Waterproofing Systems

Jim Hunter
R.M. Hunter Co.

Objectives

- To review, discuss, compare and contrast various systems available for below grade, foundation walls, plaza deck, split slab and planter area waterproofing.
- To discuss ways to avoid common waterproofing problems on projects.

Agenda

- Introduction
- Product Types
  1. Cold Applied
  2. Peel and Stick
  3. Bentonite
  4. Hot Applied
  5. Cementitious
  6. Loose Laid
- How to Choose a Product
- How to Avoid Problems

Waterproofing or Dampproofing

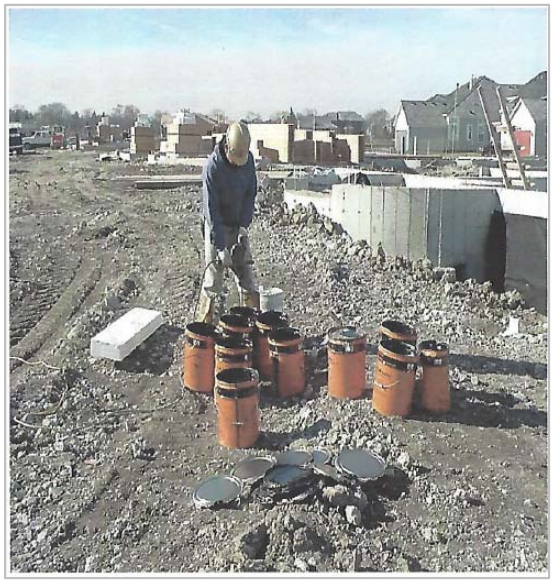
- Dampproofing
  - Retards the passage of moisture, primarily vapor, through a substrate in the absence of hydrostatic head. It is not effective if the substrate has cracks or may develop cracks.

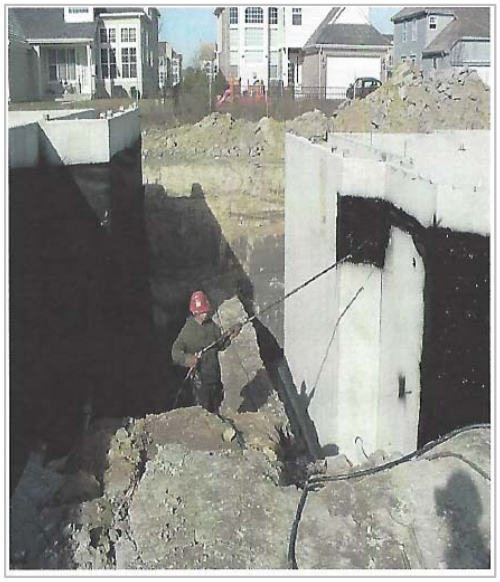
- Waterproofing
  - Stops the passage of water through a substrate even in the presence of hydrostatic pressure.

Waterproofing- Types
Cold Applied

- Description
  - Liquid- 5 gallon cans
  - Asphalt Modified, Urethane, PMMA based
  - One and two components
  - Roll, spray, or trowel
  - 60 or 120 mils
- Advantages
  - No seams
  - Easy to install
  - Bonds to substrate
  - Irregular surfaces
  - Penetrations
  - No primer
  - Some M&L warranties
- Disadvantages
  - Uniform thickness
  - Some odor
  - Black and messy
  - Cured concrete
  - Anyone can install it

Waterproofing- Types
Cold Applied



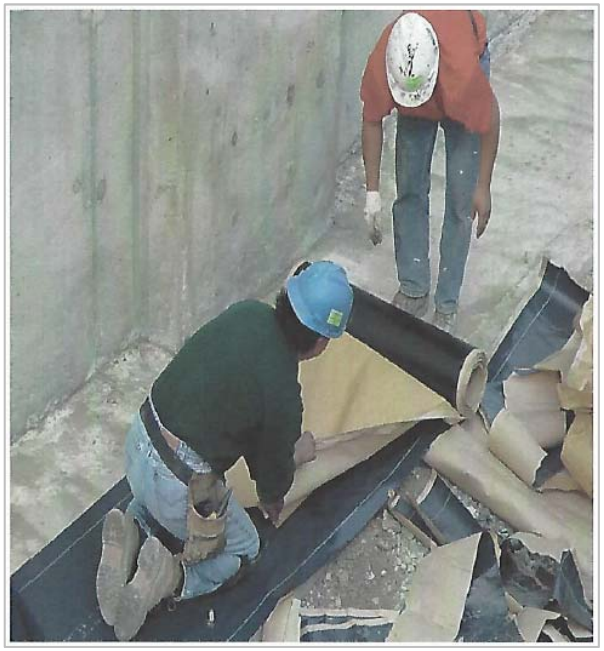


Waterproofing- Types

Peel and Stick

- Description
  - Asphalt based
  - Roll (3′ x 67′)
  - 60 mils
  - Self-adhering
- Advantages
  - Uniform thickness
  - No odor for membrane
  - Bonds to substrate
- Disadvantages
  - Difficult to install
  - Primer needed and does have an odor
  - Temperature sensitive
  - Needs Smooth substrate
  - Fully-cured substrate
  - Seams
  - Needs protection bd.
  - Material only warranty
  - Anyone can install it

Waterproofing- Types
Peel and Stick



Waterproofing- Types

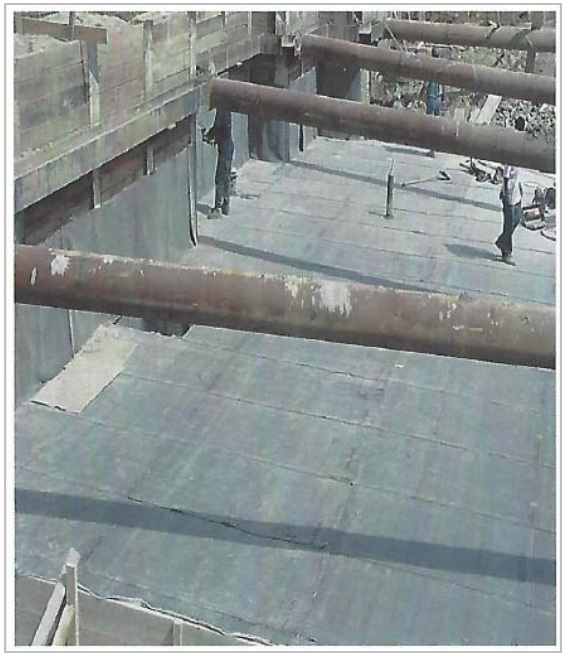
Bentonite

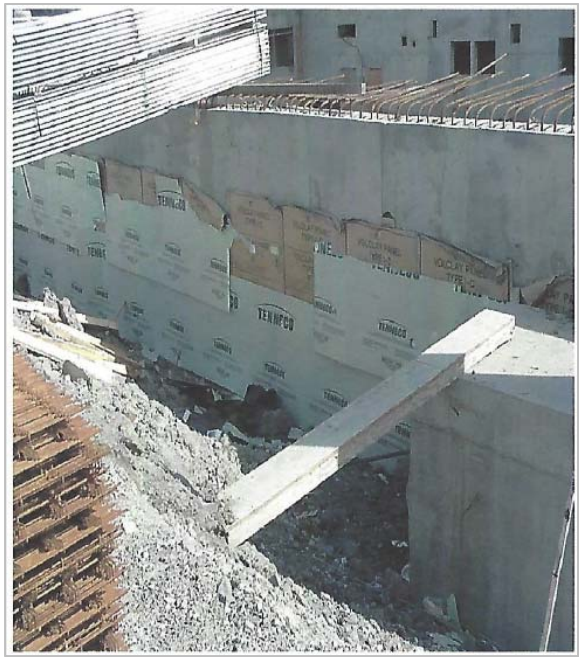
- Description
  - Clay
  - Types
    - Panels
    - Geotextile
    - HDPE or PVC rolls
  - Nail or loose lay

- Advantages
  - No odor
  - Easy to install
  - Difficult applications
  - Environmentally friendly
  - Green concrete
  - No primer
  - Cold temperatures
  - M&L warranties avail.

- Disadvantages
  - Can be damaged
  - Panels need protection board
  - No water test
  - No bond
  - Containment needed
  - Seams
  - Very Heavy to install
  - Hydrostatic Head pressure needs to be considered.
  - Must be wet to activate
  - Anyone can install it

Waterproofing- Types
Bentonite

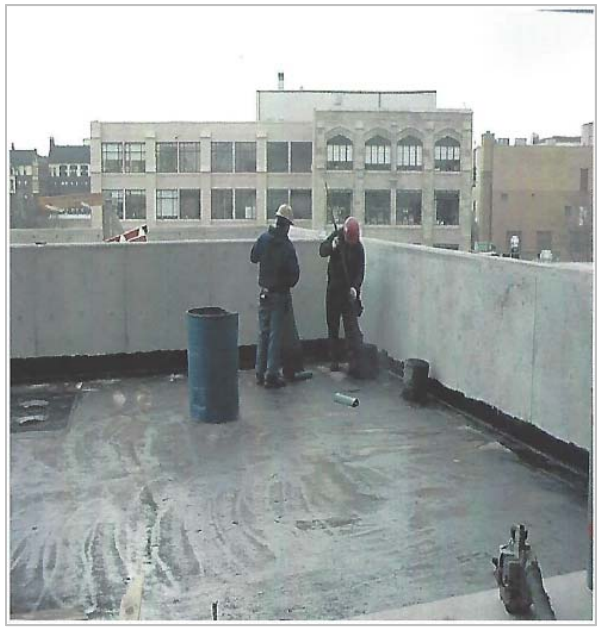




Waterproofing- Types
Hot Rubber Asphalt

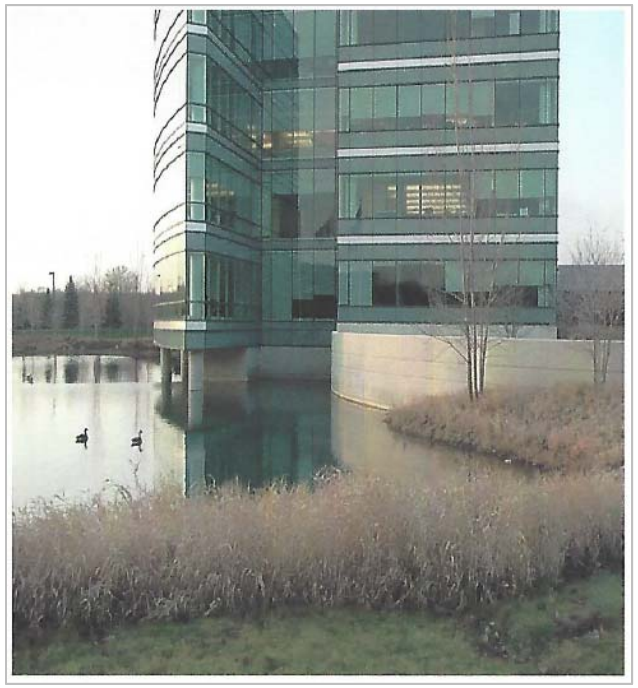
- Description
  - Asphalt based
  - Hot applied, melter
  - Spread or Roller Applied
  - 180 or 215 mils thickness
- Advantages
  - No seams
  - Bonds to substrate
  - Thick systems
  - Plaza decks/pavers
  - No temperature requirements
  - Installed by Approved applicators
  - M&L warranty up to 30 years
- Disadvantages
  - Can be messy
  - No uniform thickness
  - Surface Conditioner needed

Waterproofing- Types
Hot Rubber Asphalt



Waterproofing- Types
Cementitious/Crystalline

- Overview
  - Crystalline
  - Spray or brush
  - Can be left exposed
  - No uniform thickness
  - Cannot bridge moving cracks
  - No M&L warranty
  - Anyone can install it



Waterproofing- Types

Loose Laid

- Overview
  - PVC, neoprene
  - Chemical resistant
  - No odor
  - Not bonded
  - Seams

Waterproofing- Types

Drainage Board and Protection Board

- Drainage Board
  Is it waterproofing?
  When needed?
  Types
    - Dipple Board
    - Geonet

  Protection Board
  Types
    - Modified Asphalt
    - Insulation
    - Drainage Board

  When needed?

