

# Lower Gallatin Watershed Water Quality Assessments and TMDLs

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# Intro & Overview

- Why this meeting?
- What is a TMDL?
- Regulatory framework
- TMDL Technical Process/Steps
- Lower Gallatin 2008 & 2009 Data Results
  - Sediment, e.coli, nutrients
- Upcoming TMDLs and Allocation Approaches

# Total Maximum Daily Load:

A Number...

Amount of pollutant that a waterbody can receive from point, nonpoint & natural sources & still meet water quality standards.

A Plan...

Systematic approach to assessing water quality, determining the problem, developing and implementing solutions.

# Regulatory Framework

- 1972 FEDERAL CLEAN WATER ACT
  - Montana Water Quality Standards
- 
- Water Quality Assessment Process
  - Impaired Streams – 303(d) list
- 
- State TMDL Law (MCA 75-5-703)
  - EPA Settlement Agreement/Lawsuit

# Again...What's a TMDL?

## A Problem-Solving Exercise



Sample/monitor streams (is there a problem?)

Determine the degree of the problem

Determine the source(s) of the problem

Implement projects to solve the problem

Monitor progress and success

# TMDL Plans – Required Components

## Water Quality Standards & Impairment Status Review

- Define standards and water quality targets
- Evaluate individual streams and define pollutant issues

## Pollutant Source Assessment

- Estimate existing pollutant loading from potential sources

## Establish Total Maximum Daily Loads & Allocations

- Define maximum amount of pollutant allowed
- Allocate loads to contributing sources

## Monitoring, Restoration and Adaptive Management

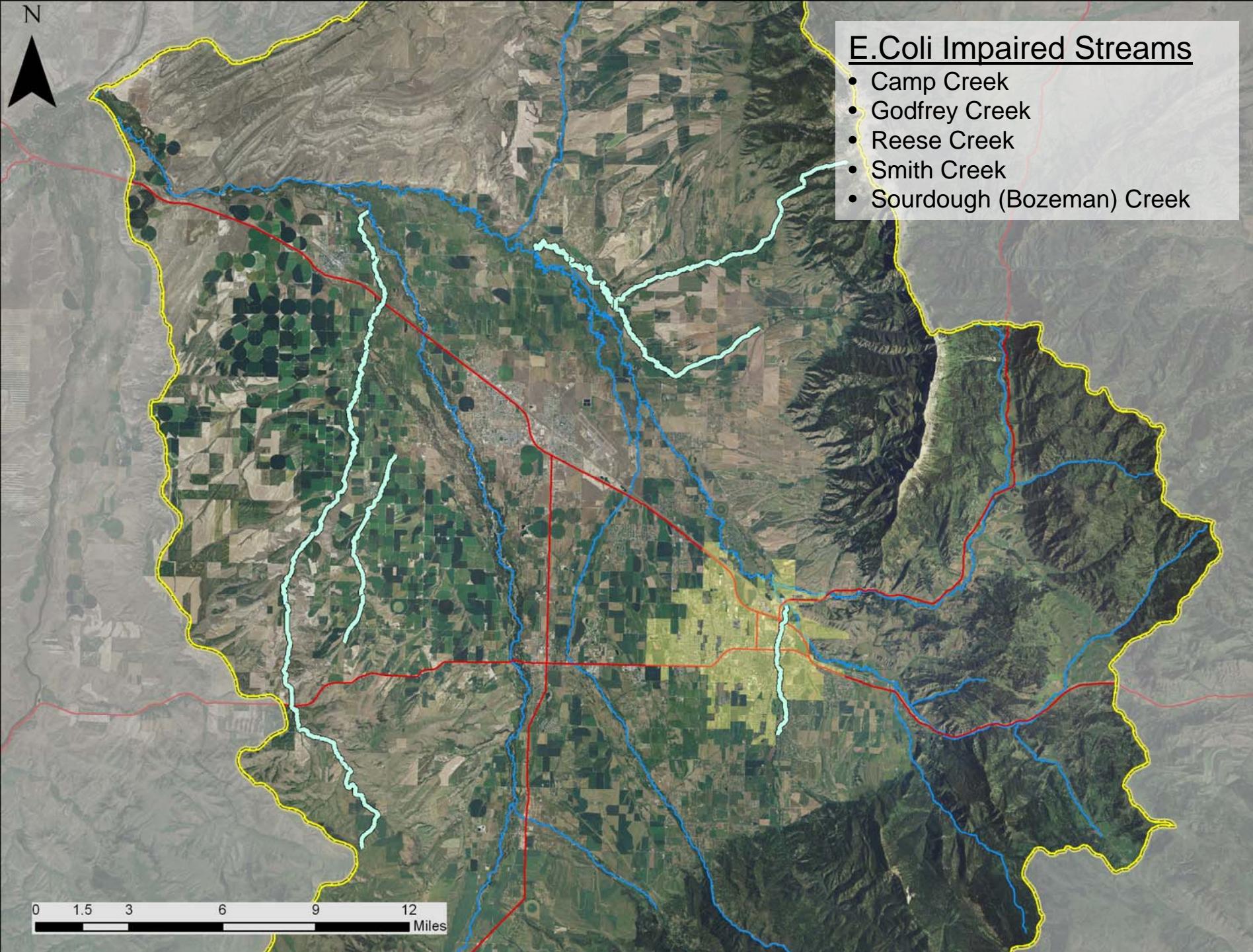
# Maps & Data Results

## Pollutants & Water Quality Standards

- Sediment
- E.coli
- Nutrients

## Pollutant: E.Coli

- E.coli impaired streams
- Potential E.coli sources
- Maps of sampling stations
- Data results 2008 & 2009
- TMDL and Allocation Approach

