

Chatfield Watershed Authority Model Update

January 26, 2016



Chatfield
Watershed Authority

Introduction

Project Overview

Phase 1

- Data compilation -> Memo, database

Phase 2

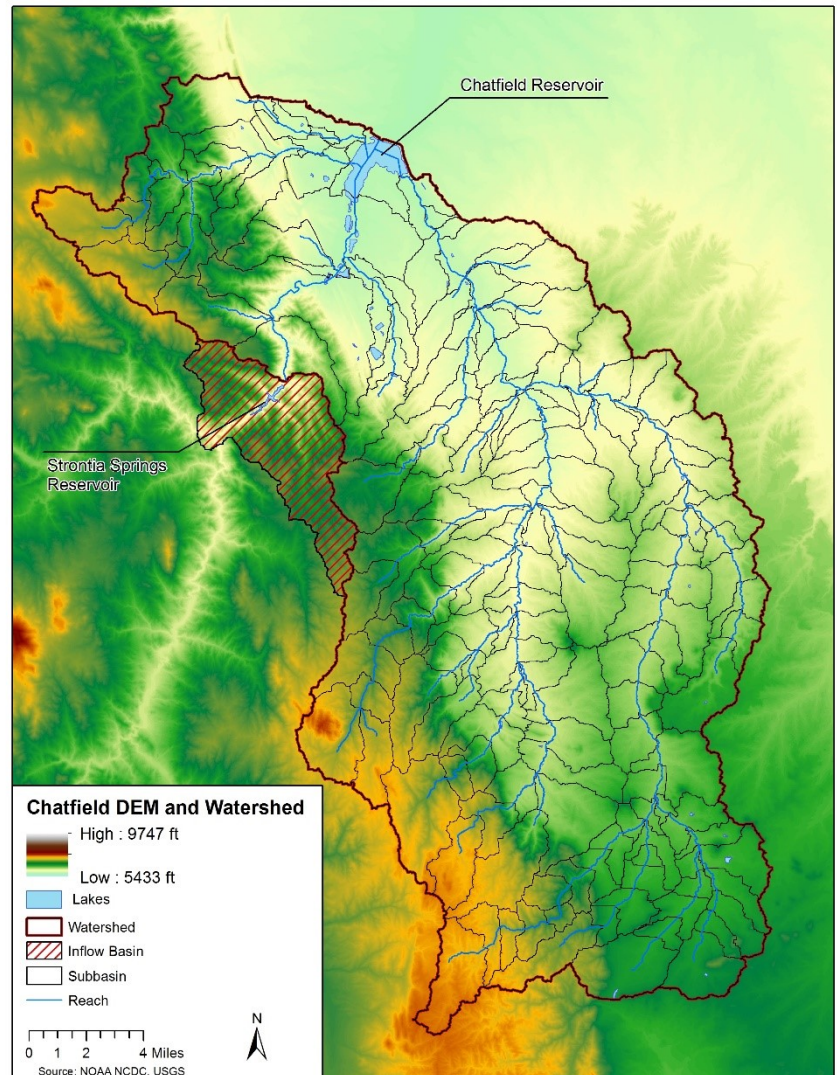
- Model selection -> HSPF
- Build model inputs
- Delineate watershed
- Initial model build
- Model calibration and validation
 - Hydrology, sediment, water quality
- Model results -> Memo

Phase 3

- Model training

Watershed Delineation and DEM

- Watershed delineated according to best practices for the HSPF model
 - 160 subbasins, 160 reaches
- Additional considerations:
 - USGS flow monitoring locations
 - Land use
 - Topography
 - Water quality sampling
 - Point sources
 - Diversions



Model Segmentation

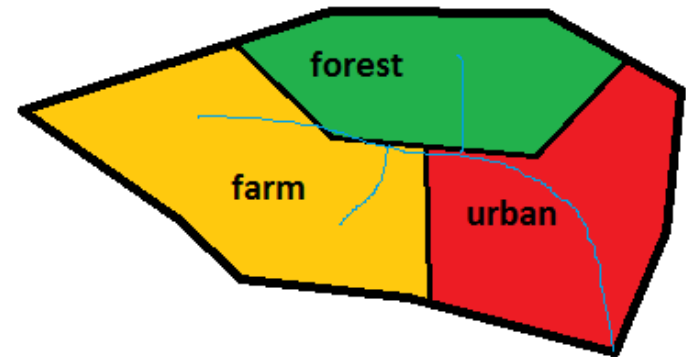
Overview

- Model segments are the way HSPF incorporates spatial data into an otherwise “lumped” parameter model
- Capture the variability of the watershed in a simplified manner

