Low Impact Development and Pervious Concrete

Sustainability

- Low-Impact Development
- Pollution Treatment
- Recharging Groundwater
- Tree Protection
- Building Rating Requirements
- Cool Communities

What is Low Impact Development?

- Comprehensive, landscape-based approach to sustainable development
- Set of strategies to maintain existing natural systems, hydrology, ecology
- Cost-effective, flexible approach based on a toolkit of simple techniques
- Collection of practices that have been implemented nationwide

What is Low Impact Development?

- NOT rocket science
- NOT formulaic
- NOT the answer to every challenge
- NOT yet finished evolving

WHY DO WE NEED LOW IMPACT DEVELOPMENT?

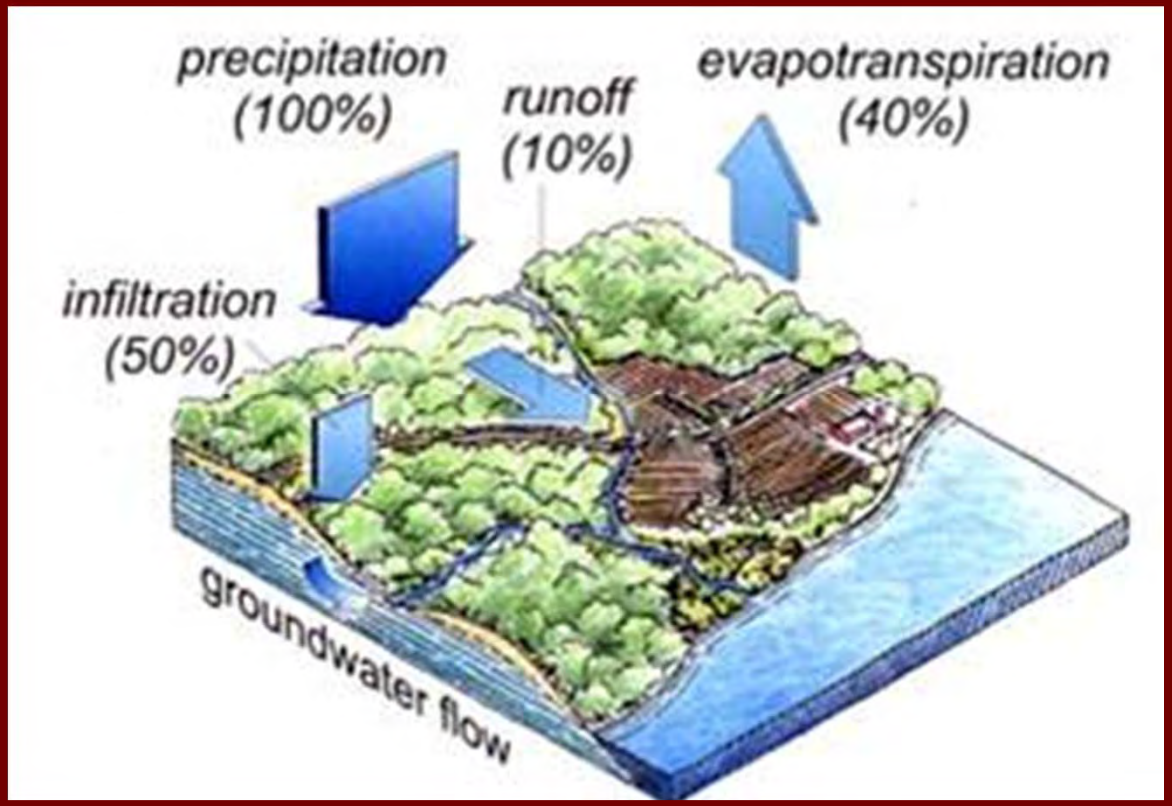
Conventional strategies aren't working

- Increased runoff & decreased recharge
- Loss of vegetation and wildlife habitat
- Loss of community character
- Polluted waterways
- Cost of development

WHY DO WE NEED LOW IMPACT DEVELOPMENT?

Typical pre-development conditions:

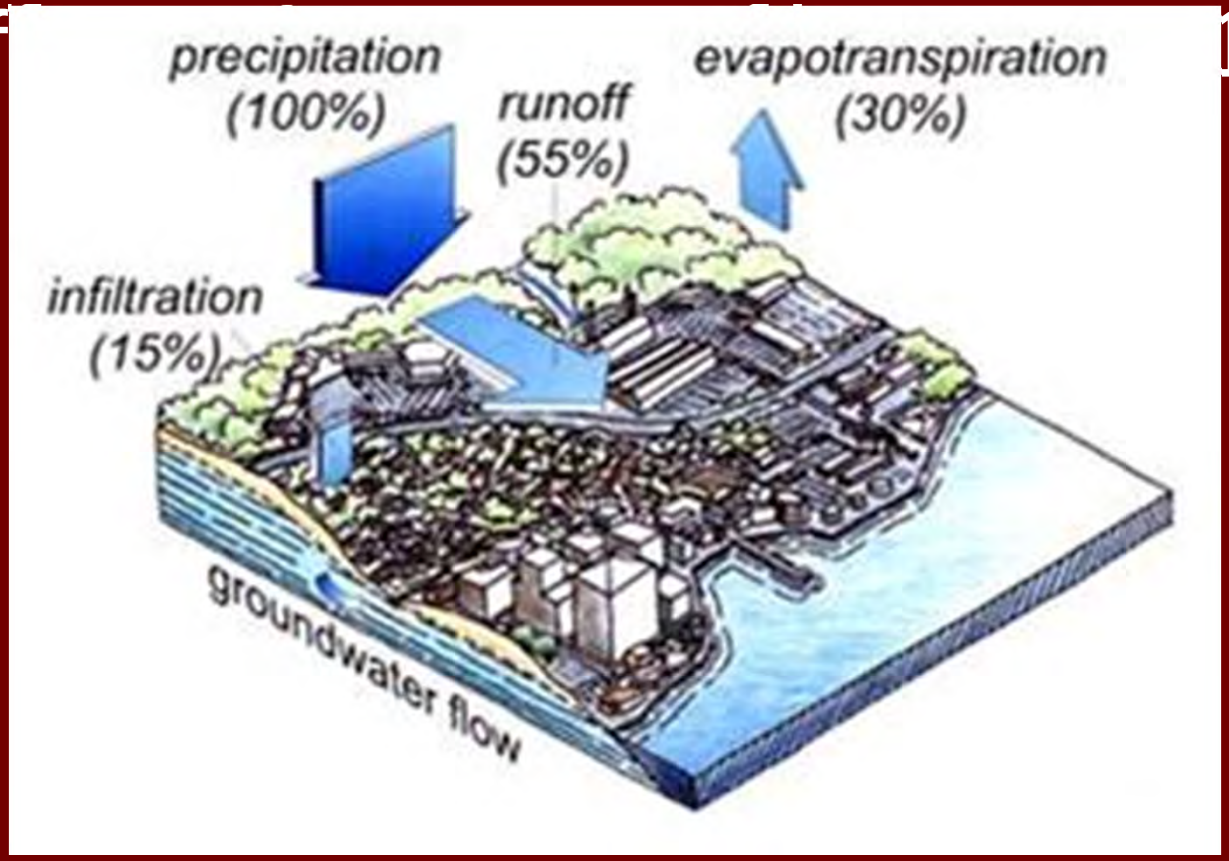
Runoff = 10% Infiltration = 50%



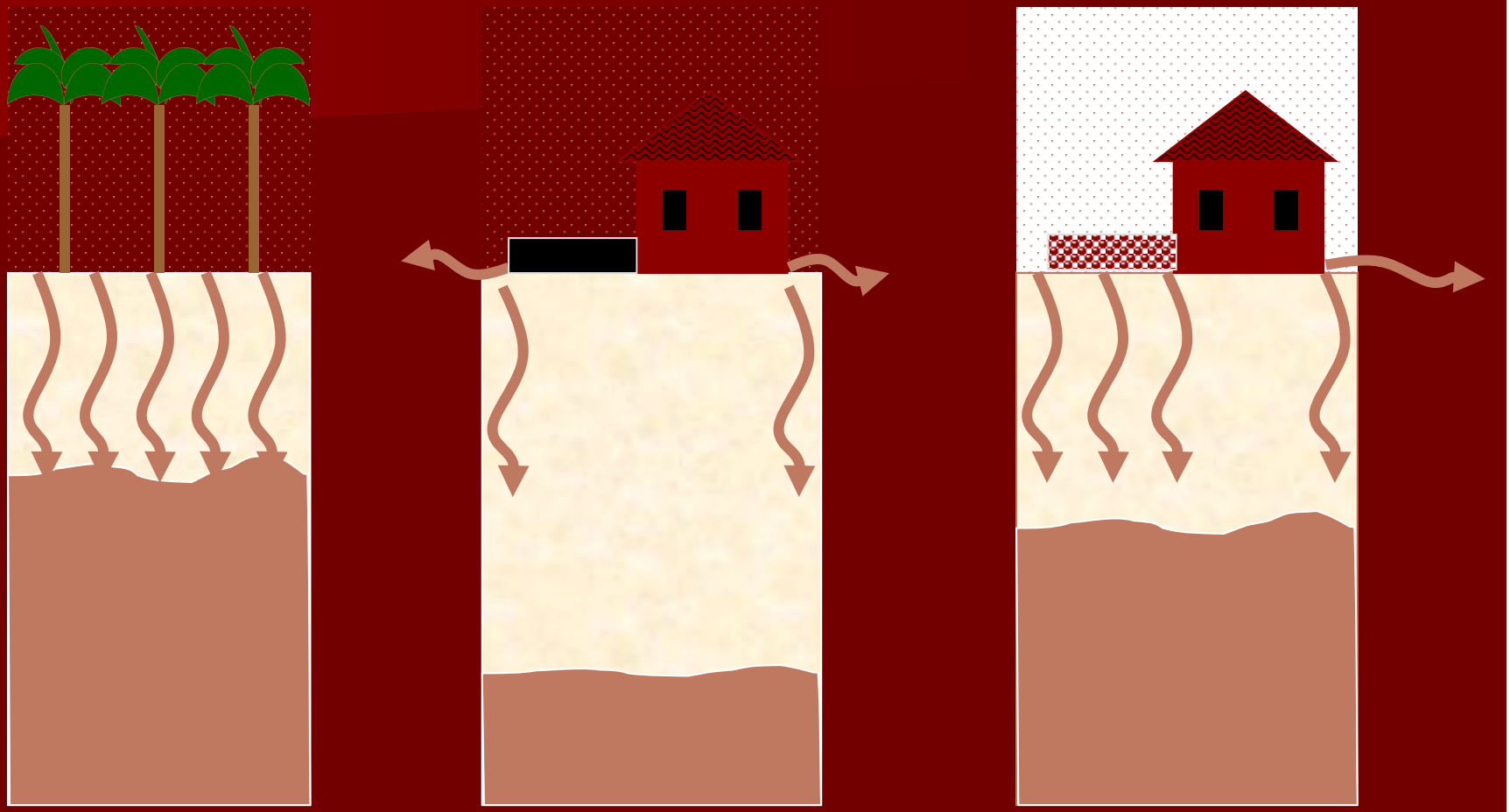
WHY DO WE NEED LOW IMPACT DEVELOPMENT?

Typical post-development conditions:

- Runof 15%



Low Impact Development



Pre-Development

Post-Development

Low-Impact Development

WHY DO WE NEED LOW IMPACT DEVELOPMENT?

Social and ecological impacts of too much asphalt

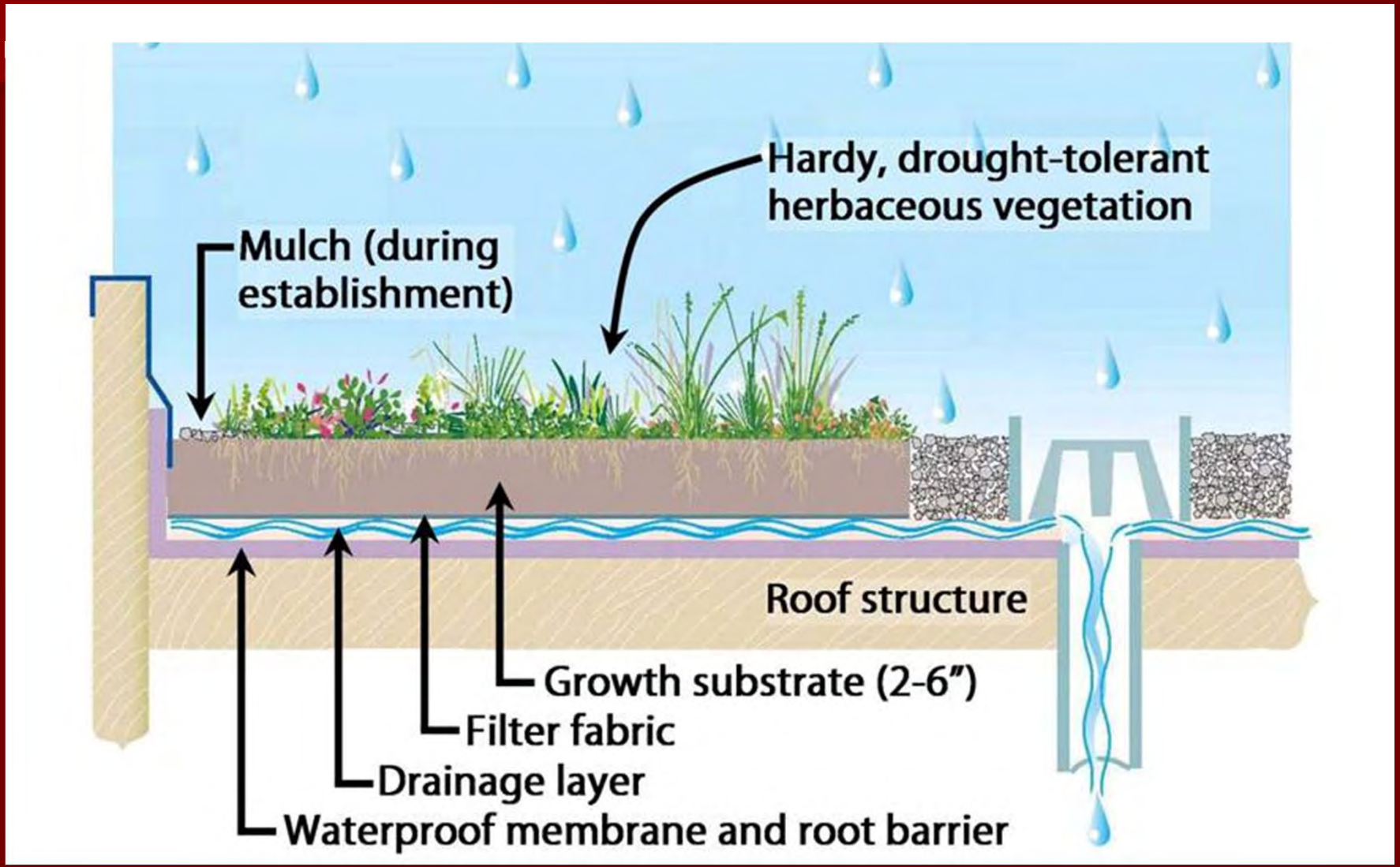
WHY DO WE NEED LOW IMPACT DEVELOPMENT?

