Hangman Creek TMDL

- **Phosphorus –** a quick review of sources and processes
- **WARMF model** – a quick overview
- **Scenario results**
- **Where do we go from here?**

Phosphorus Sources

- ✓ Soils and underlying geology
- ✓ Air particulates – burning, hydrocarbon exhaust, windborne dust
- ✓ Decaying vegetation and organic materials
- ✓ Municipal Wastewater treatment plants
- ✓ On-site (septic) systems

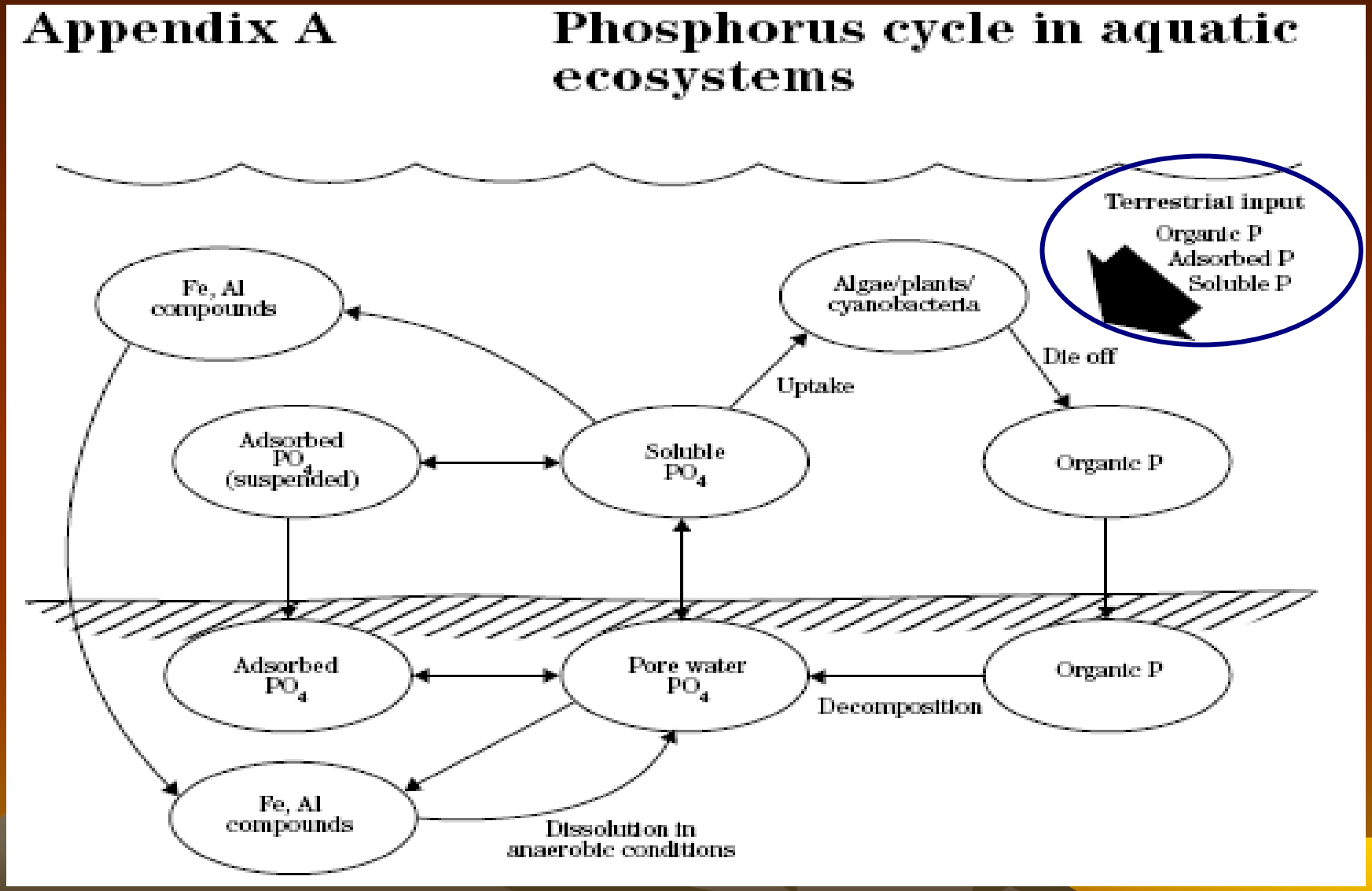
Phosphorus Sources (continued)

- ✓ Industrial and commercial processes
- ✓ Stormwater run-off
- ✓ Fertilizers
- ✓ Manure

Phosphorus Transport

- ✓ Soil erosion – water and wind
- ✓ Stormwater run-off
- ✓ Streambank and bed erosion
- ✓ Fallout – dry and rainfall
- ✓ Point source collection and discharge systems
- ✓ Groundwater

Aquatic Phosphorus Cycle



WARMF Model

- WARMF = Watershed Analysis and Risk Management Framework
- Multiple sub-watershed loads individually run and linked by a stream course network.
- Stream channel erosion and other water quality features simulated in the stream course network.
- Daily time-step loads calculated

