

# Stormwater and Green Roofs

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Douglas County

Environmental Services

March 13, 2009

# The big(ger) picture



Photo credit: K Holm

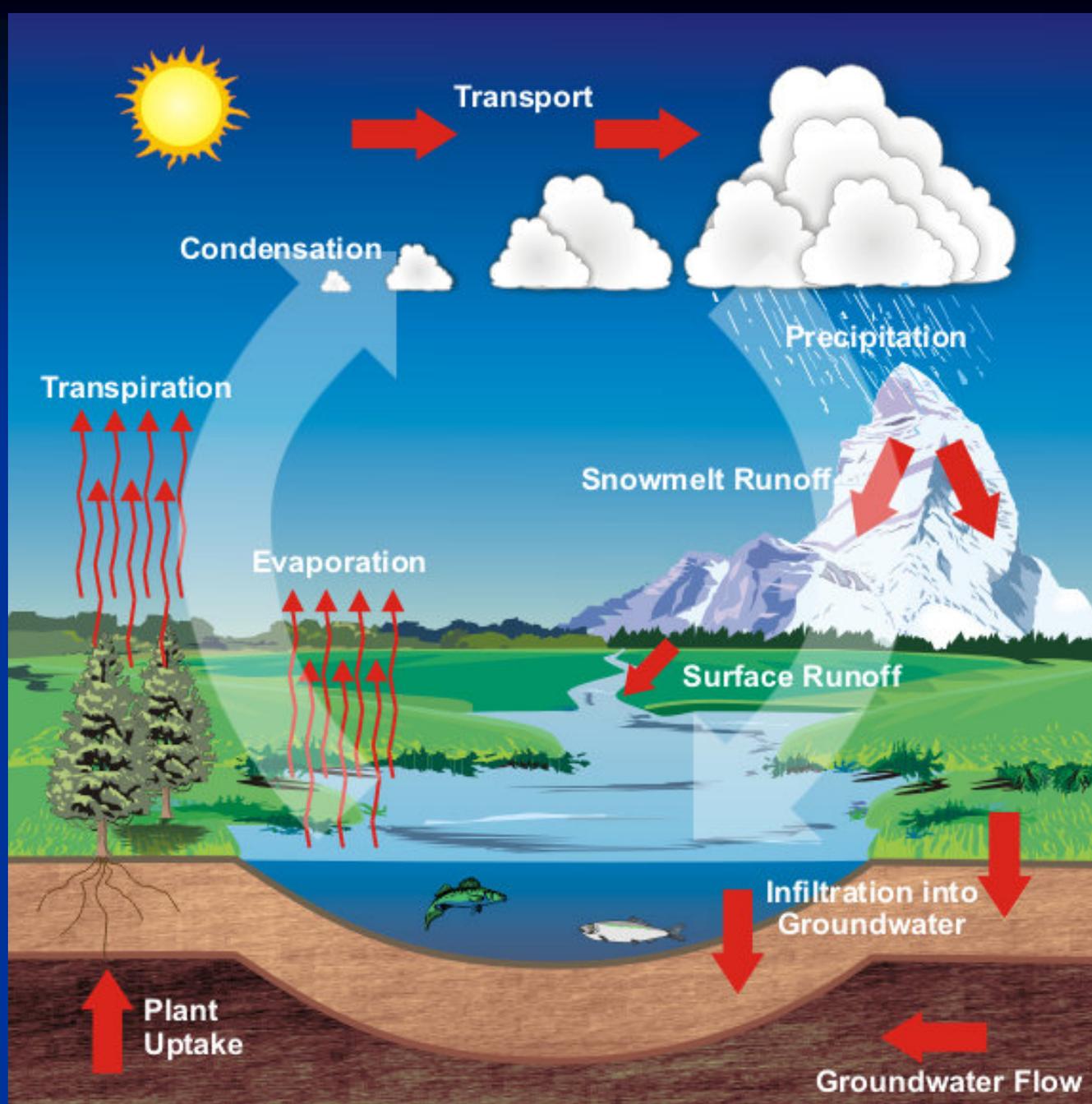


