Urban Soils and Suitability for Green Infrastructure

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• How is the current urban soil performing?

• What are the naturally occurring soils?

• What impacts have human had on the soils during construction and destruction (demolition)?

• What should be done to improve these urban soils?
If you remember only one thing.....

DON’T ASSUME WHEN IT COMES TO SOILS!!!
# United States Urban Demographics

<table>
<thead>
<tr>
<th>CITY</th>
<th>CENSUS 1950</th>
<th>CENSUS 2010</th>
<th>% CHANGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baltimore</td>
<td>949,708</td>
<td>620,961</td>
<td>-34.6%</td>
</tr>
<tr>
<td>Philadelphia</td>
<td>2,071,605</td>
<td>1,526,006</td>
<td>-26.3%</td>
</tr>
<tr>
<td>Wilmington</td>
<td>110,356</td>
<td>70,851</td>
<td>-35.8%</td>
</tr>
<tr>
<td>Cincinnati</td>
<td>503,998</td>
<td>296,945</td>
<td>-41.8%</td>
</tr>
<tr>
<td>Cleveland</td>
<td>914,808</td>
<td>396,815</td>
<td>-56.6%</td>
</tr>
<tr>
<td>Detroit</td>
<td>1,849,568</td>
<td>713,777</td>
<td>-61.4%</td>
</tr>
<tr>
<td>Omaha</td>
<td>251,117</td>
<td>408,958</td>
<td>+62.7%</td>
</tr>
</tbody>
</table>
772 Combined Sewer Systems
Urban Soil Research Cities (to date)

- 2014
What is Your Approach?

OUTSIDE - IN

INSIDE - OUT
What’s The Existing “Pre” Condition?
Soil Characterization

- Color
- Texture
- Structure

- Rock Content
- Redox Features
- Artifacts
- Soil Classification
Soil Surface Characterization
Alternative Techniques for Exploration
This is Brightmoor, Detroit
This is East Detroit
Natural Variability

Subsoil hydraulic conductivity (Native areas, cm/hr)
- 0.00000 - 0.57557
- 0.57557 - 1.71237
- 1.71237 - 4.19597
- 4.19597 - 26.60811
- 26.60811 - 65.22547

Streams:
- 2006 cuzoka ga_streets

Lake Erie
Human Variability
DON'T ASSUME!!!

Demolition Variability
Regional Variability

CINCINNATI
EVAPOTRANSPIRATION

OMAHA
SOIL STORAGE

CLEVELAND
INfiltration/recharge
How we Arrive to Vacant Land

DEMOLITION

BASEMENT REMOVAL
Once The Debris Has Been Removed, You’re Now Working With Either Fill Or Native Soils

Even The Native Soil Layers Have Been Impacted By Human Activities

Import Soil Materials That Are Similar In Composition To What Is Presently On-site

Don’t be afraid of Fill!
This Is The Primary Factor Regulating Drainage (along with density)

Texture Varies From Site To Site And Within The Soil Profile!
Pennsylvania Surface Soil Textures
What kind of soil do you have?

**Sassafras – Maryland’s State Soil**

- Sandy Loam, 12% Clay
- Sandy Clay Loam, 33% Clay
- Loamy Sand, 4% Clay

The imported fill material should have similar textural characteristics to the native soils encountered after demolition.
What kind of soil do you have?

Hagerstown – A Typical Western Maryland Soil

18% Clay

44% Clay

LIMESTONE PINNACLE
What Not to Do!!!

Existing Soils Are From A Former Sand Dune And Are 95% Sand And 3% Clay

Contractor Imports Silty Clay Fill Material That Is 15% Sand And 42% Clay
What’s even worse!!!

Construction Debris!

- Rebar
- Macadam
- Concrete
Is all Topsoil the Same???

6” Loamy Sand Topsoil

12” Silt Loam Topsoil With 15% Rocks And 10% Debris
“Pre” Topsoil

- Majority Of These Lots Are Impervious And The Topsoil Is Removed During Demolition Process

- Pervious Areas Are Often Impacted By Demolition And Debris Is Deposited Into The Topsoil

- Most Sites Are Topsoil Deficient
Topsoil

- Become A Net Importer Of Topsoil
- Quantity And Quality
  - At Least 6”
  - Organic Matter Content >5%
A Word about Engineered Soils

+  
=  
=  
Is this the right way to do it?
End Product
CONCLUSIONS

- Urban soils are already acting as Green Infrastructure in cities
  - How are they performing?

- The variability needs to be quantified
  - Regional planning

- How can these soils be improved
  - Limited resources
QUESTIONS?

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THANK YOU!!!