Items to Consider

- What's the application?
  - Free-standing wall
  - Property line
  - Plaza deck
  - Planter
- What's the condition of the substrate?
  - Smooth
  - Honey-combed concrete
  - Stone
- High number of joints and penetrations?
- Wintertime installation?
- Odor an issue?
- Warranty needed?
- Don't be afraid to use more than one system

How to Avoid Problems

- Pre-installation meetings
- Qualified applicator
- Water tests
- Jobsite inspections
- Get copy of warranty upfront
- Work with a qualified product representative
- Get the product representative involved early
- Ask the product representative, “What happens if this building leaks?”
- Good project details

Remember

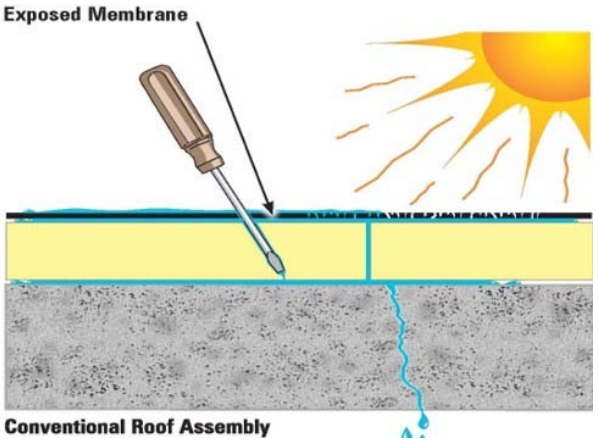
- No one membrane works for every situation- match the membrane to the condition
- Utilize the product representative
- Don’t forget the pre-installation meeting

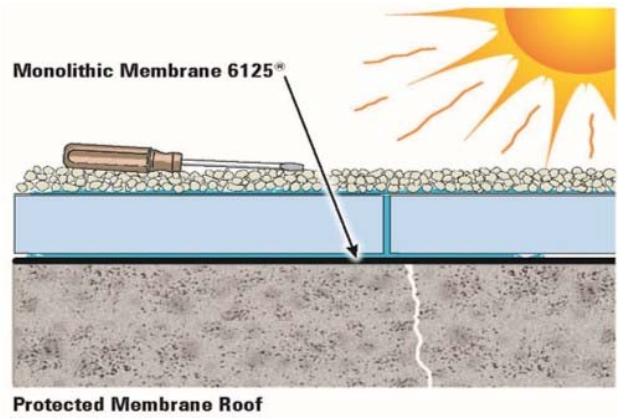
Protected Membrane Roofing

Protected Roof Membrane Advantages

- **Conventional Roof**
  - Membrane is on top
    - Exposed to the elements and physical damage
  - Insulation is below membrane
    - Damage to membrane allows water to enter insulation layer
  - Water migrates below insulation
    - locating leaks is very difficult

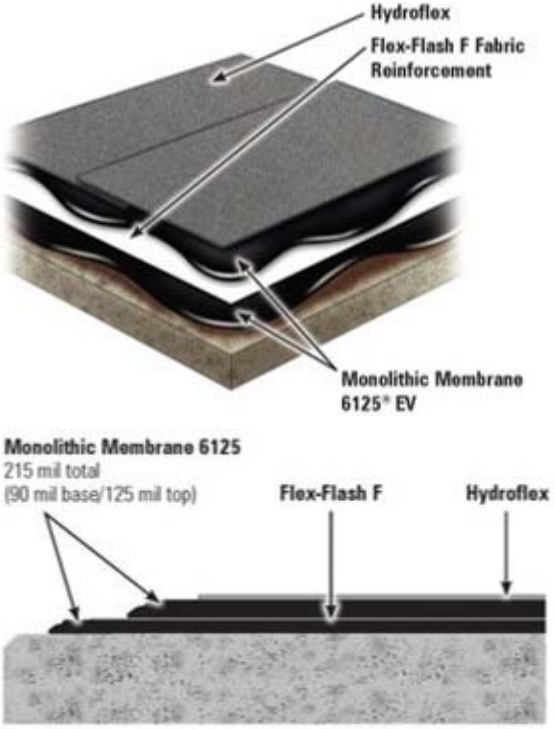
- **PMR Roof**
  - Membrane is bonded to roof deck
    - Water cannot migrate between deck and membrane
  - Membrane is protected by overburden
    - Insulation, Ballast, Pavers, or Garden Roof
  - Insulation is above membrane
    - Helps protect membrane





Hot Rubberized Asphalts

- **The best waterproofing membrane for vegetated roofs**
  - No seams to fail
  - Bonded directly to substrate
  - Can be installed with little or NO slope
  - Easy and simple to detail critical penetrations
  - Resistant to fertilizers and mild acids
  - No VOC restrictions; No PVCs
  - Installed only by trained, authorized applicators



