Regional Wastewater Services Plan and Conveyance System Improvement Program Planning Assumptions

PRESENTED TO:

ENGINEERING AND PLANNING SUBCOMMITTEE OF THE METROPOLITAN WATER POLLUTION ABATEMENT ADVISORY COMMITTEE

OCTOBER 3, 2013

King County

Department of Natural Resources and Parks
Wastewater Treatment Division

Schedule for Briefings with E&P

Date	Planned Topic
May 2, 2013 COMPLETED	Overview of process to update planning assumptions
June 6, 2013 COMPLETED	Future population, planning horizon, and water conservation assumptions
August 1, 2013 COMPLETED	Sewered area growth rate and average wet-weather I/I degradation rate
September 5, 2013 COMPLETED	Follow-up from May 2, June 6, and August 1 discussions
October 3, 2013	New system I/I and Peak I/I degradation rate -- procedures
November 7, 2013	New system I/I and Peak I/I degradation rate Follow-up from previous meetings as needed

Today's Presentation

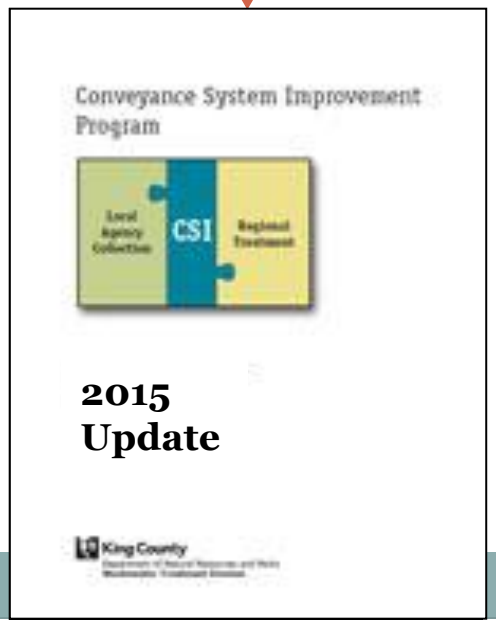
- Discussion of WTD procedure to develop peak I/I planning assumptions:
  - flow monitoring
  - model calibration
  - peak I/I standard
  - calculation of peak I/I
  - degradation rate associated with peak I/I
- New system I/I
- Next steps

Update of Planning Assumptions

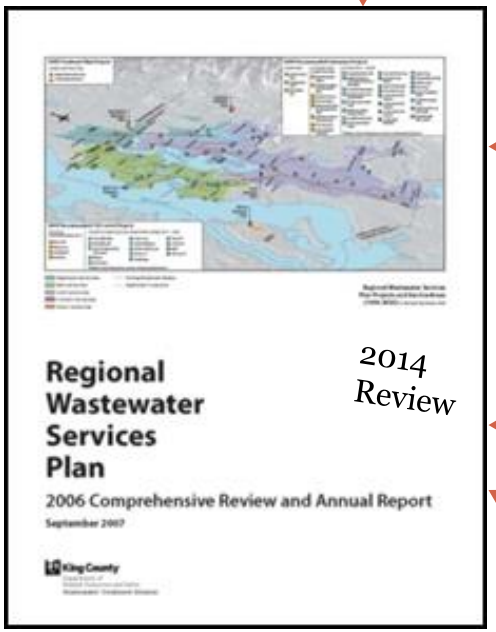
Regional Conveyance System Needs Assessment