WARMF Model Structure

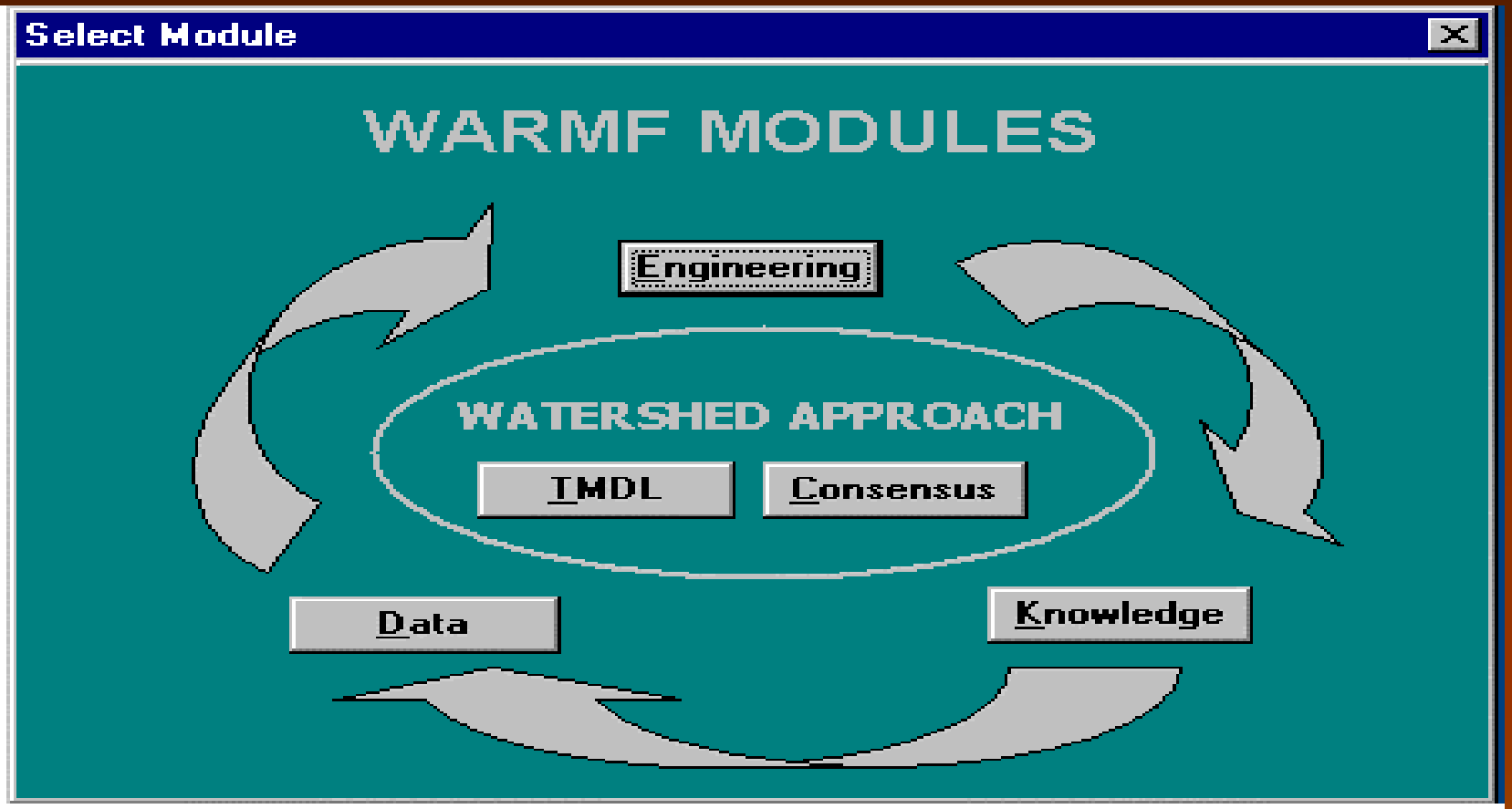