Vegetated Roofs

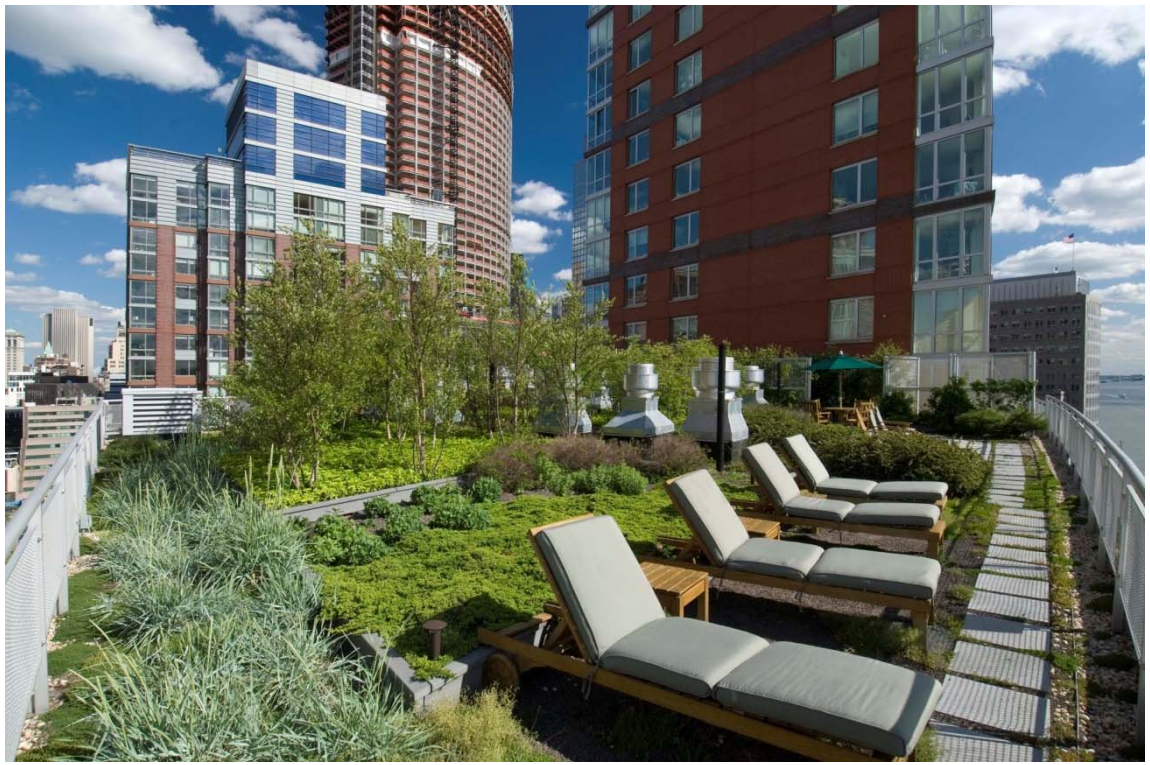
Outline of Presentation

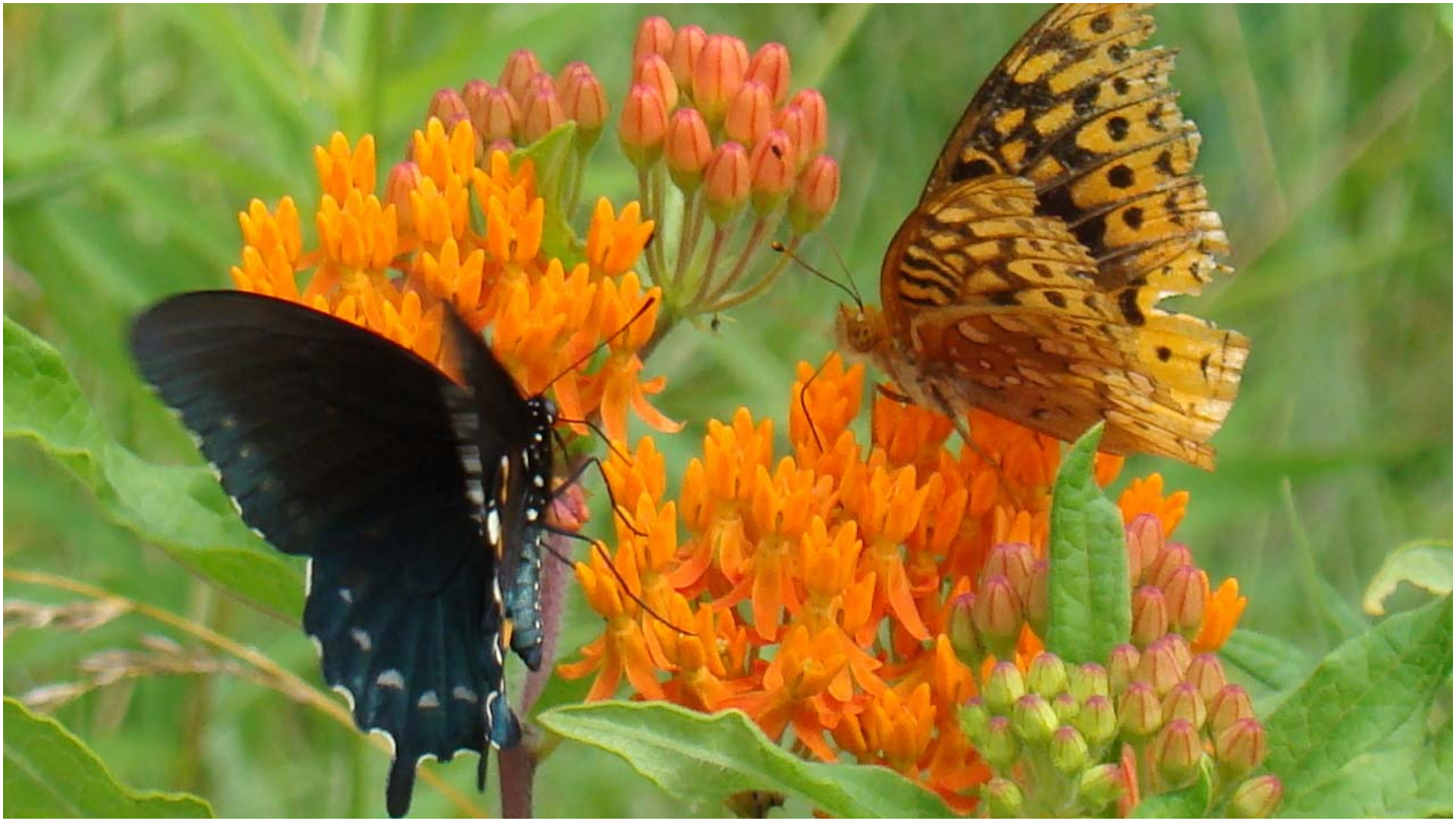
- **Benefits of Vegetated Roofs**
- **Design Considerations**
- **Vegetated Roof Assemblies**
- **Stormwater Performance of Vegetated Roofs**
- **Blue / Green Roofs**

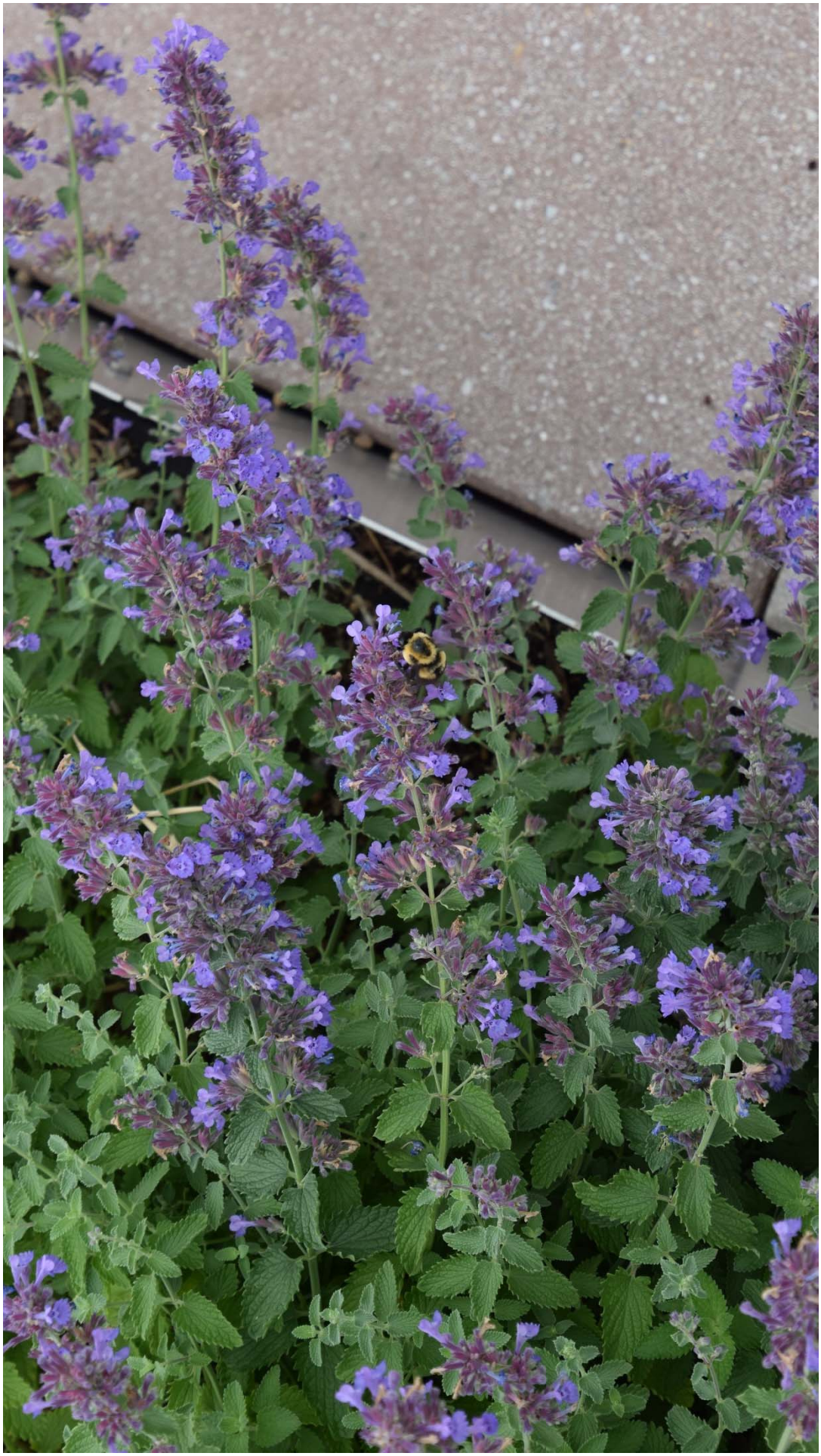
Benefits of Vegetated Roofs

Vegetated Roof Benefits

- **Economic Benefits**
  - Increased Roof Life Expectancy
  - Additional Usable Space
  - Building Incentives
    - FAR Bonus
    - Incentive Programs
- **Environmental Benefits**
  - Mitigates Urban Heat Island Effect
  - Oxygen Production
  - Reduces Dust and Smog Levels
  - Recreates Habitat





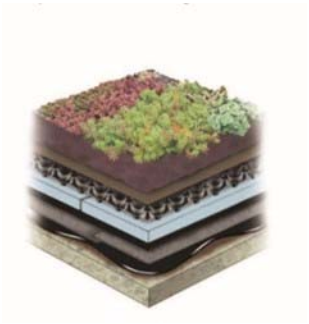


Vegetated Roof Benefits

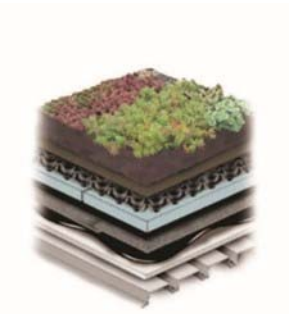
- **Technical Benefits**
  - Lower Energy Costs
  - Reduce Reflective Sound
  - Improve Sound Insulation
  - Improve Solar Energy Performance
- **Additional Benefits**
  - Urban Agriculture
  - Therapeutic and Healing Environments

Vegetated Roof Assemblies

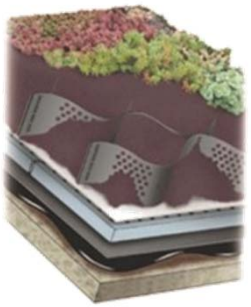
Vegetated Roof & Paver Assemblies



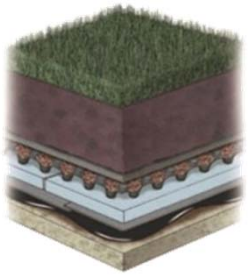
Extensive



Extensive Over Metal Deck

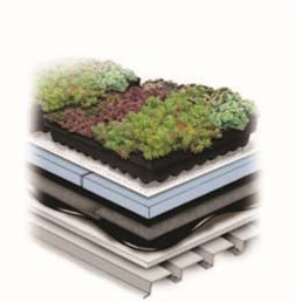


Sloped

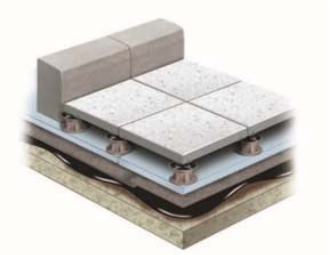


Lawn

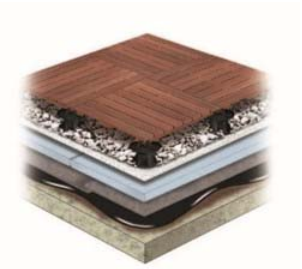
Intensive



Trays



Architectural Pavers



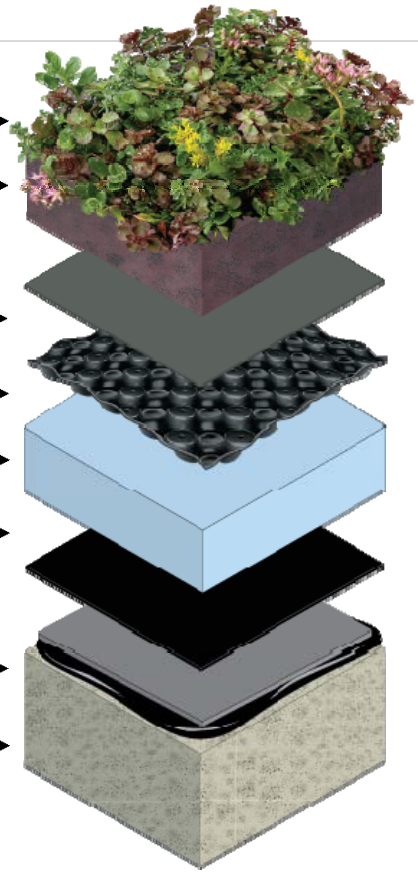
Wood Tile

Components of a Vegetated Roof Assembly

- Carefully Selected Plants
- Lightweight Growing Media

- Filter Fabric
- Water Retention / Drainage Component
- Rigid, Extruded Insulation
- Root Stop

- Waterproofing Membrane
- Approved substrate



Design Considerations

Design Considerations

- **Watertight assembly & detailing**
- **Structural requirements**
- **Slope & drainage**
- **Wind uplift resistance**
- **Design intent**
- **Plant selection**

- **Stormwater Management**

Engineered Growing Media

- **Specifically designed for vegetated roof applications**
  - Growing media consists of three main components
  - Proportions dictated by region, climate and intended plantings
  - Provides a stable structure for the anchorage of the plants' root system