Conveyance System Improvement Project Identification

Prioritize Projects and Update Cost Estimates



Treatment Plant Flow Projections

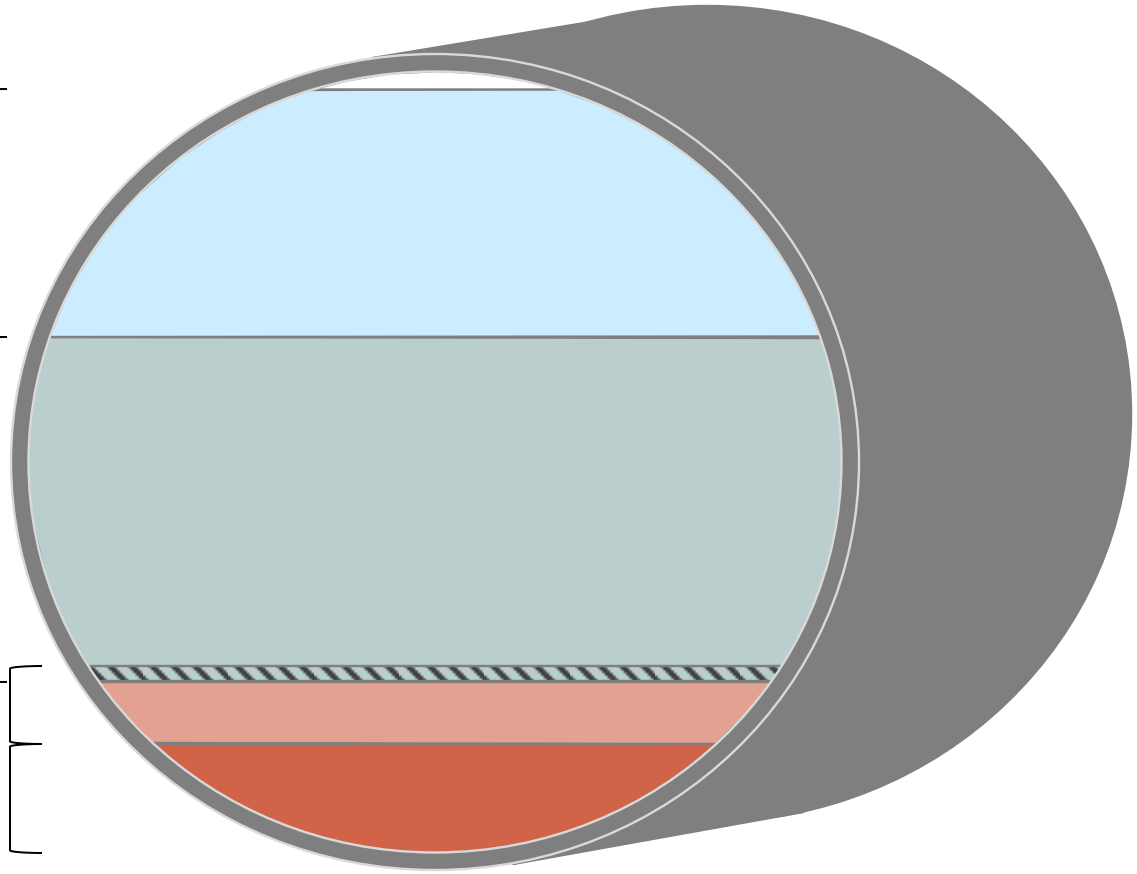


Review of RWSP Programs & Policies

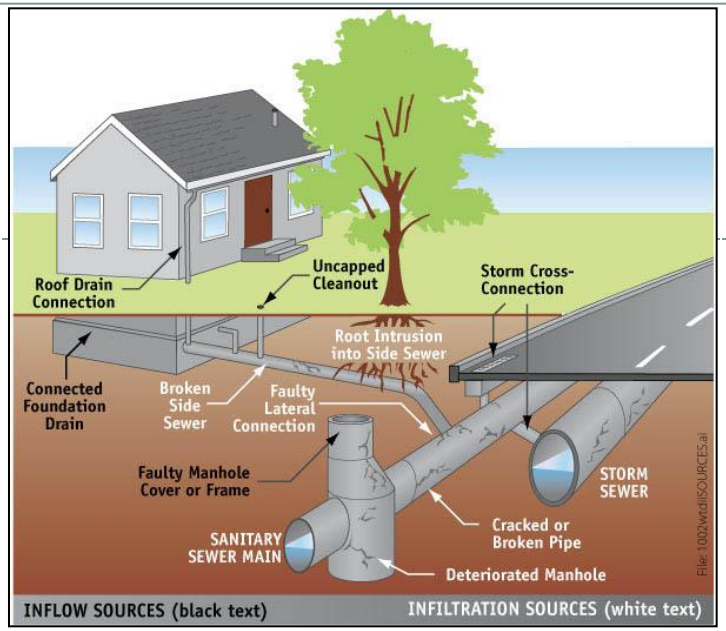
Review of Asset Management Assumptions

Review of Technology & Regulatory Trends

Components of Future Flows



Assumption: Peak I/I Degradation



Previous Assumption: WTD assumes that I/I degradation starting in 2000 would be 7 percent per decade, with a limit of 28 percent over a 40-year period.

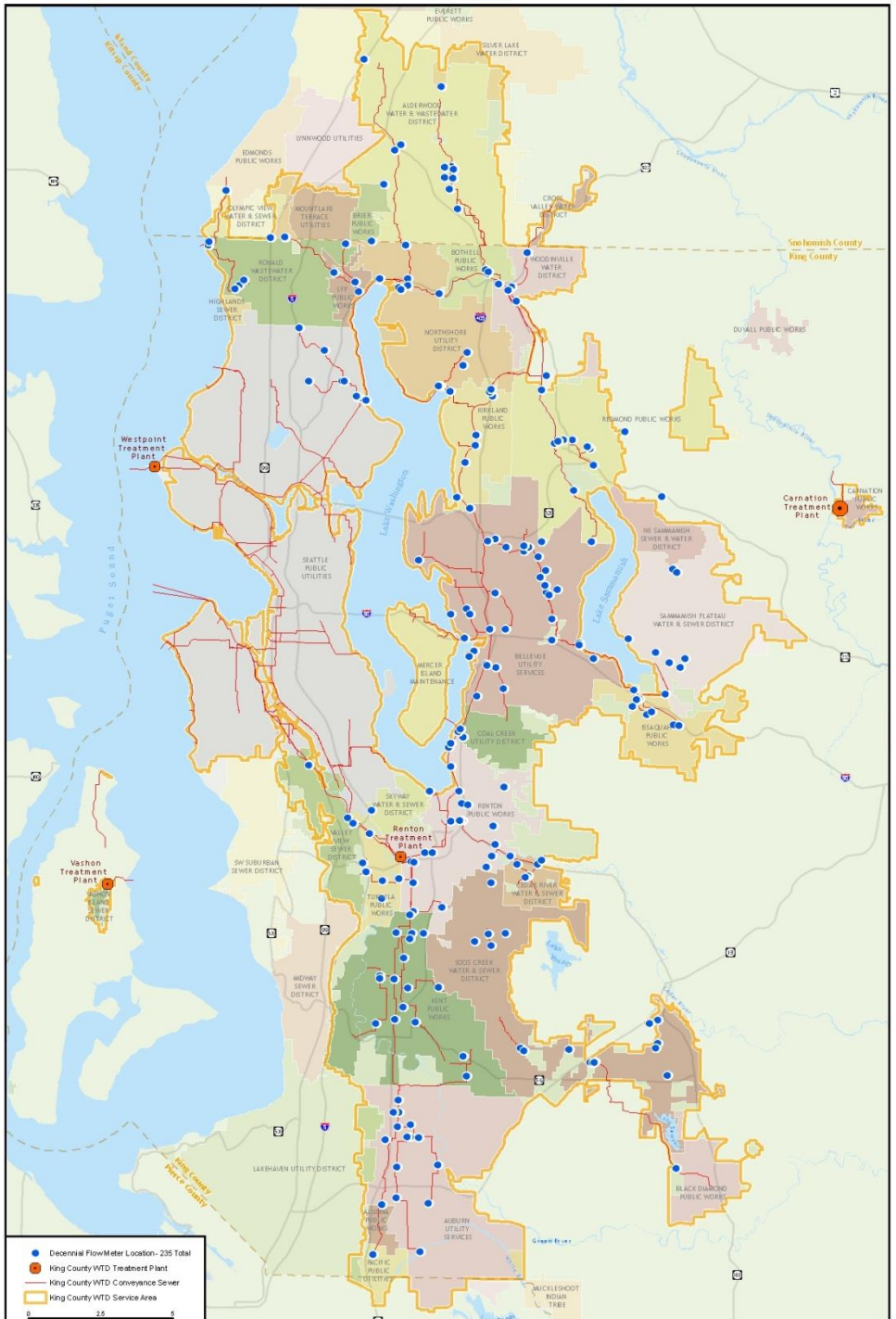
Applied to: Peak I/I rate

Process to update: Identify model basins with minimal change in previous decade. Compare calculated peak I/I rates with previously documented I/I rates.