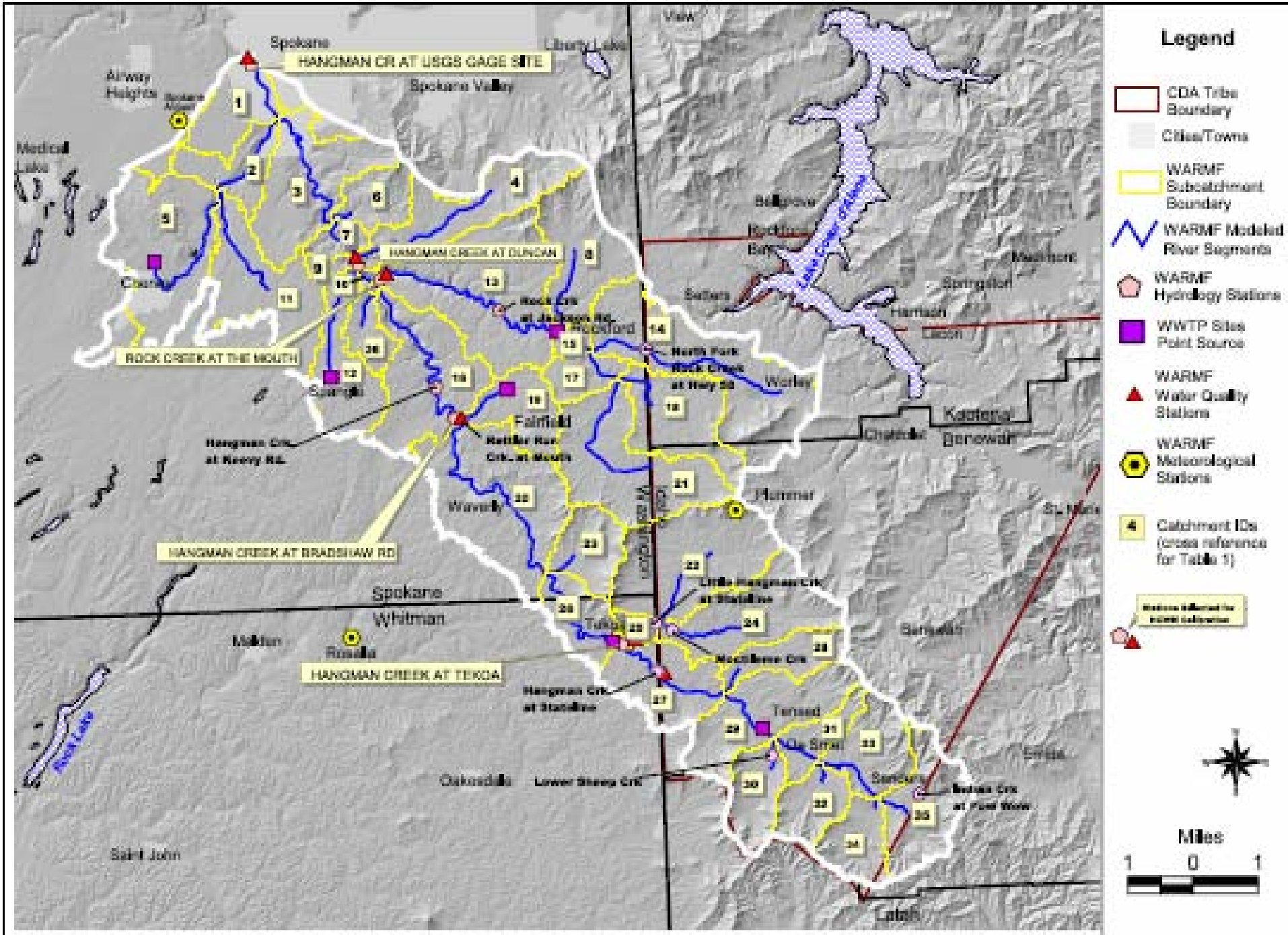
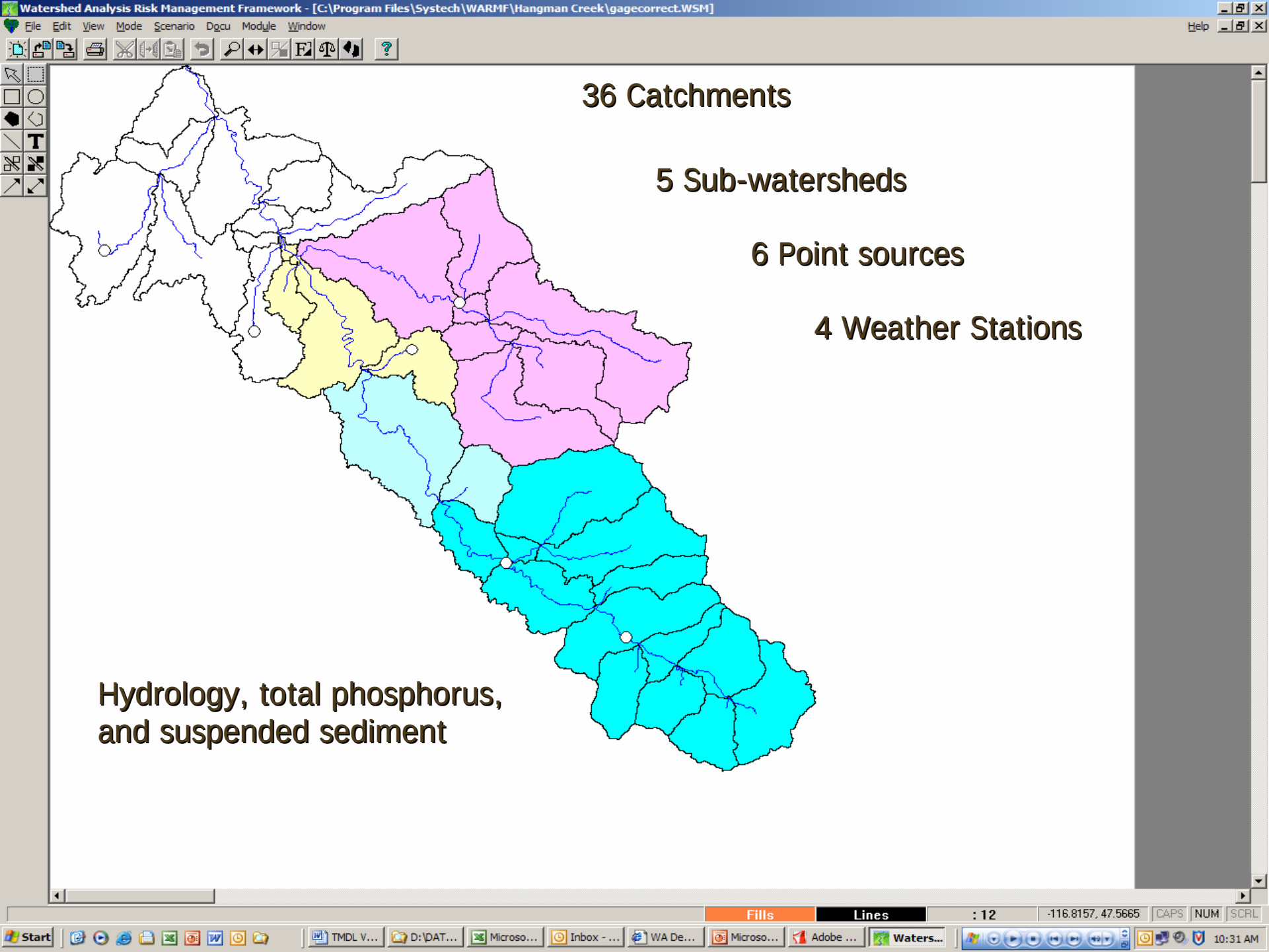