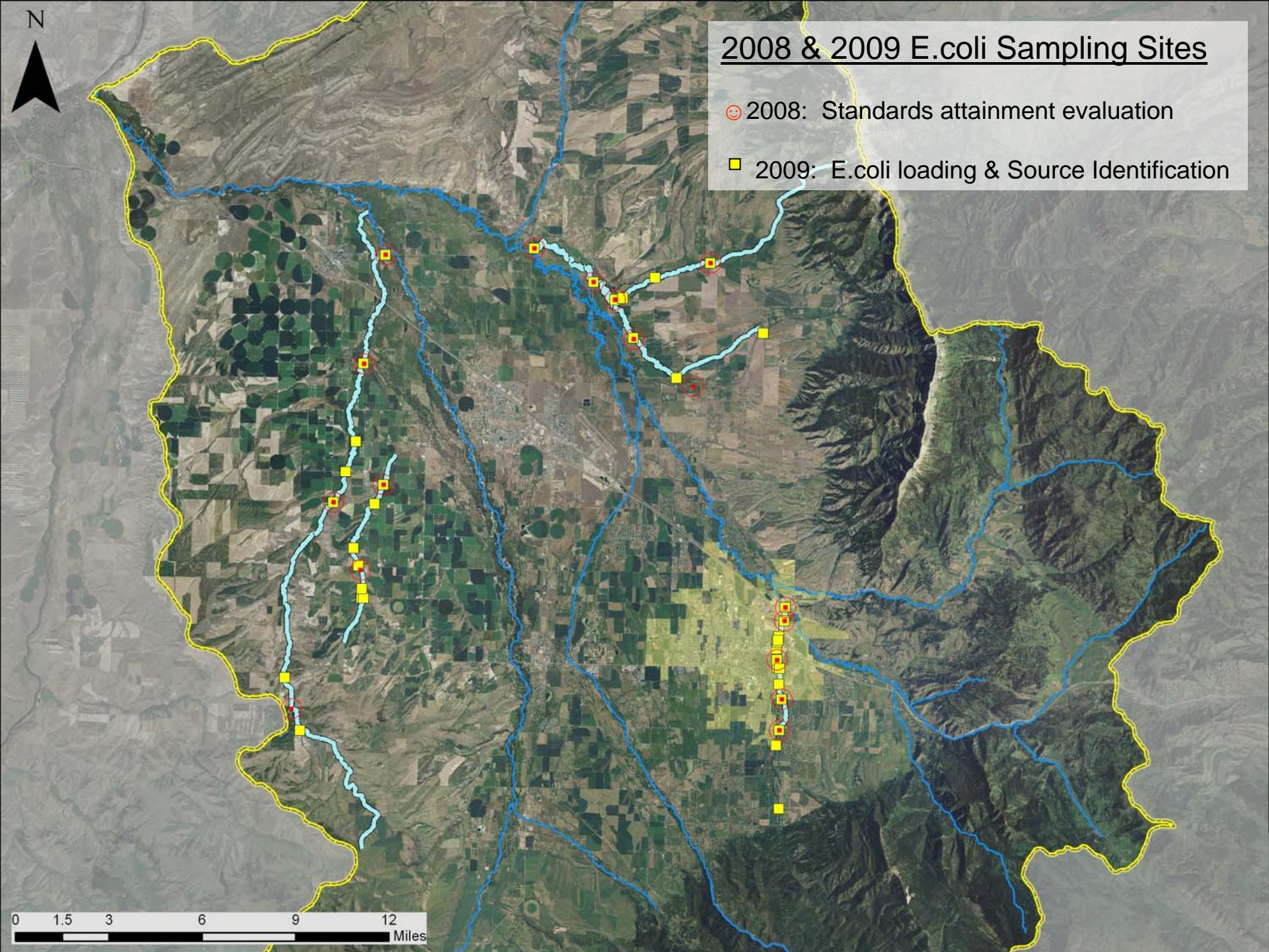


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## 2008 & 2009 E.coli Sampling Sites

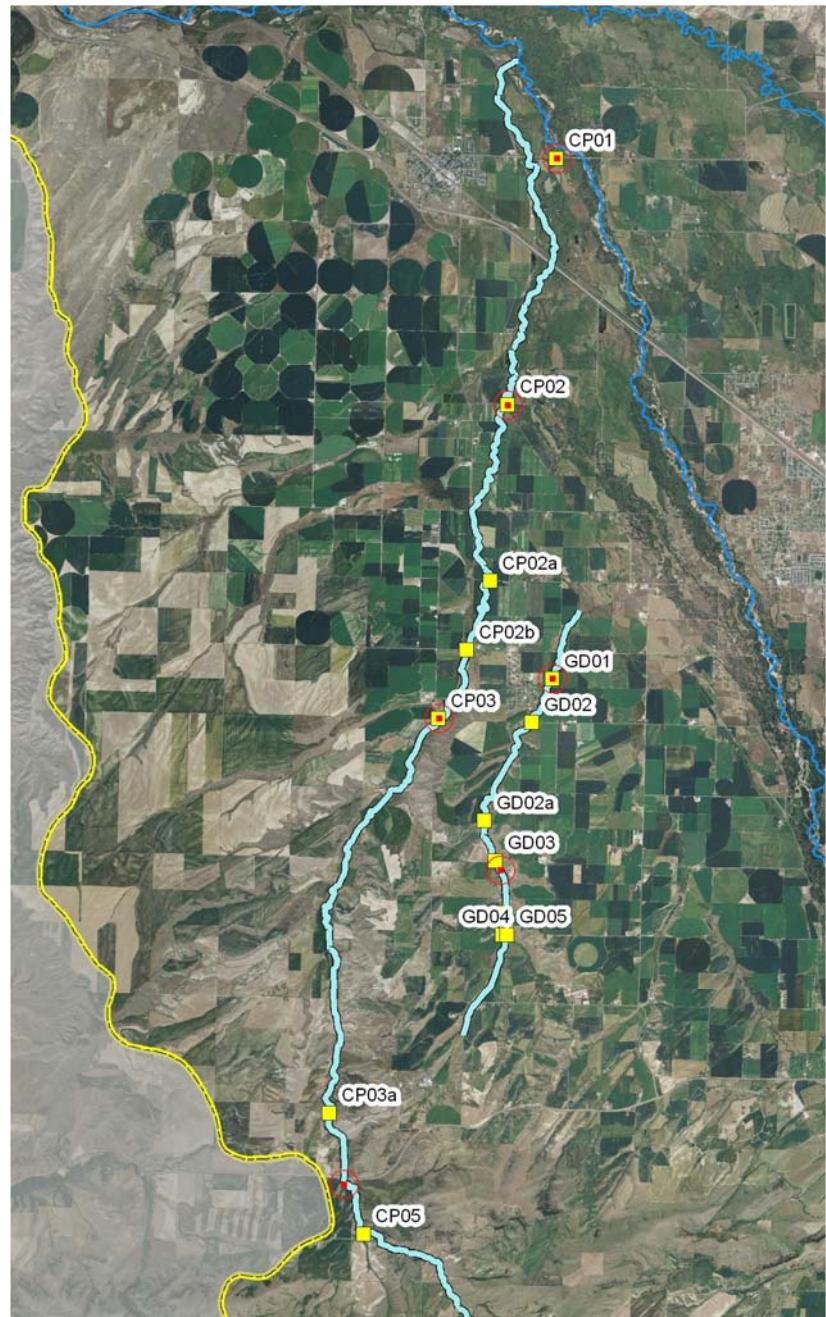
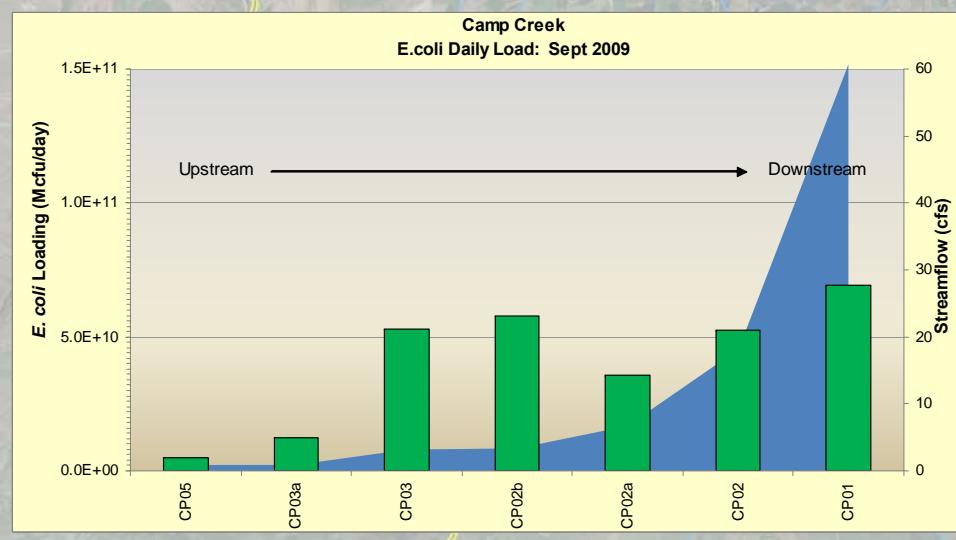
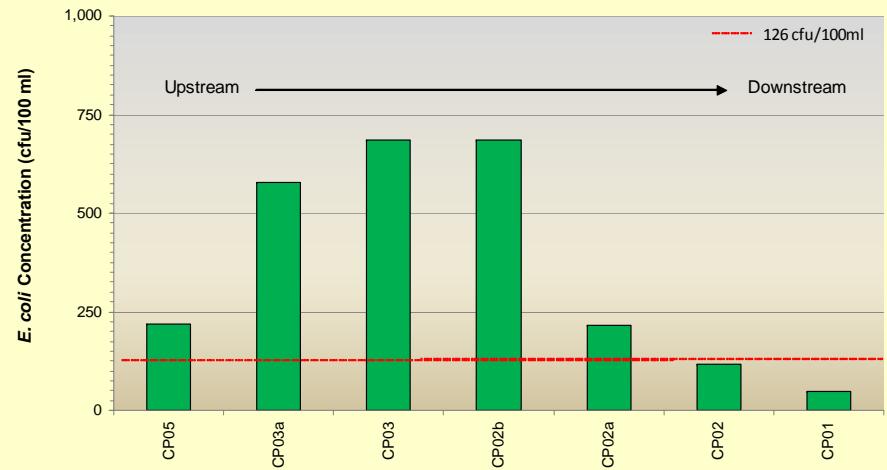
● 2008: Standards attainment evaluation

