Bio Retention in an Urban Environment
Shaw Nature Reserve
Landscape Series

June 19, 2012
SOUTH GRAND GREAT STREETS INITIATIVE
BIO-RETENTION PROJECT
Great Streets

- Are representative of their places (context sensitive)
- Allow people to walk comfortably and safely
- Contribute to economic vitality of the area
- Are functionally complete (accommodate all modes)
- Provide mobility (travel, local circulation, and access)
- Facilitate place making (identity, space, art, activity)
- Are green (ecological & attractive)

“To design a street according to its probable use is a reasonable but uncommon practice.”

…1917 - City of St. Louis Plan
SOUTH GRAND GREAT STREETS INITIATIVE

City of St. Louis and South Grand Community Improvement District
PROBLEM AREAS

- **Off-Street Parking**: Potential exists to utilize neighboring parking lots during peak hours.
- **Deteriorated Streetscape**: Much of the pavement has heaved, cracked, and created tripping hazards due to insufficient sub-surface conditions for tree root growth.
- **Need for Site Furnishings**: Current site furnishings do not meet user demands.
- **Sidewalk Functionality**: Existing sidewalks are often cluttered and do not provide efficient pedestrian access along street.
- **Crosswalk Safety**: Long street crossing distances create unsafe crosswalks and present need for improvement.

![Map with problem areas indicated](map.png)
Great Streets Planning

Ecological Issues Addressed:

- Education – establish expectations, priorities, and tools
- Plantings – hardiness / maintenance intensity
- Storm Water – quantity and cleanliness of piped water
- Heat Island effect – thermal battery of materials used
- Light Pollution – aesthetics and practicality
- Quantity of Motorized Travel – amenity for bike / ped / transit
- Carbon Footprint – materials selected & ongoing maintenance
- Waste Management – construction practices
- Wildlife – birds, small animals, flora
- Air Quality – reduced carbon emissions & improve absorption
- Sound – reduced ambient and peak noise levels
SOUTH GRAND GREAT STREETS INITIATIVE

4 Lane Basic Enhancement

3 Lane Enhancement Plus

3-4 Asymmetrical (contingent upon ROW acquisition, may be re-striped for 4 lanes)

I prefer the following future street?

- 3 Lane: 72%
- 4 Lane: 14%
- Asymmetrical: 14%

* Polling results
PLAN VIEW OF THREE LANE STREET

1. Outdoor Dining
2. Pervious Parking Lane
3. Rain Garden
4. Left-Turn Lane
5. Travel Lane/Bike Sharrow
6. Bus Shelter
7. Bus Stop
8. Accessible Parking Space
9. Pervious Concrete Sidewalk
10. Intersection Bulbout
11. Proposed Street Tree
12. Street Lamp
13. Planting Area
SOUTH GRAND GREAT STREETS INITIATIVE

Concept Design for Bulb-out & Raingarden
Proposed Design (by Design Workshop)
Classic Bulbou

City Garden

Crosswalk Distance

Existing Crossing Distance = 56'
Proposed Crossing Distance = 37'

DW LEGACY DESIGN METRICS
Green Stormwater Design Overview:
Utah Street to Arsenal Street

The ultimate green stormwater design goal of the Great Streets Initiative for South Grand is for 50 percent of the street cross-section, from the right-of-way to the centerline of South Grand Boulevard, to be pervious. The design team is proposing the following amenities to help achieve the goal:
1. pervious concrete paving for pedestrian walking and gathering surfaces,
2. permeable pavers for all parking spaces,
3. rain gardens at bulb-outs,
4. planting areas.

- **Pervious Concrete**
  - Locations: All pedestrian sidewalks
  - Quantity: 40,412 Square Feet

- **Permeable Pavers**
  - Locations: All parking spots
  - Quantity: 15,004 Square Feet

- **Rain Gardens**
  - Locations: Bulb-outs along 5th, Grand and side streets
  - Quantity: 14,133 Square Feet

- **Planting Areas**
  - Locations: tree pits
  - Quantity: 2,003 Square Feet
South Grand Bulbouts Today
### Rain Gardens: Plant List

Rain gardens are designed to filter and absorb stormwater run-off from impervious surfaces such as the roadway and parking lots to reduce the amount of water flowing into storm drains, and reduce erosion, water pollution and flooding from surface run-off.