- Example

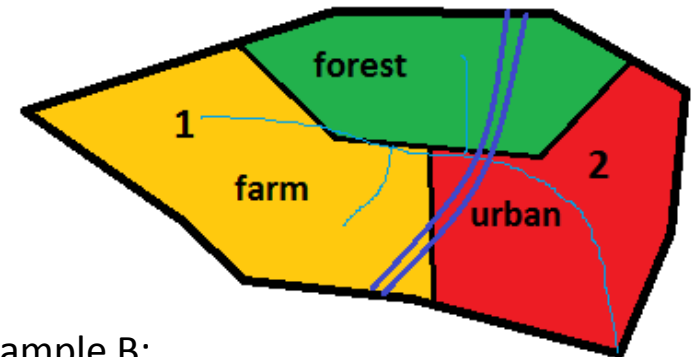
A: If there were 1 model segment, the model would be parameterized according to the different land uses. Assuming 3 land use categories, there would be $1 * 3 = 3$ different pieces to parameterize

B: If there were 2 model segments and 3 land use types, there would be $2 * 3 = 6$ different parameter sets



Example A:

$1 \text{ segment} * 3 \text{ land uses} = 3 \text{ parameter sets}$



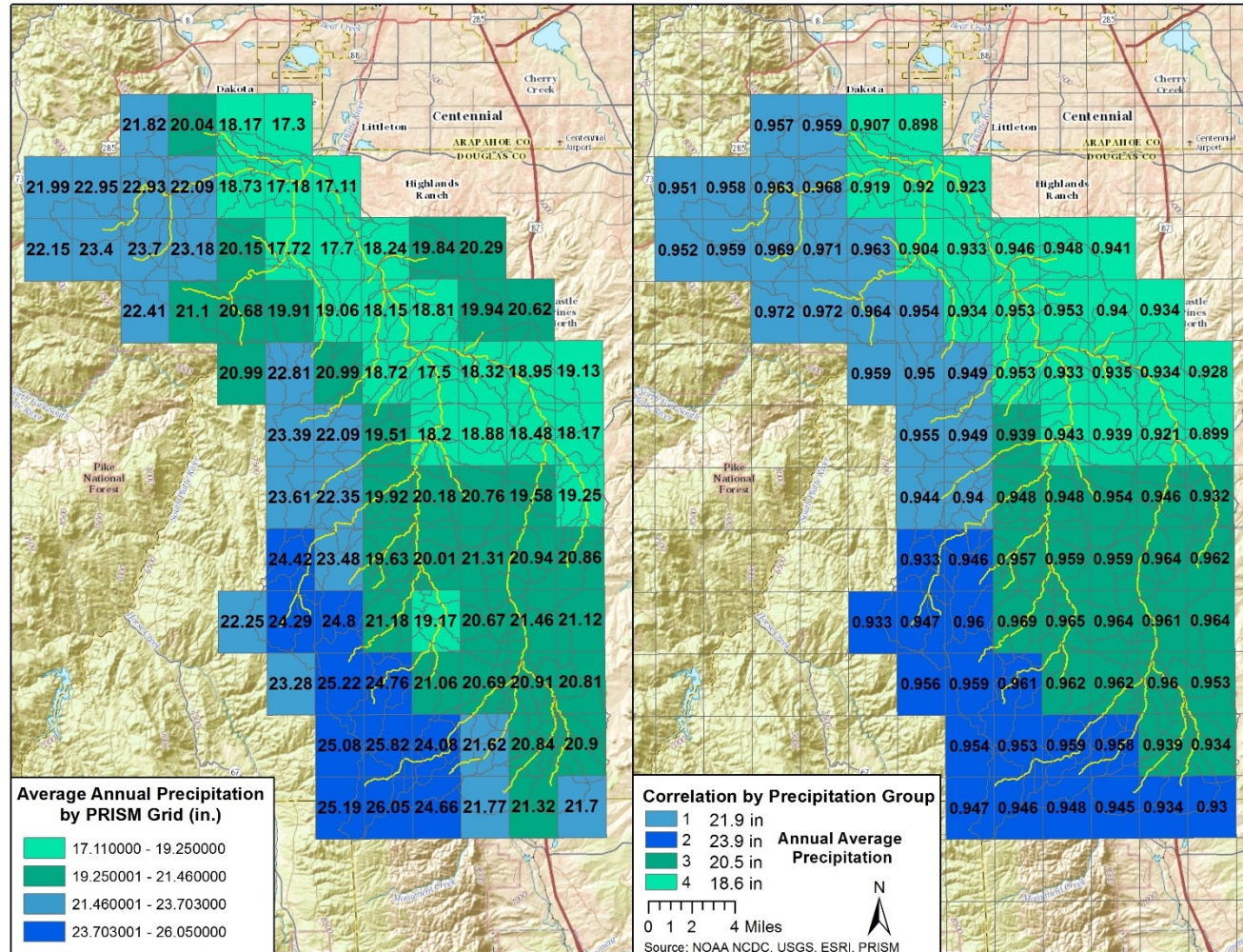
Example B:

$2 \text{ segments} * 3 \text{ land uses} = 6 \text{ parameter sets}$

Model Segmentation – Precipitation

Precipitation Analysis

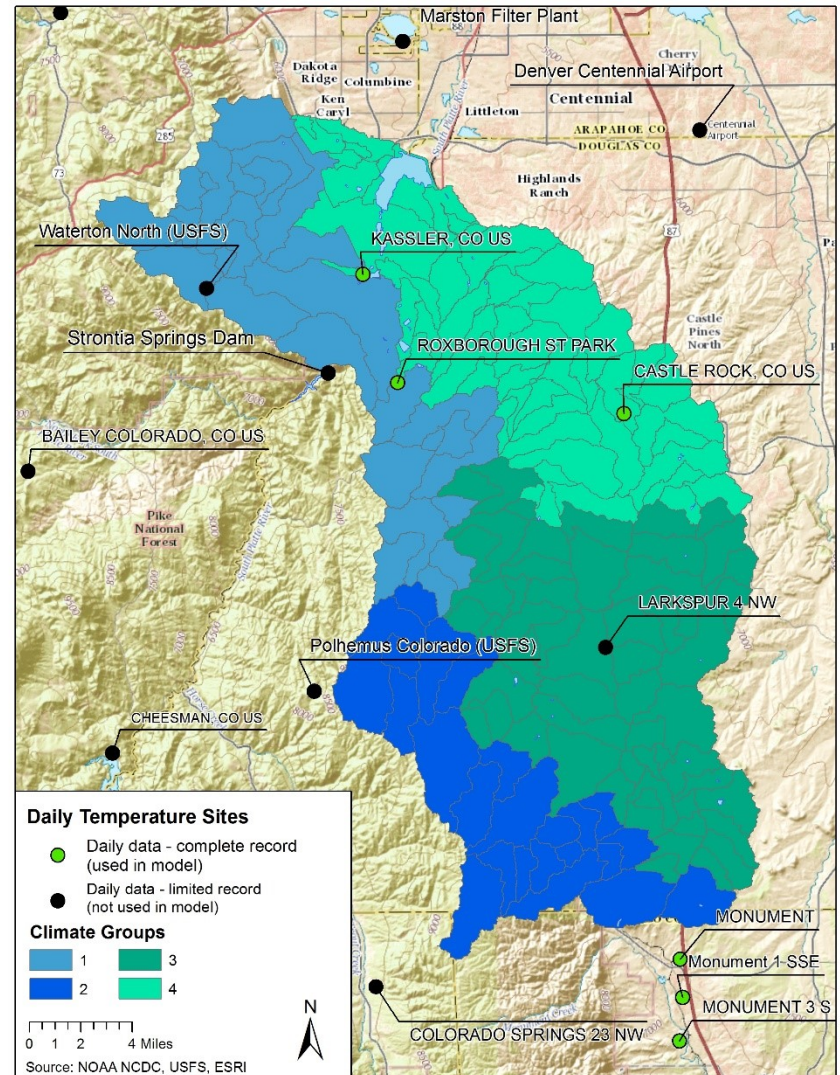
- Daily observed precipitation (NOAA) was compared to daily gridded PRISM precipitation (Oregon State University)
 - Highly correlated
- PRISM grid cells were used to determine spatial correlation
- PRISM grid cells were grouped based on average annual precipitation and spatial correlation
- Weighted average daily precipitation used for each climate group (1-4)