Lightweight aggregate

Compost

Mid-range to fine aggregates

Plant Selection Factors

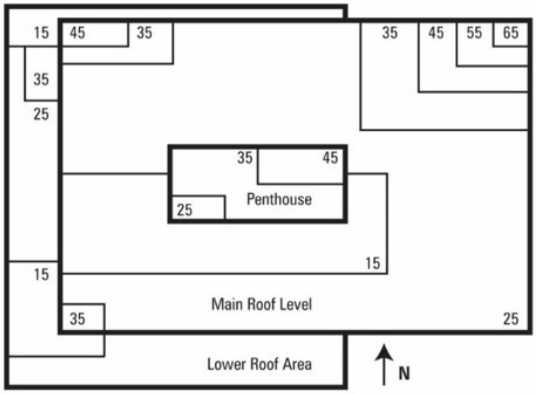
- Vegetated Roof Plants
  - Climate and microclimates
  - Tolerance to drought, frost, radiation and wind
  - Life span
  - Vegetation size
  - Maintenance requirements

Plant Selection Factors

- Vegetated Roof Plants
  - Growing media depth

Wind Considerations

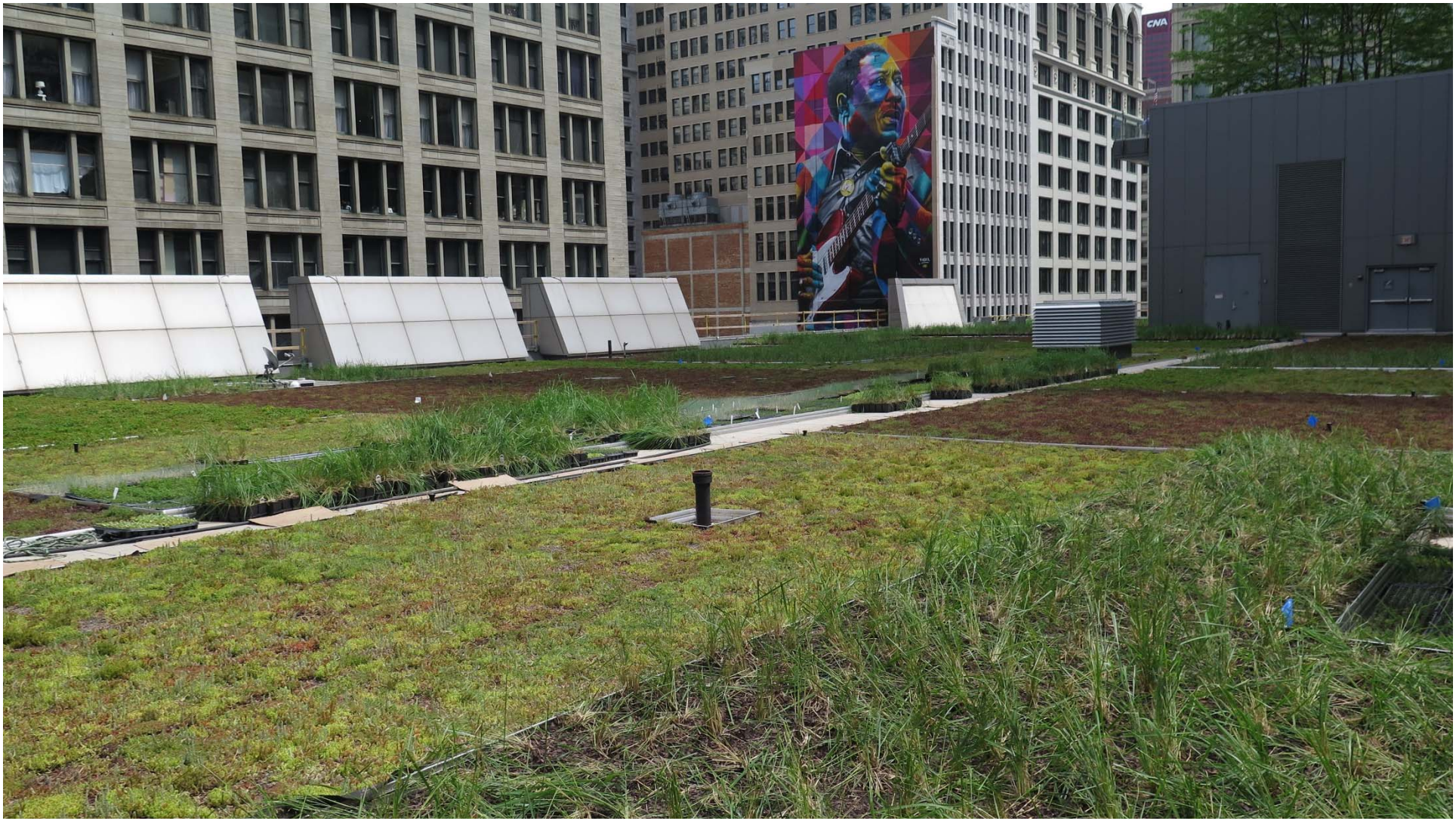
- **Wind uplift factors:**
  - Local design wind speed
  - Building height and orientation
  - Surrounding topography
  - “Effective” parapet height
    - Relationship between parapet and finished roof surfaces
  - Perimeter edge condition
    - Width and materials used



Extensive Vegetated Roofs


C. S. Mott Children's Hospital and
Von Voigtlander Women's Hospital


Miller
Lite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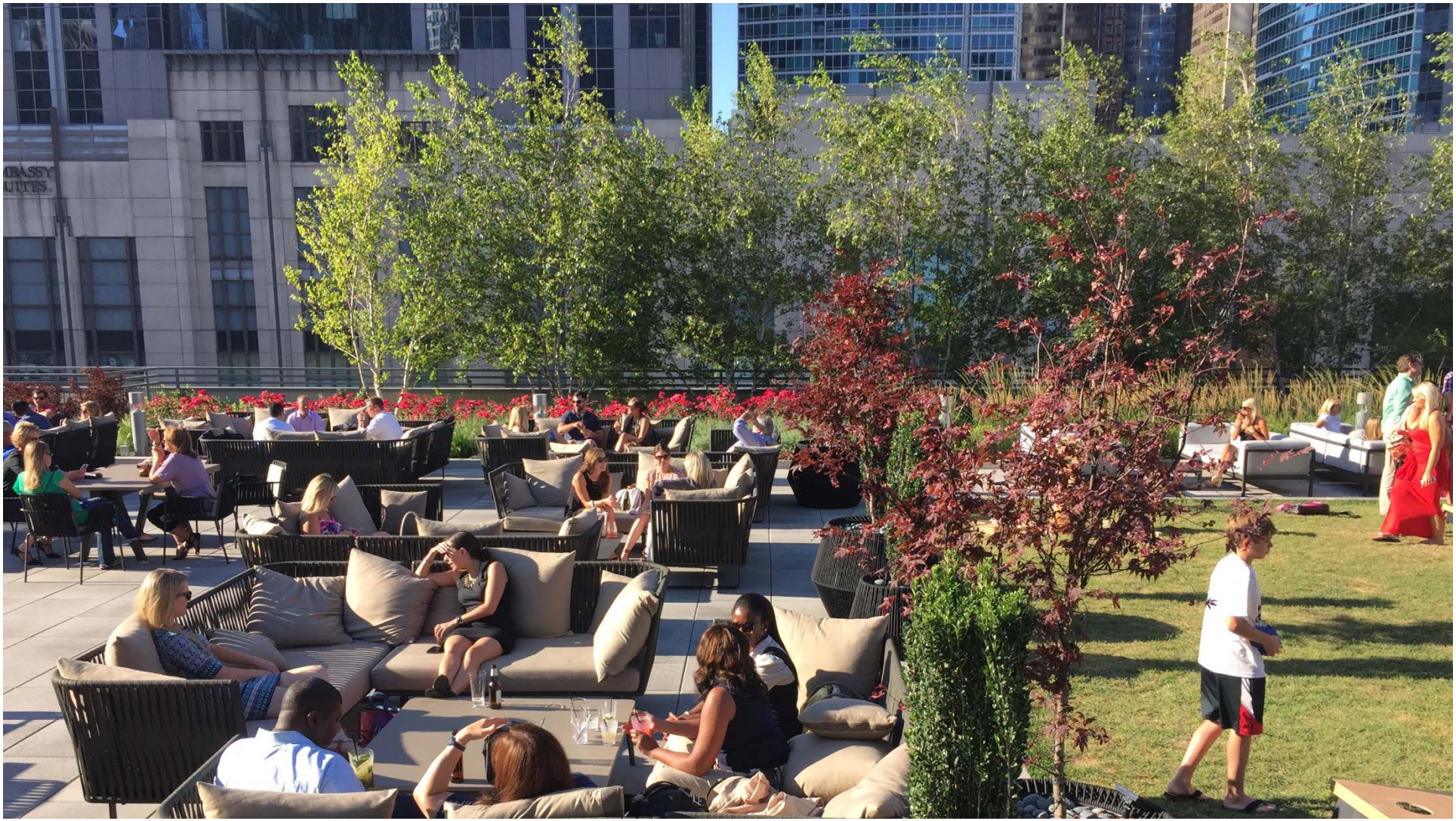
Lawn Vegetated Roofs

Intensive Vegetated Roofs


Levi's
STADIUM

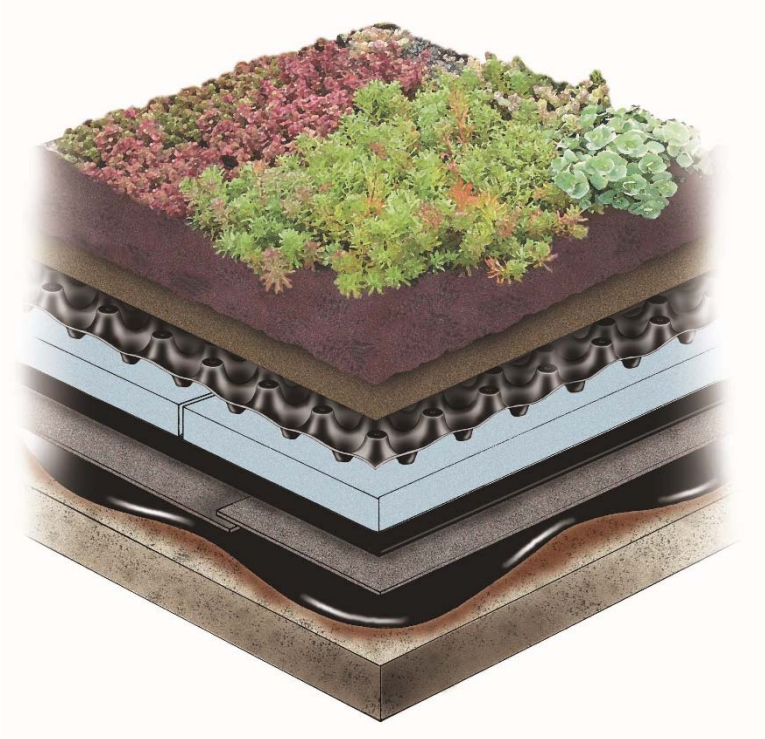



EXIT
Not
in service
2541
cta

Stormwater Performance of Vegetated Roofs

Options for Handling Stormwater

- **Conventional Vegetated Roof**
  - Primary water storage in growing media
    - **40-50% storage volume**
    - **Deeper media = more water storage**
  - Water volume **reduced**
    - By evaporation / transpiration
  - Water flow **reduced**
    - Stored in media until used by plants
  - Water flow **delayed**
    - Bound in media until saturated