The following plant list was selected based on recommendations from the Landscape Guide for Stormwater Best Management Practice Design, St. Louis Missouri, and resources from the Missouri Botanical Gardens. These native plant species were selected due to their ability to thrive in wet conditions and tolerance of frequent flooding and salt, their ability to thrive in full or partial sun, their ability to attract birds and butterflies, as well as their availability in the local nursery trade. All of these plants are native and part of Missouri’s natural heritage, providing a high aesthetic value.

<table>
<thead>
<tr>
<th>Latin Name</th>
<th>Common Name</th>
<th>Seasonal Interest</th>
<th>Color</th>
<th>Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iris setosa</td>
<td>Copper Iris</td>
<td>Copper</td>
<td>May-June</td>
<td></td>
</tr>
<tr>
<td>Lobelia cardinalis</td>
<td>Cardinal Flower</td>
<td>Red</td>
<td>July-September</td>
<td></td>
</tr>
<tr>
<td>Cephalanthus occidentalis</td>
<td>Buttonbush</td>
<td>White</td>
<td>June-August</td>
<td></td>
</tr>
<tr>
<td>Penstemon digitatus</td>
<td>Smooth Beard-Beard</td>
<td>White</td>
<td>April-May</td>
<td></td>
</tr>
<tr>
<td>Phlox paniculata</td>
<td>Meadow Phlox</td>
<td>Purple/Pink</td>
<td>July-September</td>
<td></td>
</tr>
<tr>
<td>Asclepias tuberosa</td>
<td>Butterfly Milkweed</td>
<td>Orange</td>
<td>June-August</td>
<td></td>
</tr>
<tr>
<td>Beddomea australis</td>
<td>Wild Blue Indigo</td>
<td>Blue</td>
<td>May-June</td>
<td></td>
</tr>
<tr>
<td>Echinacea purpurea</td>
<td>Purple Coneflower</td>
<td>Purple</td>
<td>June-August</td>
<td></td>
</tr>
<tr>
<td>Carex vulpinodes</td>
<td>Fox Sedge</td>
<td>Tan</td>
<td>May-July</td>
<td></td>
</tr>
<tr>
<td>Sporobolus heterolepis</td>
<td>Prairie Dropseed</td>
<td>Tan</td>
<td>August-Dec</td>
<td></td>
</tr>
</tbody>
</table>

### Species Selection

(by Design Workshop)
ENVIRONMENT | PERMEABILITY

Engaging the public in prioritizing metrics

Demonstrating porous pavement to the public
Strategy: To gain buy-in for rain gardens and permeable paving as strategies to reduce runoff and stress to the combined sewer system.
## ENVIRONMENT | PERMEABILITY

<table>
<thead>
<tr>
<th>Proposed Permeable Materials:</th>
<th>square feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pervious concrete</td>
<td>13,516</td>
</tr>
<tr>
<td>Softscape (planted areas and rain gardens)</td>
<td>23,112</td>
</tr>
<tr>
<td>Permeable pavers (proposed)</td>
<td>13,422</td>
</tr>
</tbody>
</table>

**Total Permeable Area:** 50,050

**Project Site Area:** 222,343

**Total Pervious** (Permeable Pavers removed from project) = 16.4%
ENVIRONMENT | TREE SOIL VOLUMES

: James Urban: *Up By Roots*
**Strategy**: To generate support for replacing existing trees by demonstrating the poor health of existing trees due to compaction and lack of rooting area, air, soil moisture and drainage.

**Evidence**: By providing larger tree pits for root volume and water storage, healthy street trees will decrease the urban heat island effect, improve air quality and decrease flooding.

Target rooting area is 1,000CF - 1500CF per street tree.

The **Master Plan** defines a planter area of 1156 cubic feet (CF) per street tree. The existing trees currently have between 60-100 CF per tree. Goals is to increase tree lifespan to 50 years.
Tree wells designed to increase street tree life from average of 7 years to 50+ years

- **minimum soil volume** approx. 1000 – 1200 cubic feet

- edge treatments **discourage soil compaction** - results in healthier trees and less root heave damage

- corner trees different from mid block – **avoid monoculture**

- **species selection** informed by the 2009 Davey Resource Group “City of St. Louis, Missouri Street Tree Resource Analysis” to maximize benefit to the district.

- adjacent pervious pavement structures **increase hydration**
Evidence: By implementing a pilot test of the proposed lane reduction and bulb-outs, the average peak noise levels fell by 17db, meeting the target noise level of 60db. The street is about 1/3 as loud as it was previously, therefore providing a more comfortable shopping and dining experience.
Strategy: To demonstrate the danger of existing traffic speeds and build a case for a “road diet.”