Figure 2.1
The Five Modules of WARMF.



Legend
CDA Tribe Boundary
Cities/Towns
WARMF Subcatchment Boundary
WARMF Modeled River Segments
WARMF Hydrology Stations
WWTP Sites Point Source
WARMF Water Quality Stations
WARMF Meteorological Stations
Catchment IDs (cross reference for Table 1)
Miles
1 0 1
HANGMAN CR AT USGS GAGE SITE
HANGMAN CREEK AT DUNCAN
ROCK CREEK AT THE MOUTH
HANGMAN CREEK AT BRADSHAW RD
HANGMAN CREEK AT TEKOA
Spokane
Spokane Valley
Airway Heights
Medical Lake
Liberty Lake
Cheney
Spangle
Fairfield
Rockford
Waverly
Plummer
Tekoa
Tensed
Oakesdale
Saint John
Rosalia
Malden
Whitman
Latah
Benewah
Kootenai
Worley
Harrison
Springston
Medimont
Lacon
Chatcolet
Settlers
Bellgrove
Rockford Bay
Lake Coeur d'Alene
Rock Lake
Hangman Crk at Keevy Rd.
Rattler Run Crk. at Mouth
Rock Crk at Jackson Rd.
North Fork Rock Creek at Hwy 58
Little Hangman Crk at Stateline
Moctilene Crk
Hangman Crk at Stateline
Lower Sheep Crk
Indian Crk at Fort Wolf


Watershed Analysis Risk Management Framework - [C:\Program Files\Systech\WARMF\Hangman Creek\gagecorrect.WSM]
File Edit View Mode Scenario Docu Module Window
Help
36 Catchments
5 Sub-watersheds
6 Point sources
4 Weather Stations
Hydrology, total phosphorus, and suspended sediment
Fills
Lines
: 12
-116.8157, 47.5665
CAPS
NUM
SCRL
Start
10:31 AM

Hangman WARMF Version 'Managed' Mechanisms

- **Soil**
  - estimates of physical characteristics
  - estimates of chemical characteristics
  - mechanisms for erosion and transport to waterways
  - mechanisms for groundwater transport
- **Hydrology**
  - stream network and channel characterization
  - climate, landform, soil, and land use effects on water balance
  - point source additions – constant & intermittent

Hangman WARMF Version 'Missing' Mechanisms

- **Biology**
  - accurate estimates of crop litter, harvest, and fertilizer applications
  - crop rotations and soil fertility
  - periphyton & algae biomass rates and functions
- **Wastewater**
  - stormwater network characterization
  - septic system populations and system failure rates
  - more point source data
  - proven method to simulate a wetland system