Flow Monitoring

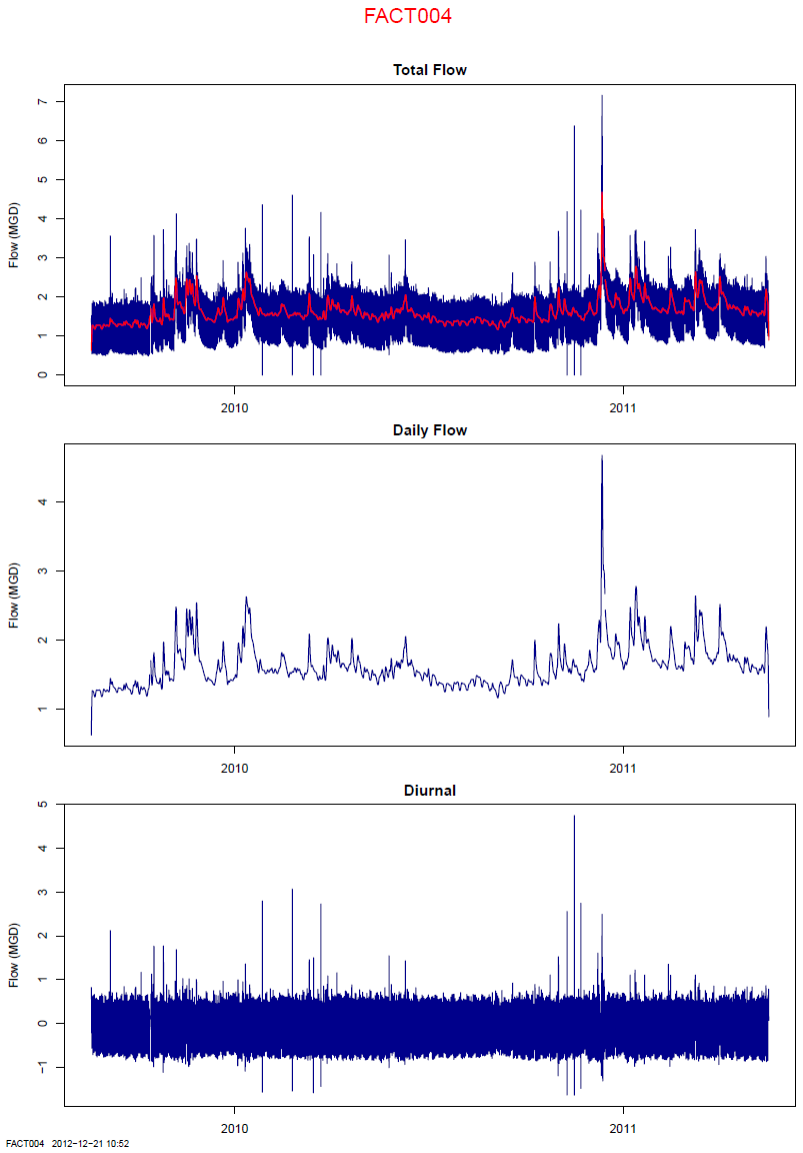
- Separated conveyance system
- 235 flow monitors in place over 2 wet seasons
  - Decennial Flow Monitoring Program
  - Local agency flow data
  - King County project verification flow meters
  - Flow meters at King County pump stations
- September 2009 – May 2011
- Effort to minimize meter downtime