High cost and low effectiveness of conventional “pipe and pond” strategies

Social and ecological impacts of too much asphalt

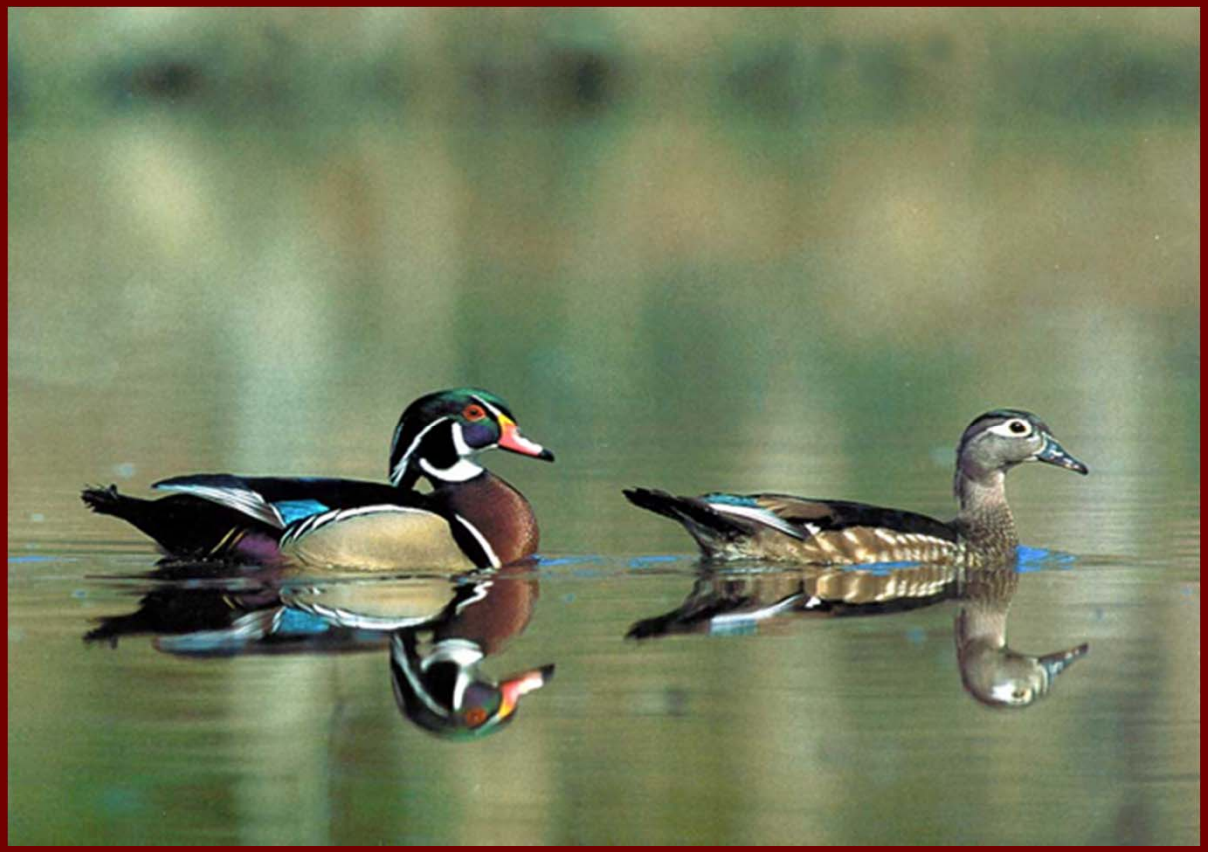
ANOTHER LID STRATEGY

Green Roof Systems



LID BENEFITS

Improved Water Quality
Increased Aquifer Recharge

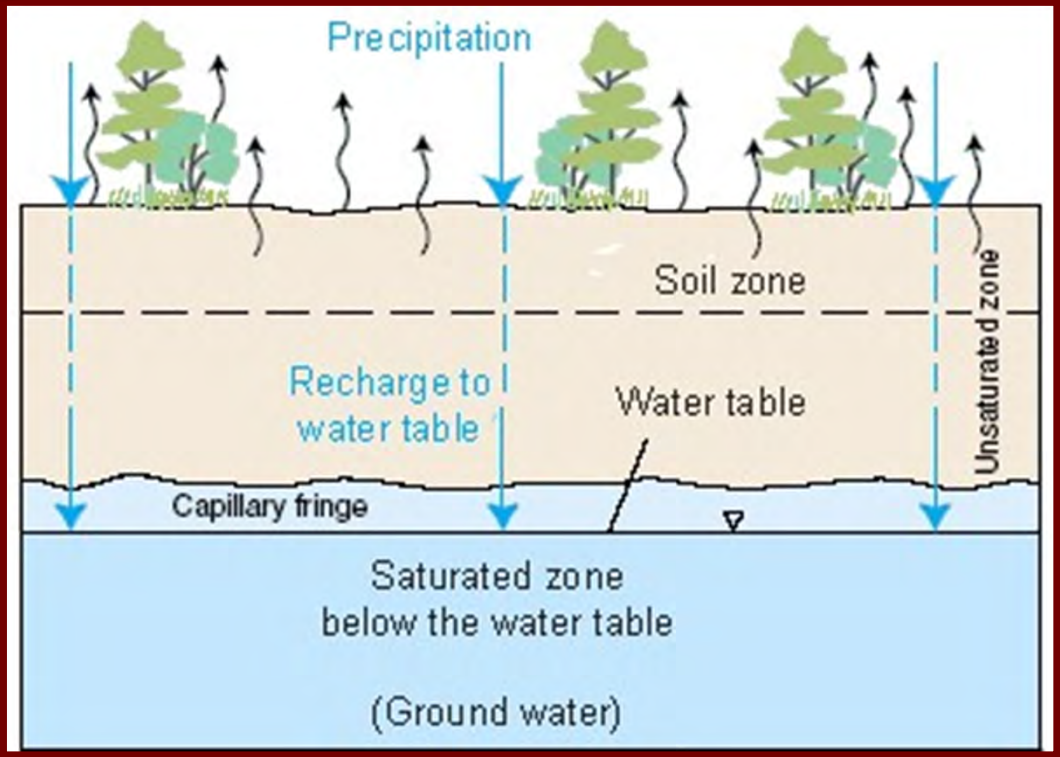


LID BENEFITS

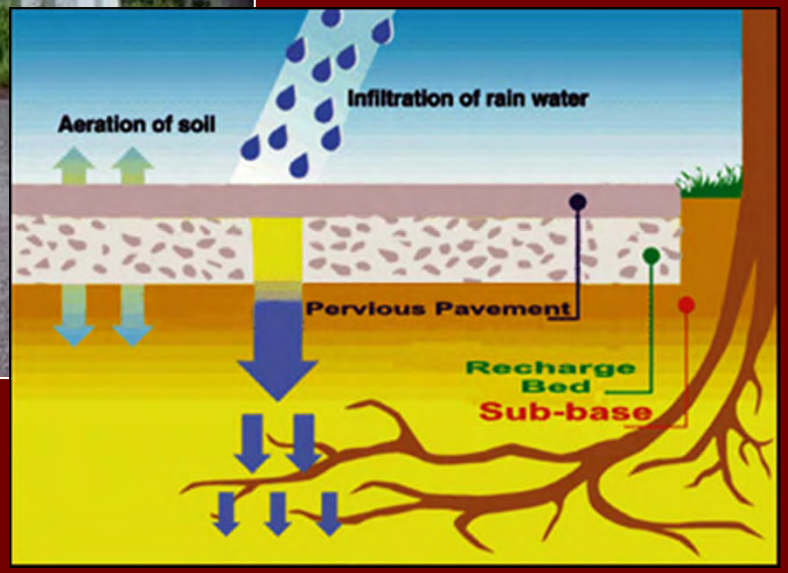
Lower Construction Costs Higher Lot Yield

	Conventional	Low Impact
Grading/Roads	**$569,698**	**$426,575**
Storm Drains	**$225,721**	**$132,558**
SWM Pond/Fees	**$260,858**	**$ 10,530**
Bioretention/Micro	**—**	**$175,000**
Total	$1,086,277	$744,663
Unit Cost	$14,679	$9,193
Lot Yield	74	81

Recharging Groundwater and Aquifer

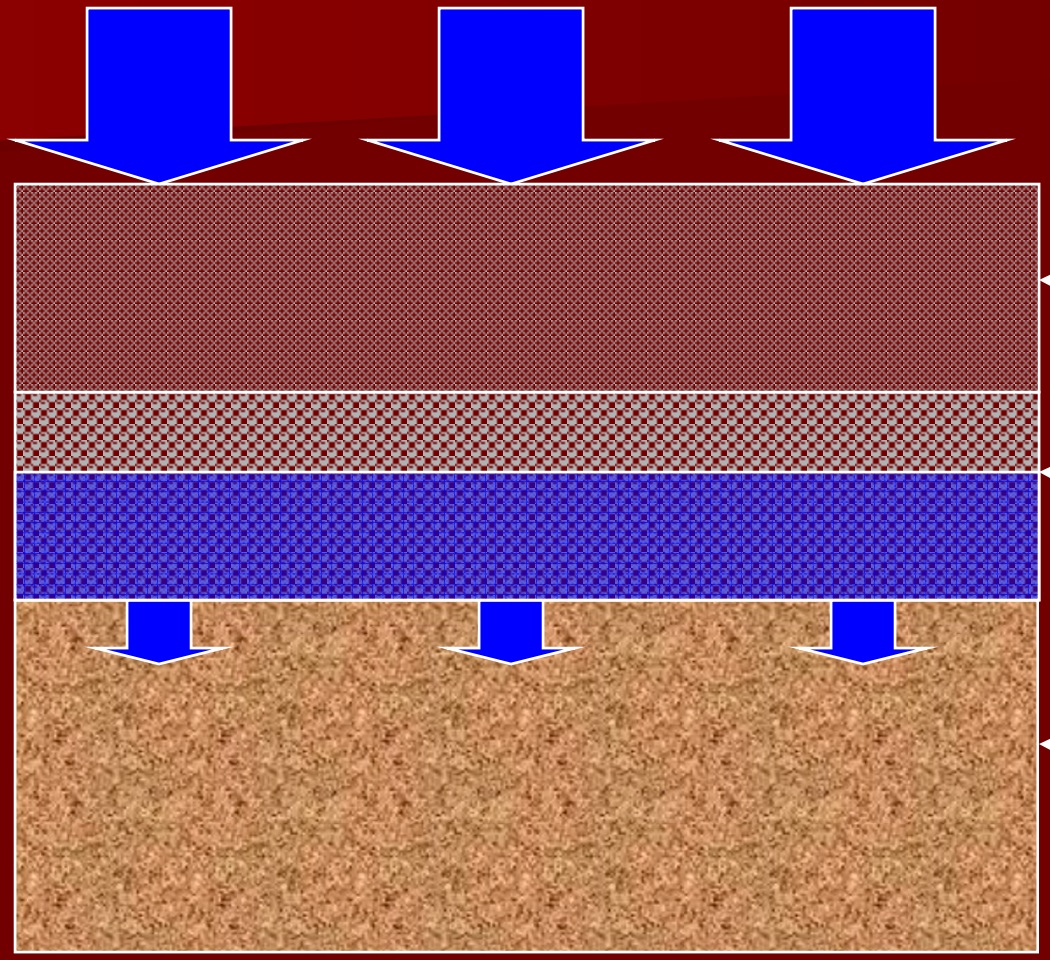


Protects Trees



Can pave within the drip line
Water and air filters to roots

Solution to Stormwater Management



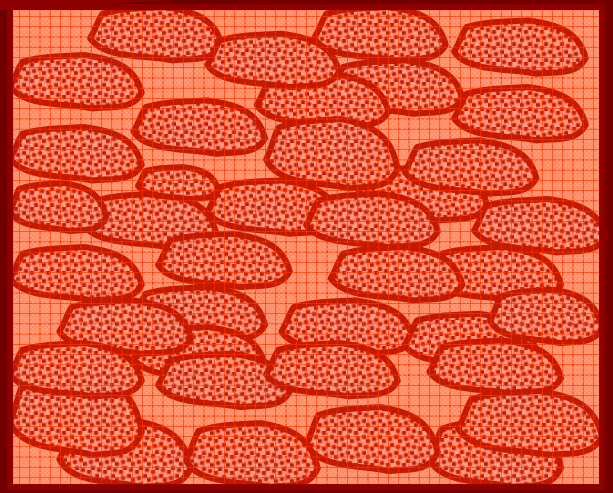
What is Pervious Concrete ?

- **The Concrete That Drinks Water**
- **A Special Mixture That Creates Voids**
- **The Voids Make the Product Highly Porous**
- **The Porosity Allows Rainfall & Surface Water to Percolate Through the Concrete to a Permeable Base**
- **University research concluded that at 15% porosity percolation rates thru pervious is around 300 inches of rain per hour. This is greater then any rainfall event in this area**

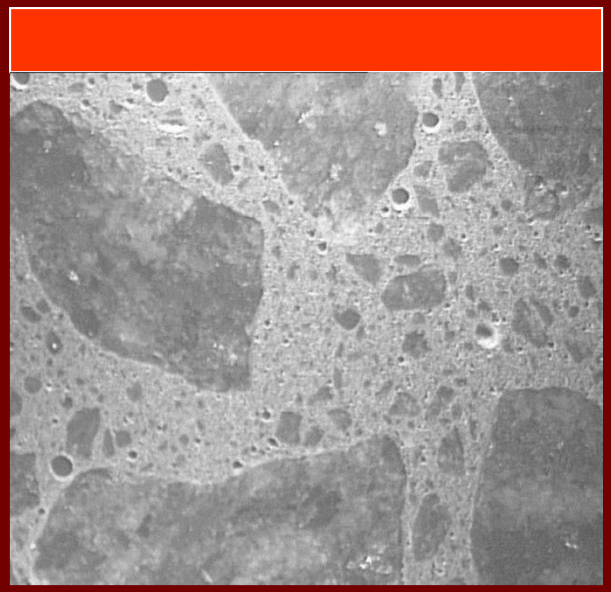
Pervious Concrete

- **Mixture of :**
- **Coarse aggregate,**
- **Cementitious material,**
- **Admixtures, and**
- **Water.**
- **Carefully controlled amounts of water & cementitious materials are used to create a paste that form a thick coating around aggregate particles without flowing off during mixing & placing.**

Simple Comparison



Pervious



Conventional

Texture Comparison

Fresh Concrete Surface

Hardened Concrete Surface

Pervious Concrete

Applications:

- Parking areas
- Driveways
- Sidewalks
- Greenhouse floors
- Road drainage control
- Swales and drainage ditches

Conventional Paving - Environmental Disasters

- Almost Total Runoff, No Perculation
- "First Flush" 1st ½ inch of Rain Full of Pollutants. These Chemical Pollutants will eventually require treatment (State or Fed)
- Runoff is Hot, Damaging the Environment
- Rapid, High Volume Runoff Requires Large Public Drainage Facilities
- Hot Paving Add systems add to Urban Heat Island Effects (Holds the heat)


850
SLT

Stormwater is Polluted

- Oils and Greases
- Metals
- Sediments
- Fertilizers

08.25.2004 14:24


WAL★MART
SUPERCENTER
FOOD CENTER
Pharmacy / Optical
Tire & Lube Express
Open 24 Hours


McKinney
Pervious Concrete
Windmill Aeration


Austin, TX
Tire & Lube
Express
1-Hr. Photo
Optical
Pharmacy
Low Prices
WAL★MART
SUPERCENTER
Pool Center


Mall of GA, Atlanta

Pervious Concrete Pavements Environmentally Friendly

- Percolation Recharges Groundwater
- Water Resources are Conserved
- Adjacent Trees and Vegetation are Allowed More Rainwater