■ 2009: E.coli loading & Source Identification

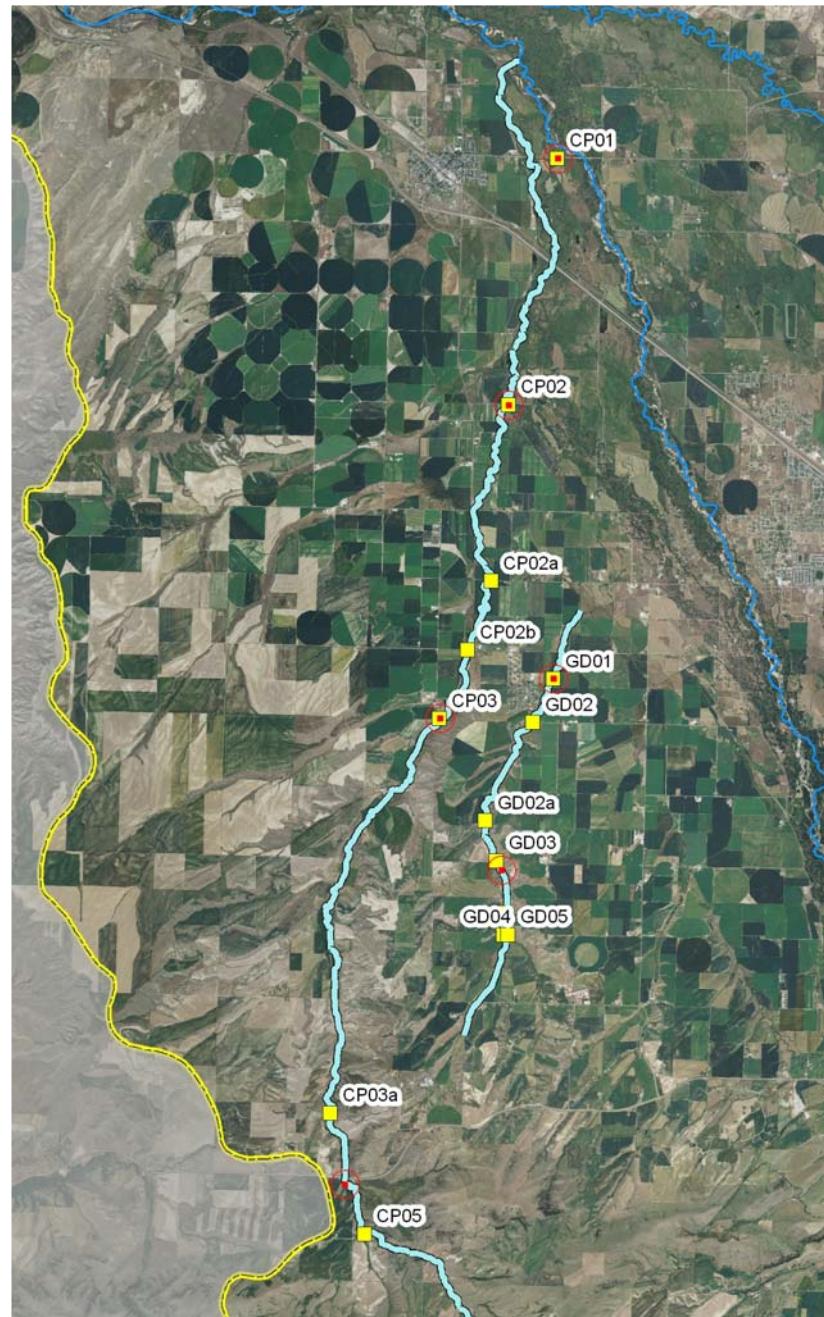
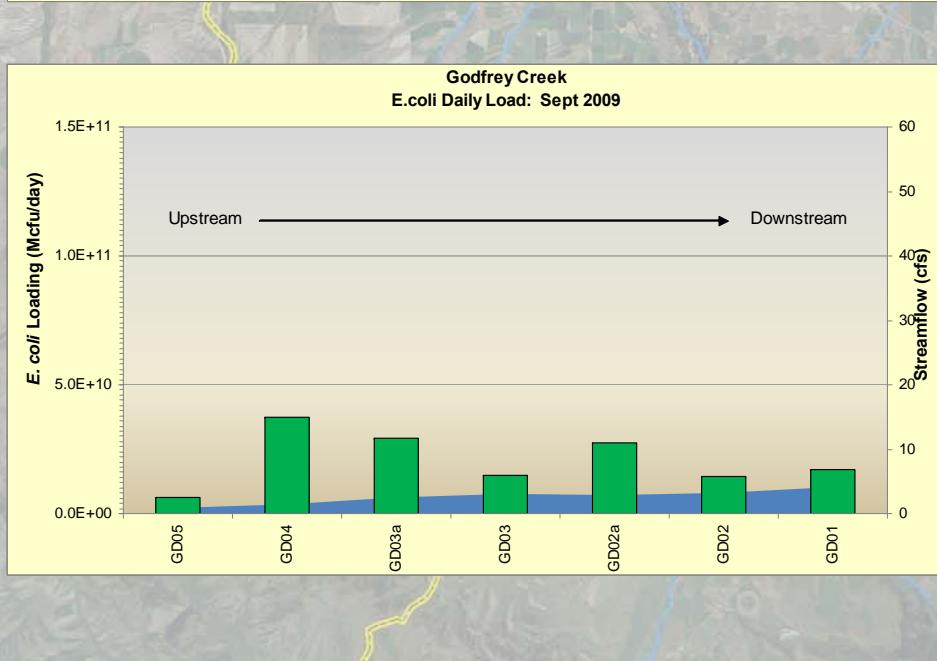
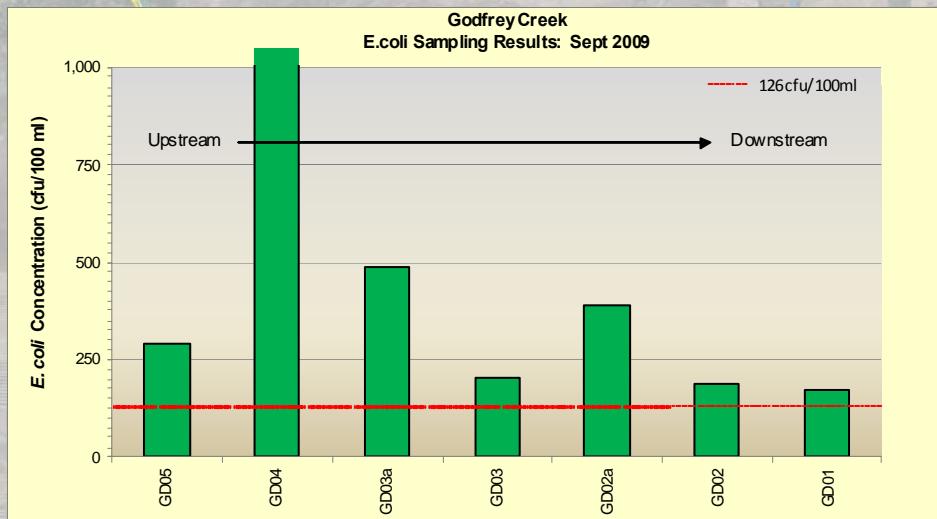