Evidence: By implementing a pilot test of the proposed lane reduction, pedestrian bulb-outs, and synchronizing traffic lights, traffic speeds were reduced to the target 25mph.

In addition:
56 percent of participants felt that pedestrian safety was improved or greatly improved.

64 percent of participants felt that crossing the street by foot was easier and safer.
SOUTH GRAND GREAT STREETS INITIATIVE

1. Pervious Concrete Sidewalk
2. Seatwall Faced with Recycled Brick
3. Ornamental Planter Fence
4. Parking Lane with Pervious Paving
5. Willow Oak Street Trees
6. 3-Lane Traffic Plan
7. Rain Garden
8. Identity Banner
9. Reused Street Lamp with High Efficiency Bulb

Streetscape Rain Garden and Seating Area
Benefits

- Stormwater management
- Air Quality improvement
- Sound/noise reduction
- Safety enhancement
- Heat island mitigation
Rain Garden Project Evaluation

- Pre and Post installation – volume and pollutants measured
  - Partnership with Metropolitan St. Louis Sewer District and University of Illinois-Edwardsville
  - N, P, K, metals and E-coli
  - Pre-sampling complete May 2012
    - Four Storm drains
  - Post installation sampling in 2014
Education

- Six large signs in Rain Gardens
  - One at each intersection
- Community Improvement District Brochure
- Bio-Blitz in Tower Grove Park and environs
- Partnership with
  - South Grand Community Improvement District
  - Academy of Science
  - Missouri Department of Conservation
- Other 319 Projects in the vicinity
  - Operation Brightside – Rain Garden & Pervious Pavement
  - City of St. Louis – Pervious Alleyways
Alley Projects
Inspire Residential Rain Gardens

- A landscaped area planted with wildflowers or native vegetation that captures stormwater from impervious surfaces.
- Rain gardens treat stormwater as a resource rather than waste.
How does it work?

- A shallow depression or catchment structure.
- Filled with soil and mulch that absorb and infiltrate storm water runoff.
- Captures runoff from adjacent impervious surfaces.
The principles apply to a variety of development types, land use patterns, and road designations.
### Environmental Matrix