Chattanooga Streetscape

Other Reasons for Pervious Concrete

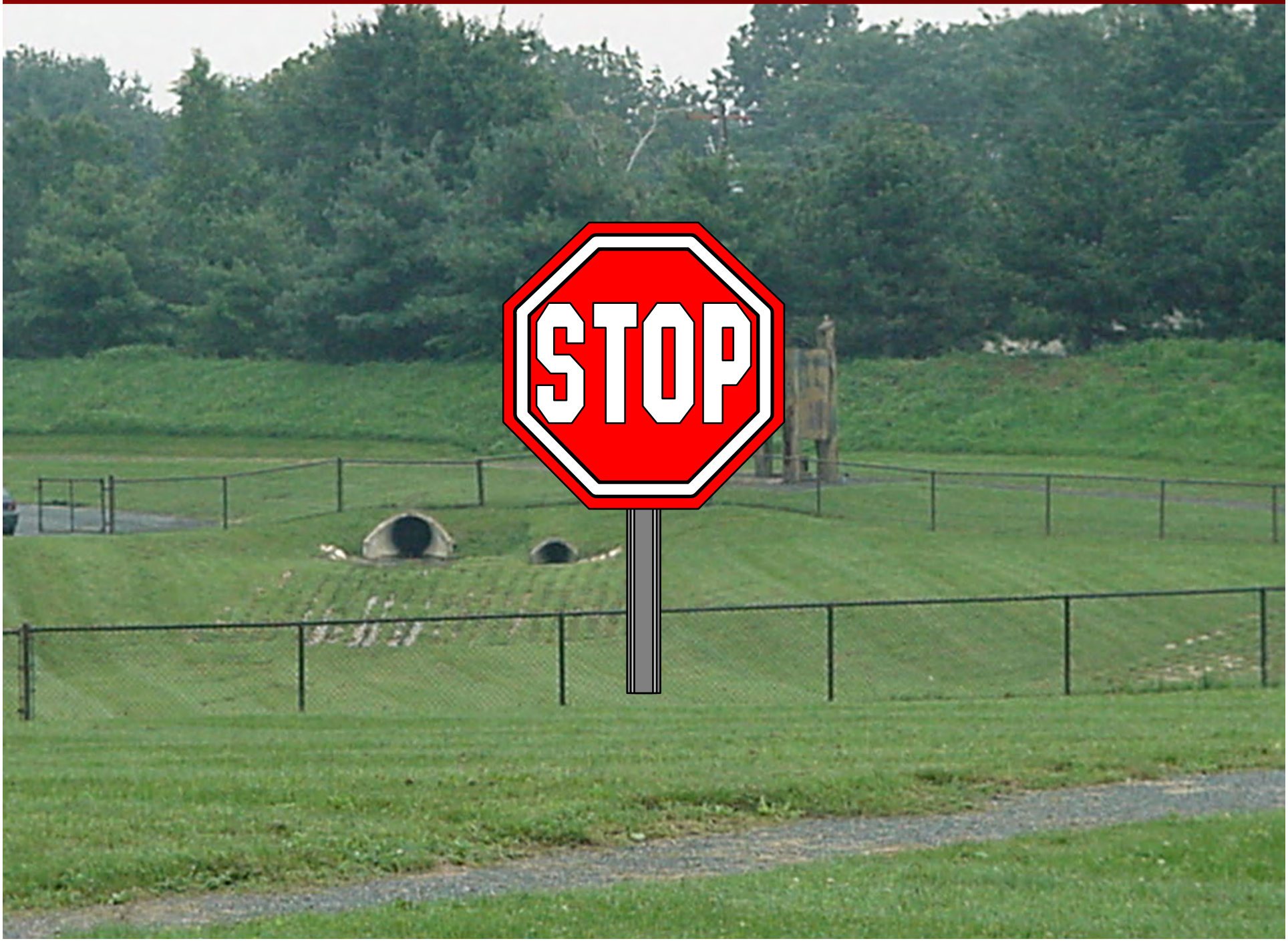
- EPA Storm Water regulations set limits on levels of pollution in our streams & lakes.
- Pervious Concrete is able to capture the 1st flush of rainfall allowing it to percolate into the soil .
- By capturing the 1st flush, soil chemistry & biology are allowed to naturally treat the polluted water.
- Storm water retention areas may be reduced or eliminated, allowing increased land use.

EPA Phase II Program

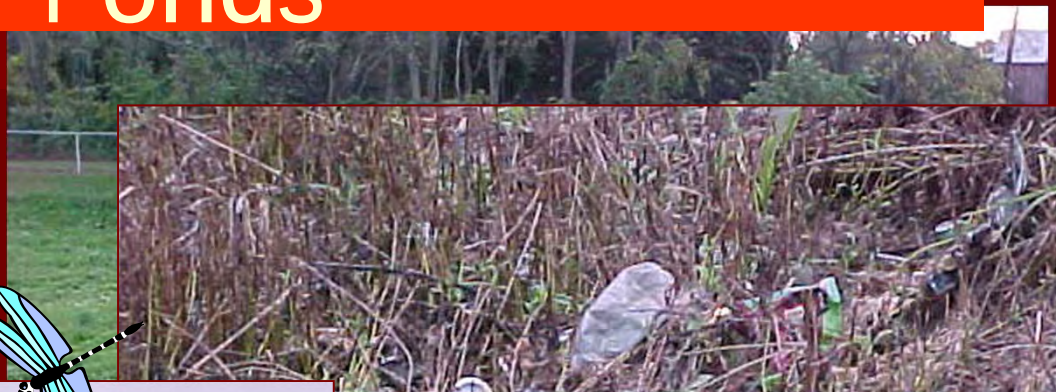
US Clean Water Act - NPDES – Natl. Pollutant Discharge Elimination System

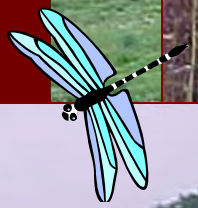
- The EPA's Ph II program requires 6 min. control measures:
  - **Education and Outreach**
  - **Public Involvement**
  - **Illicit Discharge Detection & Elimination**
  - **Const. Site Stormwater Runoff Control**
  - **Pollution Prevention for Muny ops.**
  - **Post-Const. Stormwater Mgt. - New Devel. & Re-Development**
    - **1 Acre or more**
    - **ON-SITE STORMWATER TREATMENT BEFORE DISCHARGE FROM SITE**
- EPA offers a list of Best Management Practices (BMPs) to help owners within regulated areas to control runoff. The effective use of **Porous Pavements are an approved BMP** for compliance with Phase II Stormwater regs.

Retention/Detention Ponds are high maintenance, costly and take up valuable real estate


STOP

Health Concerns of Retention Ponds





“But our soils are clayey and don’t perk, so how can pervious pavements be effective?”

- Generally, if you have septic tanks in your region, your soils have a sufficient perk rate for pervious concrete pavement.
- In clay soils, pervious concrete will model the natural ground cover, but will remove many pollutants before runoff occurs.
- You can control runoff rates with pervious and move the water on when you want to, thus controlling rapid runoff rates.

Wilmore Walk

- 2.8 acre Multi-Family Urban Redevelopment
- Over 85% of site runoff is treated

Preliminary Soils Survey

Tables — Percent Clay — Summary By Map Unit

Summary by Map Unit — Mecklenburg County, North Carolina

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
CuB	Cecil-Urban land complex, 2 to 8 percent slopes	49.4	11.3	80.3%
CuD	Cecil-Urban land complex, 8 to 15 percent slopes	49.4	2.8	19.7%
Totals for Area of Interest (AOI)			**14.1**	**100.0%**

Tables — Percent Silt — Summary By Map Unit

Summary by Map Unit — Mecklenburg County, North Carolina

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
CuB	Cecil-Urban land complex, 2 to 8 percent slopes	25.6	11.3	80.3%
CuD	Cecil-Urban land complex, 8 to 15 percent slopes	25.6	2.8	19.7%
Totals for Area of Interest (AOI)			**14.1**	**100.0%**

Tables — Percent Sand — Summary By Map Unit

Summary by Map Unit — Mecklenburg County, North Carolina

Map unit symbol	Map unit name	Rating (percent)	Acres in AOI	Percent of AOI
CuB	Cecil-Urban land complex, 2 to 8 percent slopes	29.7	11.3	80.3%
CuD	Cecil-Urban land complex, 8 to 15 percent slopes	29.7	2.8	19.7%
Totals for Area of Interest (AOI)			**14.1**	**100.0%**

Plan


Porous Concrete
Bio-Retention
Bio-Retention
40 yds
© 2007 Microsoft Corporation Image courtesy of USGS

Wilmore Walk

- BMPs were retrofitted into an existing site design, including
  6,355 sf of pervious concrete with
  3,800 cf available storage in a gravel base
- All water quality permit requirements were satisfied using “Bio-Retention” BMPs

Wilmore Walk

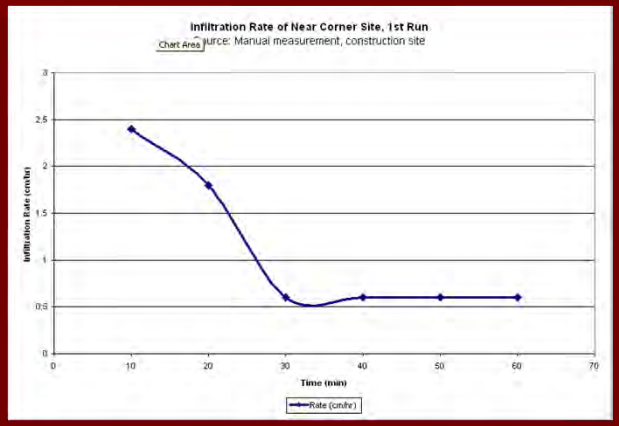
- Existing soils were investigated
- Green-Ampt equations for infiltration were used for design of basin beneath the pervious concrete area
- Bio-retention areas were located with grading plans adjusted accordingly.

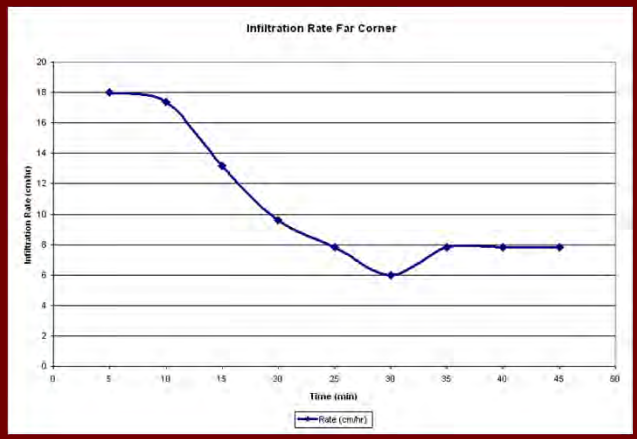
Infiltration in Sandy Clay Loam

Site-Specific Infiltration Testing:

0.24 – 3.15 in/hr

Avg. 0.9 in/hr

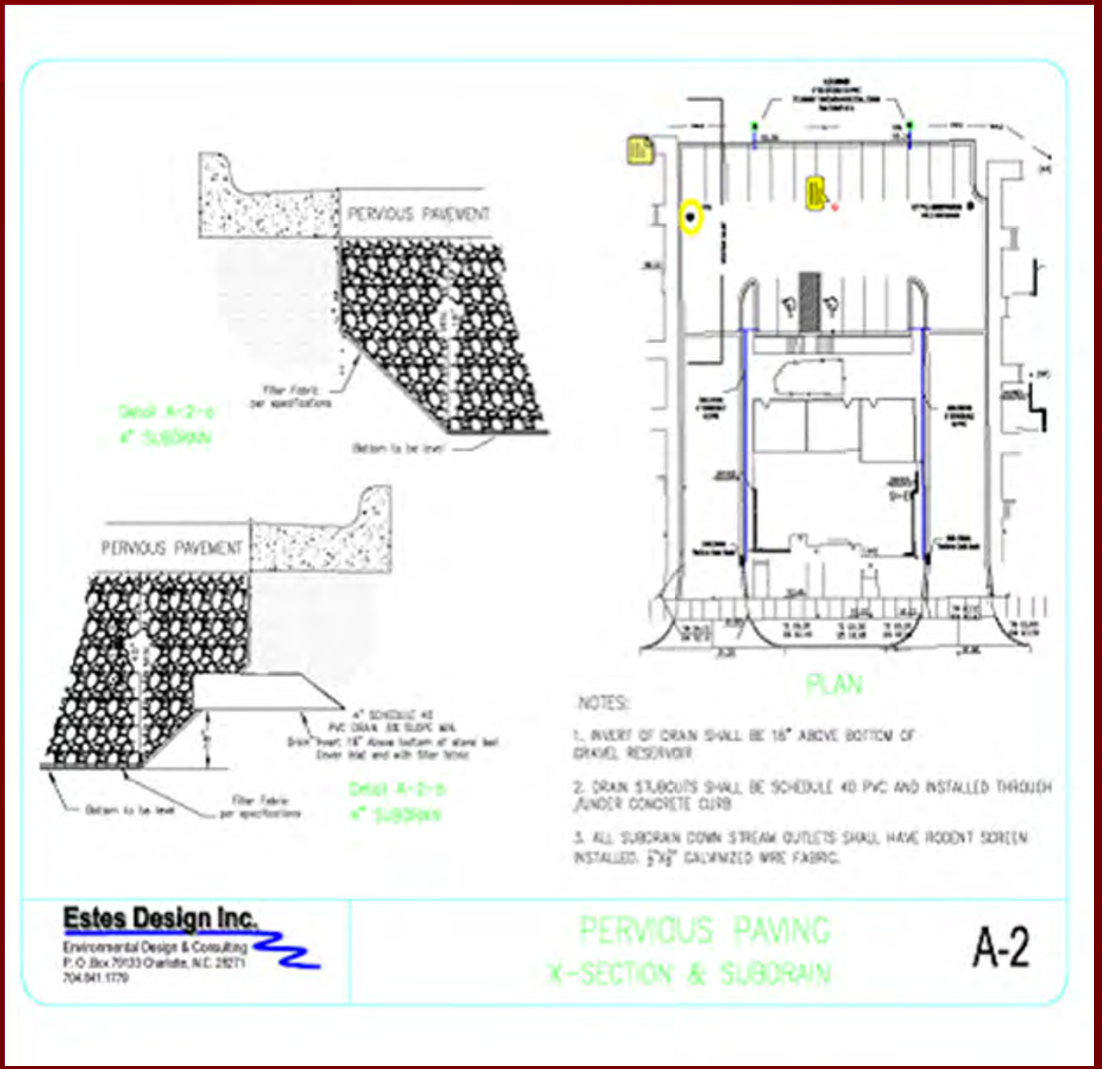




Design

Stone Infiltration Reservoir sized for the 2yr storm – 3.12” for respective watershed