# Camp Creek

**Camp Creek**  
E.coli Sampling Results: Sept 2009



# Godfrey Creek

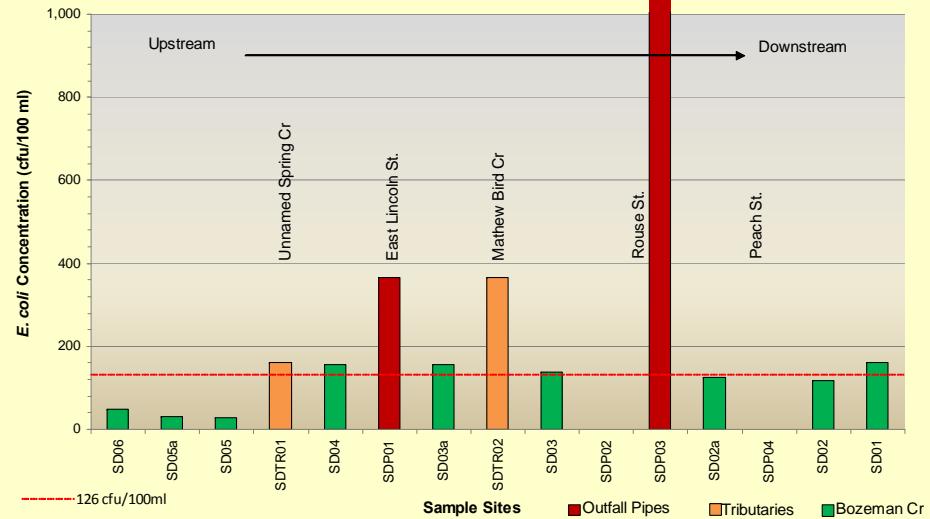


## Camp Creek & Godfrey Creek E.coli Sources

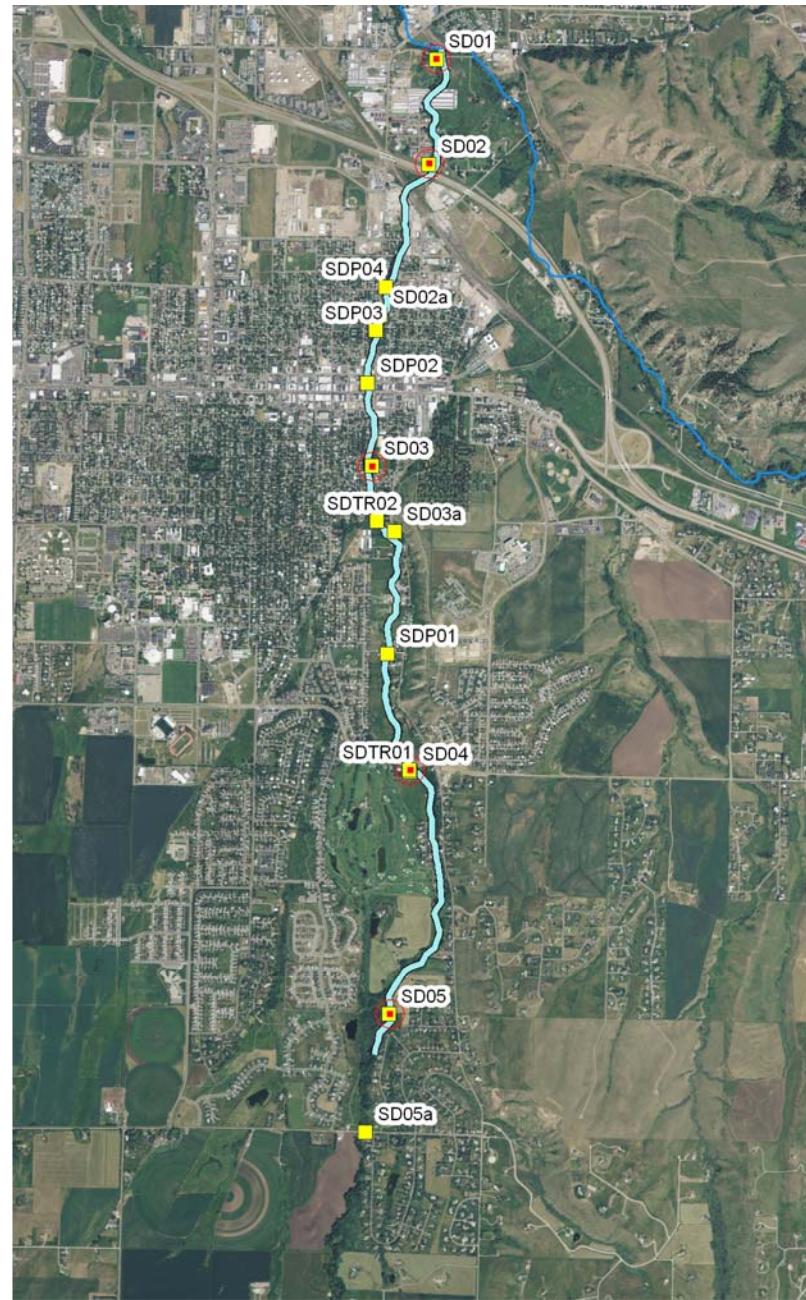
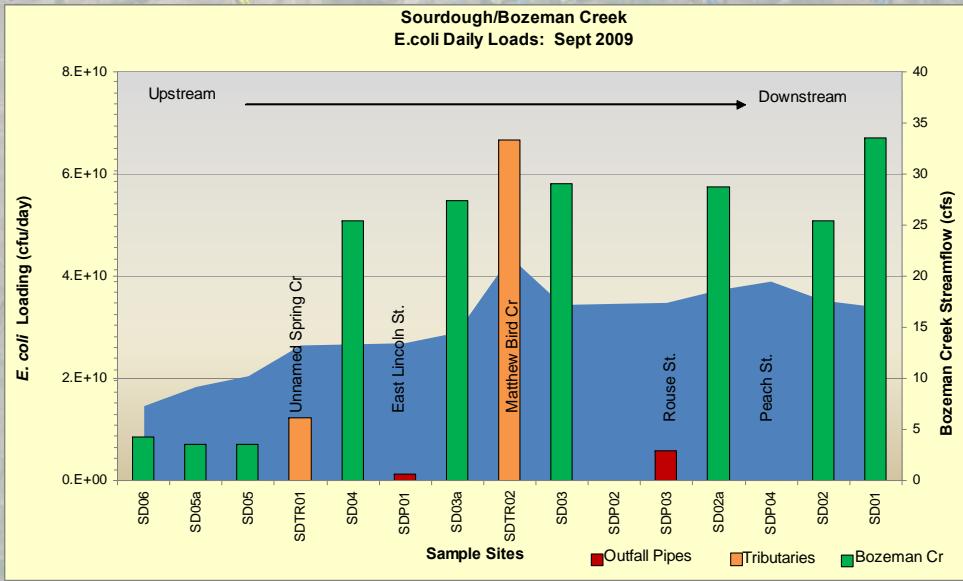


# Sourdough (Bozeman) Creek

Sourdough/Bozeman Creek  
E.coli Sampling Results: Sept 2009