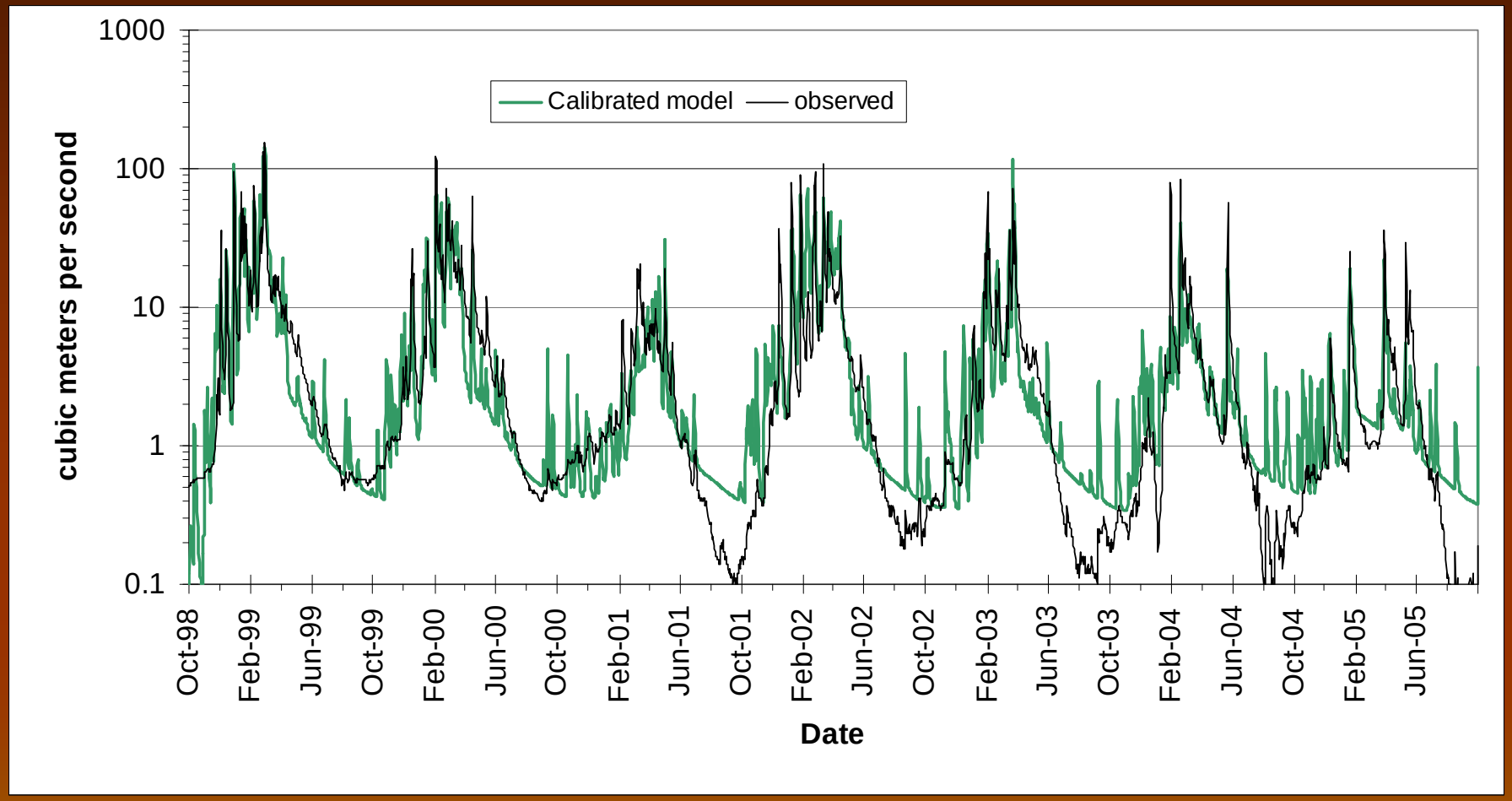
Hangman WARMF Version 'Missing' Mechanisms

- **Air**
  - estimates of dry and precipitation phosphorus fallout by region
  - variability from grass burning years
- **Wastewater**
  - stormwater network characterization
  - septic system populations and system failure rates
  - more point source data
  - proven method to simulate a wetland system