<table>
<thead>
<tr>
<th>Environment Matrix</th>
<th>Preliminary Goal</th>
<th>Baseline</th>
<th>Benchmark</th>
<th>SMART GOAL</th>
<th>Strategies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Planting Design</td>
<td>Use native plant materials to reduce water usage</td>
<td>Existing tree pits of 48&quot; diam. 62% of trees in Ward 6 are in good condition. 38% of trees in Ward 16 are in good condition.</td>
<td>Minimize the use of irrigation.</td>
<td>Davey Resource Group</td>
<td>1) Specify native plant materials for street trees, rain gardens and street planting areas.</td>
</tr>
<tr>
<td>Heat Island Effect</td>
<td>Protect against and reduce urban heat island</td>
<td>Existing temps: Grass 74.9-90 degrees, Brick 77.5-112.6, Gray Concrete 82.7-101.6, Aggregate Concrete 84.2-110.4, Painted Concrete 85.7-116.6, Asphalt 83.2-122</td>
<td>Increase soil volume to 1,000 c.f. to provide healthier street trees</td>
<td>No net increase of ambient air temperatures pool development, 65 percent paved area within the ROW is porous</td>
<td>1) Plant trees to shade landscapes, 2) Replace paved areas with either planted area or pervious materials, 3) Use landscape paving materials that are high albedo.</td>
</tr>
<tr>
<td>Noise Pollution Reduction</td>
<td>Reduce noise levels</td>
<td>Existing noise levels: Bus Traffic 76-91dB, General Traffic 64-74dB, Stopped Traffic 57dB</td>
<td>63dB - target noise level at posted speed limit of 25 mph</td>
<td>Reduce Impacts to 63dB or less</td>
<td>1) Reduce vehicular speed through lane reduction, traffic calming techniques and increasing walkability of sidewalks.</td>
</tr>
<tr>
<td>Light Pollution Reduction</td>
<td>Improve night sky visibility</td>
<td>Fluctuating light levels from very dark to extremely bright with all non-cut-off fixtures/fixtures</td>
<td>Minimize obtrusive light so that no light escapes above a horizontal plane</td>
<td>1) Provide distribution of light along the corridor and meet city standards of 1 ft on sidewalks and 2 ft at intersections, 2) Provide cut-off fixtures/fixtures to reduce light pollution.</td>
<td></td>
</tr>
<tr>
<td>Stormwater Management</td>
<td>Contain and collect stormwater on-site and increase the quality of any runoff</td>
<td>Currently 99 percent impervious</td>
<td>50 percent porous pavement within the ROW</td>
<td>Increase alternative transportation</td>
<td>1) Increase the number of bike racks, 2) Provide shared bike lanes on South Grant to encourage more bicycle riding, 3) Provide shelters at transit stops.</td>
</tr>
<tr>
<td>Landscape Materials</td>
<td>Incorporate locally harvested and manufactured materials</td>
<td>Limestone quarried locally along Mississippi River</td>
<td>LEED</td>
<td>Average distance of materials not to exceed 500 miles</td>
<td>1) Incorporate locally quarried limestone, 2) Recycle materials (see waste management) for wall clays, pavers, or similar architectural features.</td>
</tr>
<tr>
<td>Waste Management</td>
<td>Reduce amount of landfill waste generated by construction</td>
<td>Existing concrete, curbing, asphalt, brick and block can be recycled for reuse</td>
<td>LEED</td>
<td>Recycle 100% of materials removed during construction</td>
<td>1) Recycle existing concrete, brick and asphalt. Re-use existing site furnishings, granite curbing and brick. Utilize recycled materials for sub-bases and trenching fill. Chip densed street trees and reuse for mulch.</td>
</tr>
<tr>
<td>Support Recycling programs</td>
<td></td>
<td></td>
<td></td>
<td>1) Provide recycle carts for 50 percent of salvaged and reduced trash cans.</td>
<td></td>
</tr>
<tr>
<td>Wildlife</td>
<td>Provide habitat for urban wildlife</td>
<td>Existing % canopy cover in Ward 6 is 7.7%, existing % canopy cover in Ward 16 is 31%.</td>
<td>Increase tree canopy to 16%</td>
<td>Increase urban wildlife habitat</td>
<td>1) Provide healthy and adequately-spaced street trees with ample (1,000 SF min.) planting pits, 2) Encourage green roofs in new development, 3) Provide plantings and rain gardens with plants that provide for the needs of birds, insects, etc. 3) Increase the amount of tree canopy on the street.</td>
</tr>
<tr>
<td>Energy and Carbon</td>
<td>Minimize energy use</td>
<td>Total annual benefit of existing honey locust trees = $2,461</td>
<td>Increase the total annual benefit of street trees by $55 ($7,073 annually)</td>
<td>Davey Resource Group</td>
<td>1) Provide efficient street lighting, 2) Utilize materials with a long life cycle, 3) Promote solar as an energy source, 4) Promote alternative transportation options, 5) Ensure proper synchronization of traffic lights.</td>
</tr>
<tr>
<td>Air Quality</td>
<td>Improve air quality</td>
<td>Current Emissions: NOX Emissions: 364 (g)</td>
<td>Reduce Emissions: NOX Emissions: at least 50%</td>
<td>Reduce heat island effect, 2) Use low-noise paint, 3) Run synchronous and 8 bit Traffic Traction Analysis, 4) Ensure proper synchronization of traffic lights.</td>
<td>1) Reduce heat island effect, 2) Use low-noise paint, 3) Run synchronous and 8 bit Traffic Traction Analysis, 4) Ensure proper synchronization of traffic lights.</td>
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</tbody>
</table>
Need for Public Education
Manchester

"Pulse Node" at Clarkson and Manchester

Existing Condition Today (looking south from Clarkson Road):

Massive parking lots and auto-focused development dominate the existing intersection of Manchester and Clarkson, particularly on the south side of the node.

Future Conceptual Plan (same vantage point as above):

Leveraging the highly-traveled intersection as a "business generator", the concept here shows a full multi-way boulevard conversion on the south side of Manchester Road to allow patrons to easily access the new businesses via the access and parking area separated from the through traffic by a median and street trees. Future development should be primarily commercial/retail around the node itself, with mixed residential and office on the edges.
Questions?

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Project partners include:
City of St. Louis, South Grand Community Improvement District,
Academy of Science of St. Louis, Metropolitan St. Louis Sewer
District, Missouri Department of Conservation, Southern Illinois
University-Edwardsville

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