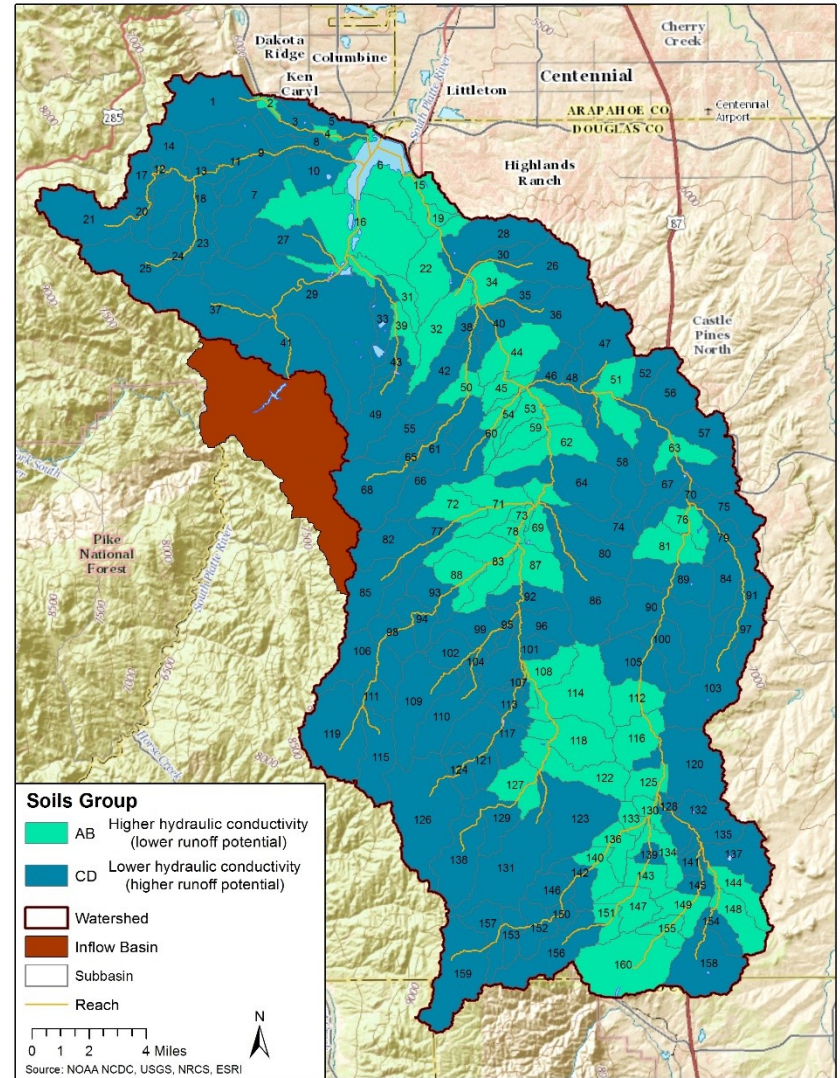
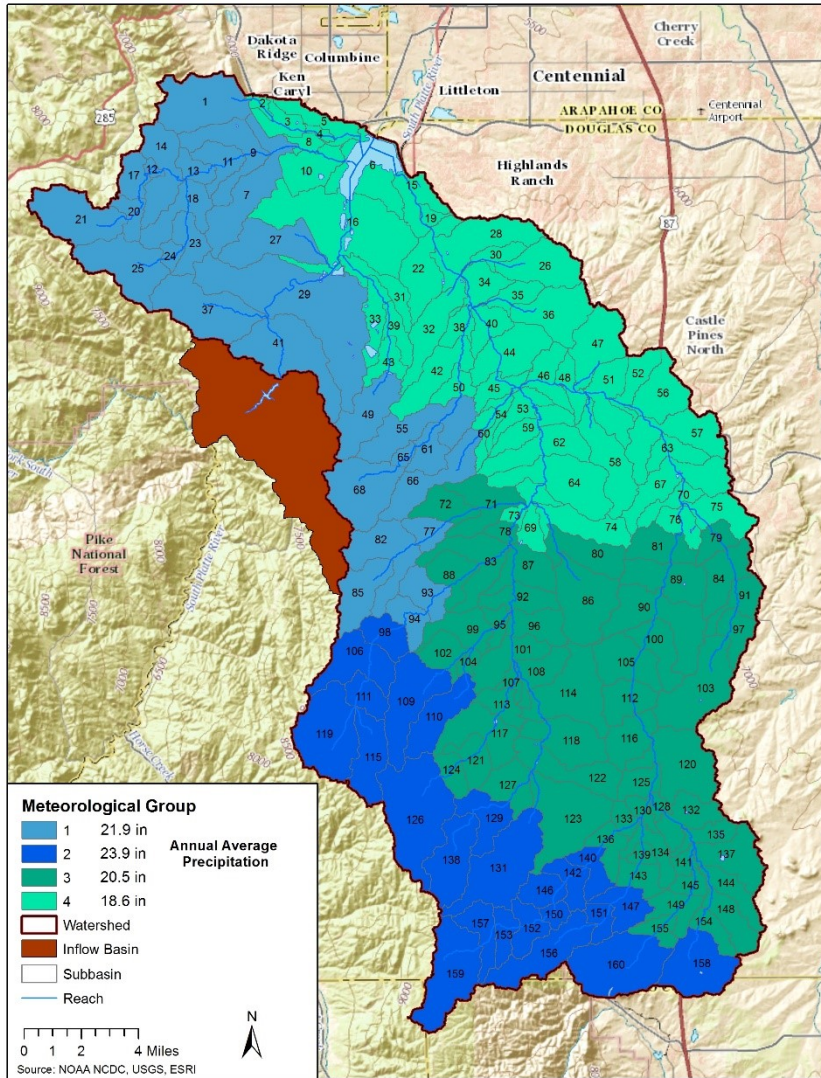
Model Segmentation – Temperature

Temperature Analysis

- 5 long-term temperature stations near the watershed
 - Kassler, Roxborough, Castle Rock, Strontia Springs, and Monument
- Final Temperature Groups
 - Group 1: Roxborough (elevation adjusted in HSPF)
 - Group 2: Monument (elevation adjusted in HSPF)
 - Group 3: Average of Roxborough and Castle Rock matched seasonality of Larkspur and correlated well
 - Group 4: Average of Kassler and Castle Rock