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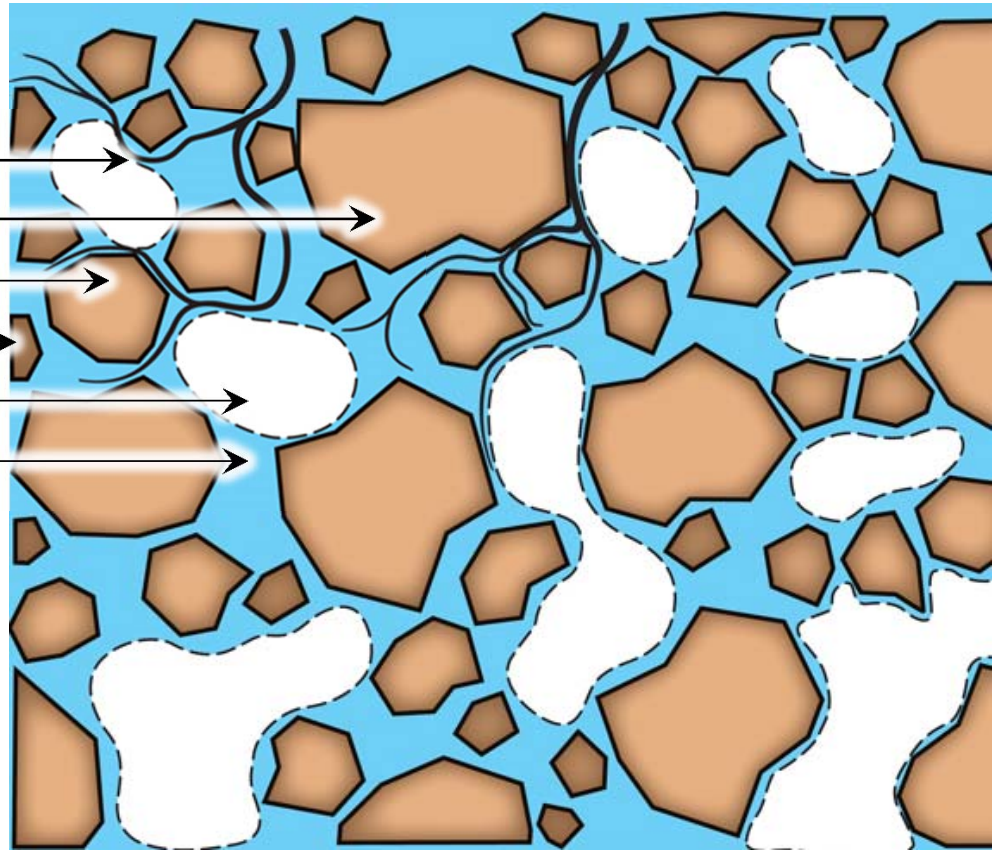
  - Growing media consists of three main components
  - Proportions dictated by region, climate and intended plantings
  - Provides a stable structure for the anchorage of the plants' root system

Lightweight aggregate | Compost | Mid-range to fine aggregates

Engineered Growing Media

Engineered Growing Media

- **Internal Structure**
  - Plant roots
  - Lightweight aggregate
  - Smaller aggregates and sands
  - Organic materials
  - Air spaces
  - Water



Blue / Green Garden Roofs

Blue Roof Concepts

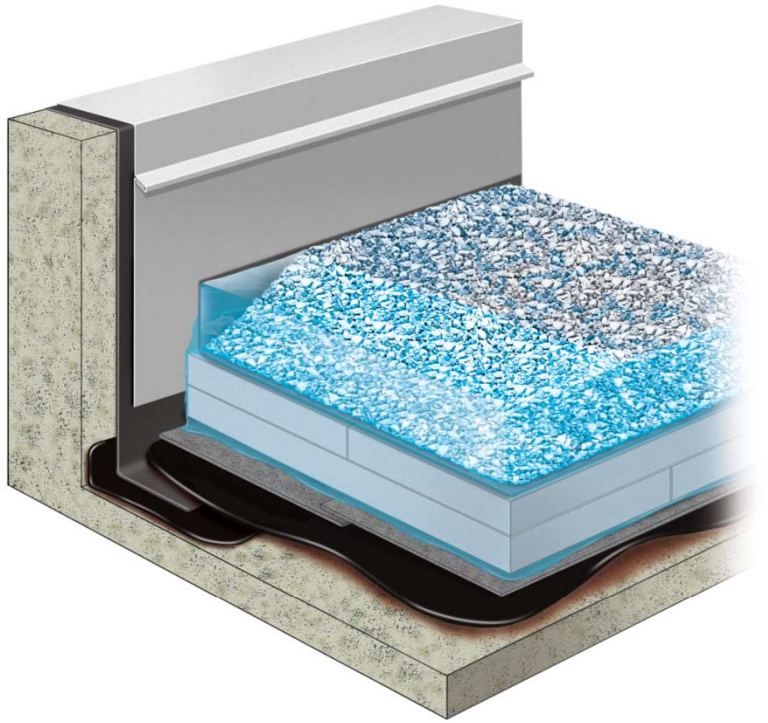
- **Watershed Dams concept**

Blue Roof Concepts

- **“Box-o-rocks” Concept**

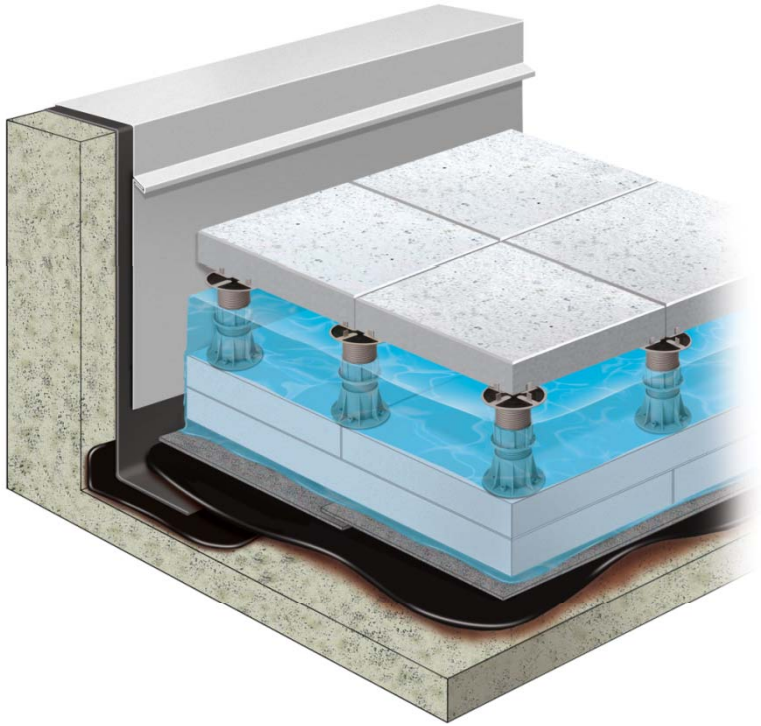
Options for Handling Stormwater

- **PMR Blue Roof**
  - Primary water storage in stone ballast
    - **30-40% volume**
    - **Flat deck ideal to maximize potential**
  - Total volume depends on depth
    - Space above ballast available
  - Water flow **regulated**
    - Control flow roof drains required
  - Water flow **delayed**
    - Gone in 48 hours (depending on municipality)
    - Allows for back-to-back rain events



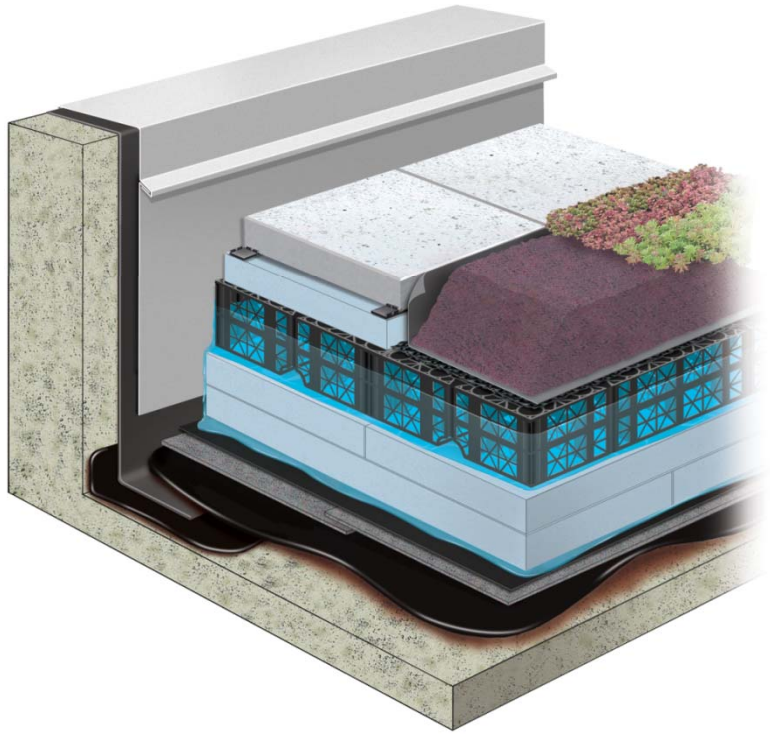
Options for Handling Stormwater

- **Ultimate Assembly® Blue Roof**
  - Primary water storage below pavers
    - **100% volume below pavers**
    - **Flat deck ideal to maximize potential**
  - Total volume depends on depth
    - Keep 2 inches clear under pavers
  - Water flow **regulated**
    - Control flow roof drains required
  - Water flow **delayed**
    - Gone in 48 hours (depending on municipality)
    - Allows for back-to-back rain events



Options for Handling Stormwater

- **Garden Roof® Blue Roof**
  - ***Primary*** water storage under Garden Roof®
    - **100% volume up to 6 inches**
    - **Flat deck ideal to maximize potential**
  - ***Secondary*** water storage in LiteTop®
    - **40-50% storage volume**
    - **Min. 6” GR Assembly (with 6” Dow)**
  - Water flow **regulated**
    - Control flow roof drains required
  - Water flow **delayed**
    - Gone in 48 hours (depending on municipality)
    - Allows for back-to-back rain events



Not unlike current detention concepts . . .