Decennial Flow Monitoring

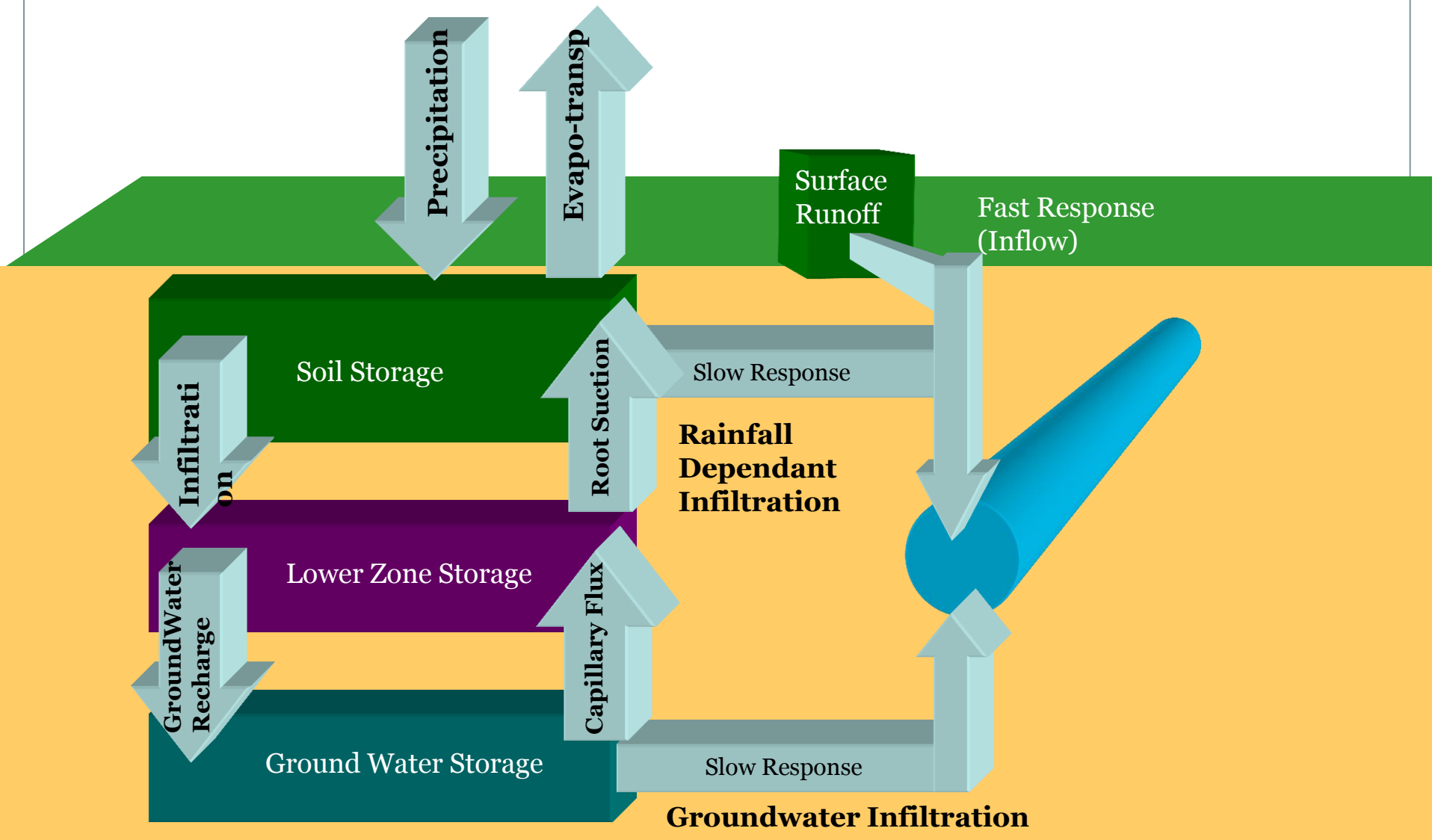


Flow Monitoring

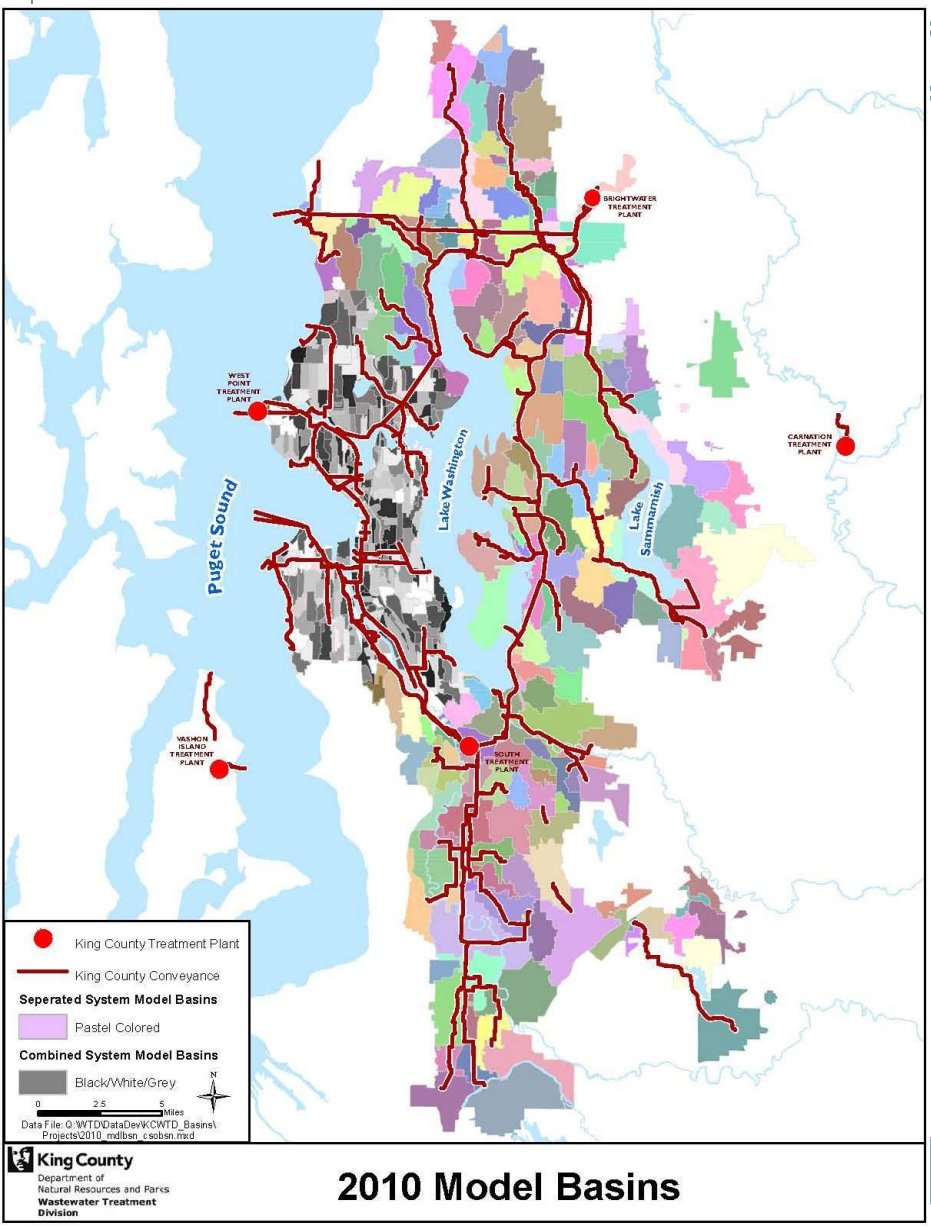
- Example data set
- Total flow separated into:
  - Daily Average
  - Daily Variation
- Daily flow used to identify calibration periods
- Daily Variation used to check data quality and meter consistency



Hydrologic Model Schematic



Model Basins

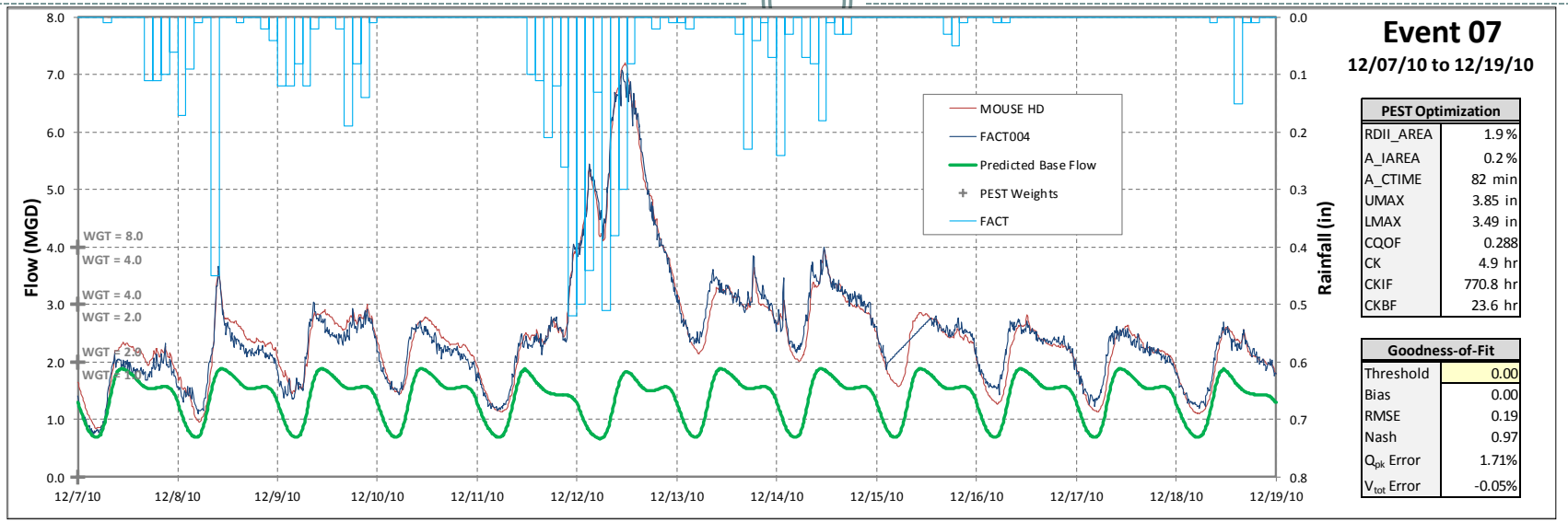


- Monitor 150 modeling basins in separated system
- Provides flow information for updated peak I & I estimates