Sourdough/Bozeman Creek  
E.coli Daily Loads: Sept 2009



# Sourdough (Bozeman) Creek E.coli Sources



## Sourdough (Bozeman) Creek E.coli Sources



# Establishing the E.coli TMDL

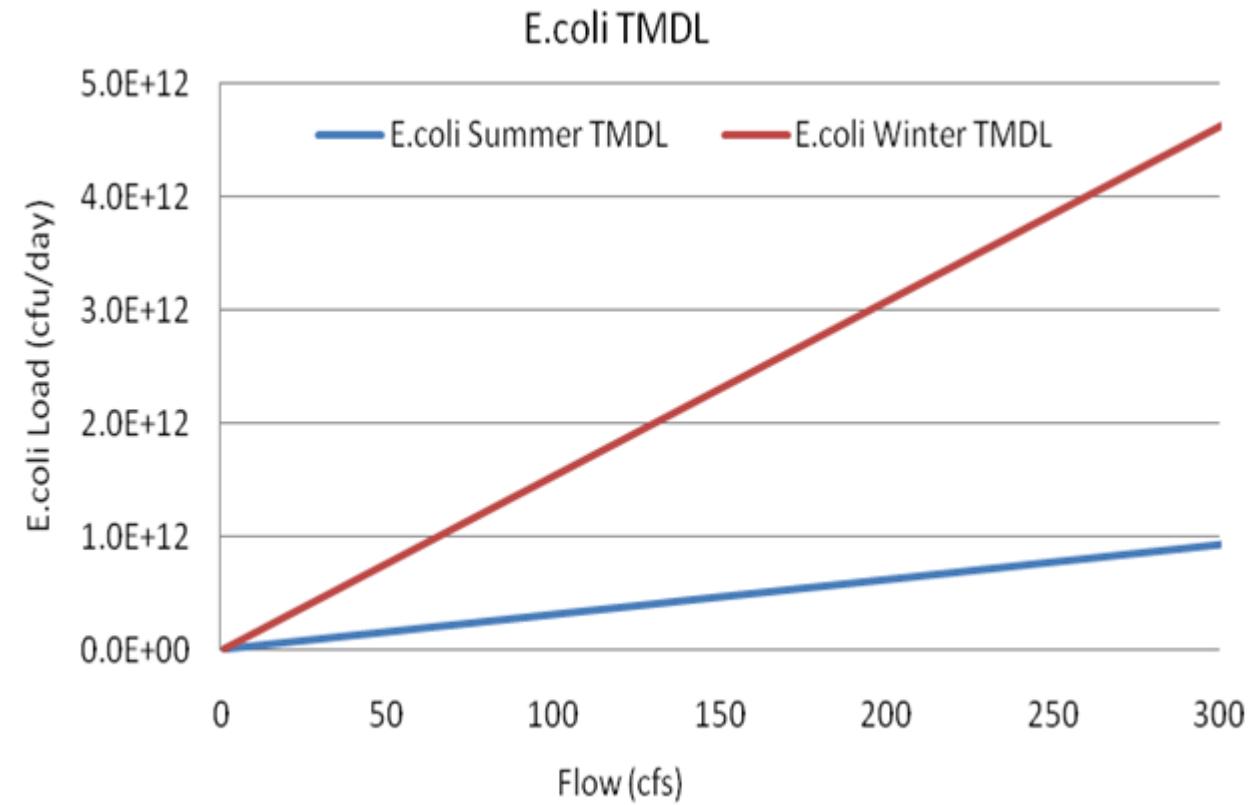
$$TMDL = (X) (Y) (2.44E+7)$$

TMDL= Total Maximum Daily Load in cfu/day

X= e.coli water quality target in cfu/100ml (126 summer, 630 winter)