Watershed includes surrounding rooflines



Porous Concrete Installation May 10, 2005

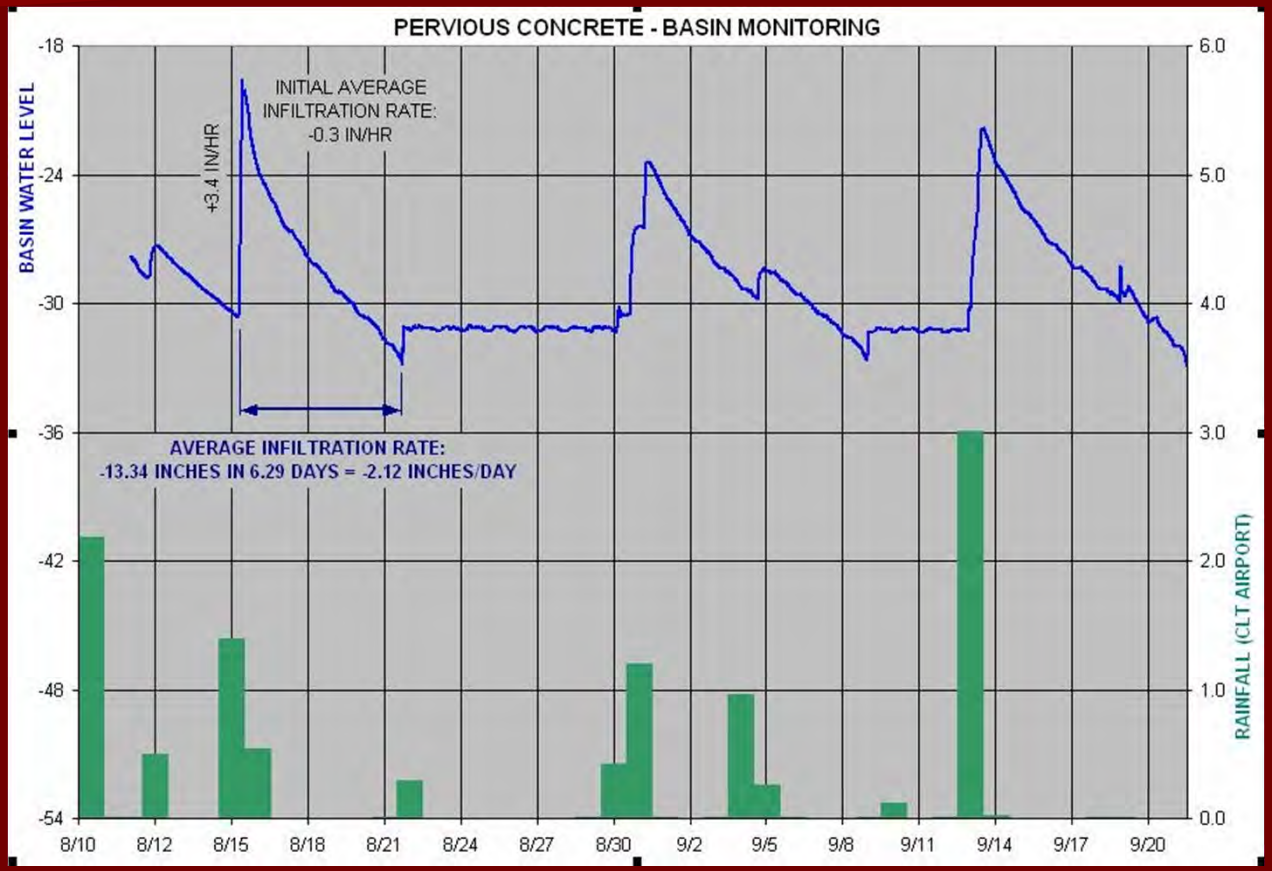
Porous Concrete Installation May 10, 2005

Monitoring

Infinities USA Pressure Water Level Data Logger

Preliminary Monitoring Data Aug-Sept 06

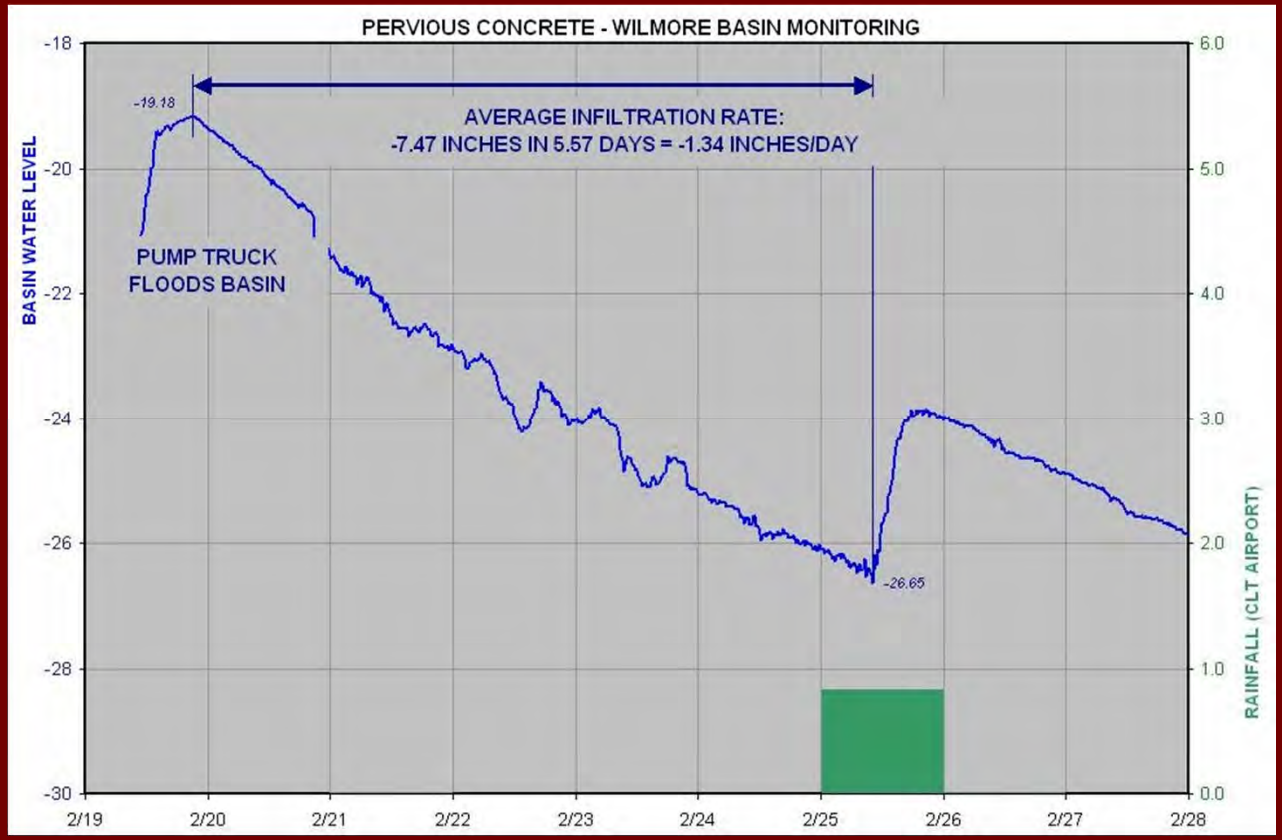
Preliminary data suggests average infiltration rate of 0.09 in/hr (13” in 6 days) in semi-dry conditions



Testing

Preliminary Monitoring Data Saturated Soils Feb. 06

Preliminary data suggests average infiltration rate of 0.06 in/hr (7.5” in 5.5 days) in saturated soil



Other Advantages

- Surface Texture ok to walk on with heels or bare feet
- Good for Bicycles/Bad for Skateboards

East Atlanta Library

Project

Denied

- Property [illegible] 1.15 Acres or 35,651 SF
- Proposed Building 9,250 SF
- Parking Requirements 27 Spaces or 5,000 SF
- Detention Requirements 4,419 CF
- Maximum Impervious 37% or 13,190 SF

Installation of geotextile under retention system

East Atlanta Library, Atlanta Georgia ©Copyright 2004, PCI Systems, LLC all rights

Installation of stone base

Installation of Recharger® chambers

- PERVIOUS CONCRETE HYDROLOGICAL DESIGN SPREADSHEET

WHAT ABOUT CLOGGING?

- Design, Design, Design
- If a paving area clogs the water will runoff to the 1st unclogged portion of the pavement.
- Proper landscaping around the pavement will insure longer life.
- Standard maintenance will enhance the life of the product. (blowing, sweeping)
- Pressure washing or vacuuming can re-establish permeability

Pervious Concrete Pavements

- Use for Car Parking and light Traffic residential roads with Occasional Trucks
- Not for Truck Terminals
- Placement is Simple for Experienced Contractor but Different from Conventional Concrete
- Follow Mixing, Placement and Curing Recommendations

Construction Techniques

- Thickness typically 25% greater than conventional concrete

  8 “ for streets with occasional truck traffic

  6” for parking lots with occasional trucks

  4” to 5” for pedestrian traffic

Construction Techniques

Forms

- Conventional concrete forms are used
- Riser strips are placed on top of forms

Construction Techniques

Placement

- Pervious concrete is extremely dry, usually placed at ½ inch slump.
- Once pervious concrete is placed, crews use a vibrating screed to strike off to the riser strip level.

Vibrating Screeds

Construction Techniques

Compaction

- **Riser strips are removed from forms**
- **A weighted roller is used to compact pervious concrete**


RCH

Finishing

Curing

Cure for 7 days with 6-mil poly sheeting

Construction Techniques

Various Placing Equipment Types
Pervious Concrete - 2008

Weighted Roller

Case Studies

Pervious Concrete Parking Lot

Piccadilly Cafeteria - Brandon, Florida - 14 years old

Olympia, Washington

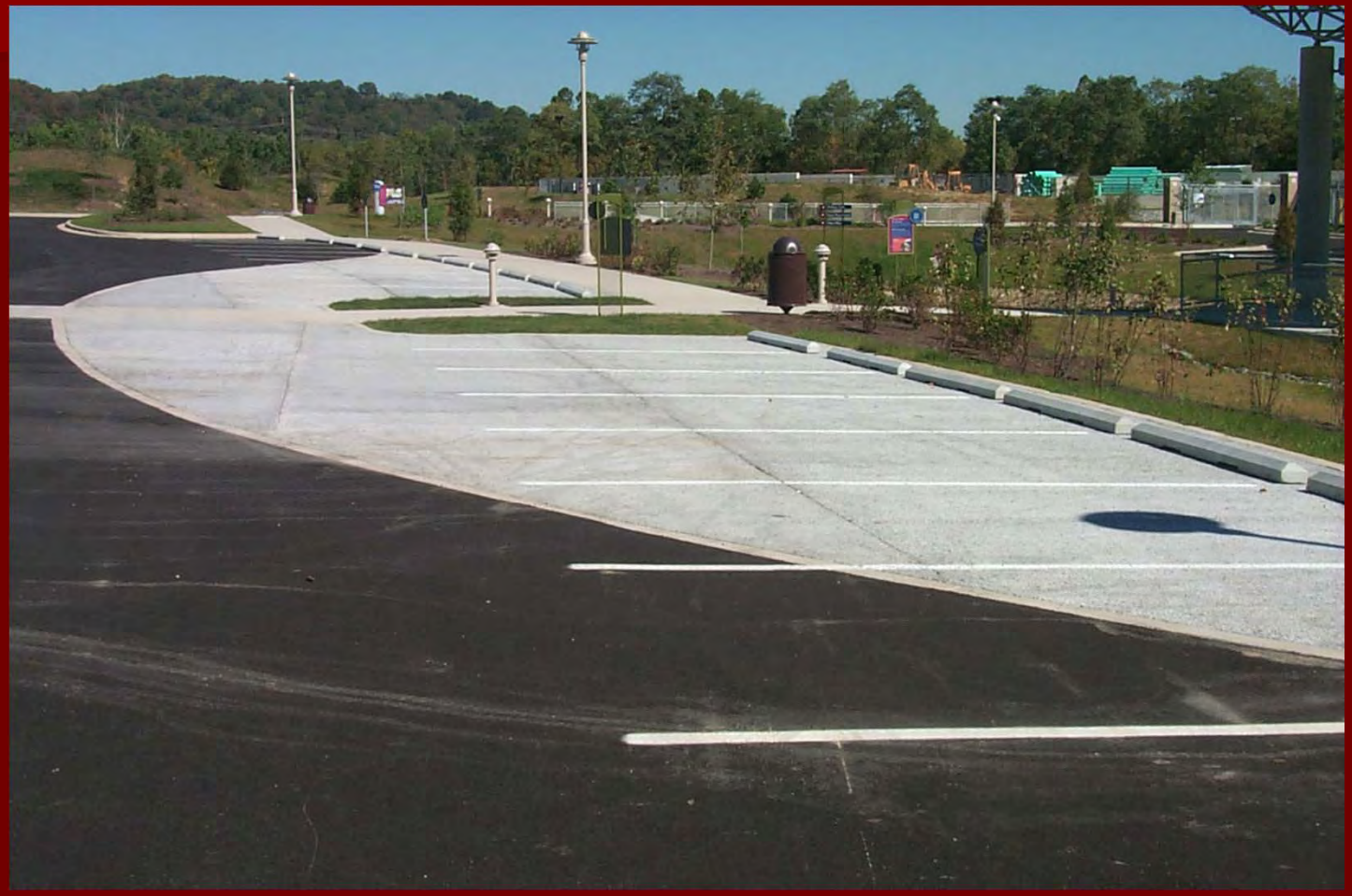
- Year: 2000
- Owner: City of Olympia
- 1500 lineal feet of sidewalk
- Sub-grade: native soil was permeable enough
- Savings: $110,000 - land acquisition for detention ponds unnecessary

Pervious Parking Areas & Grass Swales

Florida Aquarium - Tampa - 8 years old

Northern Kentucky

SD1




Girl Scout Hdqtrs. Louisville, KY
3/19/2008 5:11:36 PM
4 in. rain in last 18 hrs.
flooded Beargrass in background
event started on saturated ground, moderate rain still falling


Cherokee
park
March 4,
2008 after
3 inch rain,
part of
park
flooded
4:10 pm

2 Acres Bowling Green

Bowling Green

Bowling Green Apollo HS
5 years old-bus traffic and heavy car traffic

Zero Maintenance
Still takes water

Frankfort
Old Building and Parking Lot was 100% Runoff-It's now 0%

City of Frankfort Public Works Department Placed the Pervious Concrete

Water Testing Frankfort

London, KY

U.S. & WORLD PERVIOUS CONCRETE


THE WILLIAM AND IDA
FRIDAY
CONTINUING EDUCATION
CENTER

Monitoring Wells at this pervious concrete parking lot has crawfish living in them