Photo credit: Conservation Design Forum

# Impervious cover impacts

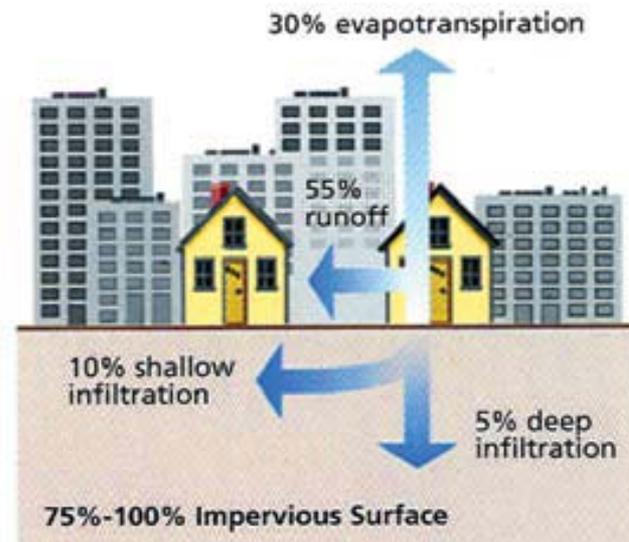
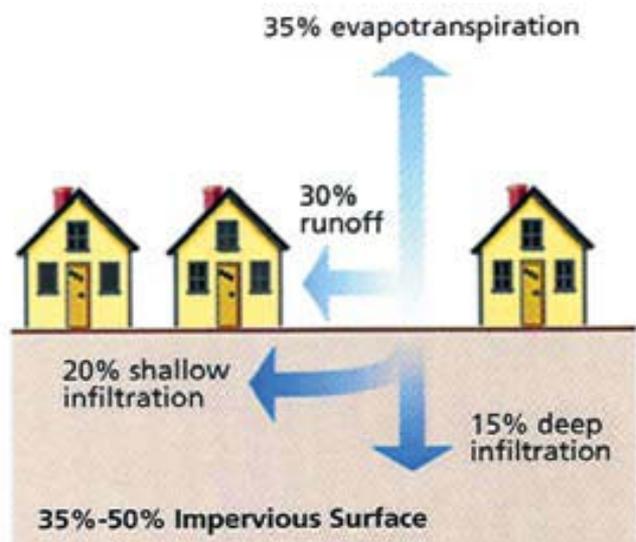
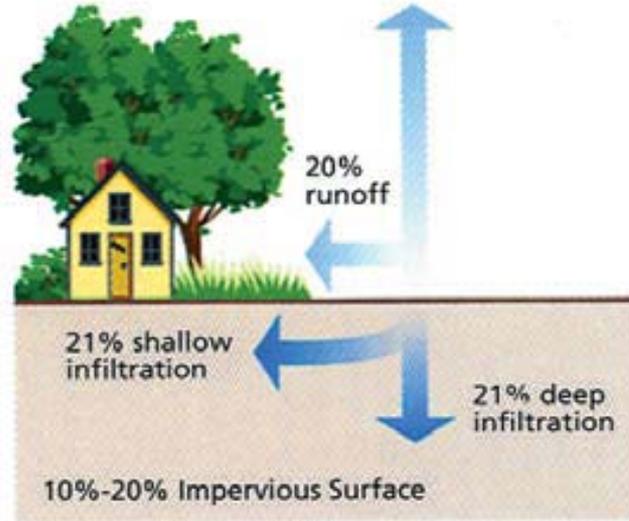
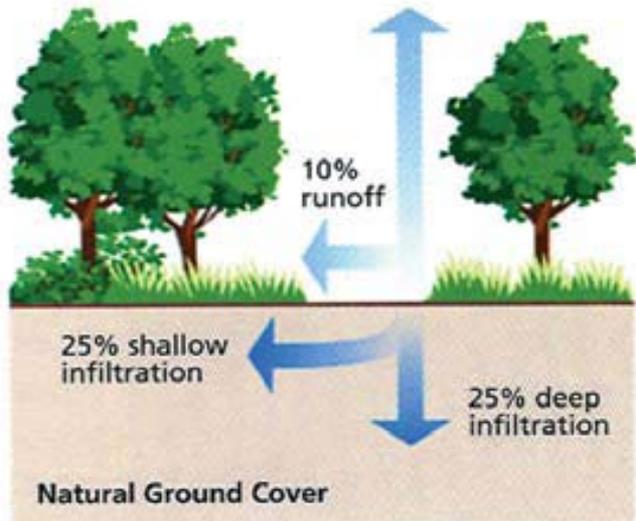