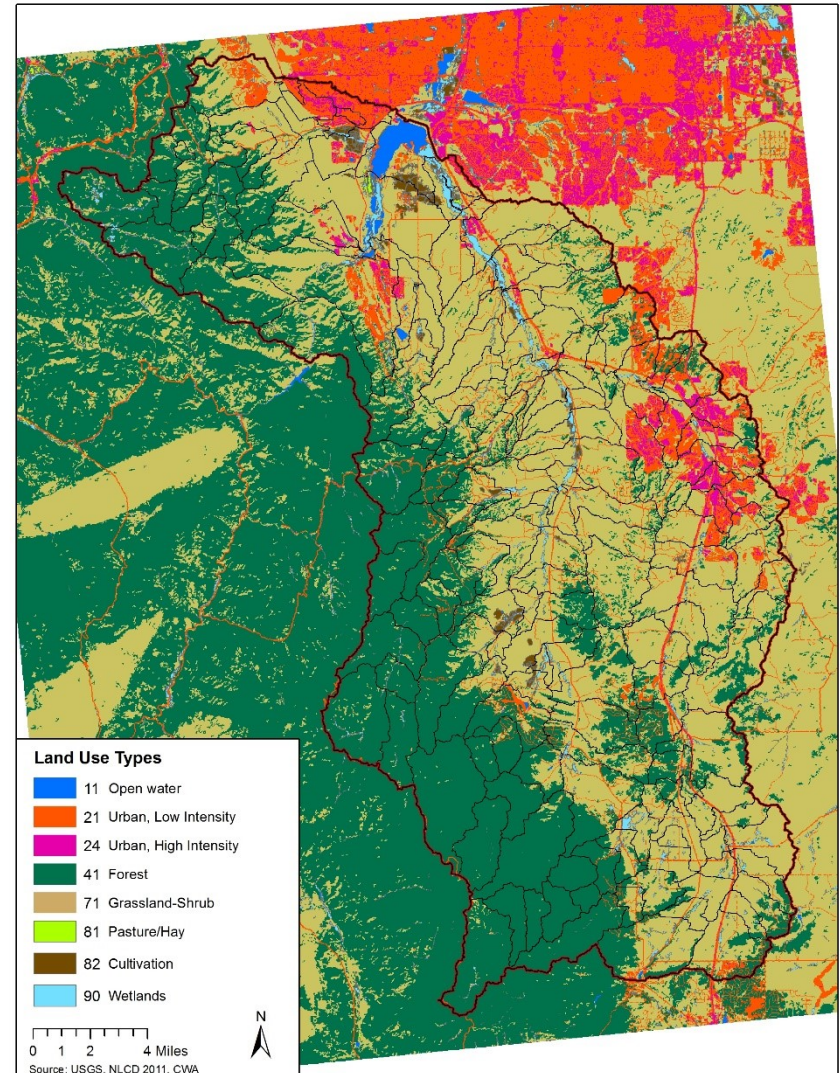
Model Segmentation – Final



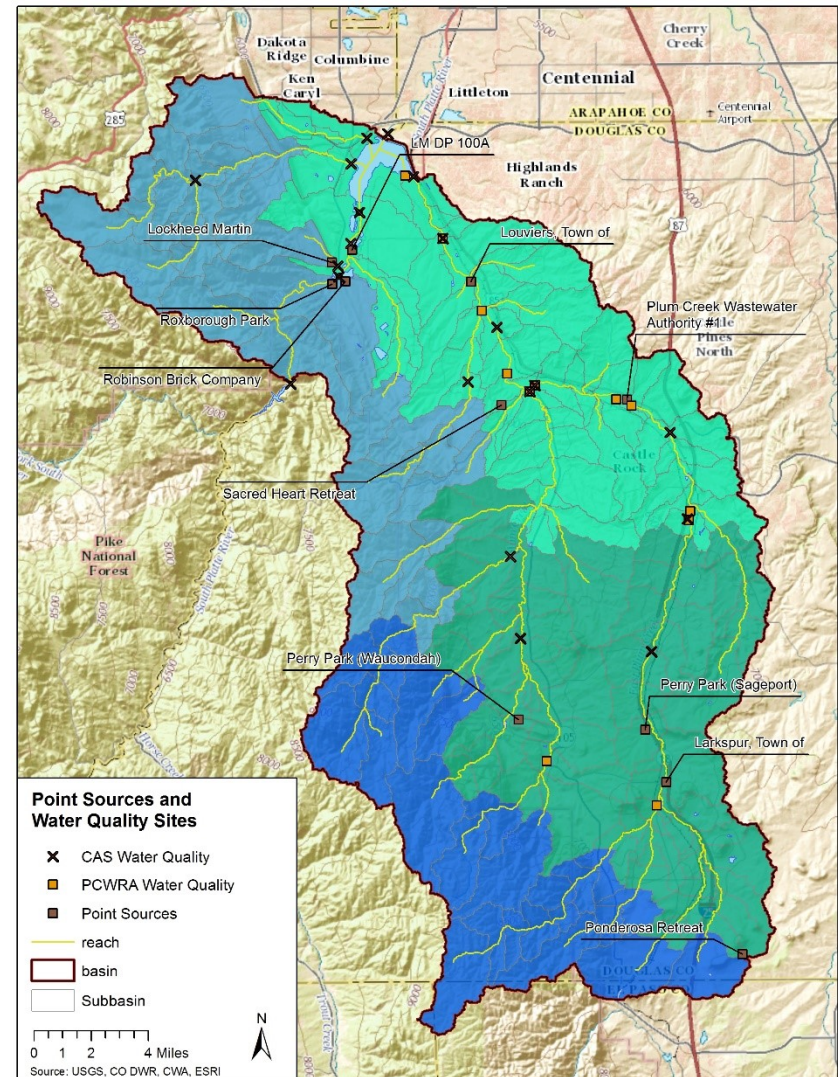
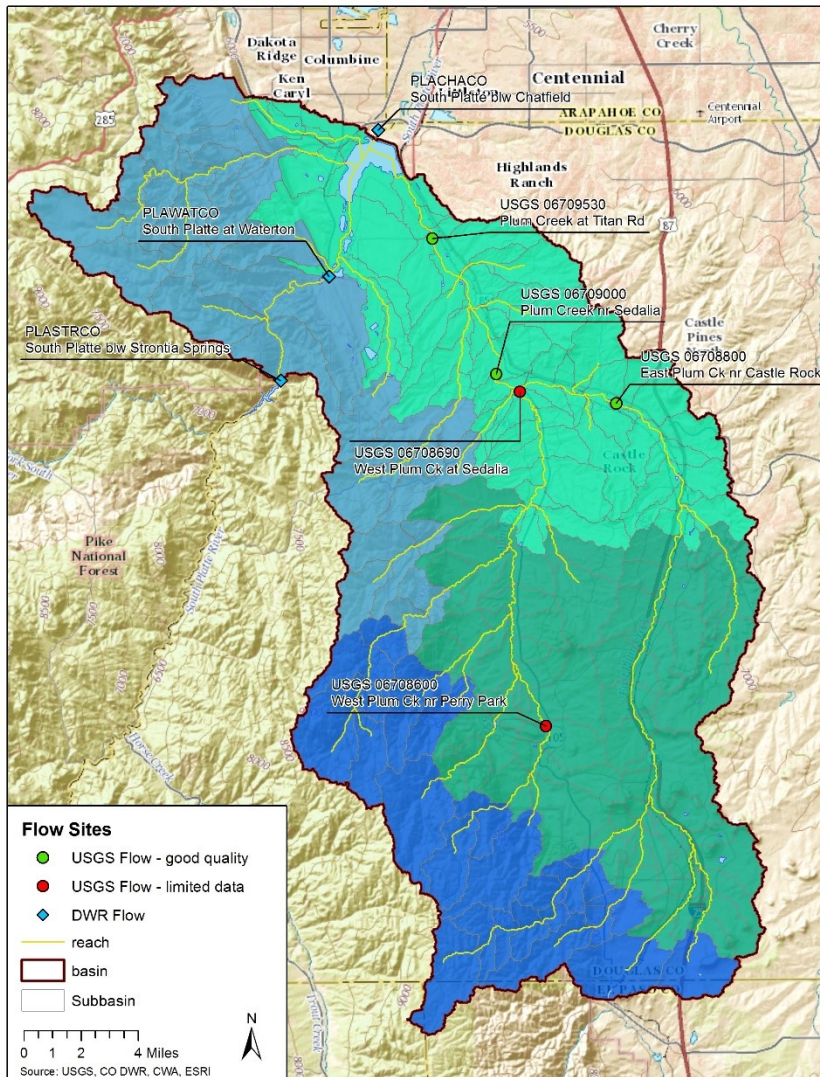
Land Use

Total Watershed Area = 419.15 mi²

- Open water = 2.64 mi² (0.63%)
- Urban, low density = 34.8 mi² (8.3%)
 - 20% imperviousness
- Urban, high density = 7.45 mi² (1.8%)
 - 65% imperviousness
- Forest = 155.2 mi² (37.0%)
- Grassland-Shrub = 205.7 mi² (49.1%)
- Pasture/Hay = 0.38 mi² (0.09%)
- Cultivation = 3.20 mi² (0.76%)
 - Updated with CDSS irrigated lands
- Wetlands = 9.73 mi² (2.32%)