Model Calibration

- DHI MOUSE model (now MIKE Urban)
- Calibrated 11 parameters to flow meter data
- Parameter Estimation with PEST
- Rain data from nearest of ~75 gauges
- Selected 10, ~2 week events for calibration
  - includes at least one dry period for dry weather flow calibration
- Increased weighting on matching high flows

Model Calibration - Example

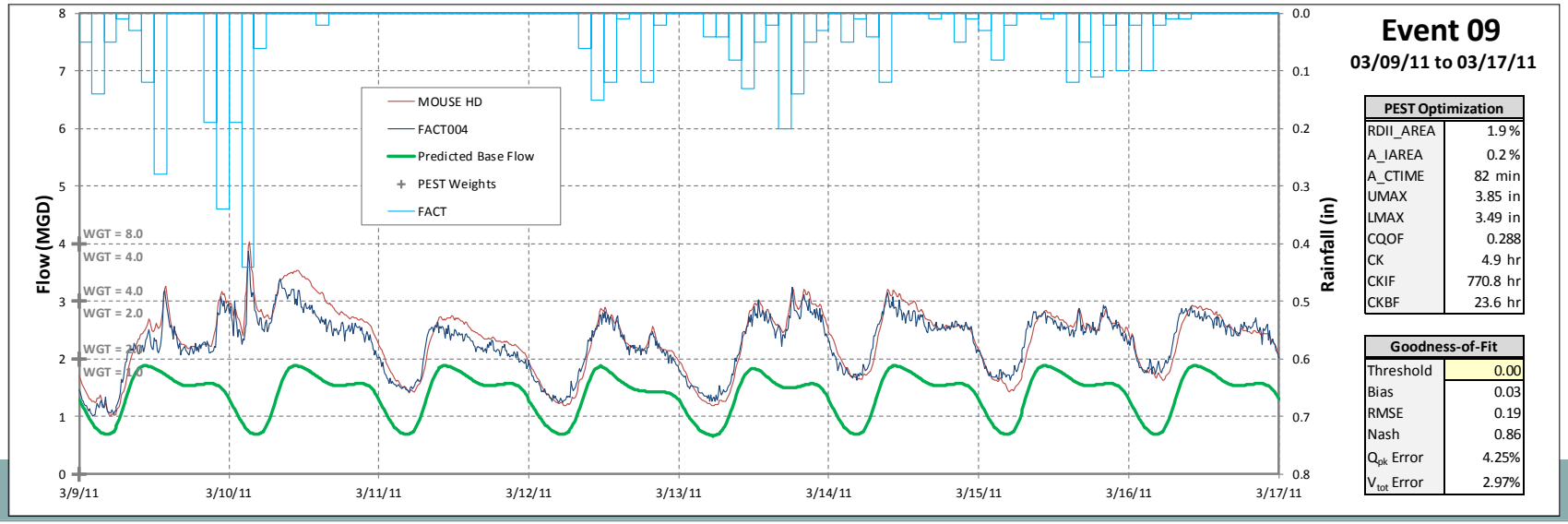


Event 07

12/07/10 to 12/19/10

PEST Optimization	
RDII_AREA	1.9 %
A_IAREA	0.2 %
A_CTIME	82 min
UMAX	3.85 in
LMAX	3.49 in
CQOF	0.288
CK	4.9 hr
CKIF	770.8 hr
CKBF	23.6 hr

Goodness-of-Fit	
Threshold	0.00
Bias	0.00
RMSE	0.19
Nash	0.97
Q_{pk} Error	1.71%
V_{tot} Error	-0.05%



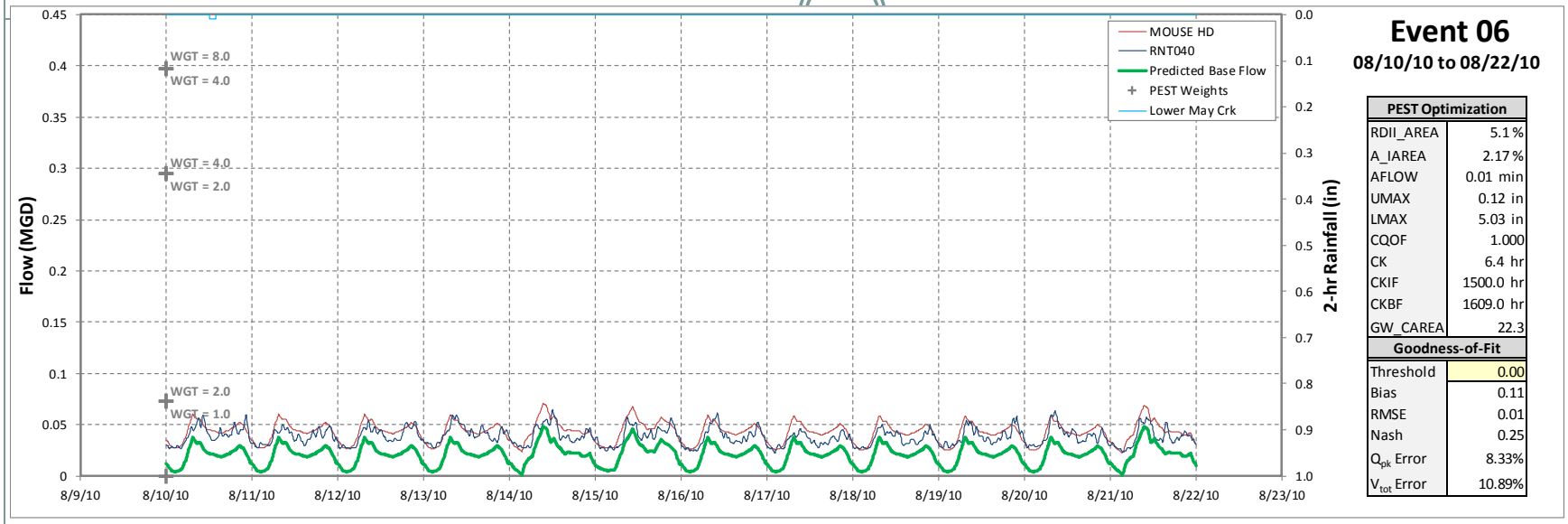
Event 09

03/09/11 to 03/17/11

PEST Optimization	
RDII_AREA	1.9 %
A_IAREA	0.2 %
A_CTIME	82 min
UMAX	3.85 in
LMAX	3.49 in
CQOF	0.288
CK	4.9 hr
CKIF	770.8 hr
CKBF	23.6 hr