Photo credit: Conservation Design Forum

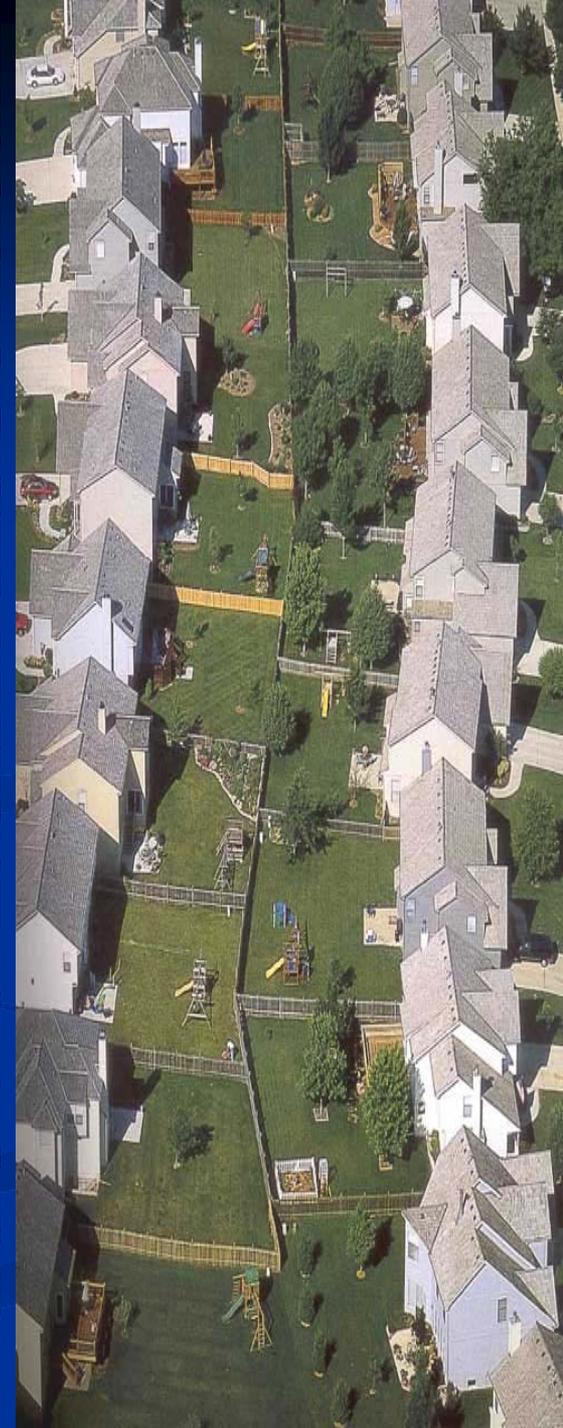
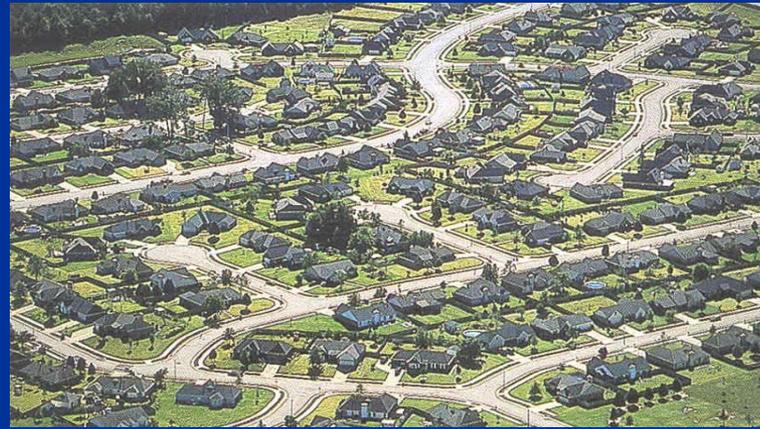
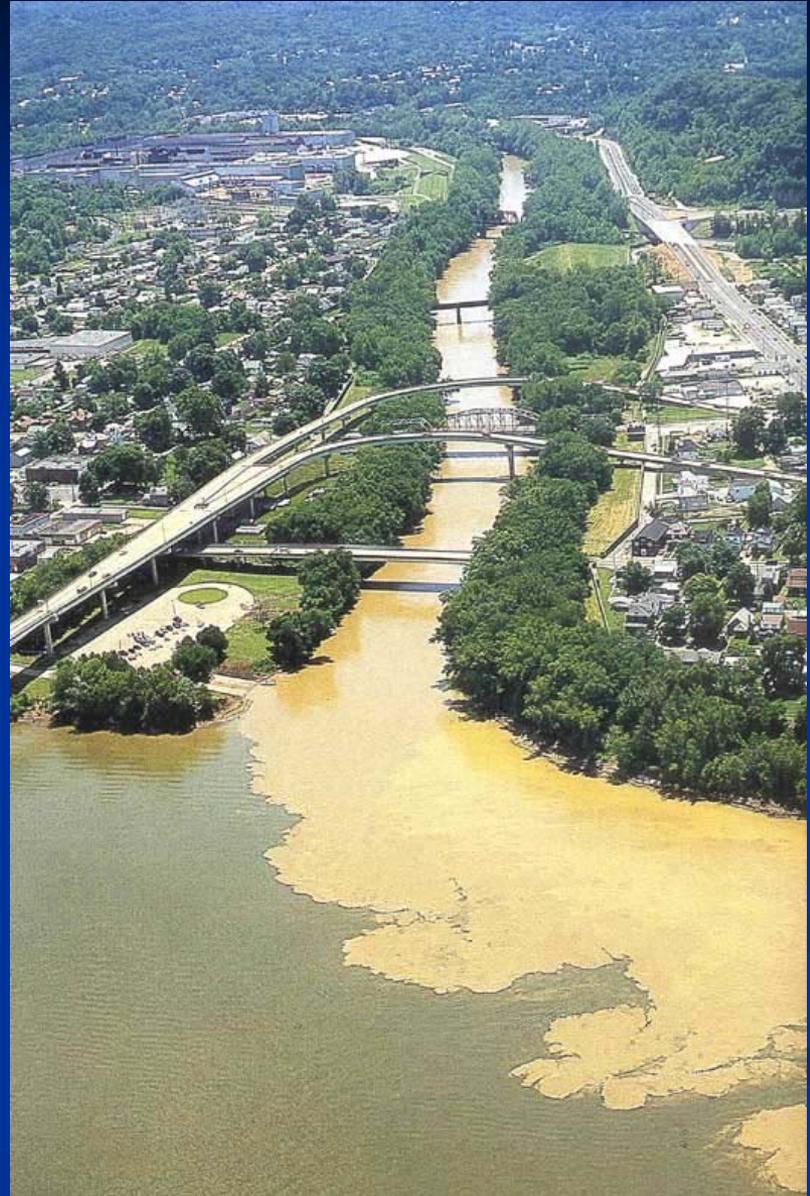


Photo credit: Conservation Design Forum









# Managing Stormwater

- Traditional approach: Put it in a pipe and get it to the stream asap.



# Managing Stormwater

- “New” approach: Mimic natural hydrology and deal with stormwater where it falls.