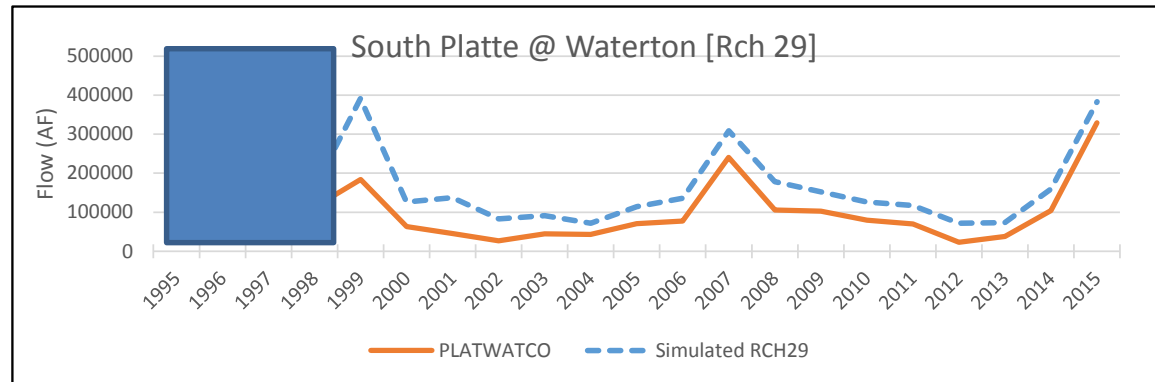
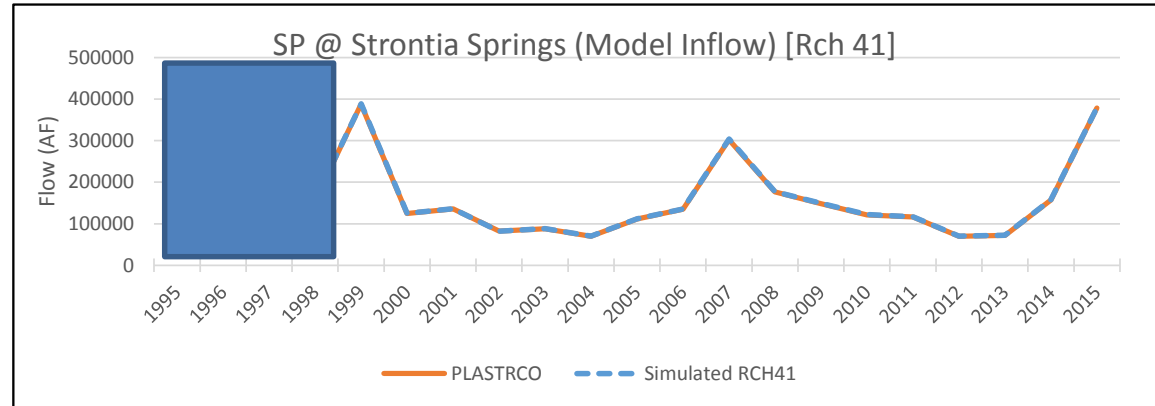
Flow and Water Quality



Initial Hydrologic Calibration

South Platte River

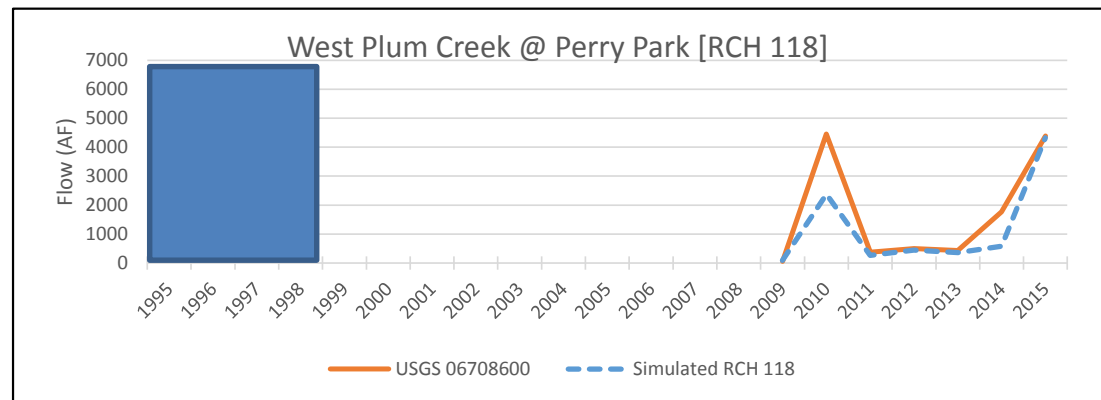
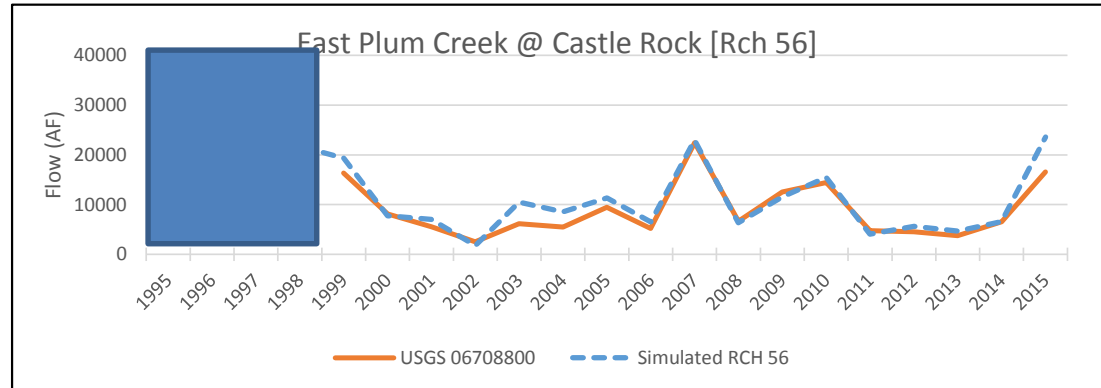
- Outflow from Strontia Springs Reservoir has been added as model inflow
- South Platte River at Waterton Canyon matches the shape of historical flow, but is biased high
 - Diversions still need to be removed from the South Platte River