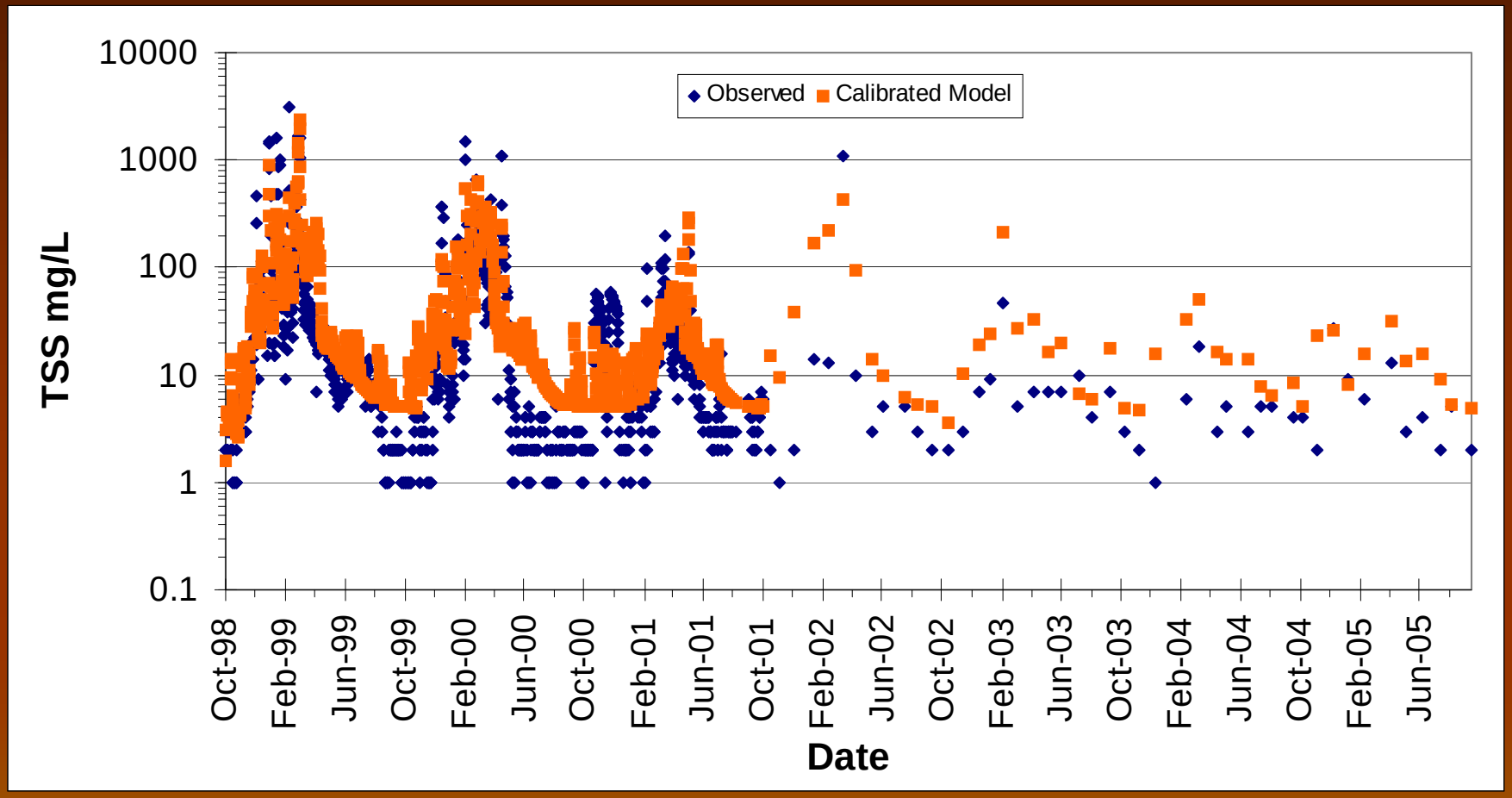
Model Calibration Corrections

- Improved stream hydrology based on SCCD gaging data
- Corrected point source operation input
  - Cheney wetland
  - Rockford and Fairfield intermittent discharges
- Improved septic system use estimates
- Took streambank erosion estimates across the border