# Bio-swales and rain gardens





# Cisterns and rain barrels



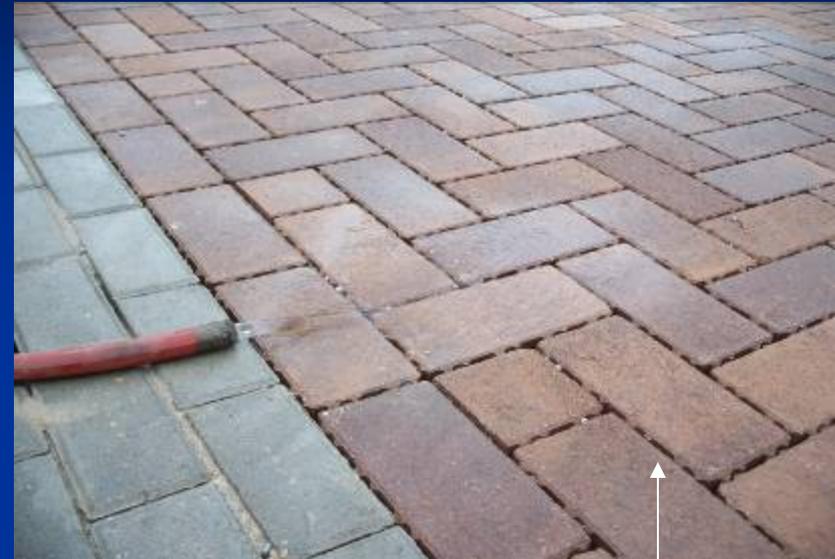


Douglas County Health Center Rainwater Collection System

# Low Impact Development (LID)



Rain Garden



Permeable pavers



Rain Harvest

Green Roof



# Green Roof Benefits

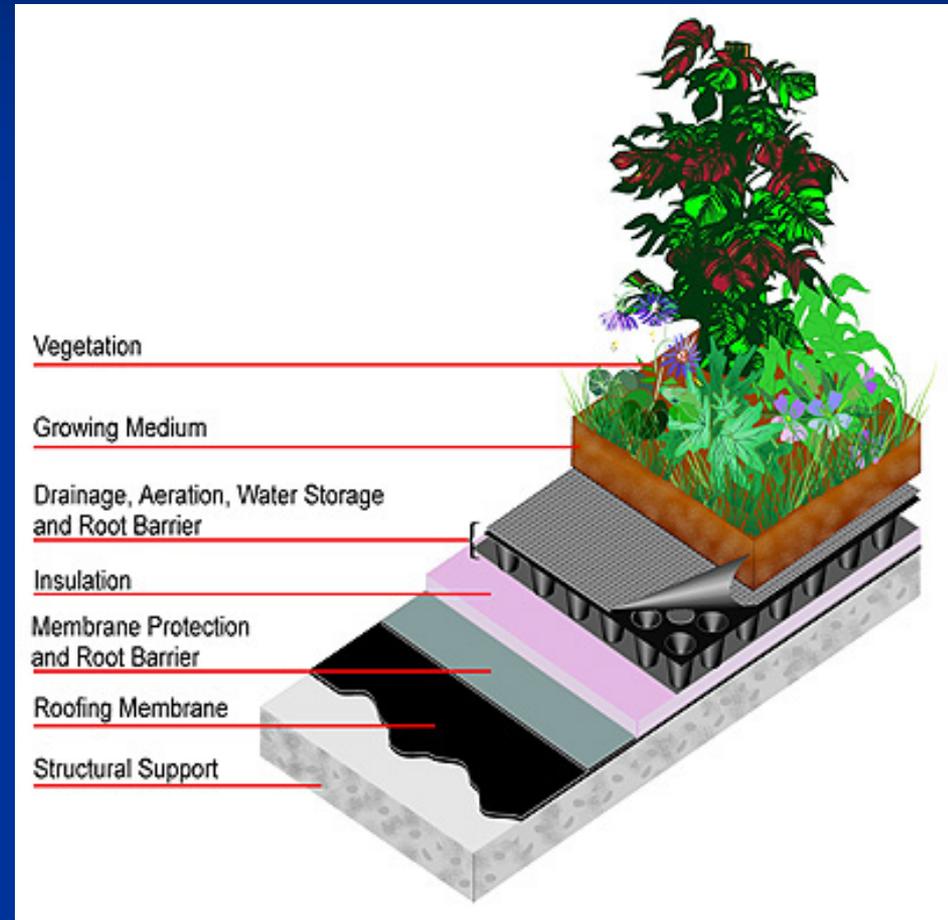
- Stormwater management
  - Water quality
  - Peak discharge & volume
  - Offset a stormwater utility fee
- Sound and thermal insulation
- Urban heat island – temperature reduction
- Extend the livable space
- Protect & extend the life of the waterproofing: 2-3 times the life of typical roofing