Catawba College Center for the Environment


Bryarton

Pervious Concrete for Local Streets & Roads

Many Ways to Place

Streets and Driveways

Years of Durability

CRMCA Office Charlotte, NC
12 years old

Atlantic Beach,NC

Waffle House
Murrells Inlet, SC

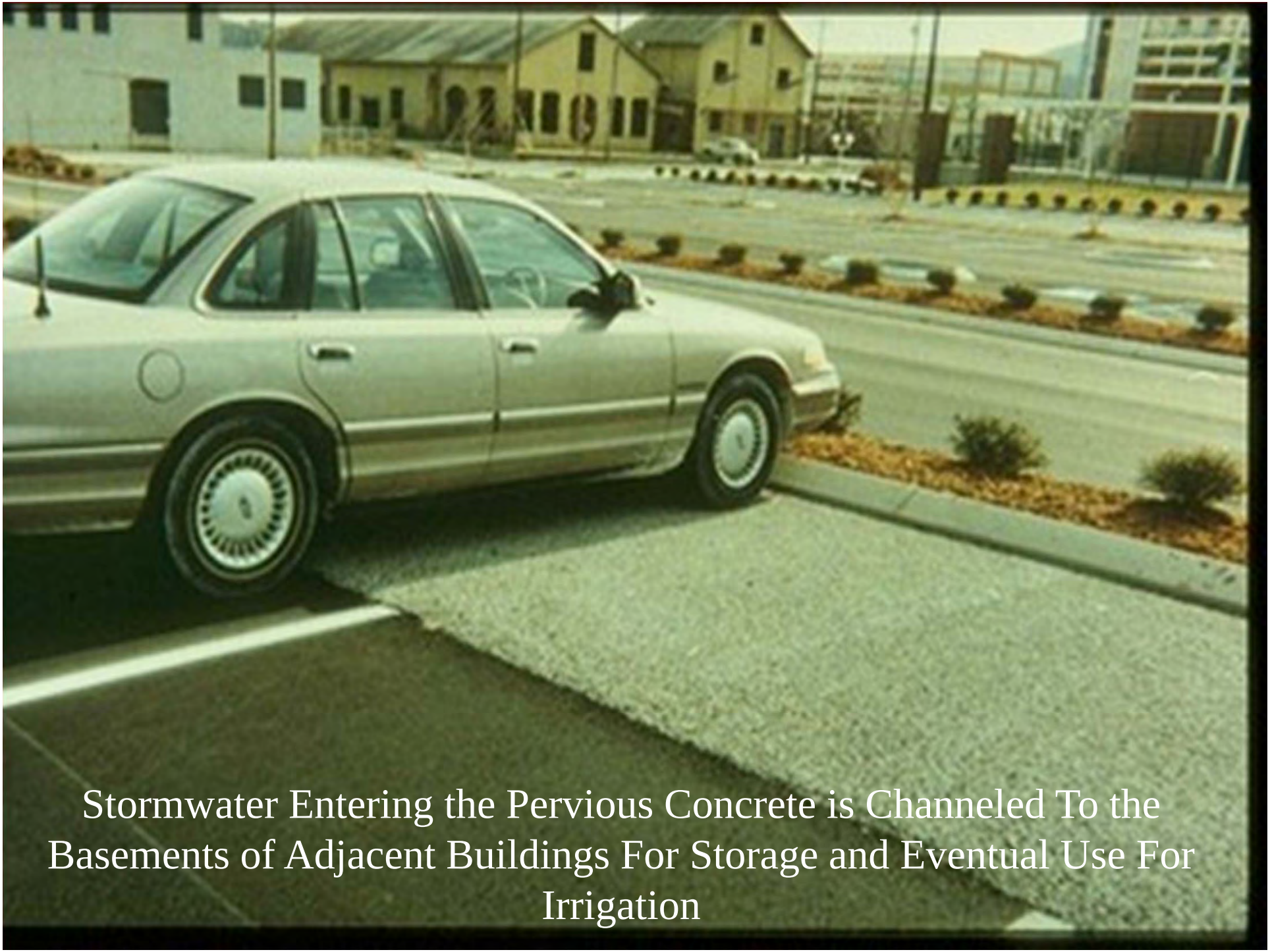
City of Wilmington Public Works Department placed this and many more pervious concrete jobs

Wilmington is using pervious concrete as a stormwater management tool

Topsail Island, NC

Pervious Concrete Is Popular In Savannah, Ga. For Tree Protection as Well as Stormwater Management

Atlanta City Jail



Stormwater Entering the Pervious Concrete is Channeled To the Basements of Adjacent Buildings For Storage and Eventual Use For Irrigation

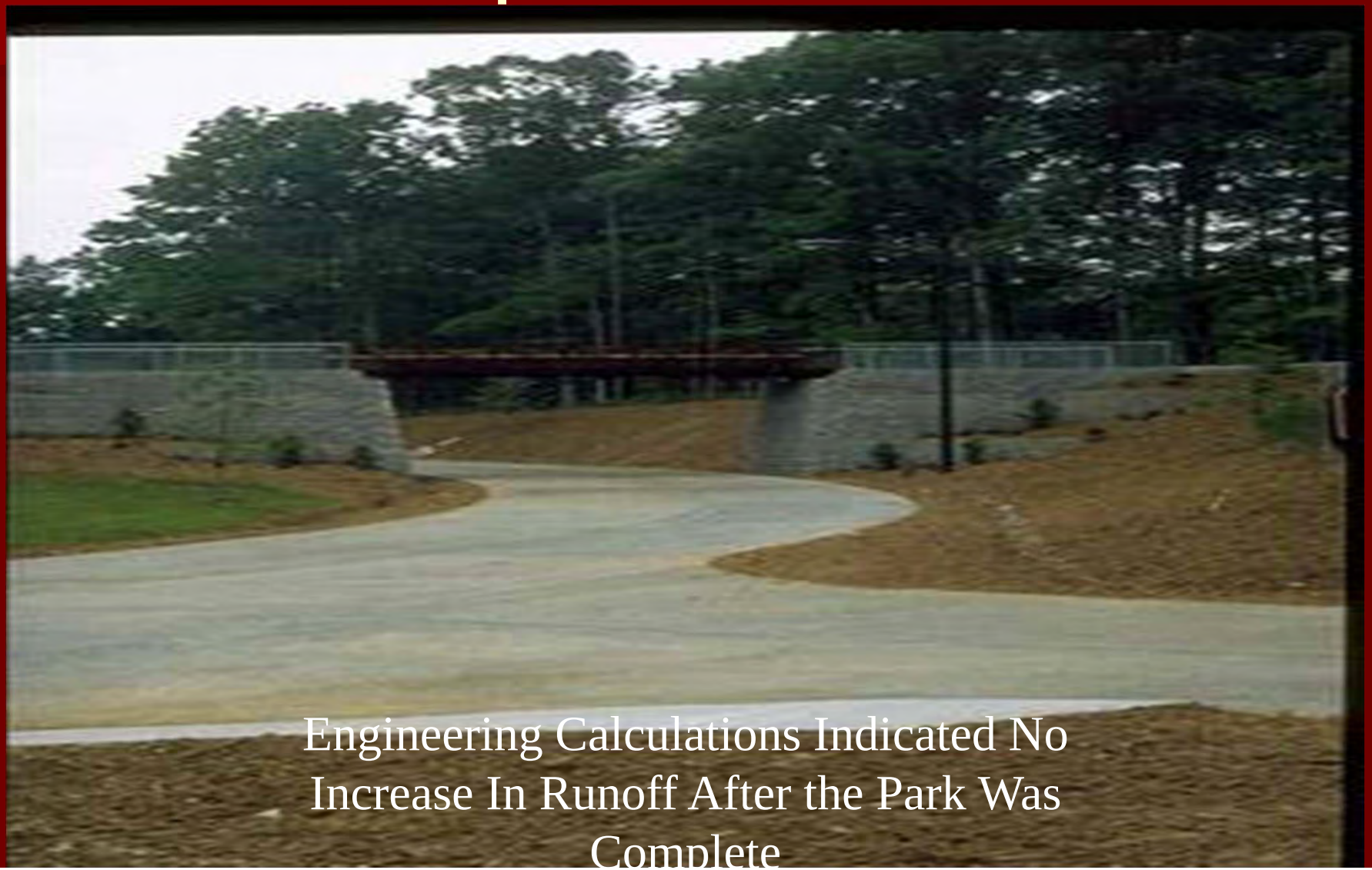
Finley Stadium

University of Tennessee-Chattanooga

Sidewalks - Eugene, Oregon

Church Parking Lot – Orlando, FL

Webb Bridge Park
Alpharetta, GA



Engineering Calculations Indicated No Increase In Runoff After the Park Was Complete

Video Warehouse - Rincon, Georgia - Pervious Paving Stormwater Management

Commercial Driveways

Shopping Center Delivery Truck Driveway - Brandon, Florida - 12 years old

Commercial Parking Lot

12 Years Old

Commercial Parking Lot

12 Years Old

Conventional vs Pervious

Asphalt Pavement **(Left)** (Same Site) Pervious Concrete **(Right)**

Western USA – After Major Snowfall

Sites Directly Across The Street – Photos Less Than 5 mins. Apart

Pervious Concrete (Left)

Conventional

Increased Composite Design Acceptance

Pervious & Conventional Complementing


Pervious Concrete – Portland, Oregon

Text reference for

Pervious Concrete Contractor Certification

NRMCA Publication #2PPCRT


Cost Savings / Site Optimization

CMI Homebuilders Inc. – Snohomish, WA

20 Home Subdivision (near Seattle)

Traditional Const.

- $175 K – Cost of traditional Detention Vault, Catch Basins, & Pipes
- $48 K – Asphalt Road Const. – 1st cost
- $37 K – Traditional Raised Curbs

CMI Homebuilders Inc. – Snohomish, WA

20 Home Subdivision (near Seattle)

Pervious Concrete Technology

- Eliminated All Catch Basins Within Plat
- Eliminated Piping To Detention Areas (Cleaning!)
- Eliminated Detention Vault
- Eliminated Street Curbing
- **Reclaimed 2 Lots worth $100 K each**

CMI Homebuilders Inc. – Snohomish, WA

20 Home Subdivision (near Seattle)

Pervious Concrete Technology

- $ 260 K – 1st Cost Differential Favorable to Pervious Concrete ($200 K vs $ 460 K)
- Site Optimization – Increased Revenue Opportunity – ROI / ROE dynamics

Cost Savings & Improved Site Optimization

Pervious Concrete

Completed – Winter, 2005

- 8 Acre Lot – 12 Acre Site – Westminster, MD
- **$400,000 SAVINGS – Underground Drainage *Eliminated*** - original plan
- **1-1/2 Acre Retention Pond *Eliminated*** – original plan & space ***reclaimed*** for facility

Prime Outlets – Williamsburg, VA

- 7.6 acres Pervious Concrete
- 3.5 acres Conventional Concrete

Prime Outlets – Williamsburg, VA

- Infiltration system design includes water harvesting
  - utilizing underground stormwater chambers

3 Strip Placements Simultaneously

Pervious Concrete

Park & Ride Parking Lot (4 acres)

Serving Site of 2008 Super Bowl – Glendale, Ariz.

Bus Stop – Pervious Concrete

Kettering, Ohio

Bus Stop – Pervious Concrete

Kettering, Ohio

Photo and slide provided by Don Wade, Magruder Construction

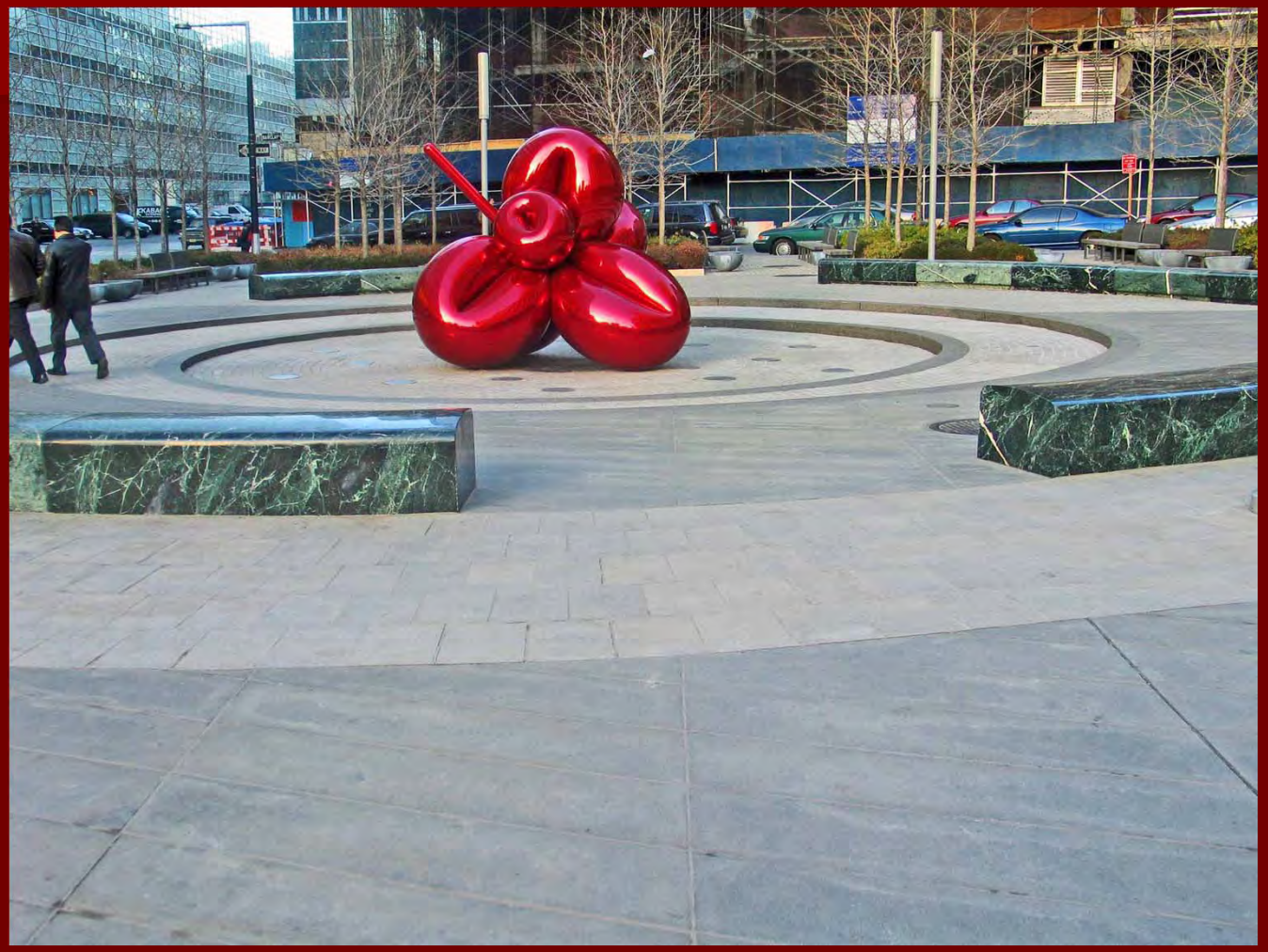

NO WET FEET !
Kettering, Ohio
Photo and slide provided by Don Wade, Magruder Construction

