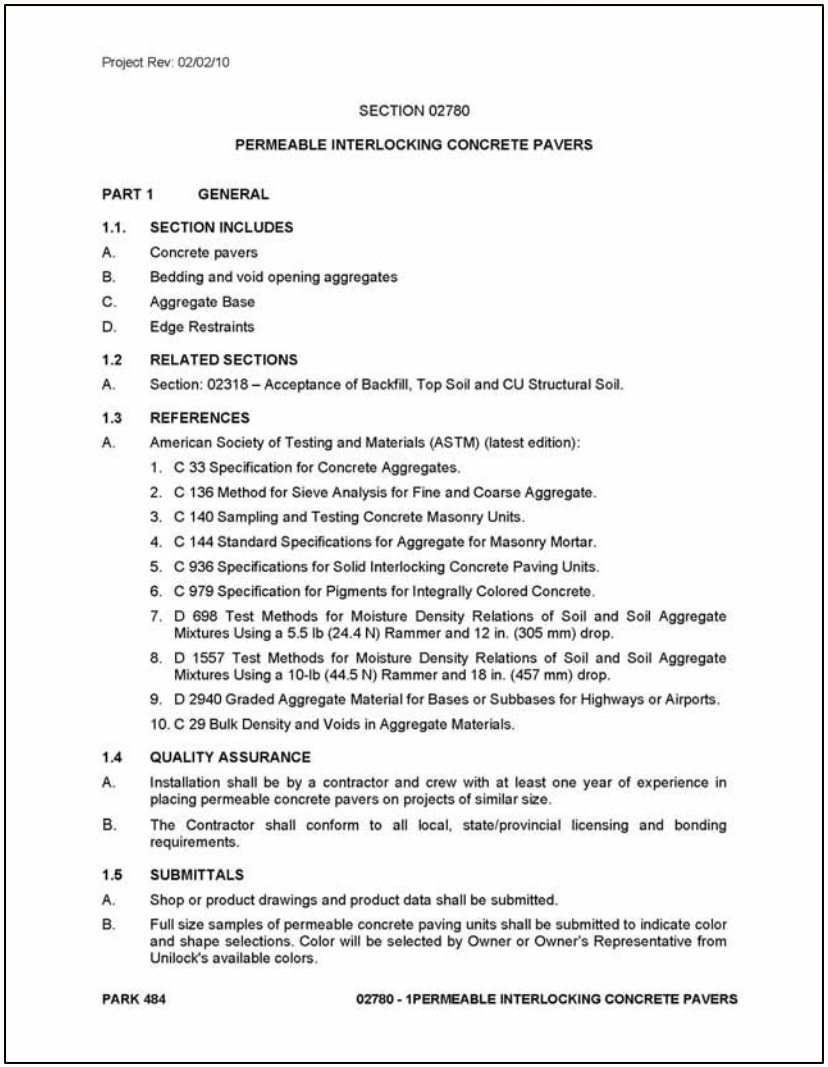
Design Plans and Specifications

- **Details**



Design Plans and Specifications

- **Specifications**



Project Rev: 02/02/10

SECTION 02780

PERMEABLE INTERLOCKING CONCRETE PAVERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Concrete pavers

B. Bedding and void opening aggregates

C. Aggregate Base

D. Edge Restraints

1.2 RELATED SECTIONS

A. Section: 02318 – Acceptance of Backfill, Top Soil and CU Structural Soil.

1.3 REFERENCES

A. American Society of Testing and Materials (ASTM) (latest edition):

1. C 33 Specification for Concrete Aggregates.
2. C 136 Method for Sieve Analysis for Fine and Coarse Aggregate.
3. C 140 Sampling and Testing Concrete Masonry Units.
4. C 144 Standard Specifications for Aggregate for Masonry Mortar.
5. C 936 Specifications for Solid Interlocking Concrete Paving Units.
6. C 979 Specification for Pigments for Integrally Colored Concrete.
7. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
8. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.
9. D 2940 Graded Aggregate Material for Bases or Subbases for Highways or Airports.
10. C 29 Bulk Density and Voids in Aggregate Materials.

1.4 QUALITY ASSURANCE

A. Installation shall be by a contractor and crew with at least one year of experience in placing permeable concrete pavers on projects of similar size.

B. The Contractor shall conform to all local, state/provincial licensing and bonding requirements.

1.5 SUBMITTALS

A. Shop or product drawings and product data shall be submitted.

B. Full size samples of permeable concrete paving units shall be submitted to indicate color and shape selections. Color will be selected by Owner or Owner's Representative from Unilock's available colors.