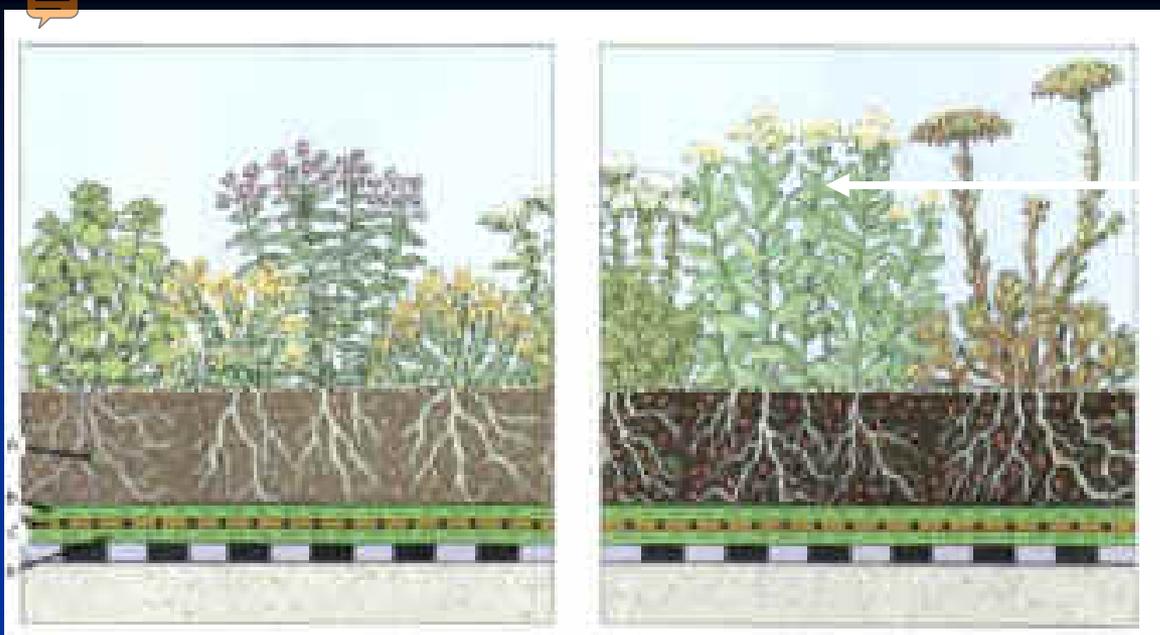


Green roof on residence in Omaha

# Green Roofs – the skinny

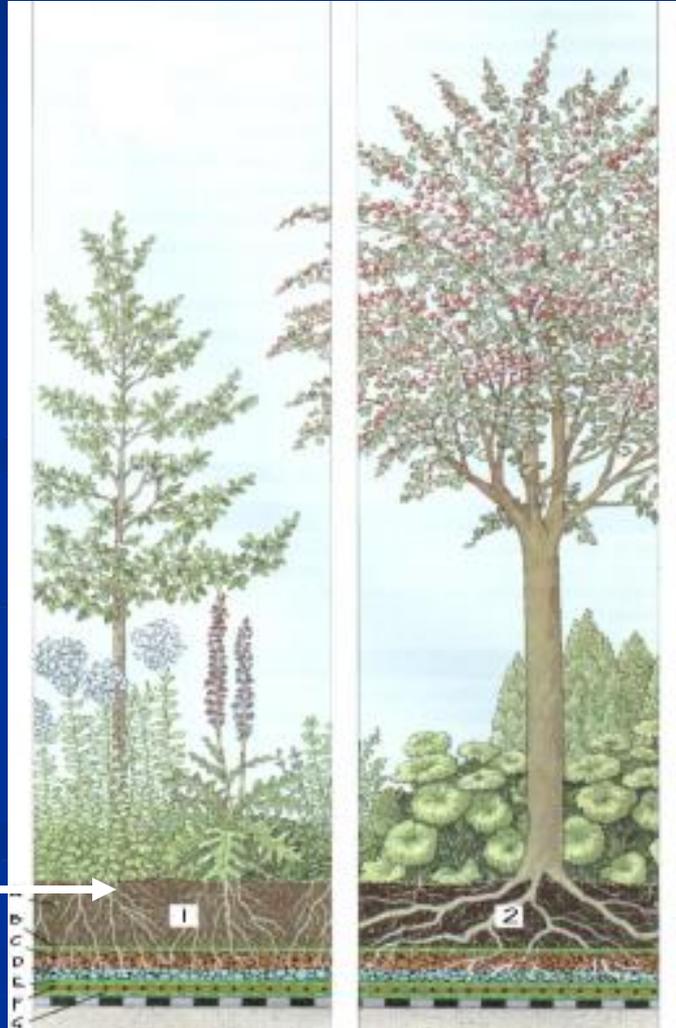
- A roof assembly that has planting medium and plants above the waterproof layer
  - Protects the waterproofing from UV degradation
  - Decreases the extreme temperature swings
- Types
  - Extensive (6" or less of media)
  - Intensive (6"+)
- Plants
  - Sedums
  - Native flowers & grasses – need to be durable
  - Shrubs & trees (intensive)





Source: Optima Planungs-Unterlage 9/97

■ Extensive  
6" or less



■ Intensive  
6" or greater

# 2 Installation types of Green Roofs

## In-Place



Scott Arboretum  
Swarthmore College, PA

## Modular



LiveRoof





Photo provided by:  
Emilio Ancyra  
Living Roofs, Inc.

[http://www.ncgreenbuilding.org/site/ncg/attachments/gallery\\_Groof7.jpg](http://www.ncgreenbuilding.org/site/ncg/attachments/gallery_Groof7.jpg)



Safeguard Europe



Conservatorium of Music, Sydney Australia, Water Sensitive Urban Design

# Who is involved?

- Architect
- Landscape Architect
- Structural Engineer
- Roofing contractor
- Horticulturalist/Landscape Contractor
- Care Taker