Park Trails-MS

Park Trials-TN

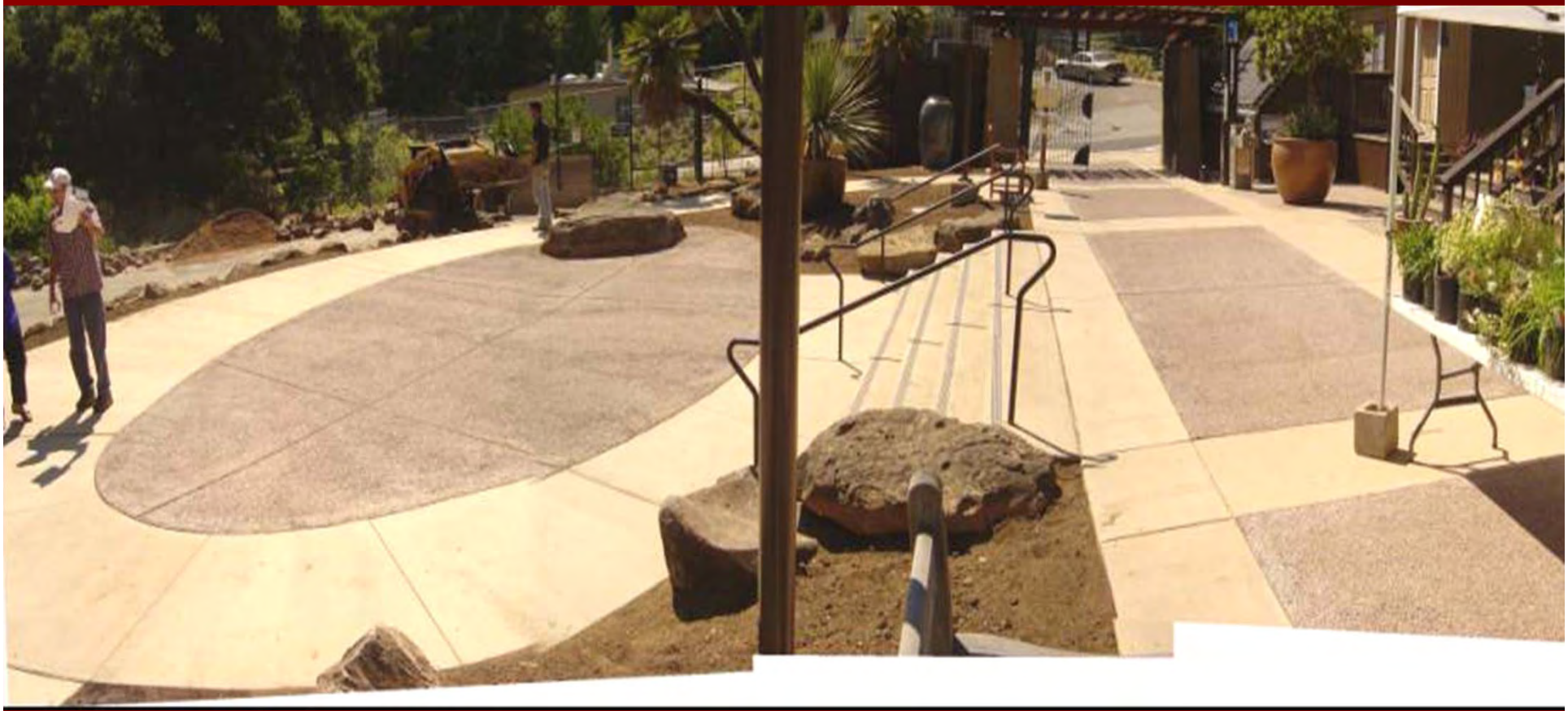
Promenade - 7 World Trade Center – NYC

Pervious Concrete Beneath The Pavers & Cut Stone



Architectural Pervious Concrete

Univ. of Calif. - Berkeley



Large Pedestrian Area

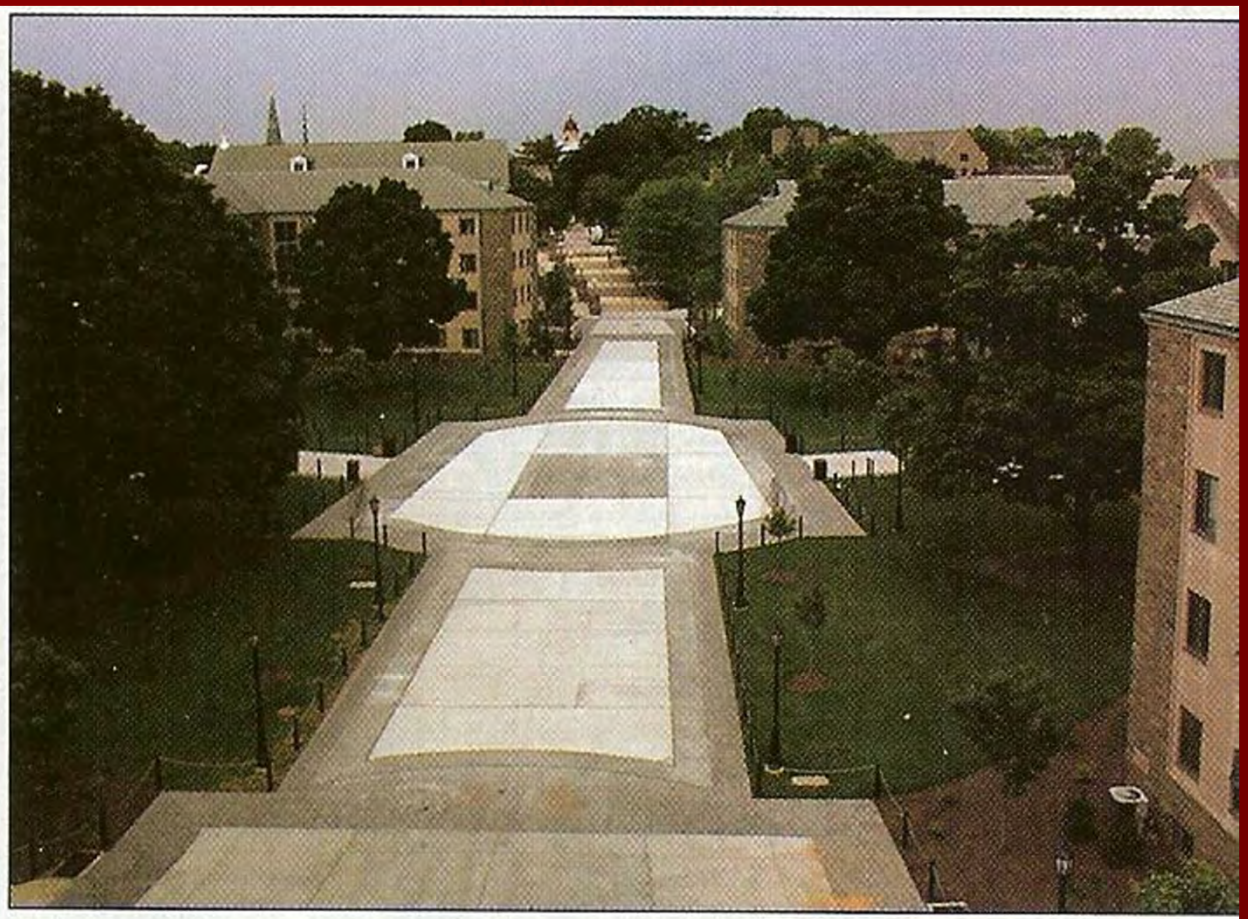


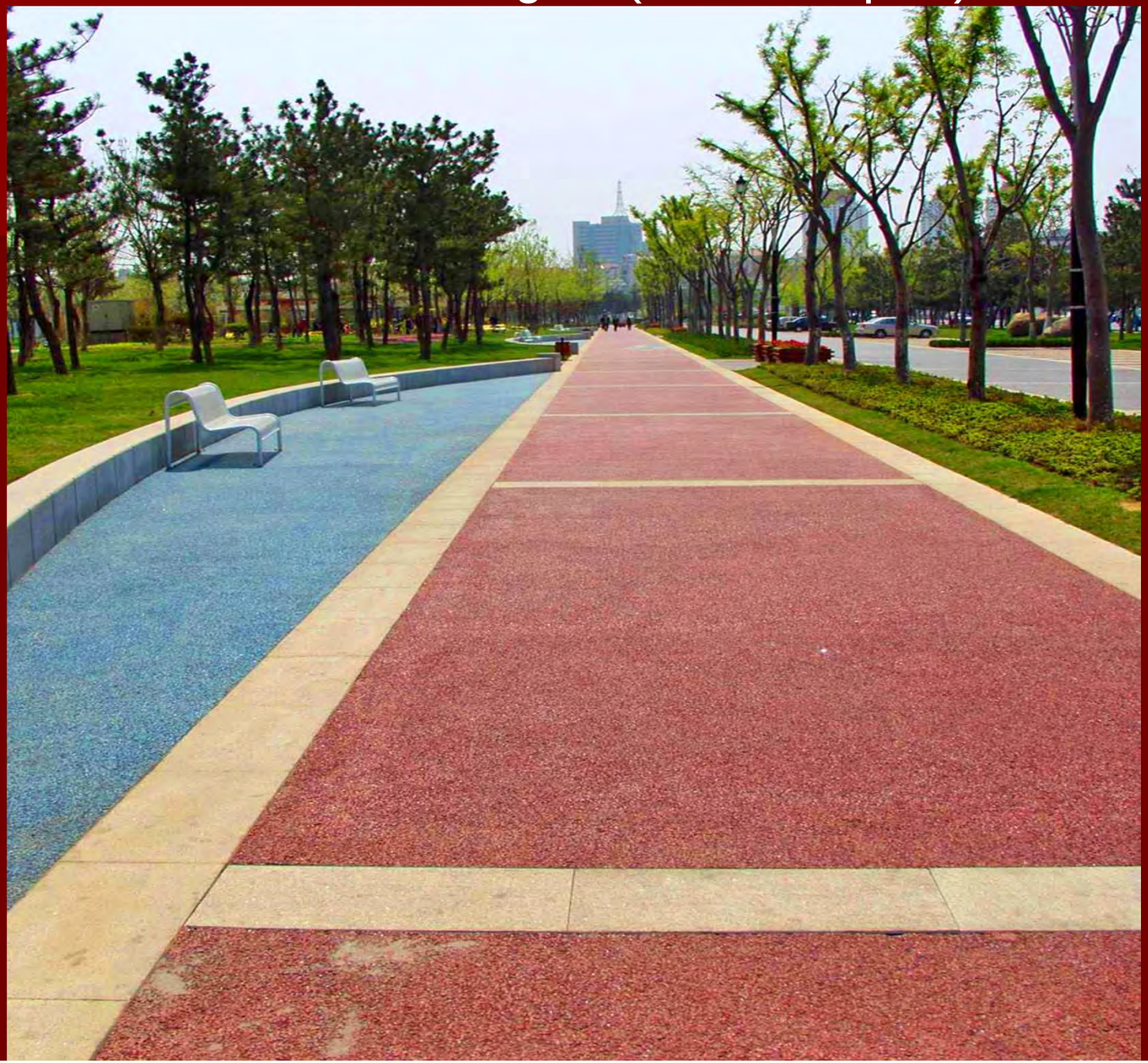
Figure 3. A porous concrete infiltration facility was constructed over one of Villanova University's high-pedestrian-traffic areas.

Pervious Concrete (Foreground) – Heavy Rain


Stamped Pervious Concrete – Fresno, Calif.

Along Mississippi River – Minneapolis Metro

China – S. of Shanghai (2.4 mil. sq. ft.)



THE NEW YORK CITY COUNCIL

CHRISTINE C. QUINN, SPEAKER

New York City to Clean Up Waterways by Greening Roadways and Roofs

City Council Adopts New Measure for Sustainable Stormwater Management Plan

NEW YORK (January 30th, 2008) – The New York City Council passed legislation today to tackle the sewage overflow problem in the City's overburdened sewer system. The legislation advances the implementation of green design elements, which mimic nature's own filtering systems, into the City's existing streets, parks, and other public spaces and into existing and new development projects.

By adopting 'green infrastructure' solutions, such as green roofs, **permeable pavement,** wetland restoration, and smarter design of street tree plantings, stormwater can be captured where it falls and used to green the city, instead of overwhelming sewers and flushing raw sewage directly into City waterways. The legislation, City Council Intro No. 630, ensures that New York City will follow through with the initiatives outlined in Mayor Bloomberg's PlaNYC 2030, by requiring the development of a city-wide Sustainable Stormwater Management Plan focusing on such measures. The mayor is expected to sign it into law.

County of Fairfax, Virginia

To protect and enrich the quality of life for the people, neighborhoods, and diverse communities of Fairfax County

DATE: December 21, 2007

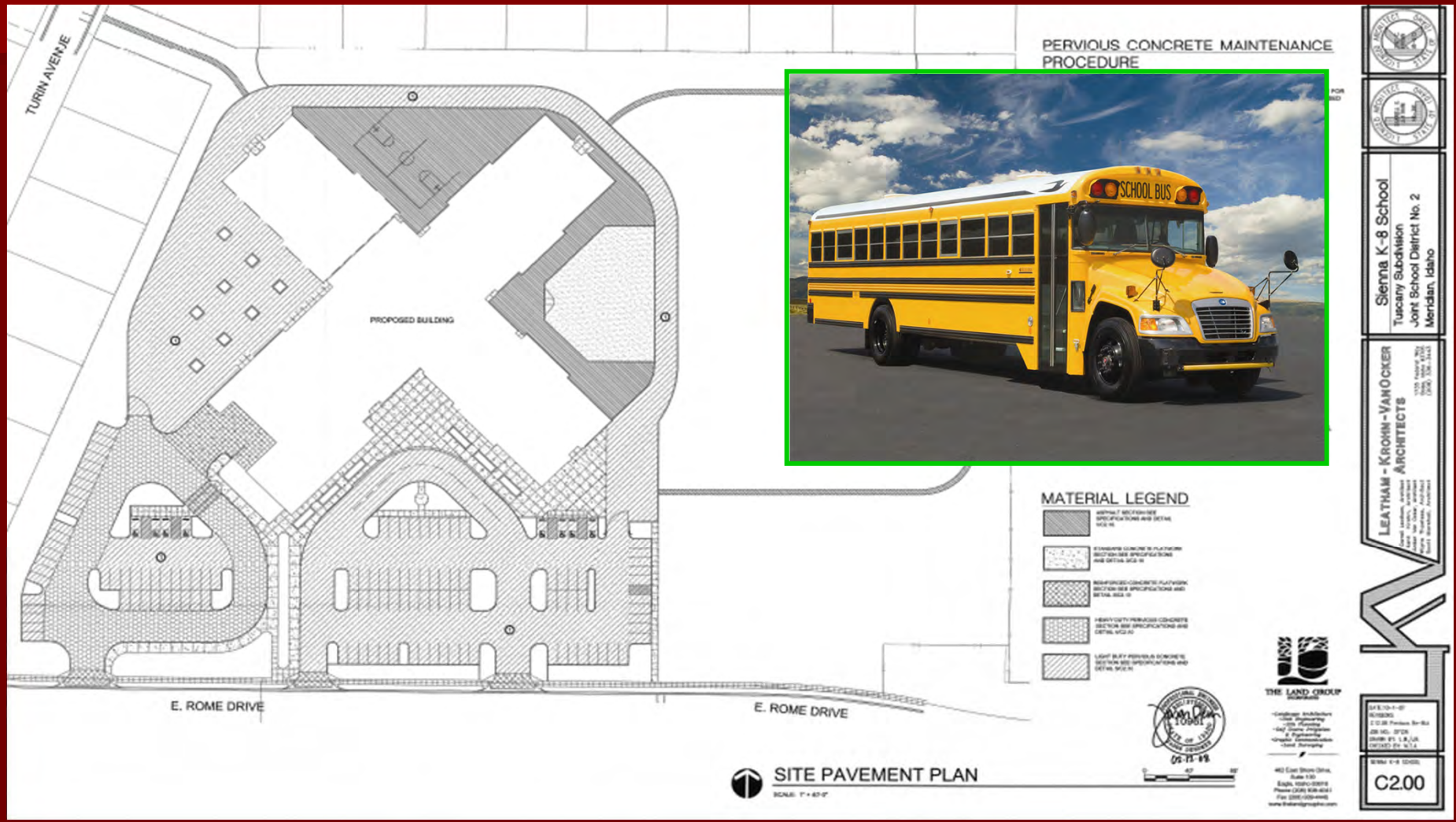
TO: All Architects, Attorneys, Builders, Developers, Engineers, and Permit Services Practicing in Fairfax County

SUBJECT: Letter **08-01** Pervious Concrete – Use under the Innovative Best Management Practices (BMP) Provisions of the Public Facilities Manual

On March 12, 2007, the Board of Supervisors adopted amendments to the Public Facilities Manual (PFM) incorporating design and construction standards, plan submission requirements, and requirements for the release of bonds and conservation escrows for 6 Low Impact Development (LID) practices. The approved LID practice for pervious pavement included two types of surface treatment, porous asphalt and open jointed concrete blocks. Although not included in the recent amendments, pervious concrete may be used as a surface treatment for pervious pavement facilities under the innovative Best Management Practices (BMP) provisions of the PFM (§ 6-0402.4). Designs utilizing pervious concrete must meet all PFM requirements generally applicable to pervious pavement systems regardless of the type of surface treatment. The purpose of this letter is to provide design criteria specific to the use of pervious concrete. Your attention also is directed to Letter-to-Industry #07-17 (Low Impact Development Practices – Amendments to the Public Facilities Manual) which provides additional discussion of facility design, plan review, plan processing, and construction requirements for LID practices.

