Assessing Impermeable Surface Area Impacts on Modeling
Implications for the Combined Sewer Overflow Long Term Control Plan in Omaha, Nebraska

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- Report available online at digitalcommons.unl.edu

OBJECTIVES
1. Digitize all ISAs in subcatchment 202 & compare with estimates
2. Model actual ISA cover & percent reductions from actual to assess modeled peak flow & volume results
3. Perform a sensitivity analysis by increasing the level of detail in existing sewer pipes & topography

Background & Existing Conditions
Summary of the Project Location & Context

PROJECT GOAL
Assess the accuracy of ISA estimation by the zoning code, its impact on the modeling of the LTCP, & identify areas of potential improvement

Study Area
Study Area

- 101 acre subcatchment of Cole Creek study basin
- 1 CSO outfall, 72nd & Bedford (NW corner)
- Zoning breakdown

<table>
<thead>
<tr>
<th>Zoning Code</th>
<th>% Cover</th>
</tr>
</thead>
<tbody>
<tr>
<td>R1</td>
<td>0.2%</td>
</tr>
<tr>
<td>R4(35)</td>
<td>74.1%</td>
</tr>
<tr>
<td>RT</td>
<td>3.7%</td>
</tr>
<tr>
<td>CC</td>
<td>3.2%</td>
</tr>
<tr>
<td>GC</td>
<td>5.3%</td>
</tr>
<tr>
<td>Subtotal</td>
<td>86.5%</td>
</tr>
<tr>
<td>Pavement</td>
<td>13.6%</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

Current Modeling Background

- Utilizes Infoworks software
- Estimated ISA percent cover by zoning code
- Supports the development of the LTCP = 4 CSOs per year (1969 season)
- All runoff enters system at one inlet
- 3 types of surfaces: Roads impervious, non-roads impervious, & pervious

Objective 1: Accuracy of Zoning Code ISA Estimation

- In model, one set ISA cover value per zoning code
- Overall good: within 3.6% when summarized into 3 categories
- More pervious than estimates
- Distinct ISA patterns between zoning codes

<table>
<thead>
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<th>Subcatchment 202 Impermeable Surface Area</th>
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</table>
Breakdown of ISA by ISA Type

ISA Types within Zoning Codes (in acres):

- Buildings: 12.36 acres
- Driveways: 11.64 acres
- Sidewalks: 12.98 acres
- Parking lots: 10.26 acres
- Patios: 6.56 acres
- Pools: 2.18 acres
- Recreation: 0.19 acres

Objective 2: Model ISA Reduction

1% ISA reduction = approx. 2% peak flow reduction

Influence of ISA % Reduction on Peak Flow Reduction

- ISA Reduction: 0.00% 10.00% 20.00% 30.00%
- Peak Flow Percent Decrease: 2.60% 22.83% 43.59% 64.48%

Influence of ISA % Reduction on Volume Reduction

- ISA Reduction: 0.00% 10.00% 20.00% 30.00%
- Volume Percent Decrease: 7.10% 24.69% 41.89% 59.61%

Objective 3: Increased Detail in Modeling

- All sewer pipes down to 18" diameter were added
- Actual ISA percentages inputted
- Topography & distribution of ISAs NOT taken into account, however

Objective 3: Increased Detail in Modeling

- Broken into 18 subcatchments for slope & widths
- Hydrographs utilized as metric
- Little change: ~2.5% flow
- TOC: approx. 5 mins
Conclusions

Points of Emphasis

- Utilizing zoning for ISA estimation provides varied results, but good for initial assessment of a given watershed
- Given ISA type distribution among zoning, good indicator of possible pollutant loads
- Significant benefits associated with ISA reduction; indicating viability as part of an integrated approach in CSO Program
- InfoWorks is powerful & has capabilities to account for Green Infrastructure & greater detail in ISAs
- Increased detail did not significantly alter output, but current modeling setup lacks parameters to build upon

Going Forward

- Currently, all ISAs in the CSO service area are being digitized & modeling to be updated
- Two key areas
  - **Defining ISA reduction** (2 strategies)
    - Physical removal & restoration
    - Disconnection
  - **Development of a dynamic, integrated management system**
    - Tracking of post-construction BMPs
    - GIS integration
    - Modeling efforts
    - Update additions & subtractions

Comments or questions?

THANK YOU VERY MUCH!

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Building Coverage

- Buildings: 14.88 acres
- Subcatchment area: 101.14 acres
- Coverage: 14.71%

Driveway Coverage

- Driveways: 7.26 acres
- Subcatchment area: 101.14 acres
- Coverage: 7.18%

Parking Lot Coverage

- Parking Lots: 5.35 acres
- Subcatchment area: 101.14 acres
- Coverage: 5.29%

Road Pavement Coverage

- Pavement: 13.62 acres
- Subcatchment area: 101.14 acres
- Coverage: 13.78%

Patios & Pools Coverage

- Patios & Pools: 4.56 acres
- Subcatchment area: 101.14 acres
- Coverage: 4.56%

Sidewalks Coverage

- Sidewalks: 1.26 acres
- Subcatchment area: 101.14 acres
- Coverage: 0.07%