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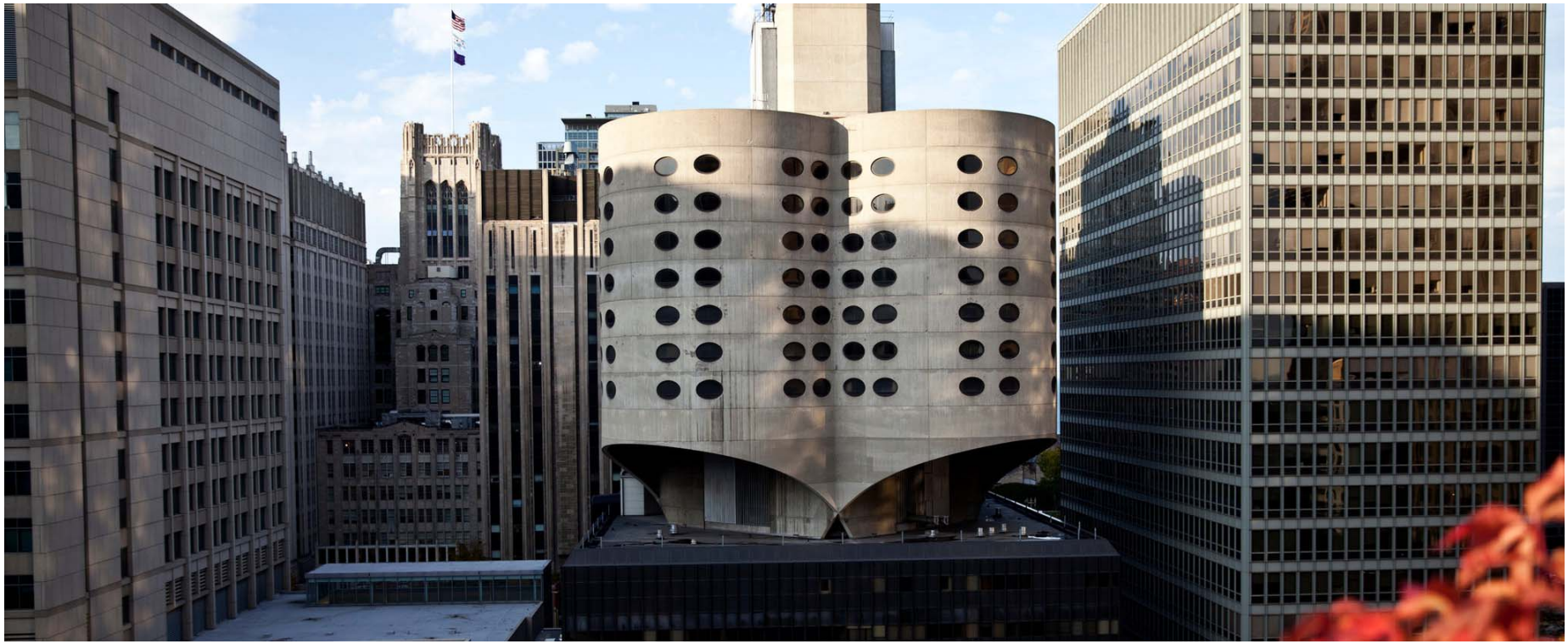
Former Prentiss Hospital Site – Chicago, IL



Project Location

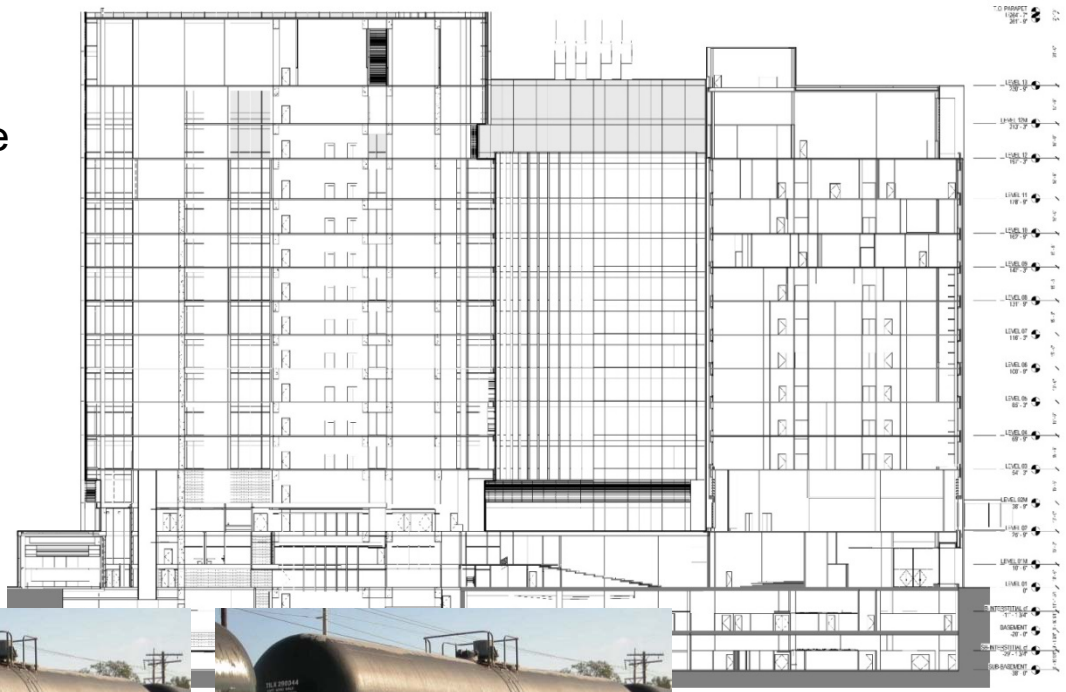
- **Urban Site**
  - Near Lake Michigan
  - High water table
  - Substantial stormwater requirement

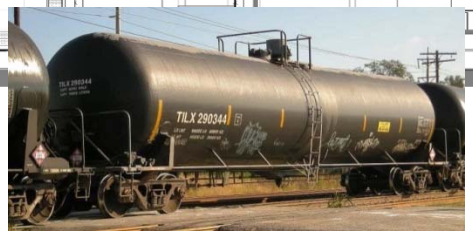
Northwestern University BioMedical Research Center

Northwestern University BioMedical Research Center

- **Stormwater Storage Options:**
  - Stored in tanks 45 feet below grade

  or
  - Stored on roof in Garden Roof assembly
- **Volume required:**
  - **10,000** cubic feet
  - **75,000** gallons





Normal Roof Drainage

- **Roof Drains**
  - Critical part of roof design
  - Often protected by inspection chambers
  - Protected by vegetation free zones
  - Sized by MEP to code

Normal Roof Drainage

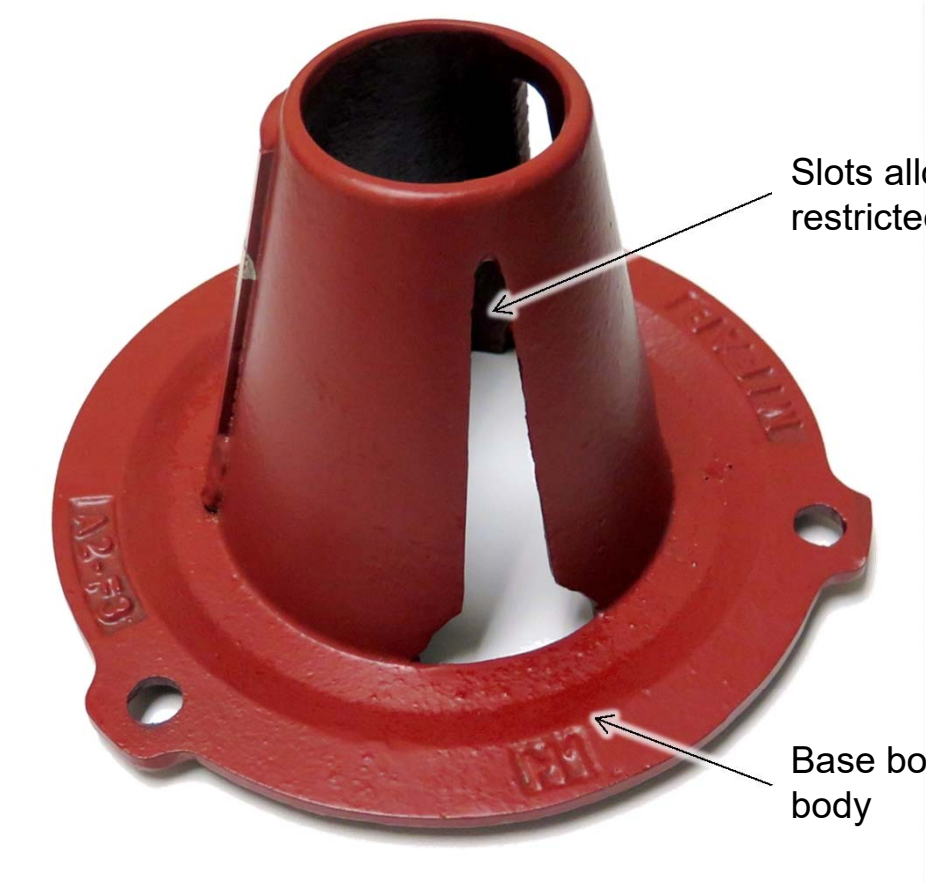
- **Roof Drains**
  - Allows free drainage of water

Normal Roof Drainage

- **Roof Drains**
  - Allows free, unrestricted drainage
  - Connects to drain pipe
  - Works on sloped and flat roof decks

Creating Blue Roofs

- **Control Flow Drains**
  - Roof drains designed to restrain water flow
  - Predictable flow rate
  - Sturdy construction
  - Simple concept
  - No moving parts
  - Engineered by drain manufacturers