# Roofing

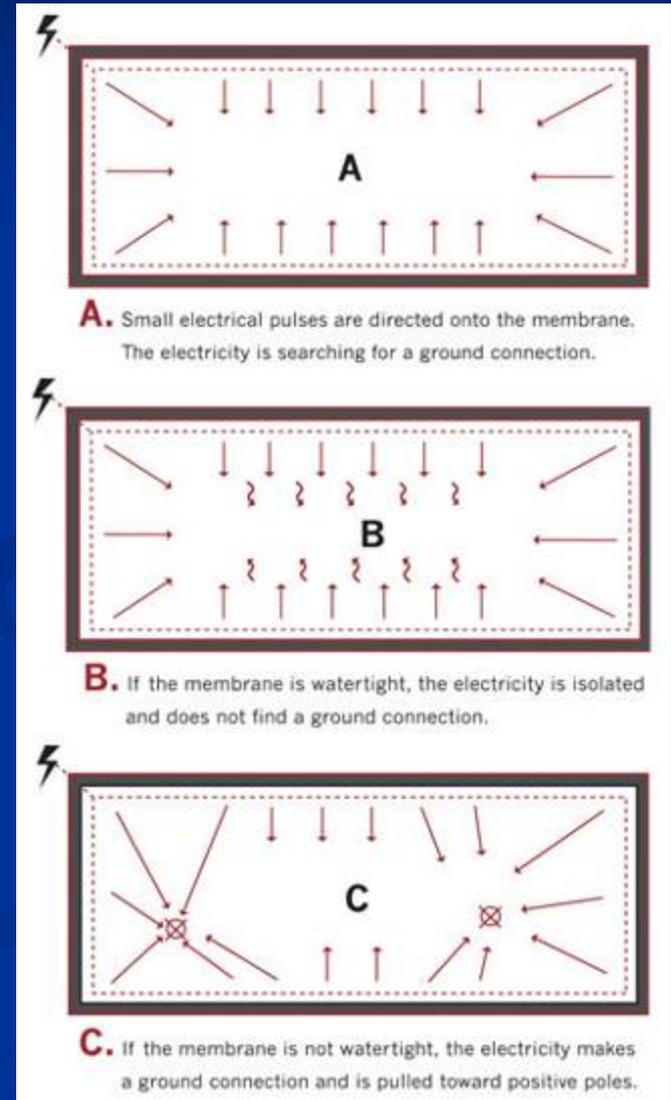
- Waterproof Membrane
  - Common types of waterproofing materials: TPO, EPDM, PVC, Bituminous
  - Take special care of the waterproofing so no tears or damage occurs during installation
  - DO NOT put a green roof over a conventional shingle roof
- What about LEAKS?
  - Electronic Field Vector Mapping
  - Flood test

# Types of Waterproof Testing



Flood Test on a roof

Electronic Field Vector Mapping  
Courtesy of ILD



# Planting Media



- The planting media on green roofs are subject to very unique requirements & conditions:
  - Needs to be free draining; limit saturation weight
  - Relatively lightweight, but heavy enough to tolerate tough wind conditions
  - Structurally stable, meaning it should have minimum settling after installation
  - Organic matter needed for plant success
  - No actual soil in the media



# Plants

- Extensive (6" or less)
  - Sedums
  - Native/adapted flowers & grasses
  - Turfgrass
- Intensive (6" or greater)
  - Shrubs
  - Trees



Carleton College

Emory Knoll Farms





# Maintenance

- Establishment of a new green roof
  - Irrigation
  - Weeding: weekly or bi-weekly inspection for weeds
  - Watch for wind scour & erosion
- Established green roof
  - Weeding: monthly visual inspection and weeding
  - Irrigation: Plant dependent, only during extended drought conditions
  - Fertilization: Usually none; but there are a couple cases
  - Replace dead/spent plant material as needed



**School of Art, Design & Media, Nanyang University,  
Singapore**

Endless  
Possibilities...



**California Academy of Sciences**

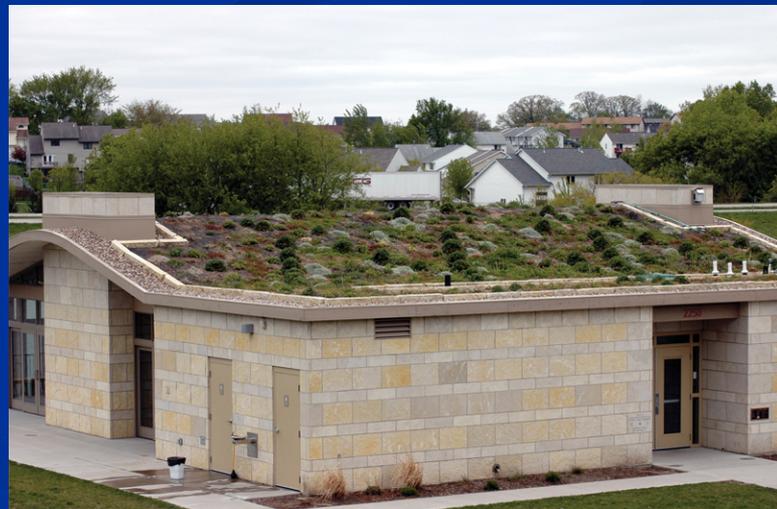




909 Walnut Building, KC, MO  
Courtesy: Jeffrey L. Bruce & Company



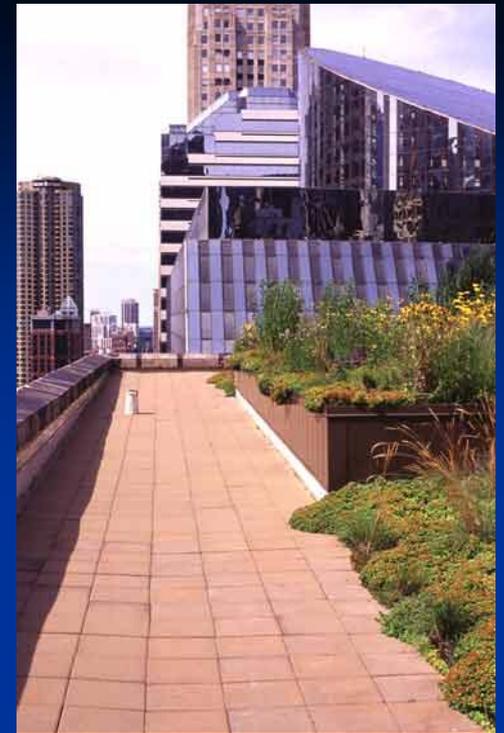
Rana Creek Habitat Restore  
Courtesy: worldchanging.com