PARK 484 02780 - 1PERMEABLE INTERLOCKING CONCRETE PAVERS

Design Plans and Specifications

- **Why LID BMPs**
- **Local Ordinances with BMP requirements**
- **Design Plans and Specifications**
- ***Construction***

- **Example Project Site**
  - Three-story school in an urban setting with rejuvenation of five adjacent ball fields
  - School is registered for LEED for Schools Gold certification
  - Sustainable features in school included:
    - Daylight system
    - Efficient lighting
    - Green and white reflective roofs
    - Low-flow plumbing fixtures
    - Recycled materials
    - Water-efficient landscaping

Construction

- **Example Project Site**
  - BMPs included with school and ballfield design:
    - Green Roof
    - Permeable Pavers
    - Bioinfiltration Swales
    - Grass Swales
    - Natural Dry Detention Pond

Construction

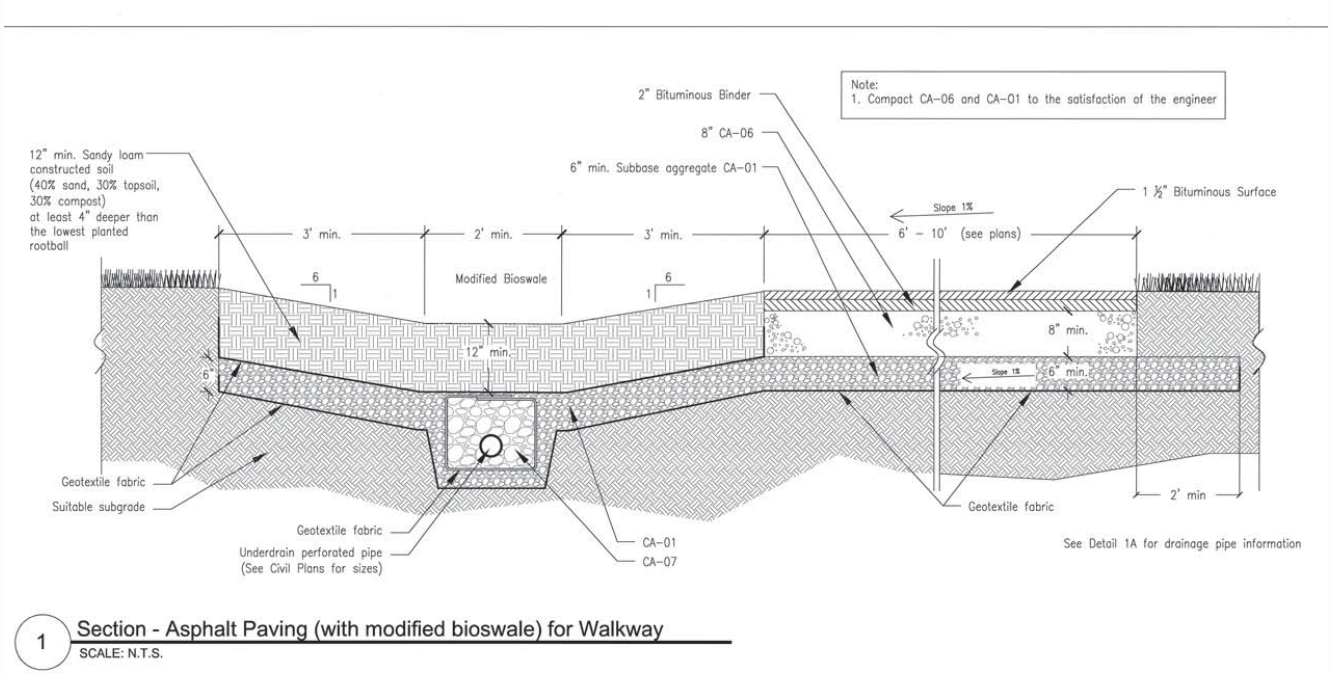
- **During Construction**
  - Pre-Con Meetings - Review plans and specifications with contractor before each constructed BMP.
  - Inspect Daily – Some BMPs contain many layers of materials. Each layer needs to be inspected.
  - Don’t assume contractor understands plans and specifications. Encourage them to ask questions.
  - Remediate any problems that arise quickly and efficiently.

Construction

- **Lessons Learned – The Good**
  - **Green Roofs, Dry Detention Ponds, Permeable Pavers, Grassy Swales**

Construction

- **Lessons Learned – The Bad and Ugly**
  - **Bioinfiltration Swales**
    - **Clear and Concise Details and Specifications**



1 Section - Asphalt Paving (with modified bioswale) for Walkway
SCALE: N.T.S.

Construction

- **Lessons Learned – The Bad and Ugly**
  - **Bioinfiltration Swales**
    - **Constant Inspection**

- **Lessons Learned – The Bad and Ugly**
  - **Bioinfiltration Swales**
    - **Immediate Remediation**

Baker

Questions??