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The Blue Roof

- **When it's wet . . .**

The Blue Roof

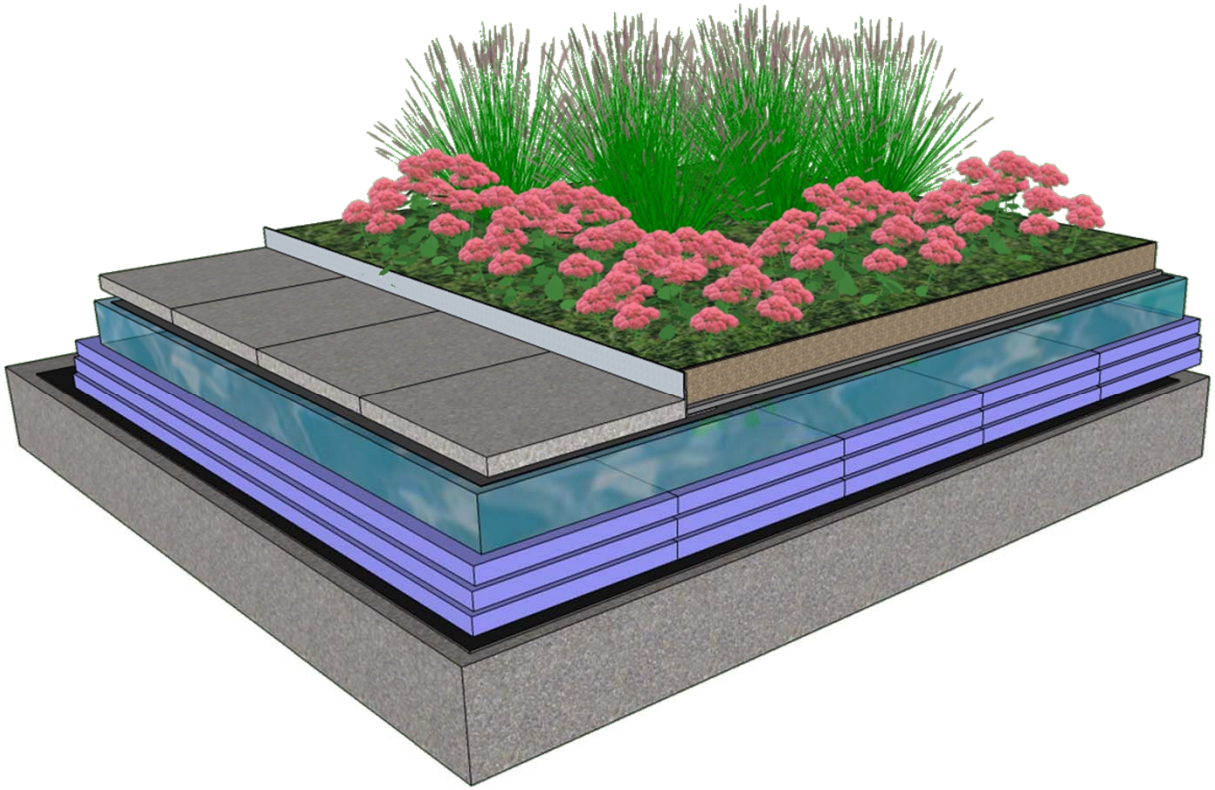
- **When it's dry . . .**

The Blue Roof

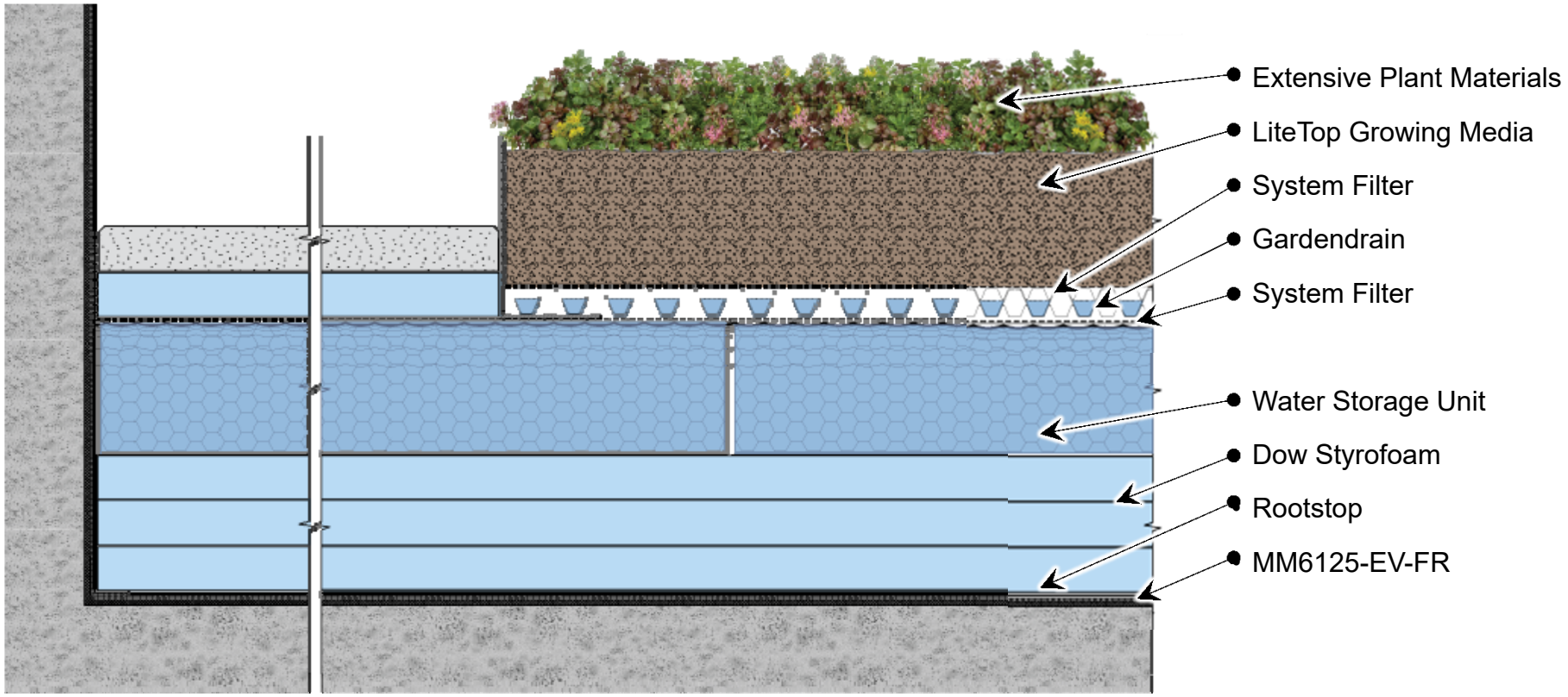
- **What they could look like . . . .**

Hydrotech's Garden Roof® Blue Roof Assembly

- **"Green Roof on Stilts"**
  - Create "free water" storage on roof
  - Water unbound by media
  - Stored for no more than 48 hours
  - Most ideal on flat decks



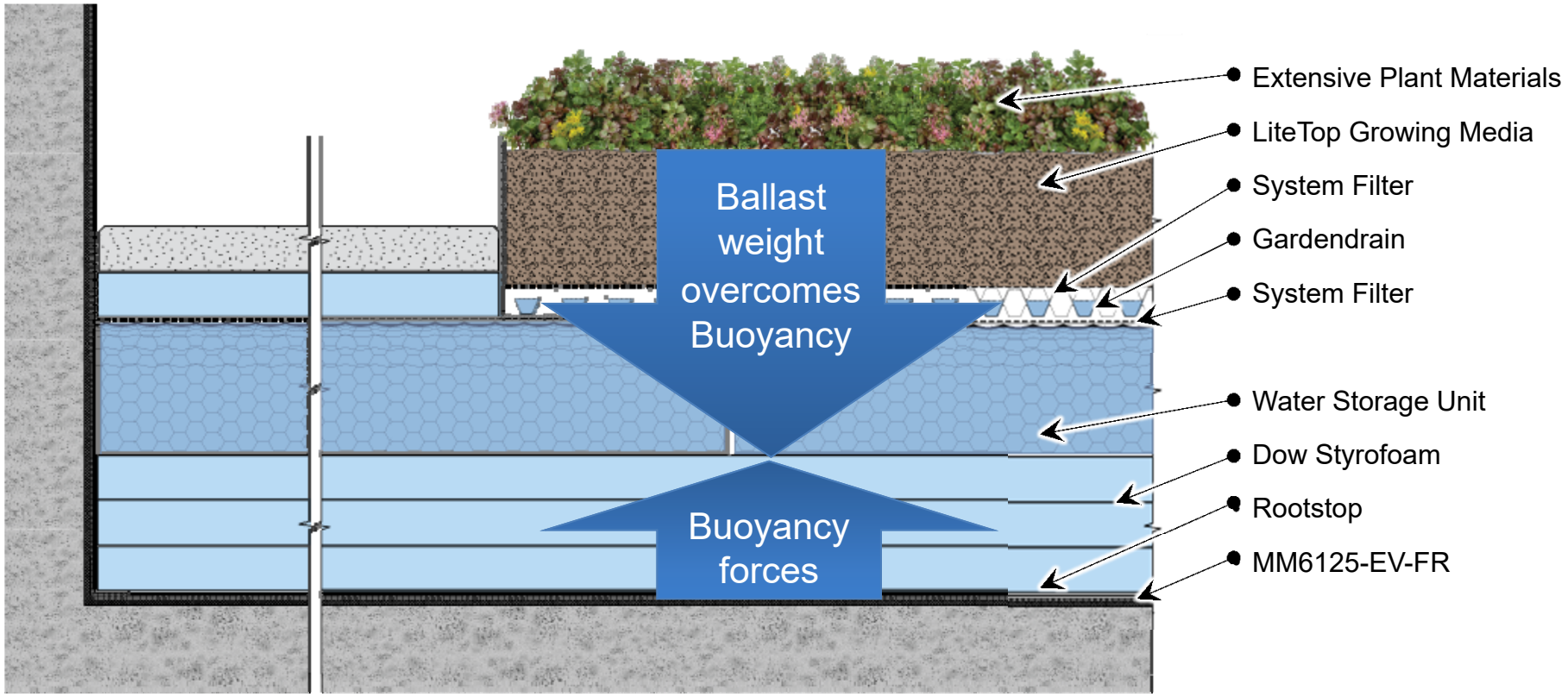
Hydrotech's Garden Roof® Blue Roof Assembly