Initial Hydrologic Calibration

Plum Creek Tributaries

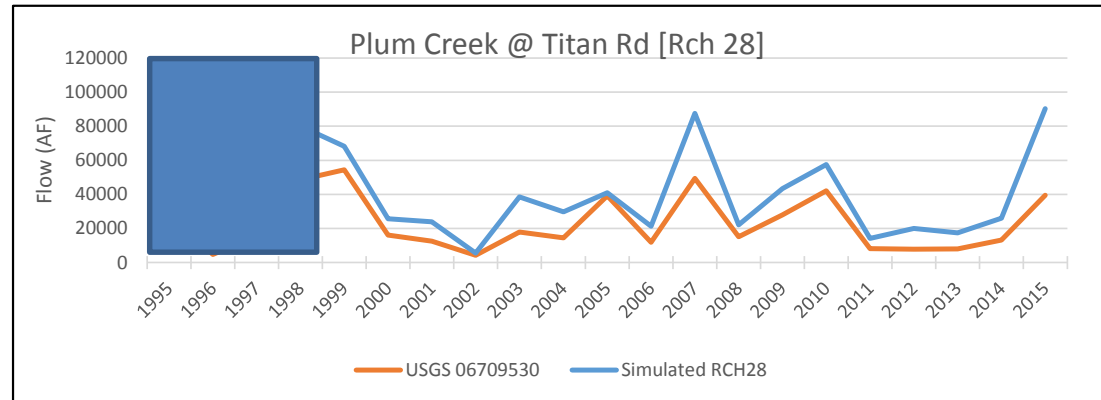
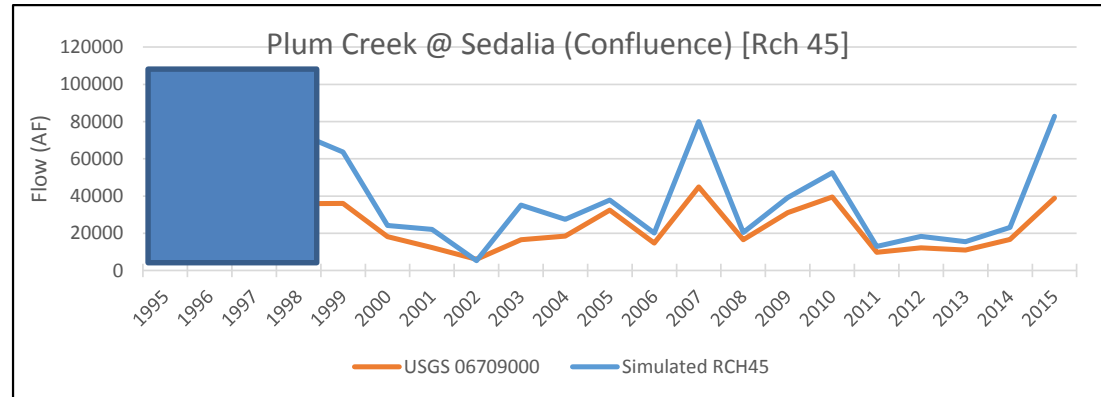
- East Plum Creek at Castle Rock matches well with historical USGS record
- West Plum Creek at Perry Park matches fairly well with (limited) historical USGS record
 - This gage is operated April - September beginning in 2009



Initial Hydrologic Calibration

Plum Creek

- Plum Creek at Sedalia and Plum Creek at Titan Road are similar due to drainage areas and geographic proximity
- Initial results are biased high for both calibration sites
 - We know there is strong interaction with the groundwater, which causes river to go dry
 - Model spin up period is 1995-1998



Looking Ahead

Model Calibration and Validation

- Finalize hydrologic calibration
- Calibrate sediment in model
- Calibrate water quality in model
- Deliver calibrated model and model report

Extras

Online Watershed Map

<http://arcg.is/1PxQQkH>