Iowa NRCS



# Green Roofs



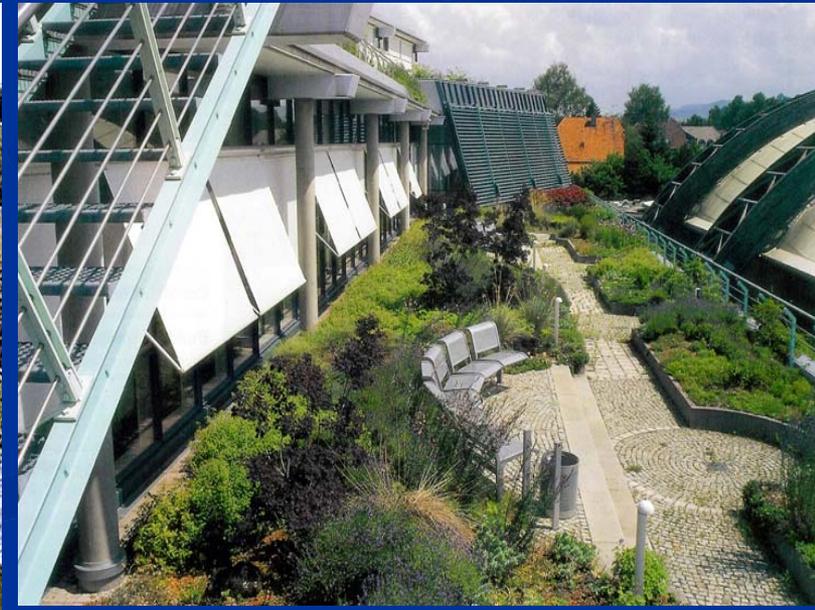


# Green Roofs





# Green Roofs



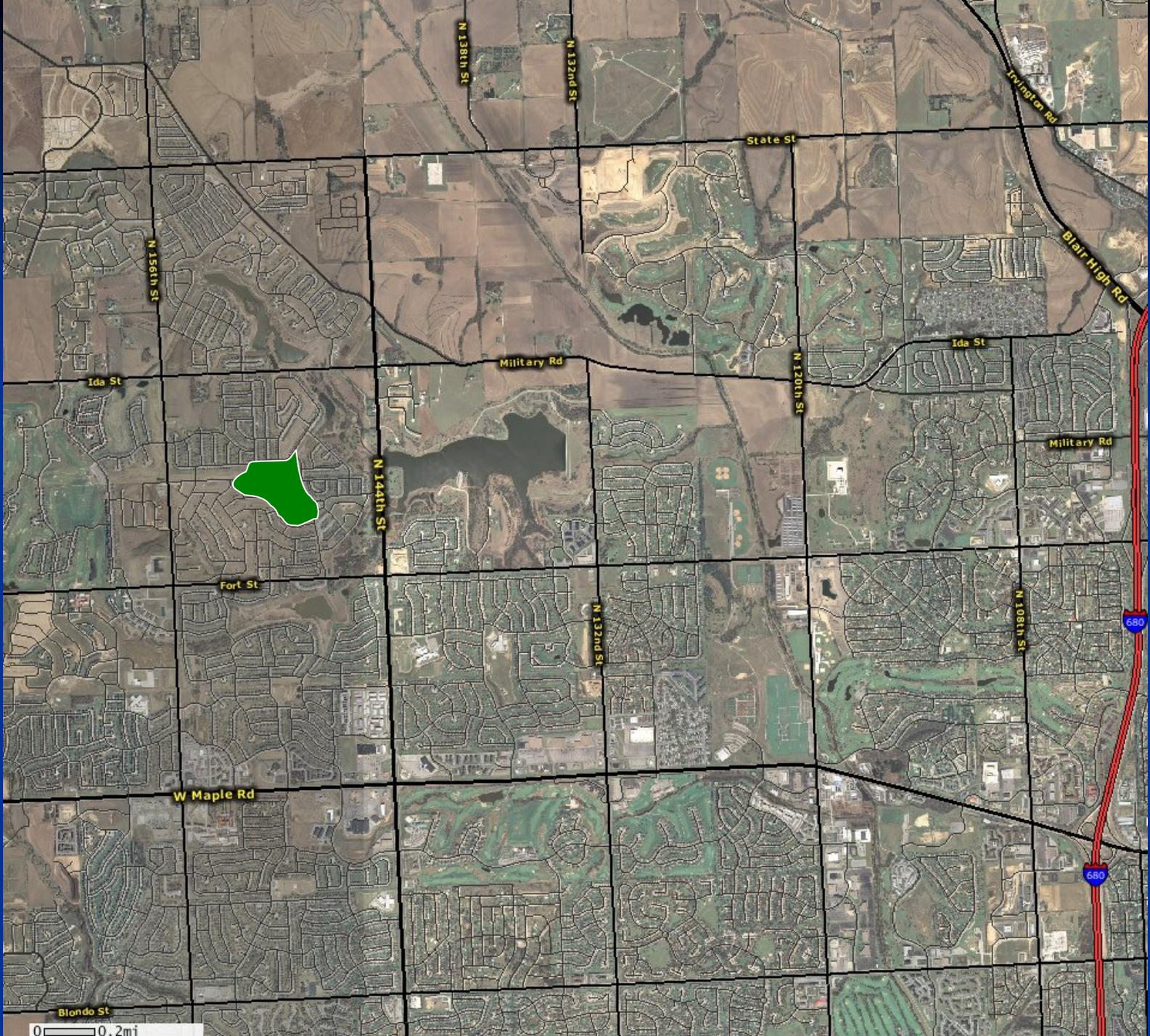


**Green roofs on residences**



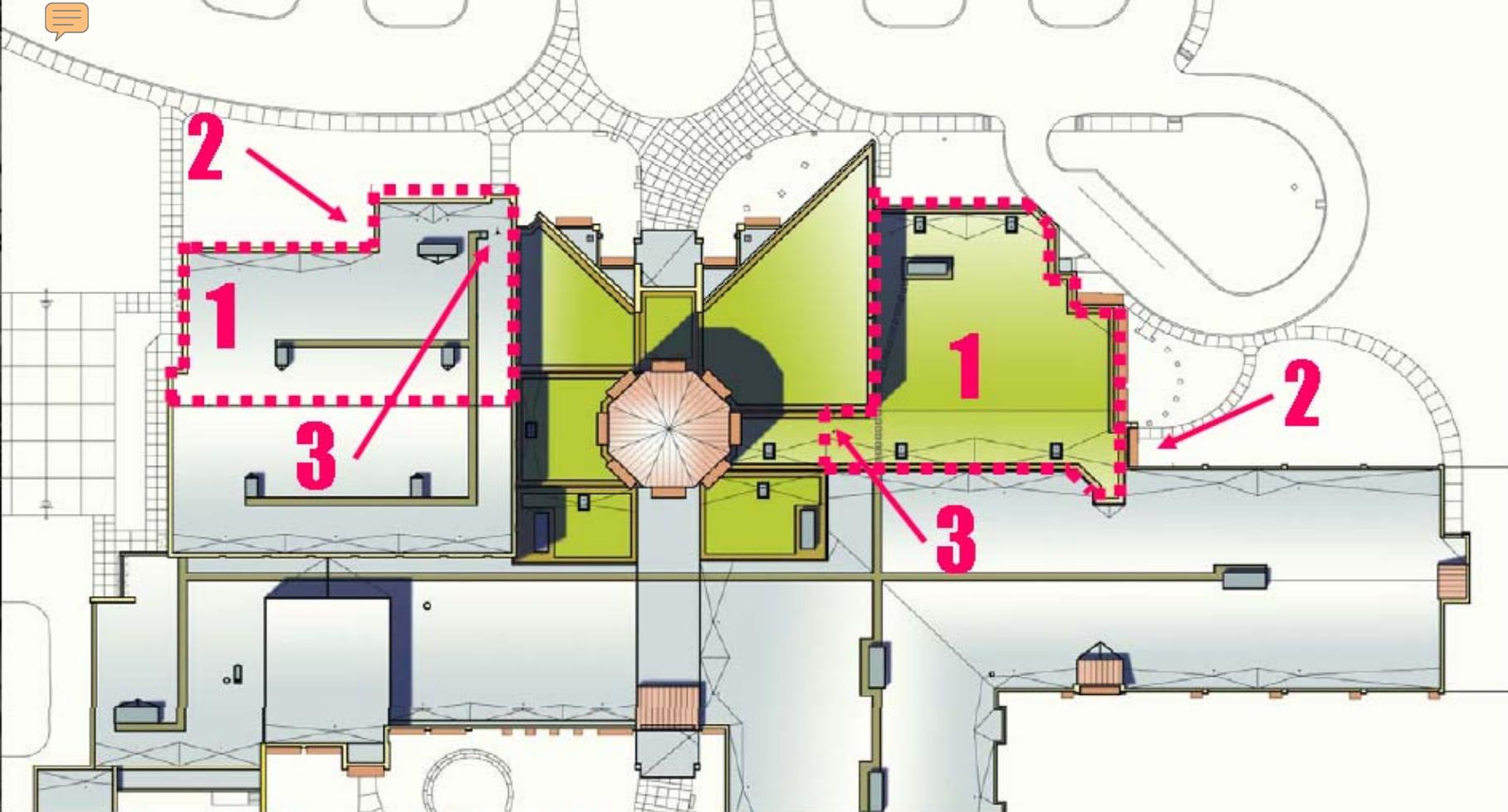
# Saddlebrook Joint Use Facility

- Green roof
- Rain garden/bioretention adjacent to parking lot.
- Monitoring



0 0.2mi





- 1 - Flow Monitored Area**
- 2 - Grab Sample / Monitor Pit**
- 3 - Weather Station**

**- Monitoring of System**

LAUREL AVENUE

SADDLEBROOK PARK

STONE AVENUE

ENTRY SIGN

203 PARKING STALLS

ENTRY SIGN

150TH STREET

PARENT DROP OFF

BUS DROP OFF

HARD SURFACE PLAY AREA

SADDLEBROOK JOINT FACILITY

BOOK DROP

OPTIONAL MONUMENT SIGN

148TH STREET

SERVICE

FUTURE PORTABLE

DROP OFF LANE

PLAY AREA

21 STALLS

147TH STREET

149TH AVENUE

SADDLEBROOK DRIVE

LAUREL AVENUE

ENTRY SIGN



# Baltimore green roof examples





Downtown hotel under construction









Non-profit organization – building rehab







Private residence







# Kansas City green roof examples

Condo building parking garage roof





Boulevard Brewing Company





Nelson-Atkins Art Museum





# Additional Resources

- Green Roofs for Healthy Cities website:
  - [www.greenroofs.org](http://www.greenroofs.org)
- Green Roof Working Committee
  - Information is available at [www.dcplanning.org](http://www.dcplanning.org) – click on the “Green Roof Working Committee” link on the main page.

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