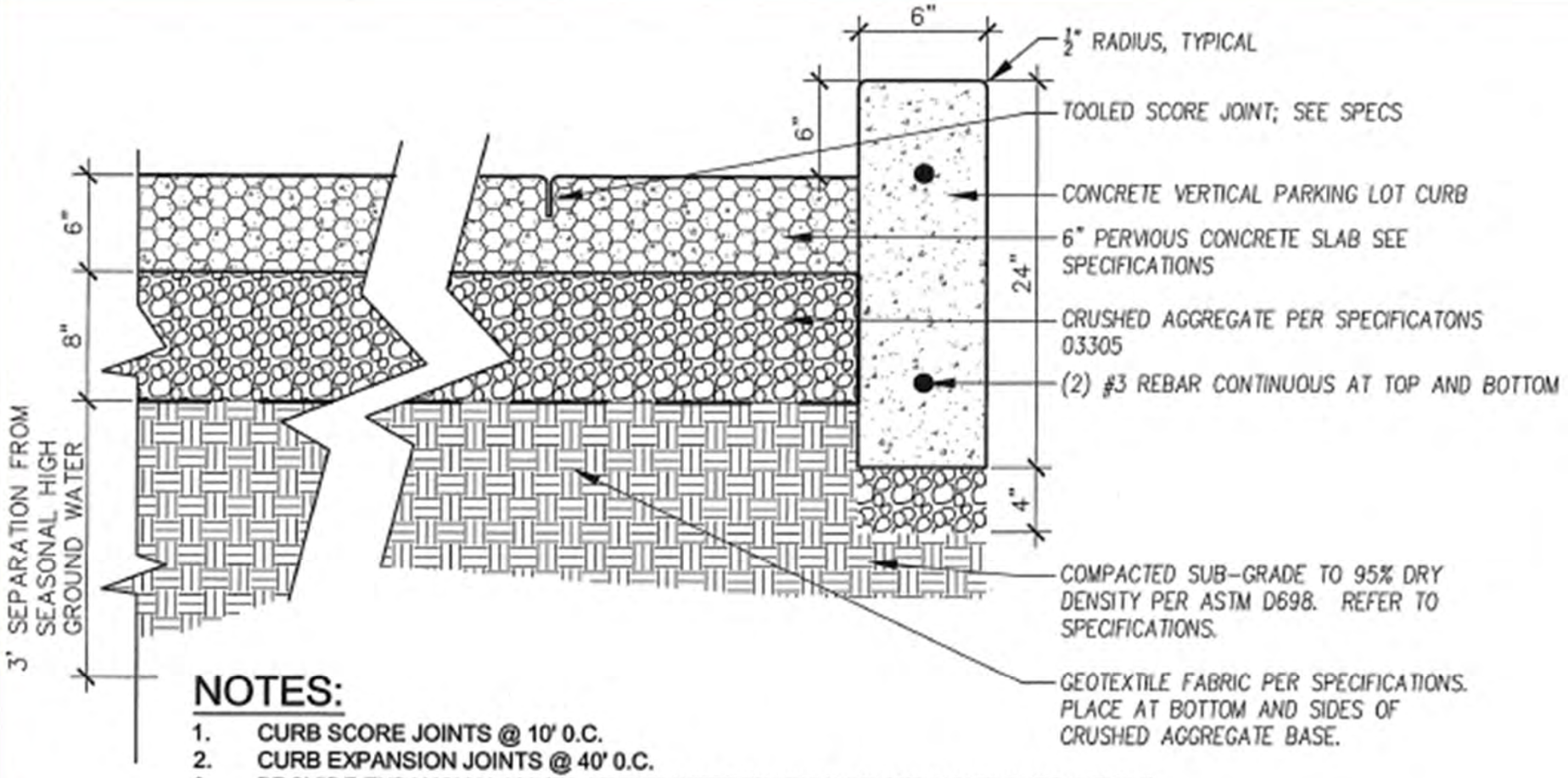
Pervious Concrete – 3 ½ Acres

Sienna K-8 School – Meridian (Boise), Idaho



Pervious Concrete

Variable Designs ("6 on 8") – Same Project



NOTES:

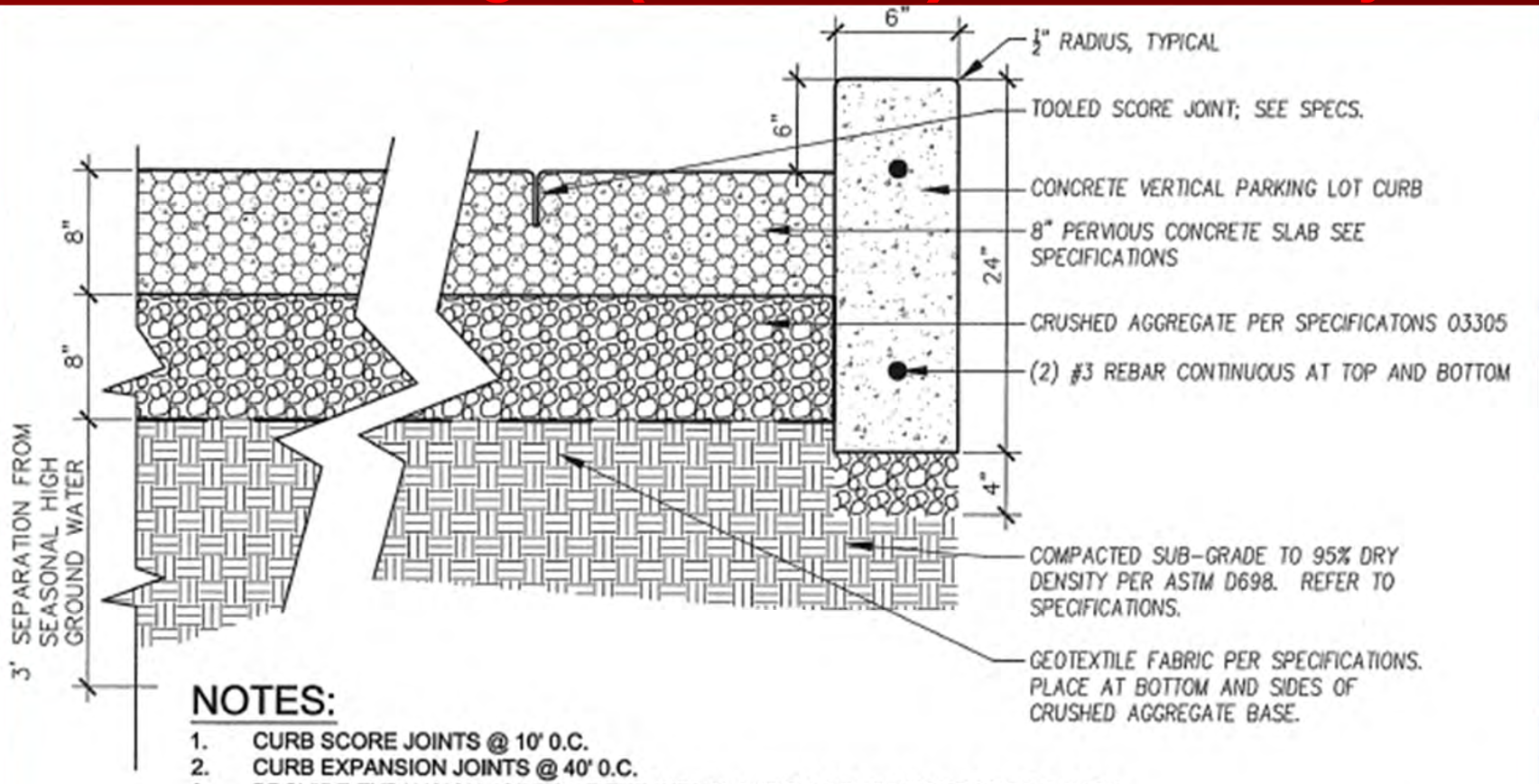
1. CURB SCORE JOINTS @ 10' 0.C.
2. CURB EXPANSION JOINTS @ 40' 0.C.
3. PROVIDE EXPANSION JOINTS AT THE INTERSECTION OF STRAIGHT CURB & RADII.
4. EXPANSION JOINTS SHALL BE PREFORMED JOINT FILLER OF 3/8" THICKNESS.
5. CURB SCORE JOINTS SHALL BE MINIMUM 1/8" WIDE, 1-1/2" DEEP, AND ROUNDED CORNERS.

5 LIGHT DUTY PERVIOUS CONCRETE SECTION

Scale: 1"= 1'-0"

Pervious Concrete

Variable Designs ("8 on 8") – Same Project



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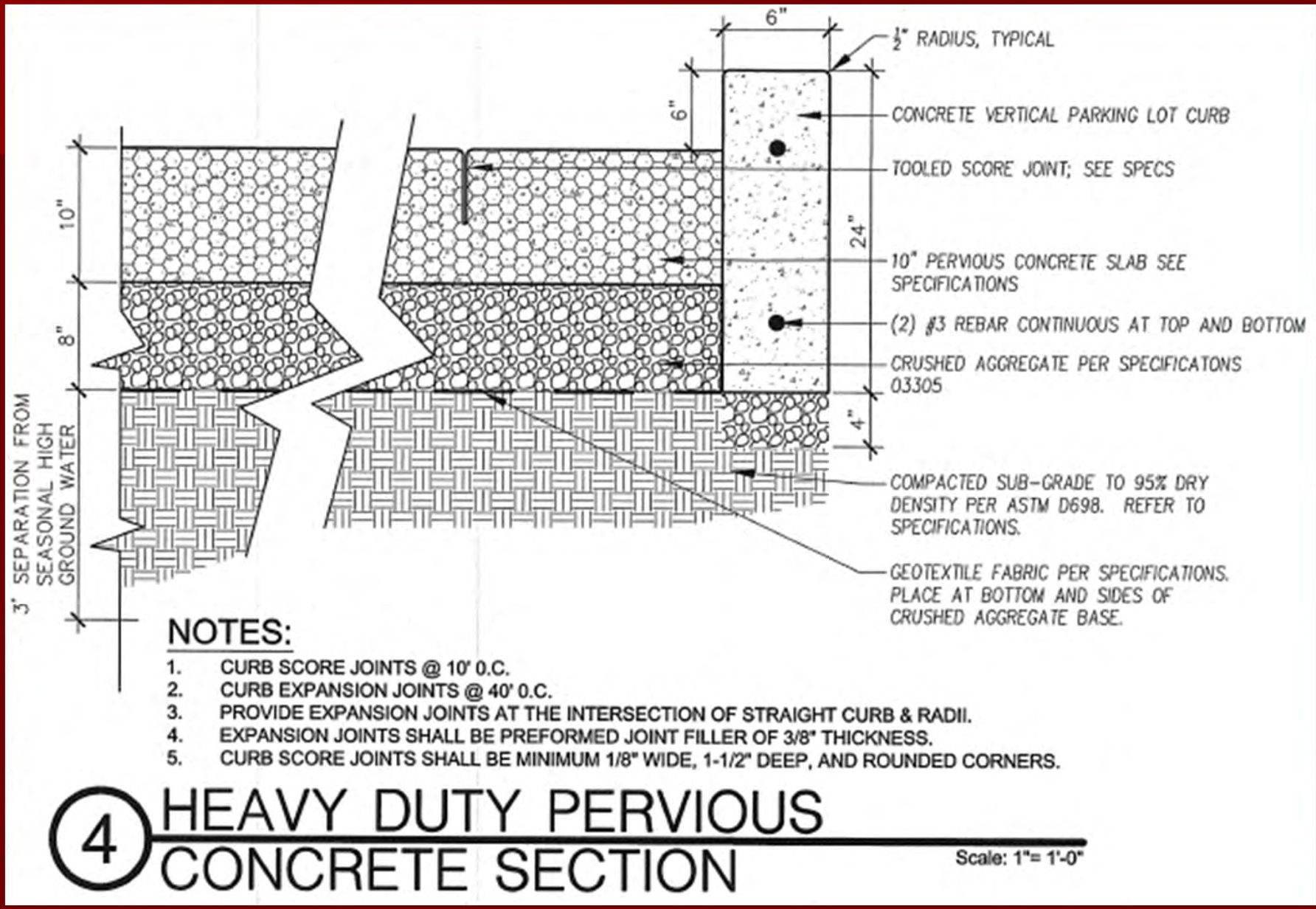
ADD ALTERNATE

Pervious Concrete

Variable Designs ("10 on 8") – Same Project



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4 HEAVY DUTY PERVIOUS CONCRETE SECTION

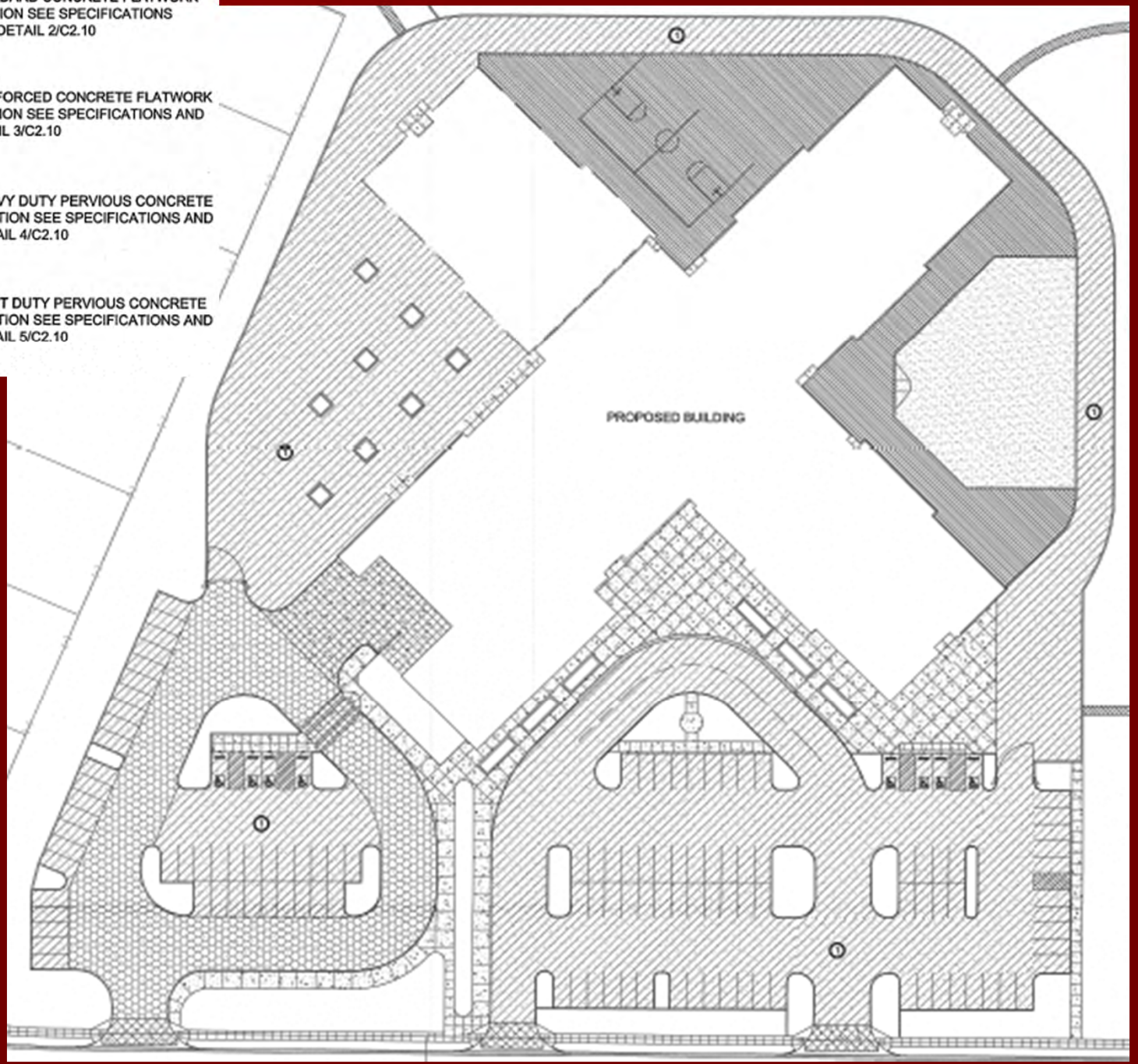
Scale: 1"= 1'-0"