Goodness-of-Fit	
Threshold	0.00
Bias	0.03
RMSE	0.19
Nash	0.86
Q_{pk} Error	4.25%
V_{tot} Error	2.97%

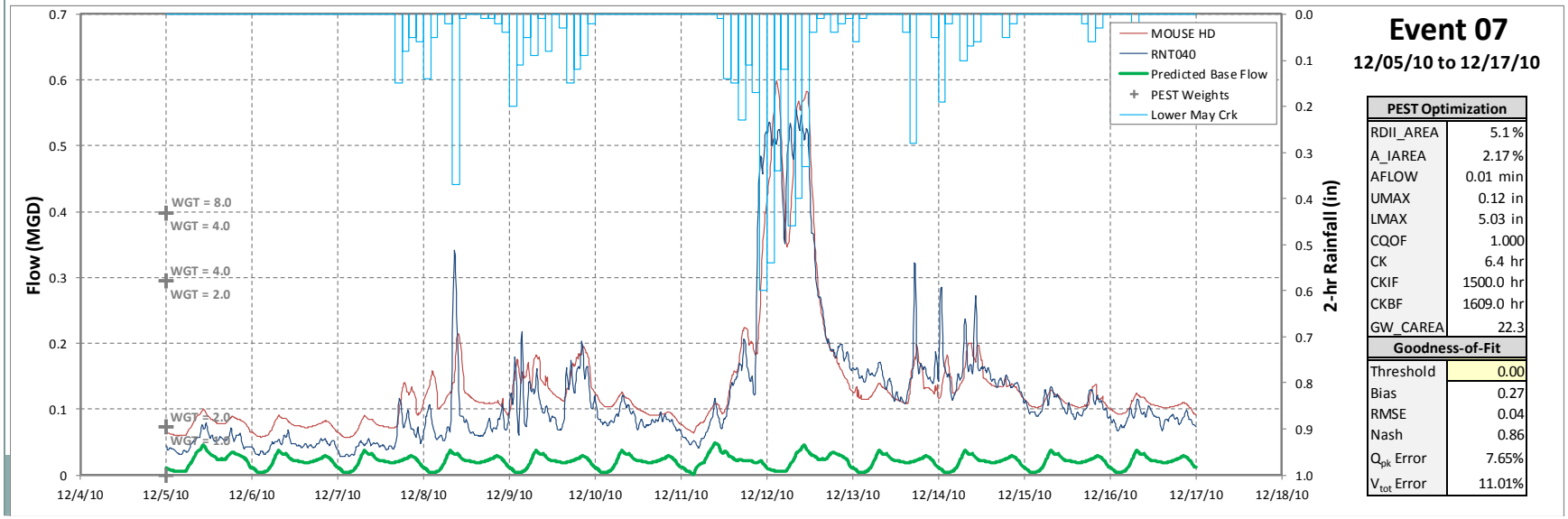
Model Calibration



Event 06

08/10/10 to 08/22/10

PEST Optimization	
RDII_AREA	5.1 %
A_IAREA	2.17 %
AFLOW	0.01 min
UMAX	0.12 in
LMAX	5.03 in
CQOF	1.000
CK	6.4 hr
CKIF	1500.0 hr
CKBF	1609.0 hr
GW_CAREA	22.3
Goodness-of-Fit	
Threshold	0.00
Bias	0.11
RMSE	0.01
Nash	0.25
Q_{pk} Error	8.33%
V_{tot} Error	10.89%



Event 07

12/05/10 to 12/17/10

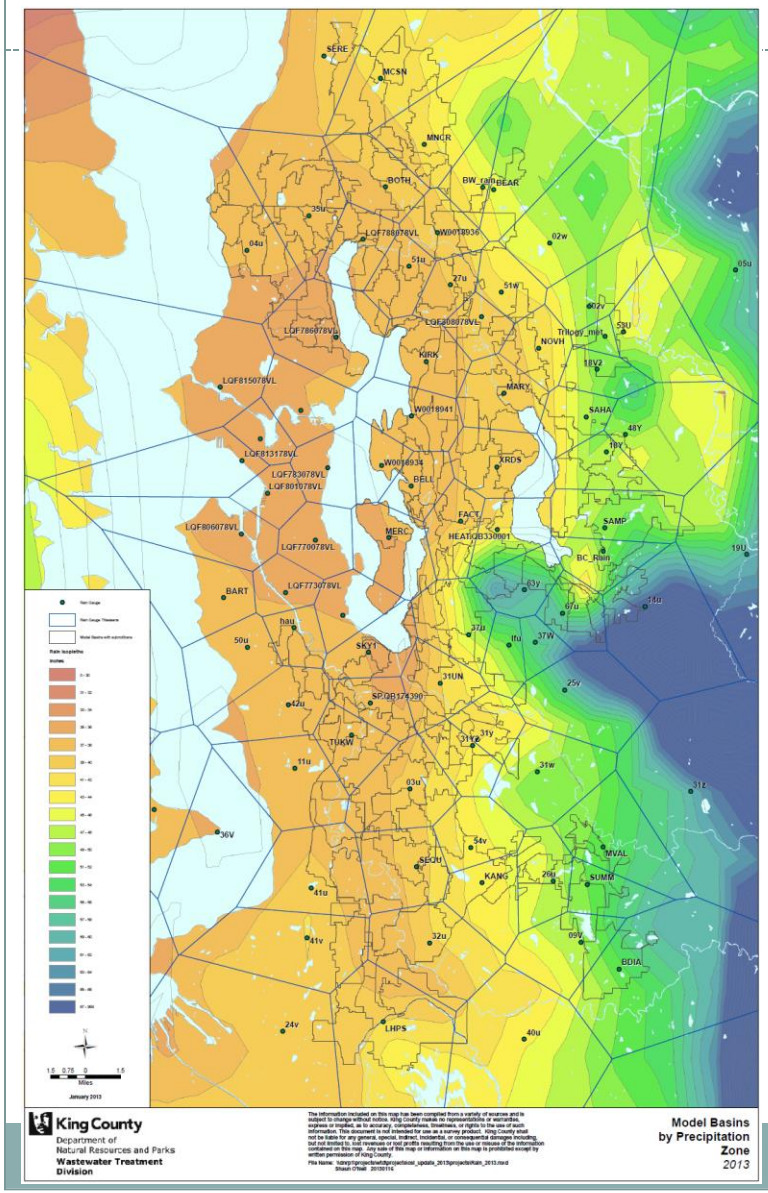
PEST Optimization	
RDII_AREA	5.1 %
A_IAREA	2.17 %
AFLOW	0.01 min
UMAX	0.12 in
LMAX	5.03 in
CQOF	1.000
CK	6.4 hr
CKIF	1500.0 hr
CKBF	1609.0 hr
GW_CAREA	22.3
Goodness-of-Fit	
Threshold	0.00
Bias	0.27
RMSE	0.04
Nash	0.86
Q_{pk} Error	7.65%
V_{tot} Error	11.01%