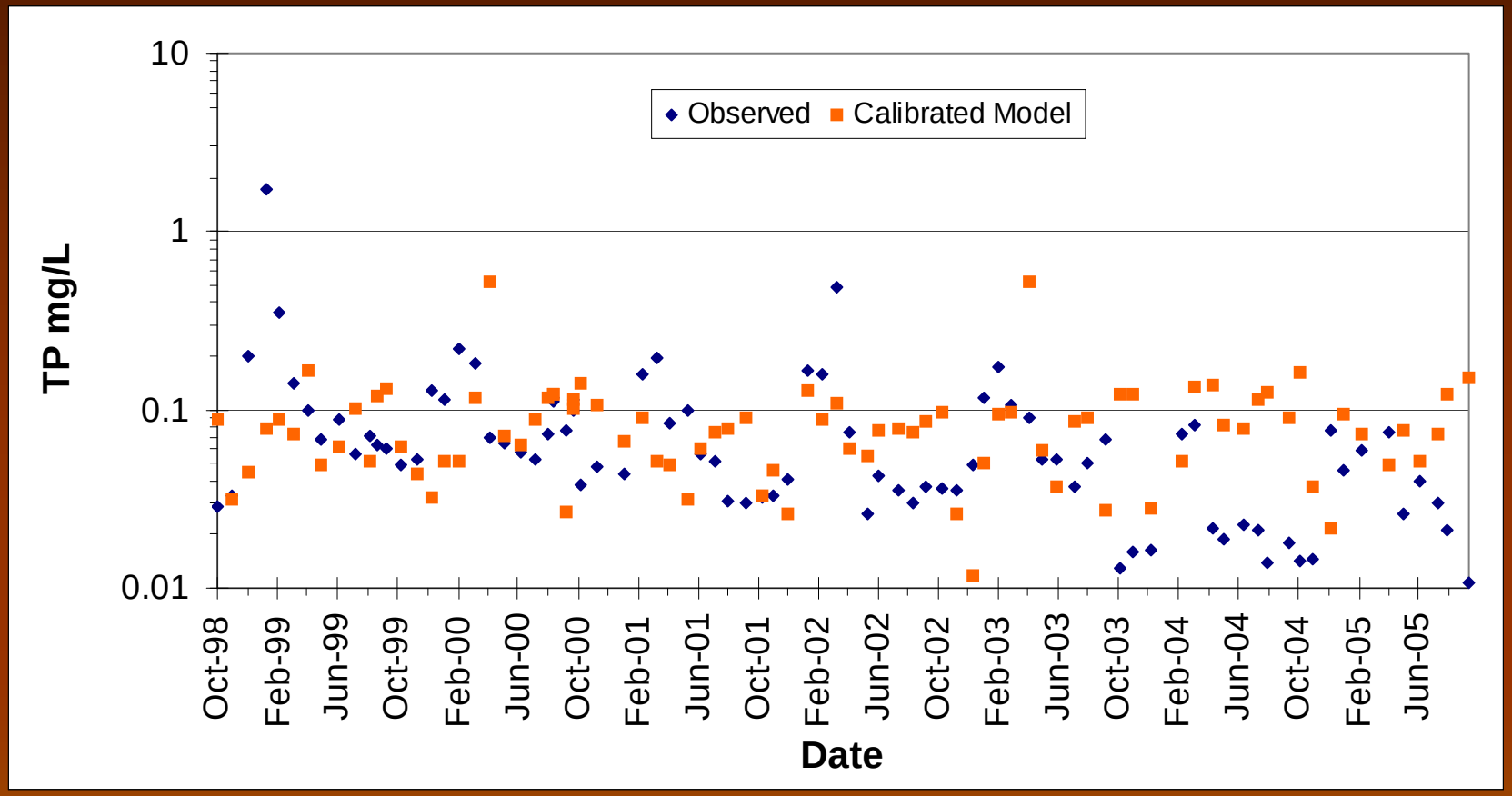
Hangman Creek Model Calibration



Hangman Creek Model Calibration



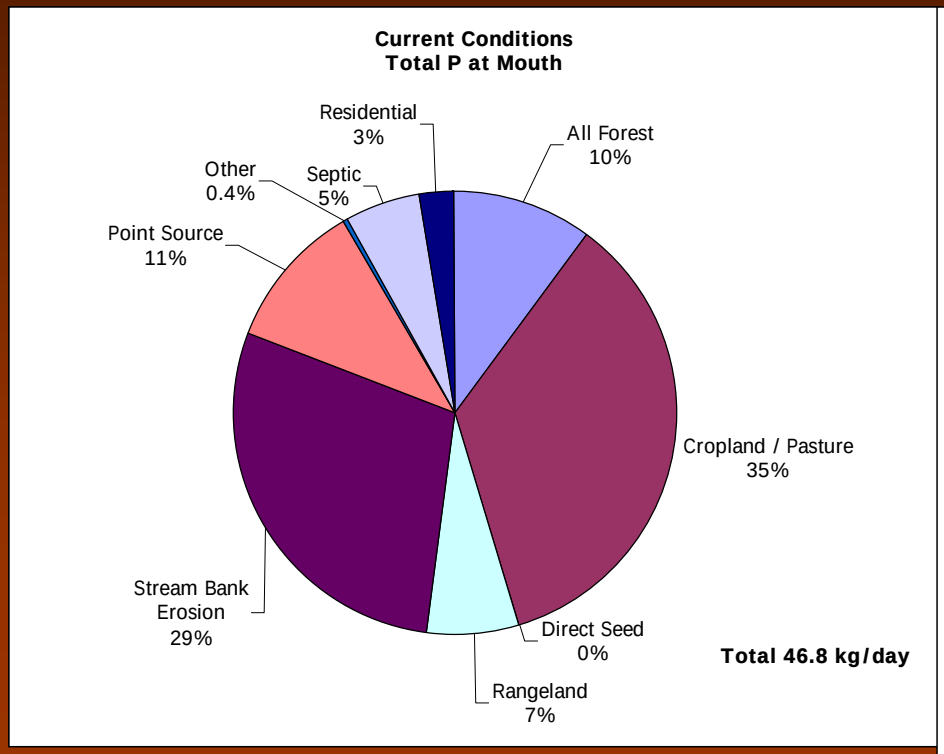
Hangman Creek Model Calibration

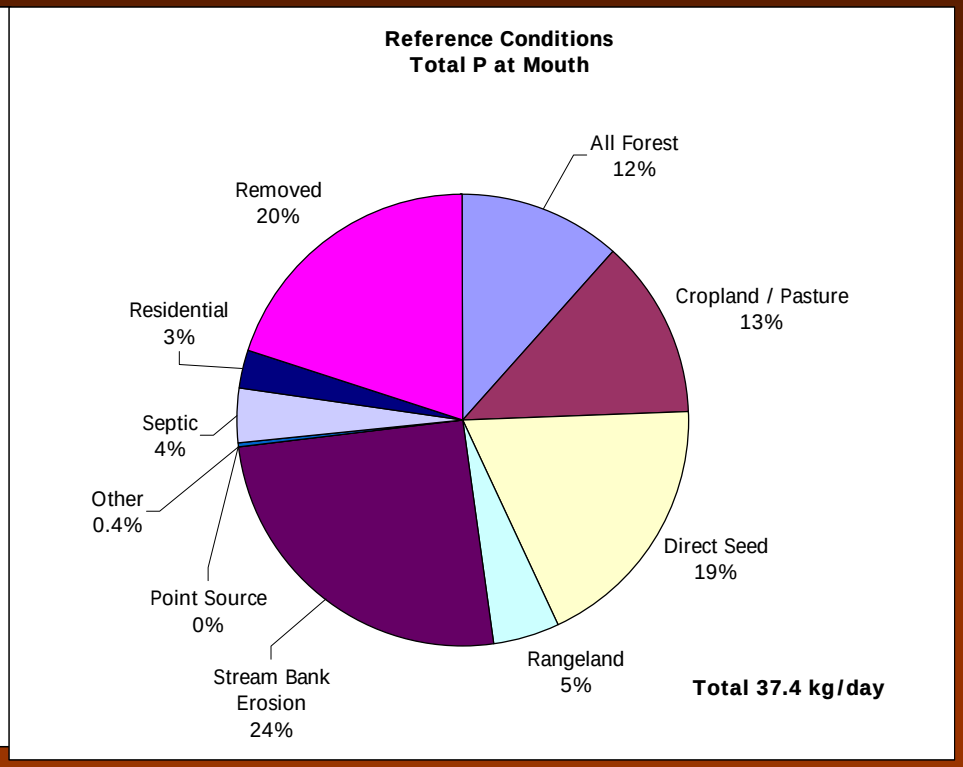


Requested Scenarios

- **Reference condition (best future)**
  - No point sources
  - 10’ riparian buffers
  - Increased forest cover above Rockford and Tensed
  - Limited residential growth in lower watershed
  - 60% of agriculture in direct seed type

