Outfall Elimination

Is it a Cost-Effective Alternative?

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Part 1: Setting
Part 2: Why Outfall Elimination?
Part 3: Opportunities and Constraints
Part 4: Methods
Part 5: Results
Part 6: Next Steps
Part 1: Setting
Welcome to Pasco
Pasco Stormwater Subbasins

Infiltrates – No Outfalls (84% of City)

Legend
- Subbasin boundary
- Urban Growth Area boundary
- River
- Stream
- Highway

Setting
Why Outfall Elimination?
Opportunities and Constraints
Methods
Results
Next Steps
5 Subbasins with Outfalls

Project Area Map

Legend
- Drywell
- Catch basin
- Manhole
- Infiltration pipe
- Stormwater main
- No Discharge
- S# Subbasin
- Discharge to Army Corps Ditches
- Discharge Directly to the Columbia River
- 10-ft contour

Setting
Why Outfall Elimination?
Opportunities and Constraints
Methods
Results
Next Steps
Aging Stormwater Infrastructure

Erosion

Holes in pipes

Why Outfall Elimination?
Part 2: Why Outfall Elimination?
**Potential Advantages and Disadvantages of Outfall Elimination**

**Advantages**

• Reduced risk of surface water pollution and liability

• Improved surface water quality

• Eliminated or reduced cost of conveyance system rehabilitation

• Opportunity to address other existing problems

• Potential reduction in regulatory requirement

**Disadvantages**

• Increased risk of groundwater pollution

• Cost of new facilities

• Cost of infiltration system maintenance
title: potential benefits of outfall elimination
Meghan Mullen, 5/4/2017

make title, matt to fill in bullets
Meghan Mullen, 5/4/2017
Part 3: Opportunities and Constraints
Opportunities

Ideal conditions in Pasco:
• High infiltration rates
• Low rainfall amounts
• Only 5 outfalls
• Land area associated with outfalls is relatively small (16% of the City)
• Opportunities for retrofitting in the Right of Way
these make approach feasible; this is an opportunity not an objective
Meghan Mullen, 5/4/2017

ROW photo
Meghan Mullen, 5/4/2017

Matt will find a picture of the wide planter with this diagram beneath it (in the opportunity slide)
Meghan Mullen, 5/4/2017
Pasco Soils

- Hydrologic Soil Group A
- 20 to 30 inches per hour infiltration rate
- Design infiltration rate of 5 inches per hour
Constraints

- Design for the 100 year storm
- High impervious percentages
- Arid climate; < 8” / yr
- Not all ROWs are ideal
- Some ROW outside of City control
<table>
<thead>
<tr>
<th>MM12</th>
<th>constraints</th>
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<tbody>
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<td>Meghan Mullen, 5/4/2017</td>
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<table>
<thead>
<tr>
<th>MM13</th>
<th>WW - only match forest duration standard; 50 year storm only</th>
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<tbody>
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<td>Meghan Mullen, 5/4/2017</td>
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<table>
<thead>
<tr>
<th>MM14</th>
<th>picture of ROW and figure that illustrates the imperviousness</th>
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<td>Meghan Mullen, 5/4/2017</td>
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<thead>
<tr>
<th>MM15</th>
<th>picture of bioretention facility full of dust and sage brush (Teresa)</th>
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<tbody>
<tr>
<td>Meghan Mullen, 5/4/2017</td>
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<thead>
<tr>
<th>MM34</th>
<th>potential question: what happens in the bad ROWs? Scaling up assumptions from the good sites missing something?</th>
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<tbody>
<tr>
<td>Meghan Mullen, 5/4/2017</td>
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</table>
Other Right-of-Way Examples
MM2 header = figure title
Meghan Mullen, 5/4/2017

MM3 title: stormwater system rehabilitation
Meghan Mullen, 5/4/2017

MM4 images of conditions in the pipe, things that need to be restored
Meghan Mullen, 5/4/2017
Part 4: Methods
Process

- Calculate mitigation area
- Determine land use
- Develop BMP templates
- Soil properties & design storm
- Size and cost facilities

<table>
<thead>
<tr>
<th>Land Use</th>
<th>Description</th>
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<tbody>
<tr>
<td>Residential</td>
<td>Combination of pervious and impervious area</td>
</tr>
<tr>
<td>Undeveloped</td>
<td>Minimal impervious area</td>
</tr>
<tr>
<td>Commercial</td>
<td>Minimal pervious area</td>
</tr>
</tbody>
</table>

- Native Soil Infiltration: 5 inches/hour
- BSM Infiltration: 6 inches/hour
- Depth to groundwater: 21.5 feet
- Hydrologic Soil Group: A
- 100-yr, 24 hour storm (2 inches)
Mitigation Area

- Setting
- Why Outfall Elimination?
- Opportunities and Constraints
- Methods
- Results
- Next Steps
Land Use

Stormwater System and Land Use Map

Legend
- Commercial
- Residential
- Undeveloped

Mitigation Area
- 500 acres per basin (about 50%)
• Approximately 50 percent impervious
• Roof runoff partially dispersed
• Infiltration swales / Bioretention
• Size facilities to mitigate the 100-year storm event
MM24  take figures from CIP summary sheets  
Meghan Mullen, 5/4/2017

MM25  put them in as-is, may need to tweak later  
Meghan Mullen, 5/4/2017

MM28  figure and basic assumptions and uncertainties (like roof area) in bullets  
Meghan Mullen, 5/4/2017

MM29  bullets on impervious area calculations (% roof area, how to model the roof area, % of residential areas that is impervious)  
Meghan Mullen, 5/4/2017
• Approximately 99 percent impervious
• Subsurface infiltration pipes / chambers
• Treatment BMP
• Maintenance access
• Size facilities to mitigate the 100-year storm event
Sensitivity Analysis

Residential

• Range of facility costs per square foot
• Roof credit in hydrologic modeling

Commercial

• Percent impervious cover
• Site complexity

Roof Modeling

• 100 percent impervious
• 50 percent impervious; 50 percent landscape
• 100 percent landscape
• 100 percent infiltration
MM30  
discuss things examined for sensitivity analysis: roof area, impervious area for commercial  
Meghan Mullen, 5/4/2017

MM31  
figures are somewhere... One in commercial retrofit summary sheet "industrial basin" for simple or complex options  
Meghan Mullen, 5/4/2017

MM32  
show both options  
Meghan Mullen, 5/4/2017

MM33  
99 or 95 percent impervious for commercial  
Meghan Mullen, 5/4/2017
Part 5: Results
Retrofit Costs Are High

Cost per acre

- Residential: $32,000 to $50,000
- Commercial: $47,000 to $93,000

Cost per Subbasin

- Basin 1: $20 million to $36 million
- Basin 2: $15 million to $27 million

All 5 Subbasins

- $60 million to $110 million
Part 6: Next Steps
Pilot Projects

- Gauge public support for retrofits
- Collect additional soils data
- Refine construction cost assumptions
- Monitor facility performance over time
- Consider lifecycle costs
- Compare with status quo or end-of-pipe
Questions?