Y= streamflow in cubic feet per second

(2.44E+7) = conversion factor



# Establishing load allocations

$$TMDL = \sum WLA + \sum LA + MOS$$

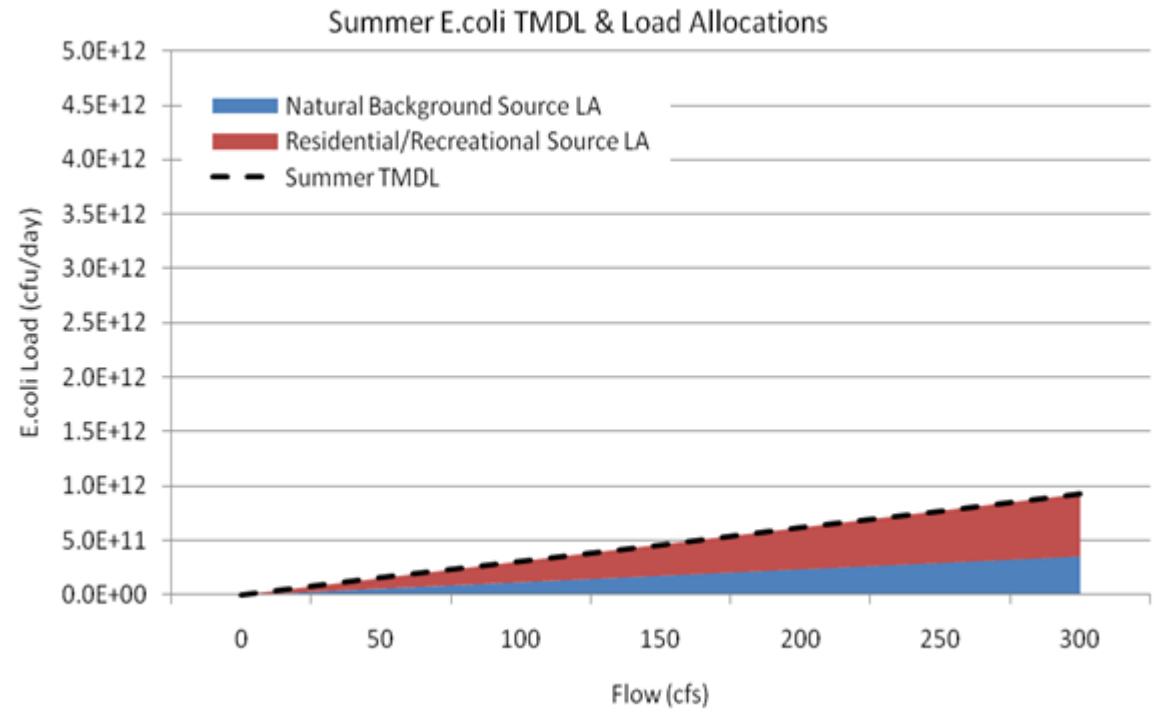
$$TMDL = WLA + LA_{NB} + LA_{ag} + LA_{RES}$$

*WLA = Wasteload Allocation to urban stormwater sources*

*LA<sub>NB</sub> = Load Allocation to natural background sources*

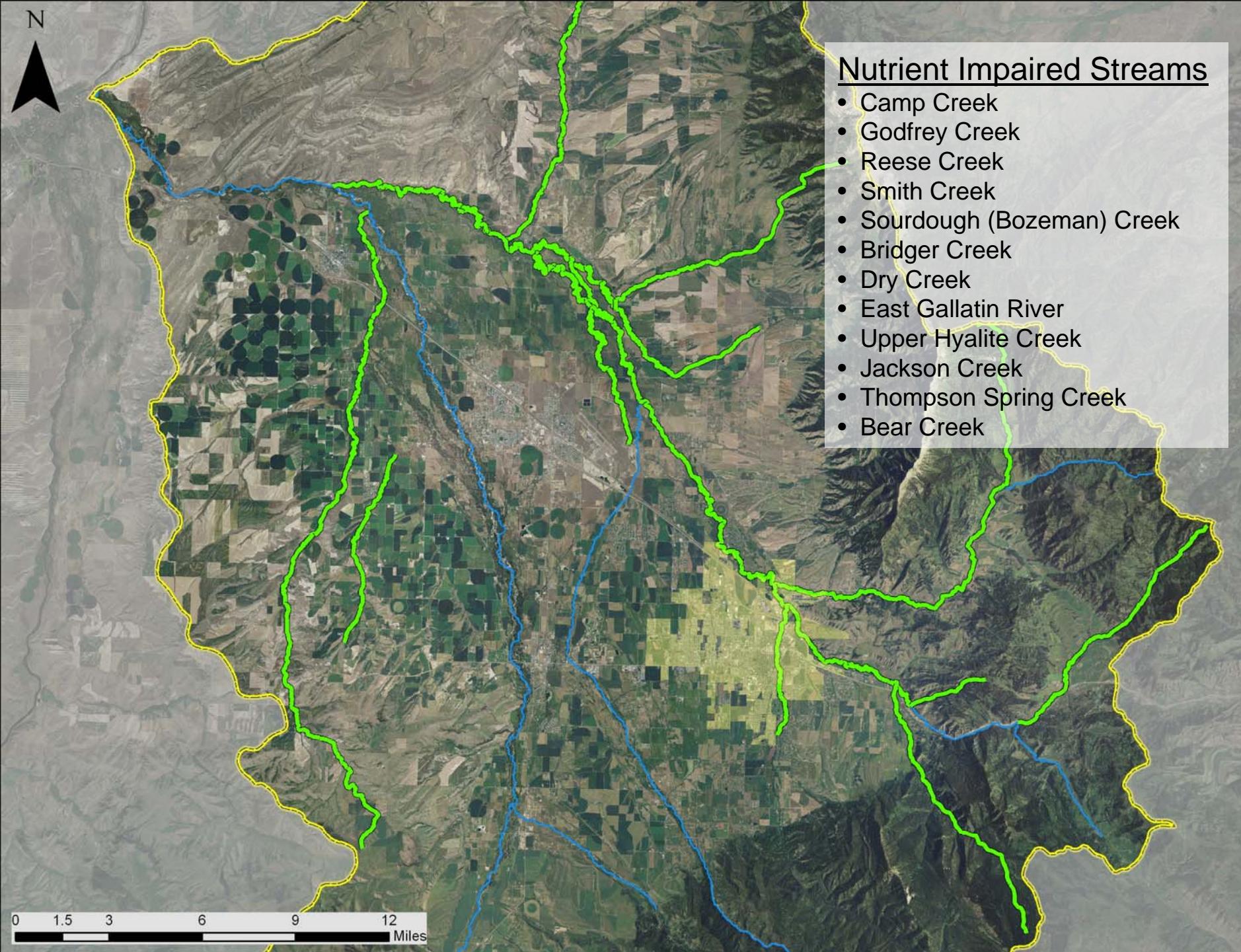
*LA<sub>ag</sub> = Load Allocation to agricultural sources*

