Bear Creek Watershed Model Approach and Inputs

Jeff Burkey and Scott Miller
King County DNRP-WLRD
Bear Creek Watershed-Scale Stormwater Plan
11/15/2016
Modeling Approach Overview

Physical Parameters, Existing Conditions, Future Land Use, BMP information

HSPF Hydrologic Modeling

SUSTAIN BMP Modeling

Modeling Output and Analyses

Achieve Goals?

Yes!

No
HSPF Watershed Modeling

- Hydrologic Simulation Program – Fortran (HSPF)
- Simulate current, future and historic (pre-disturbed) conditions of watershed.
- Calibrate model using observed water quality and flow data.

Wetlands (NWI)
Impervious land cover
Land Use
Soils
Catchments
Slope Percent
Integrated Layer (HRUs)
EPA SUSTAIN Modeling

**System for Urban Stormwater Treatment and Analysis Integration (SUSTAIN)**

U.S. EPA model developed to assist stormwater managers in selecting cost-effective stormwater BMPs to meet watershed goals.

**Model Inputs:**
- HSPF Model Output
- BMP Design and Cost Assumptions
- Flow or water quality goals
SUSTAIN Modeling Output examples

Cost-Effectiveness

BMP Cost-Distribution
Rainfall

- Precipitation from local gauges

- Grouped into four precipitation zones based on PRISM 30-year normal annual depth for 2010
  - NE 47.2 in
  - SE 45.7 in
  - NW 43.8 in
  - SW 42.6 in

- Precipitation may be modeled to represent effects of climate change
Monthly Rainfall
Translating Sea-Tac Rainfall to Area
Model Resolution

- Approx 100 Catchments range from a few acres to hundreds acres.
Interim Calibration Results
Flow rates Impacts of disturbance

- Scale basin to compare flow to similar size
  - Mackey 445 acres
  - Monticello 358 acres

<table>
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<tr>
<th>Year</th>
<th>Gauge</th>
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<th>HPR</th>
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High Pulse Count (HPC 3/7)
SUSTAIN Results (HPC Reduction for Monticello Creek)
Projected B-IBIs (10-50 scale)
Questions?
Bear Creek Land Use Conditions

Jeff Burkey
King County DNRP-WLRD
Bear Creek Watershed-Scale Stormwater Plan
11/15/2016
Existing Land Use (NLCD 2011)

- Disturbed Dev
  - 52%
    - 11% Impervious
- Disturbed Other
  - 2 %
- Undisturbed
  - 46%

Basin Area 16,385 acres
## DRAFT: Land Cover Distributions

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<th>Grass</th>
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<th>Low</th>
<th>Cleared</th>
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<th>Scrub</th>
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<td>Perennial Ice/Snow</td>
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<td>Developed, Open Space</td>
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<td>Shrub/scrub</td>
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<td>Grassland/Herbaceous</td>
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<td>Pasture</td>
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<td>Cultivated Crops</td>
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<td>Woody Wetlands</td>
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<td>Emergent Herbaceous Wetlands</td>
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Current Land Use (2011)
Population Growth Projections

- **King County**
  - 2010 - 1.9 mil
  - 2040 - 2.4 mil
- **Snohomish County**
  - 2010 - 0.7 mil
  - 2040 - 1.0 mil
Puget Sound Regional Council
Population Projection by FAZ

<table>
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<tr>
<th>FAZ</th>
<th>2000</th>
<th>2010</th>
<th>2025</th>
<th>2030</th>
<th>2035</th>
<th>2040</th>
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<td>13,433</td>
<td>15,206</td>
<td>15,414</td>
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<td>5546</td>
<td>15,413</td>
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<td>7435</td>
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<td>8,601</td>
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<tr>
<td>Total</td>
<td>45,750</td>
<td>49,940</td>
<td>58,388</td>
<td>59,524</td>
<td>60,848</td>
<td>62,363</td>
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Bear Creek Study Area Population Growth Projection
Future

- Based on Comprehensive Land Use Plans (2040)
- Some existing development occurred at densities greater before KC’s Current Comp Plan in the Rural areas.
Questions?
Bear Creek – Regulations and Existing Stormwater Infrastructure

Mark Wilgus, P.E.
King County DNRP-WLRD
Bear Creek Watershed-Scale Stormwater Plan
11/15/2016
BEAR CREEK WATERSHED REGULATORY TIMELINE

- SEPA
- GMA
- Stormwater Permit
- Stormwater Manual
- Bear-Evans TMDL
- Comprehensive Plan
- Sensitive Areas Ordinance (SAO)
- Critical Areas Ordinance (CAO)
- CAO Clearing Limits
- Stormwater Manual
- Poll Prev Manual
- KCC Basin Plans
- KCC Water Quality Policy
- Bear Creek Community Plan
- Bear Creek Basin Plan
- Salmon Conservation Plan


Washington State  King County
Existing Stormwater Facilities (Ponds, vaults)
## Overview of Design Manual Requirements for Stormwater Facilities/BMPs

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<tr>
<th>Year</th>
<th>Flow Control Standard</th>
<th>Water Quality</th>
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<tbody>
<tr>
<td>Pre - 1990</td>
<td>• Aimed to prevent flooding.</td>
<td>• No water quality treatment required.</td>
</tr>
<tr>
<td>1990</td>
<td>• Improved modeling methods (results in larger facilities)</td>
<td>• Added water quality treatment.</td>
</tr>
<tr>
<td>1998</td>
<td>• Improved to prevent erosion relative to existing conditions.</td>
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<tr>
<td>2005-9</td>
<td>• Improved to require matching historic (forested) conditions • Flow Control BMPs (aka LID BMPs) incentivized and required at minimum levels</td>
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</tr>
<tr>
<td>2016</td>
<td>• Requires maximizing the use of flow control BMPs.</td>
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Low Impact Development (LID’s) = Flow Control BMPs

- Preservation and use of native vegetated surfaces to fully disperse runoff
- Use of other pervious surfaces to disperse runoff
- Roof downspout infiltration
- Permeable pavements
- Bioretention
- Limited infiltration systems
- Reduction of development footprint.
Questions???