Model Application

Long Term Simulation of a Calibrated Model

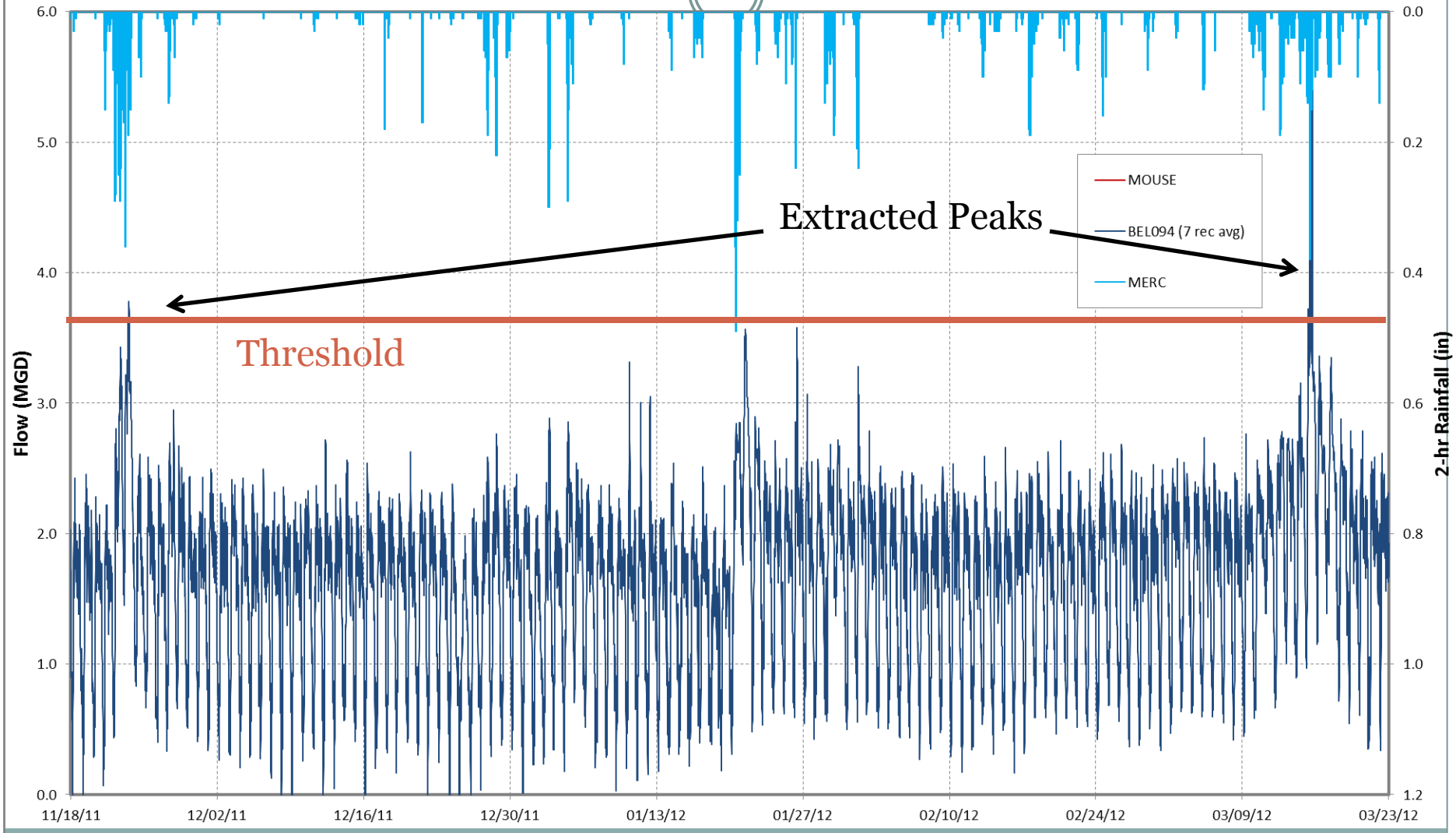
- Calibrate Model to Local Rainfall
- Simulate Using Long Term Rainfall
- Get Flow Peaks from Long Term Simulation
- Apply Probability Analysis to the Peaks