*LA<sub>RES</sub> = Load Allocation to residential/recreational land use sources*



## Pollutant: Nutrients (N and P forms)

- Nutrient impaired streams
- Potential nutrients sources
- Maps of sampling stations
- Data results 2008 & 2009



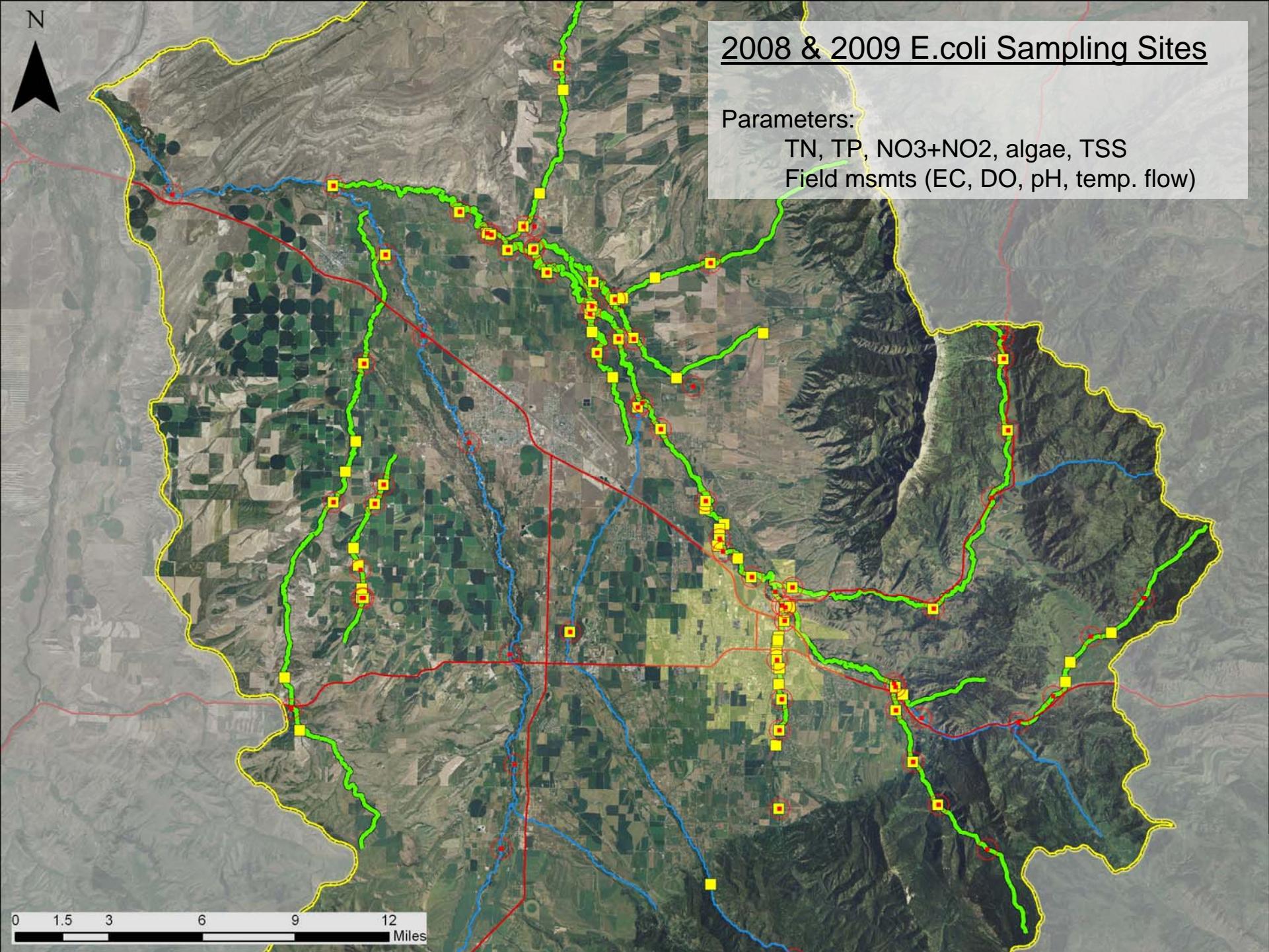


## 2008 & 2009 E.coli Sampling Sites

Parameters:

TN, TP, NO<sub>3</sub>+NO<sub>2</sub>, algae, TSS

Field msmts (EC, DO, pH, temp. flow)





Low Algal Concentrations (<50 mg/m<sup>2</sup> chlorophyll-a)



Medium Algal Concentrations (50-100 mg/m<sup>2</sup> chlorophyll-a)