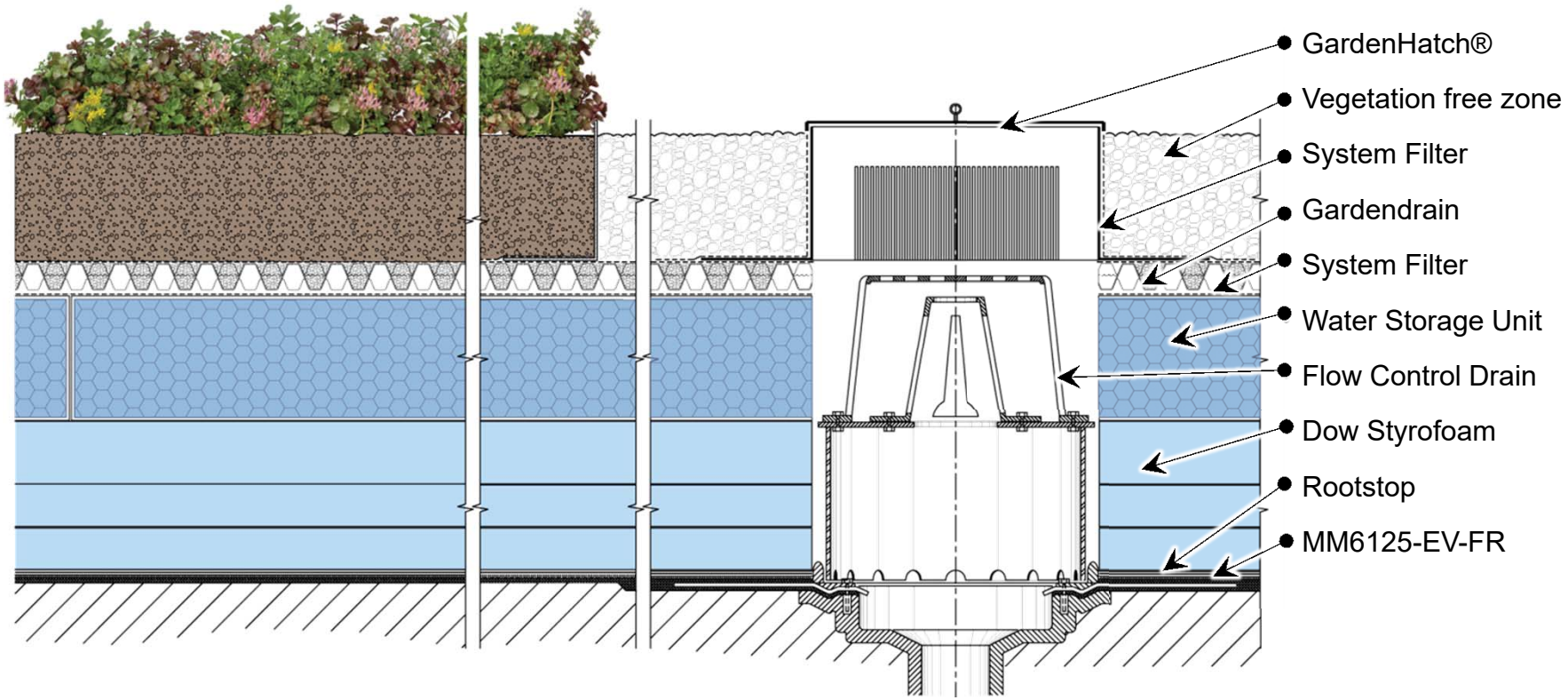
Creating Void Space – Water Storage Unit

- Arrives in pre-assembled layers
- Loose laid

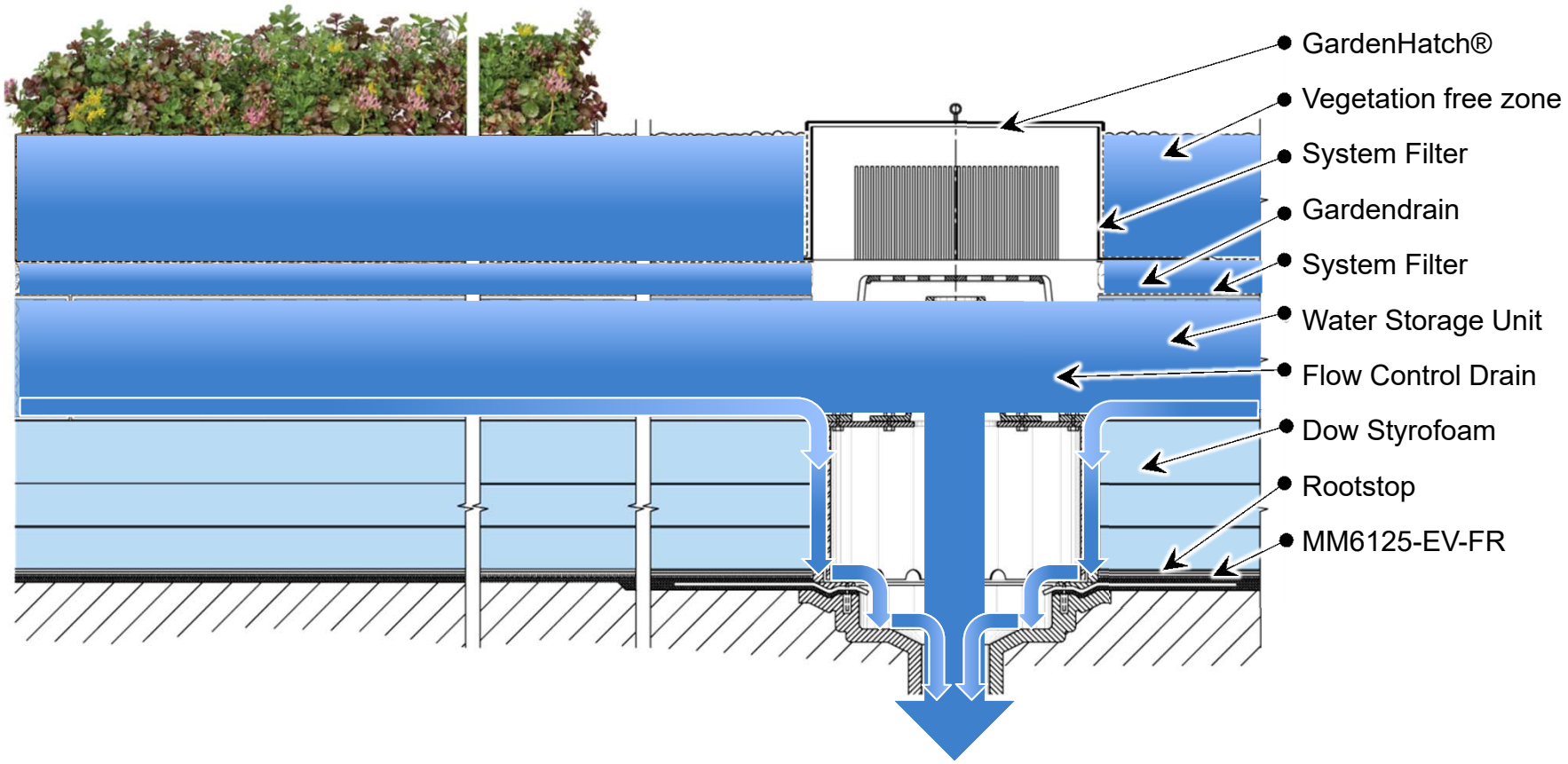
Hydrotech's Garden Roof® Blue Roof Assembly



Blue Roof Assembly – Flow Control Drain



Blue Roof Assembly – Flow Control Drain



Blue Roof Summary

- **Ideal for urban sites**
  - No at-grade space available
  - Limited or no BMP options
    - Bedrock issues
    - High water table issues
- **Ideal for flat, zero slope decks**
  - No storage loss due to slope
  - Requires architect and municipal coordination
  - MEP coordination for drains
  - Additional structural consideration
- **Keeps stored water above ground**
  - Works by gravity
  - No below grade infrastructure
  - No moving parts
    - (pumps, electrical, valves, etc.)
- **Combining Blue and Green**
  - Green roof often required
    - Code requirement
    - Reduces stormwater requirement
    - Contributes as stormwater BMP
    - LEED contributions

Blue/Green Garden Roofs

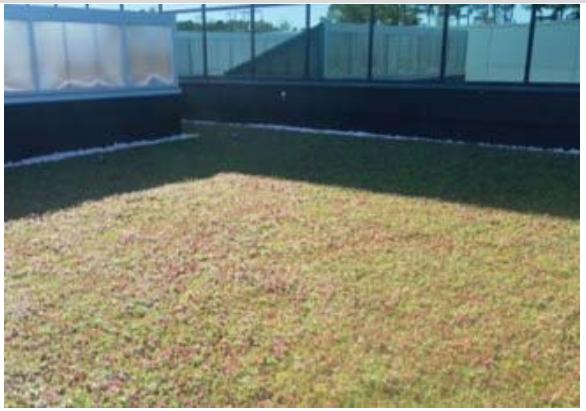

Thank You!

Other Considerations – Vegetation Free Zones

- **Building ventilation**
  - Be aware of ventilation areas
  - Creates microclimates
    - Dries out vegetation and media
    - Creates artificially warmer than normal environment that can prevent normal plant seasonal responses (dormancy)
    - Accommodate by proper plant selection
- **Accessory structures**
  - Skylights and clerestory units, etc.
  - Creates additional watershed areas
    - Can keep media wetter than normal
    - Accommodate by providing additional drainage pathways and capacity

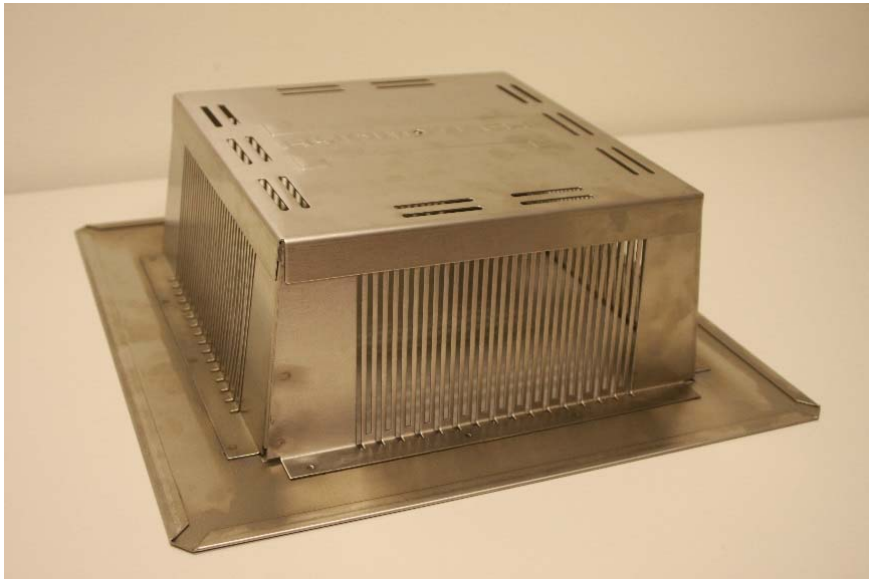
Other Considerations – Vegetation Free Zones

- **Sun and Shade Exposures**
  - From adjacent buildings
  - From overhangs
- **Reflective Light**
  - Builds concentrated heat and light
  - From windows
  - From tall reflective parapets



Other Considerations – Vegetation Free Zones

- **Drains**



Access to Water

- **Importance of water**
  - For installation and establishment of plant materials
  - For maintenance
  - For times of drought
- **Planning for water**
  - Work with architect and mechanical engineer
- **Sufficient water**
  - What is sufficient water?
  - Minimum pressure: ***35 psi***
  - Minimum volume: ***8-10 gpm***
  - Minimum values at roof

Water Delivery Systems

- **Drip Irrigation Systems**
  - Delivers water slowly
  - Can be used at low pressures and low volumes
  - Suitable for plug installations
  - Uses same equipment as at-grade irrigation systems

Water Delivery Systems

- **Overhead Irrigation Systems**
  - Delivers water from above and at higher rates
  - Requires higher pressures and volumes than drip irrigation
  - Recommended for InstaGreen Sedum Carpet and Tile installations
    - Delivers water to surface where roots can get access to water
  - Recommended for Lawn Garden Roof Assembly
  - Uses same equipment as at-grade irrigation systems