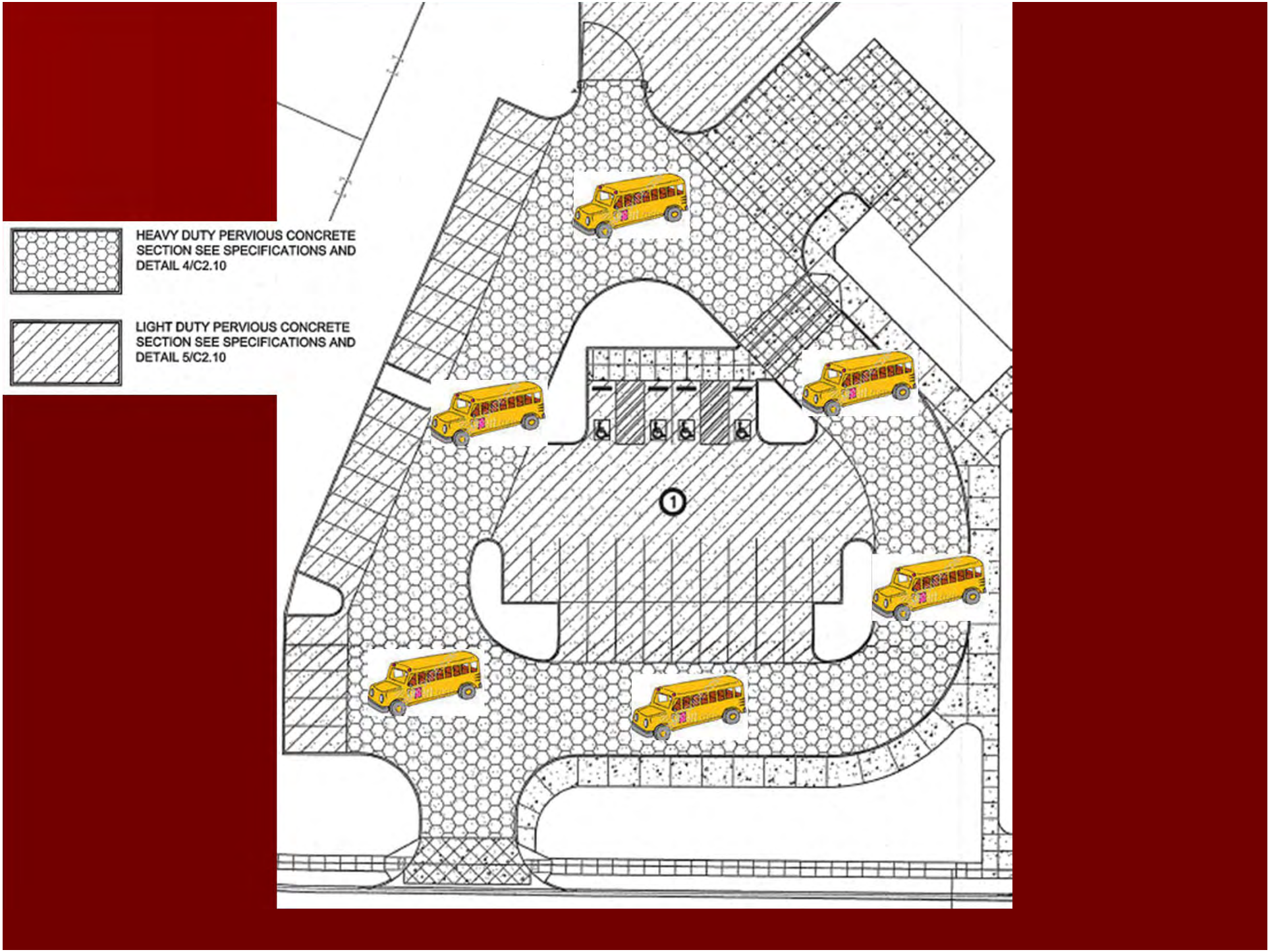
STANDARD CONCRETE FLATWORK
SECTION SEE SPECIFICATIONS
AND DETAIL 2/C2.10

REINFORCED CONCRETE FLATWORK
SECTION SEE SPECIFICATIONS AND
DETAIL 3/C2.10

HEAVY DUTY PERVIOUS CONCRETE
SECTION SEE SPECIFICATIONS AND
DETAIL 4/C2.10

LIGHT DUTY PERVIOUS CONCRETE
SECTION SEE SPECIFICATIONS AND
DETAIL 5/C2.10

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1

Pervious Concrete

Johnson Space Center (NASA) – Houston, TX

4 Acres – Parking Lot (8” thick)

Energy Independence and Security Act of 2007

Signed into Federal Law 12-19-07

SEC. 438. STORM WATER RUNOFF REQUIREMENTS FOR FEDERAL DEVELOPMENT PROJECTS:

"The sponsor of any development or redevelopment project involving a Federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction, and maintenance strategies for the property to maintain or restore to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the temperature, rate, volume, and duration of flow."

Downtown Shelbyville or China?

Questions?

Paving Alternatives

- When integrating parking systems, don’t forget long lasting regular concrete is the perfect companion for pervious concrete.

Concrete Parking Lot

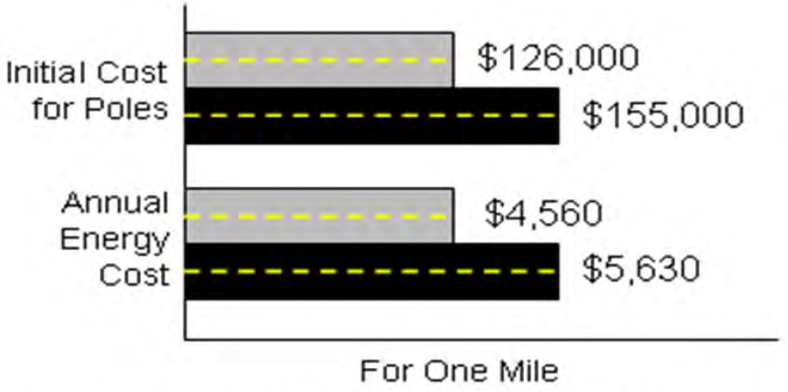
- Durability
- Competitive Initial Costs
- Lower Life Cycle Costs
- Versatile Material
  - Standard Mix
  - White Topping
  - Ultra-Thin White Topping
  - Fast Track
  - Pervious (storm water runoff)
- Environmentally Friendly
- Lower Maintenance Costs
- Energy Efficient (less lighting needed for same illumination)
- Solar Reflectance for LEED

It's time to look at an alternative to Asphalt

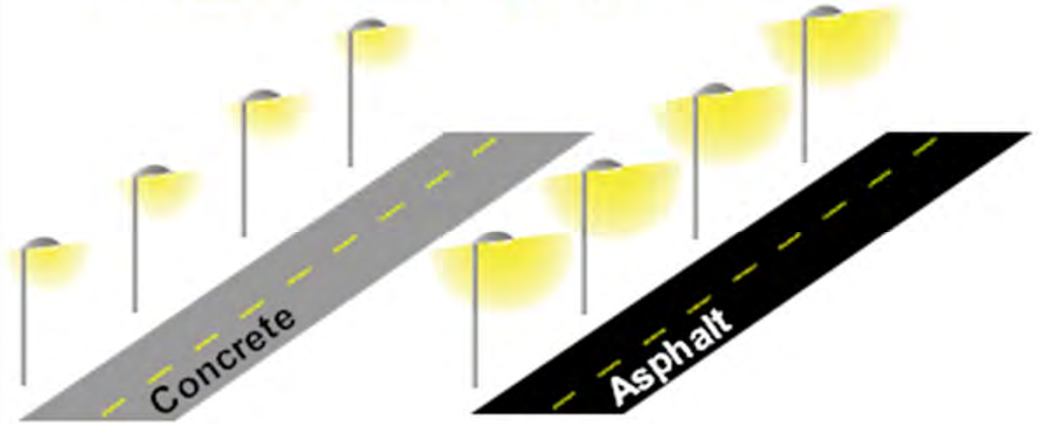
Over 90% of all parking lot and local road paving in the United States is asphalt.

Lighting cost comparison

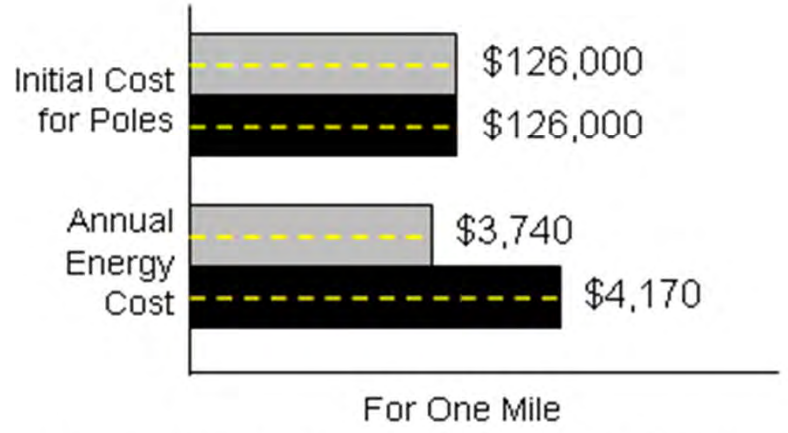
- Asphalt requires 24% more poles
- Initial costs, maintenance costs, and energy costs are 24% higher



Assumes: Initial cost = $5,000/pole; Maintenance cost = $100/pole/year; Energy cost = $0.0814/kwh; Operating time = 4,000 hours/pole/year



- Initial and maintenance costs similar
- Asphalt requires 33% higher energy costs each year.



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Reflectivity = Safety

Concrete

Same mall – one side concrete and one side asphalt – same amount of lighting on each side!

Asphalt

- Doug,
- We recently did a concrete overlay on a driveway for Kim and Jay Reaves at 1020 Falmouth Street. Kim stated they were going to have Jim Evans put a 1”cap and seal the driveway for $14,000. I took Tim Sexton and he did the job in about 8 days. He also added sidewalks to the front and rear doors in his bid with concrete and labor for the same price, with the concrete averaging 4.5-5 inches deep.
- I just wanted to let you guys know with the price of oil and the way the petroleum industry are now refining their product, that the price of asphalt has skyrocketed to where liquid asphalt is around $600.00/ton.
- Concrete has always been the superior product with little maintenance required and I would like to give you a concrete alternate bid on your upcoming parking lot. Just get me a set of plans and I will go from there.

10 Years Old, Is This What You Are Offering Your Clients?

Owners now has a fifty + years beautiful concrete welcome mat to their home

Concrete placement has moved into the 21st century

Laser Screeds with 3-D profilers use GPS tracking to pour parking lots to 1/16 inch on grade

Concrete is actually faster than asphalt, it only takes one lift and now the concrete industry can pour up to 2 acres in one day

You Need to Have the Strength to be Able to Bear Loads

Urban Heat Island

- **Temperatures are 4-10 degrees higher**
- **More power needed for air conditioning**
  - U.S. - $40 billion to cool buildings
  - Burn higher amounts of fossil fuels (contributes to pollution)
- **Ozone levels are higher - Smog is greater**
- **Higher incidence of heat and smog related health problems**
  - L.A. - $3 billion/year in health related costs

Reflectivity Test

Asphalt- 4.5%

Sidewalk – 20.5%

Ambient Temp. 107° F

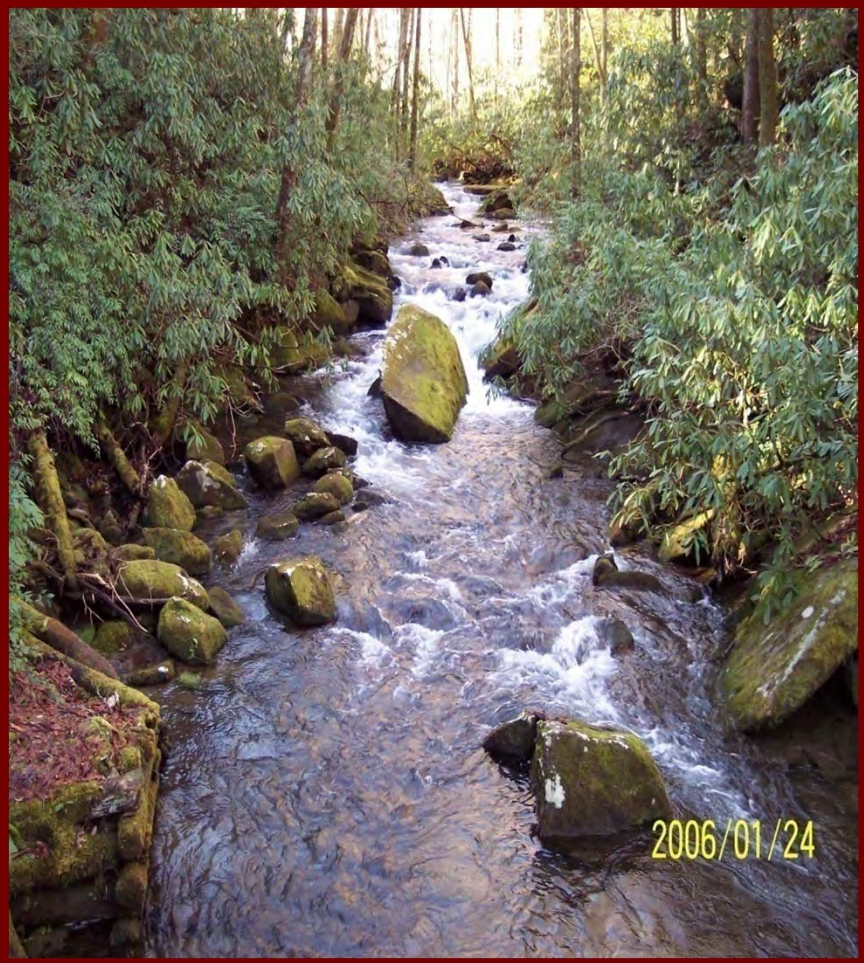
Speed bump Temp. 112° F *

Asphalt Temp. 148° F *

* Laser temp. gun

Conservation of our Rivers, Lakes and Streams

- The hot water runoff from asphalt paving runs into our Kentucky rivers, streams and lakes raising the water temperature.
- Water temperatures above 90 degrees F kills most aquatic life.



Environmentally Friendly

- Concrete is produced from abundant natural resources, produces no toxic run-off and can be easily recycled.
- We worry about oil spills yet we use millions of barrels of tar constructing and sealing parking lots every year.

The greater good ... *Concrete is one of the most environmentally friendly construction products currently available.*

We can continue to pollute our lakes and streams.....

Or we can take responsibility for our future environment.....

....with relatively minimal upfront cost!

Pervious Concrete Helps Keep Freddy Healthy!

KENTUCKY
READY MIXED CONCRETE
ASSOCIATION

Krmca.org

502 695-1535