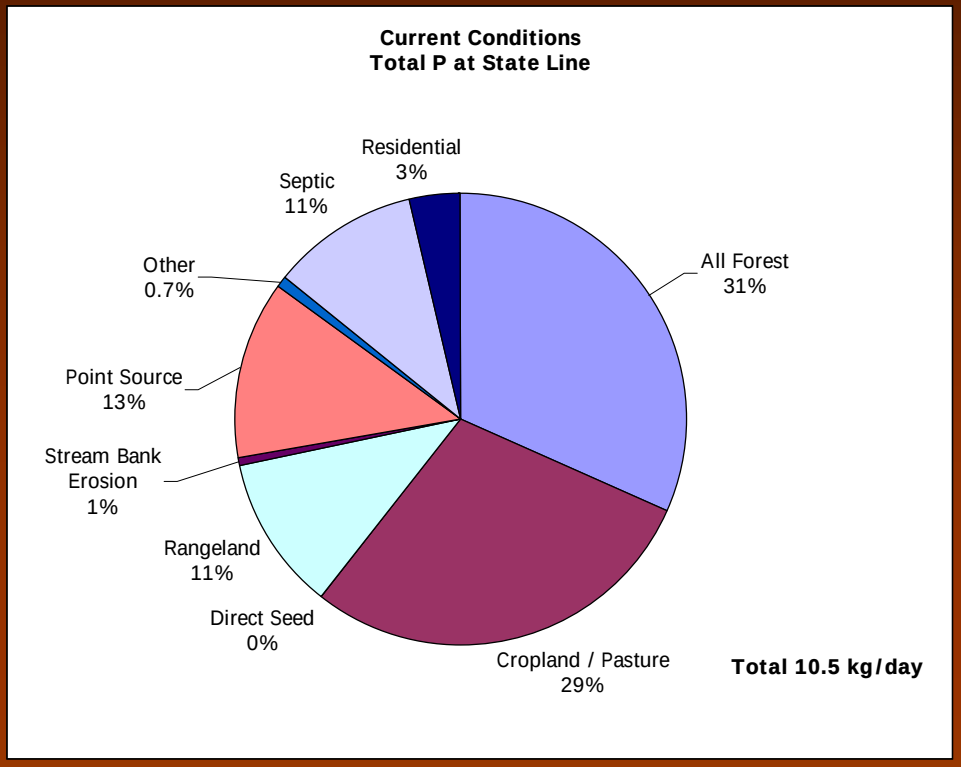
Comparison: Base to Reference

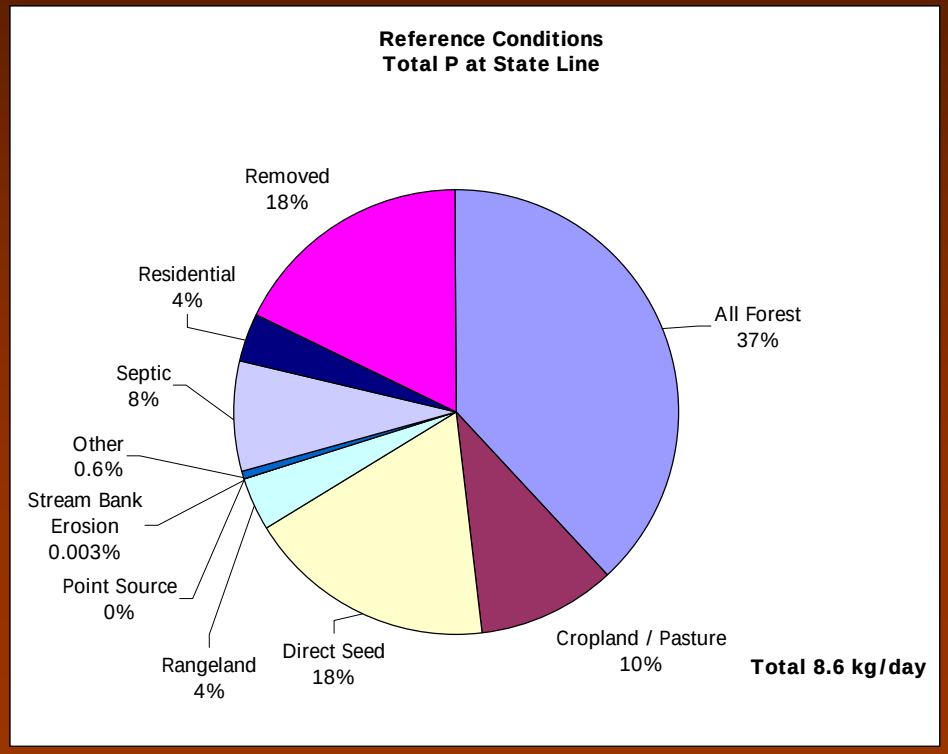




	Hangman Creek at the Mouth	
	Reference Condition	Current Condition
All Forest	11.9	10.7
Cropland / Pasture	13.4	35.9
Direct Seed	19.1	0.0
Rangeland	4.9	7.0
Stream Bank Erosion	26.0	29.8
Point Source	0.0	11.2
Other	0.4	0.4
Septic	3.9	5.5
Residential	2.8	2.7
Removed	20.7	

Comparison: Base to Reference





1 kg = 2.205 lbs

Hangman Creek at the Idaho Border

	Reference Condition	Current Condition
All Forest	8.8	7.3
Cropland / Pasture	2.3	6.7
Direct Seed	4.2	0.0
Rangeland	0.9	2.6
Stream Bank Erosion	0.0	0.2
Point Source	0.0	3.0
Other	0.1	0.2
Septic	1.9	2.5
Residential	0.8	0.8
Removed	4.1	

Requested Scenarios

- Idaho meets proportional phosphorus load at border
- Cheney as existing condition vs. fully discharging to Minnie Creek
- Graduated land use conversions
- Graduated streambank improvements
- Graduated reforestation
- Graduated direct seed implementation