Long Term Rainfall Record

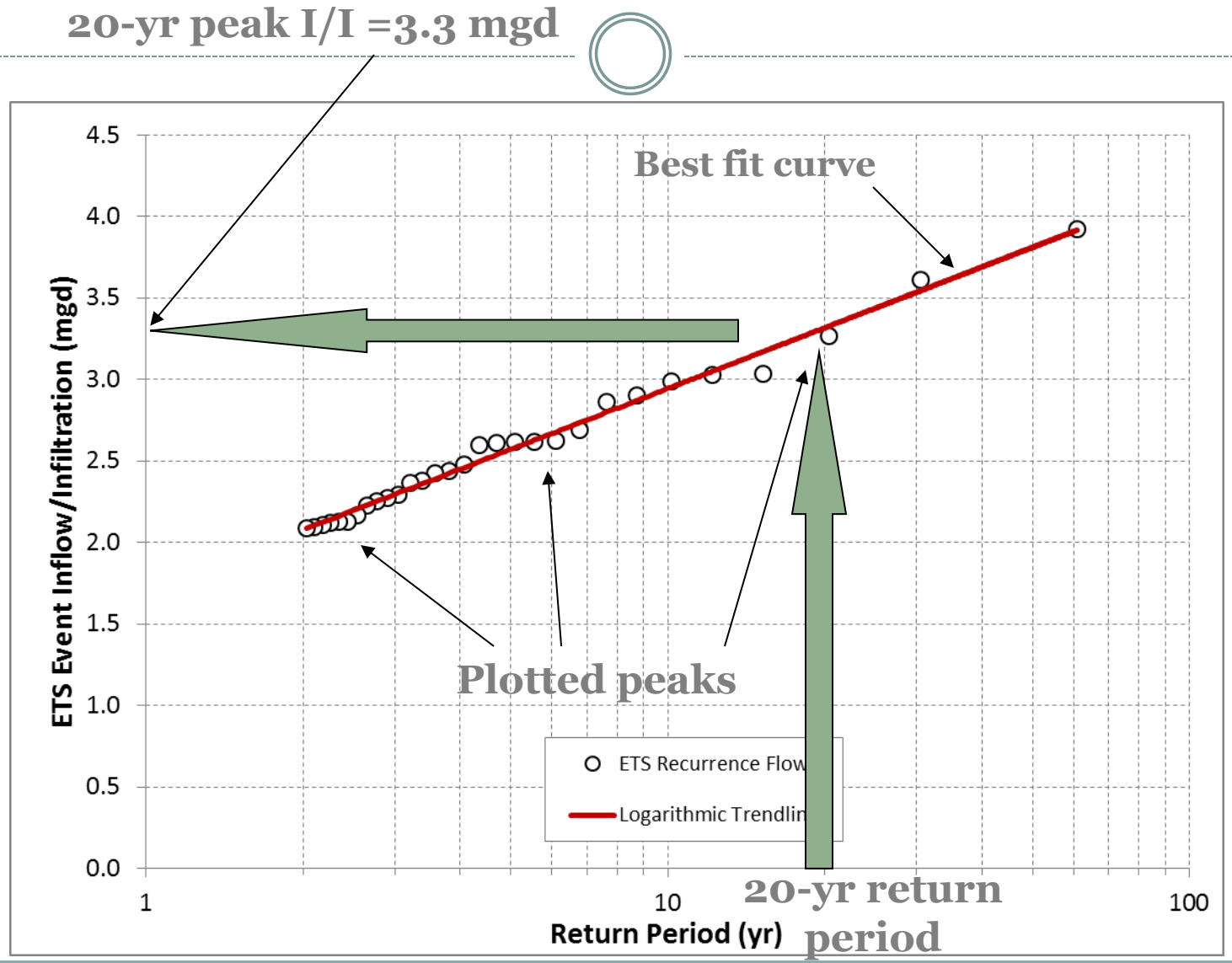


- Local gauges used for calibration
- 60 year record used for simulation
- Seatac rain data since 1940 – adjusted by rain characteristics at Western Washington gauges as grouped by Annual Precipitation

Peak Extraction



Long Term Simulations



Assumption: New System I/I

Previous Assumption: Beginning 20-year peak I/I rate of 1,500 gpad.

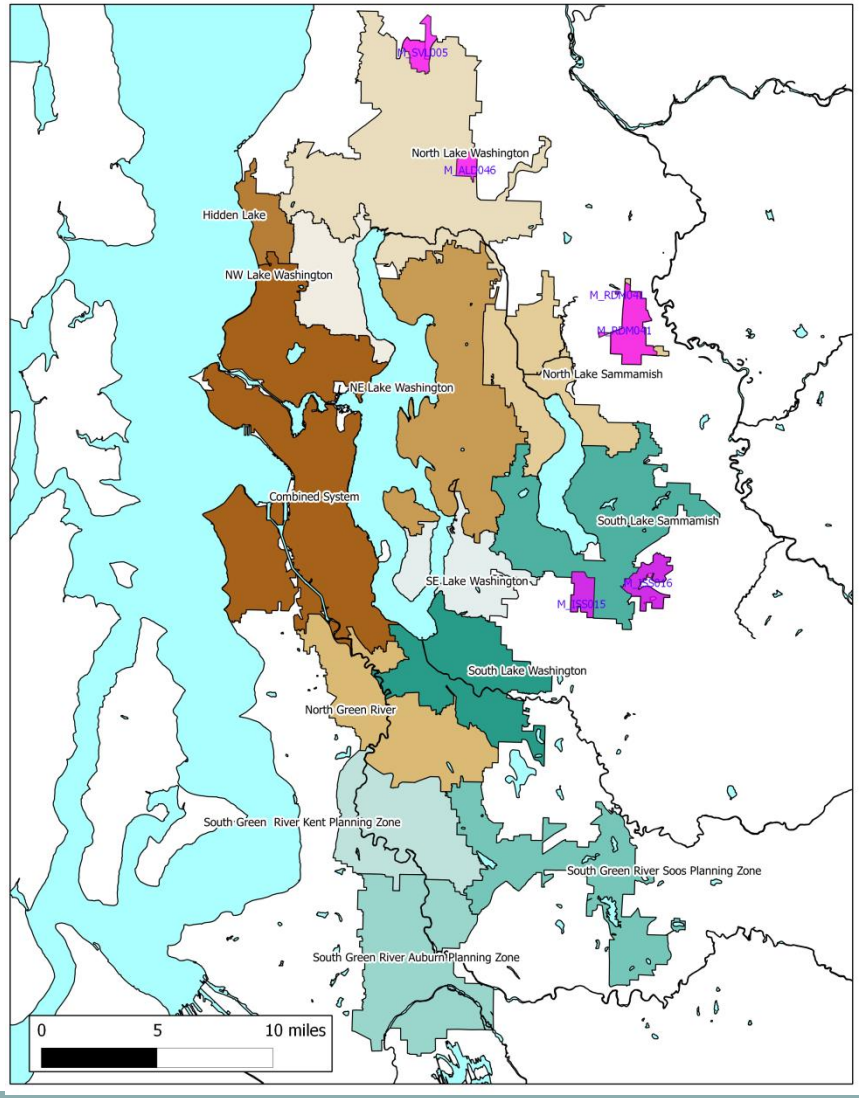
Applied to: Wastewater flow projections

Process to update:

- Basins were identified by comparing air photo and local sewer system GIS data from the 2000-2002 and 2009-2011.
- A total of 5 basins were identified as having all or mostly all new construction since the previous monitoring period.

New System I/I Basins

- 5 Basins:
  - Tallus
  - Issaquah Highlands
  - Redmond Ridge
  - Silver Lake
  - Canyon Creek



Next Meeting/Contacts

- Proposed assumptions:
  - Peak I/I degradation rate
  - New system I/I
- For questions on RWSP Comprehensive Review contact:

  Debra Ross, 206.684.1531 or

  debra.ross@kingcounty.gov
- For questions on CSI Program Update contact:

  Steve Tolzman, 206.263.6185

  steve.tolzman@kingcounty.gov