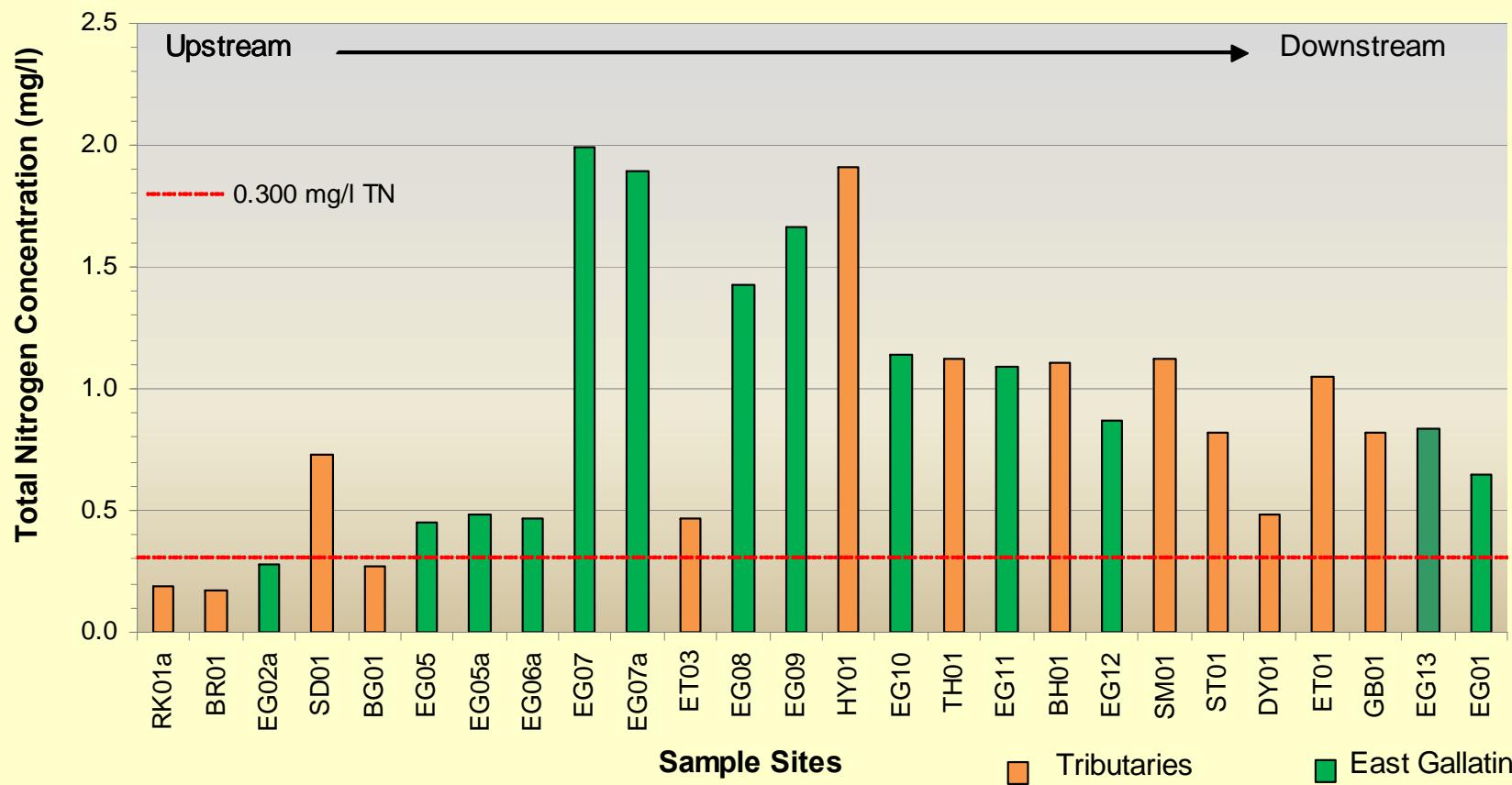


High Algal Concentrations (>200 mg/m<sup>2</sup> chlorophyll-a)

# East Gallatin Total Nitrogen Results, Sept 2009

## TN Concentrations

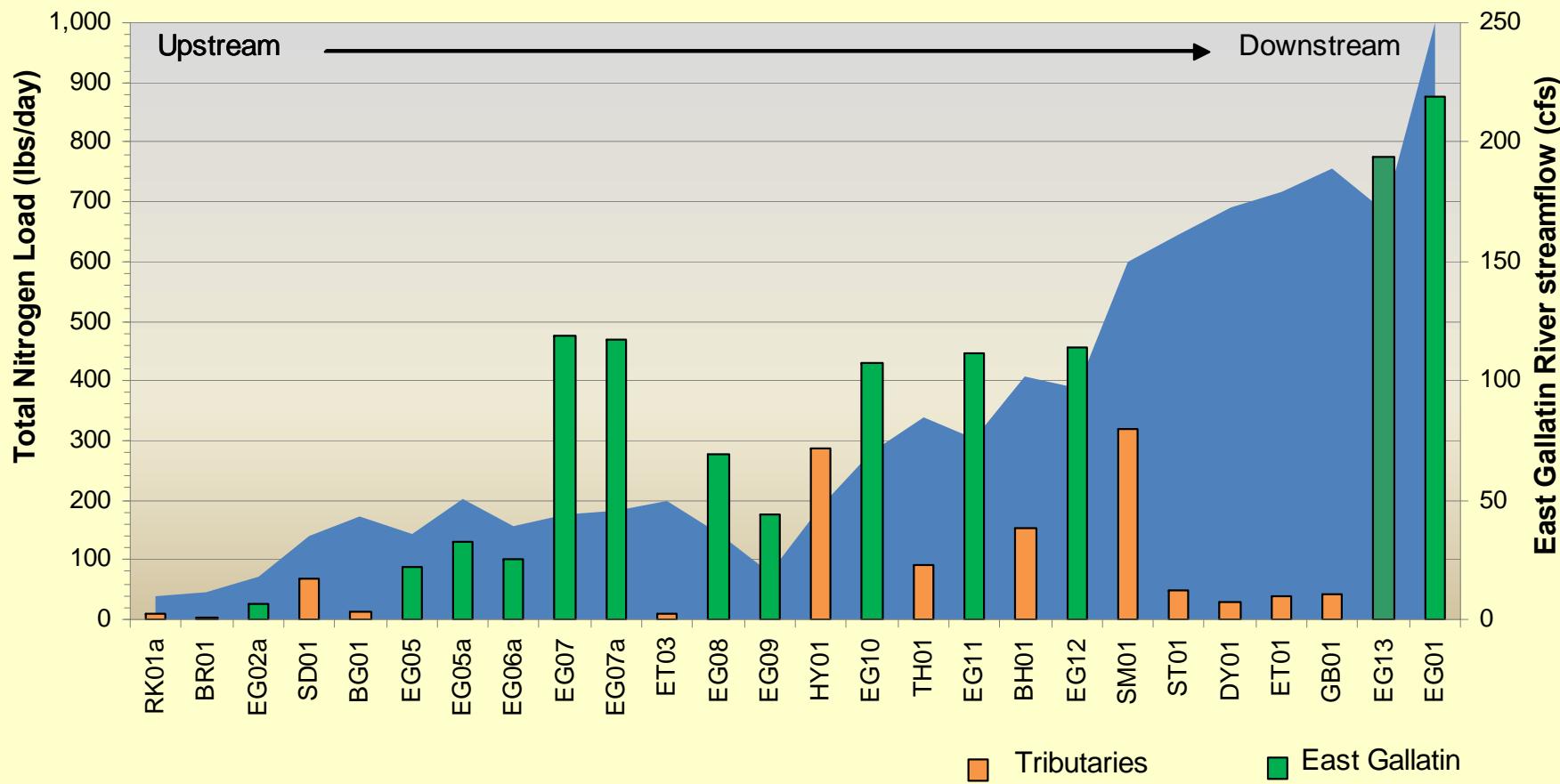
East Gallatin River and Tributaries



# East Gallatin Total Nitrogen Results, Sept 2009

TN Loads

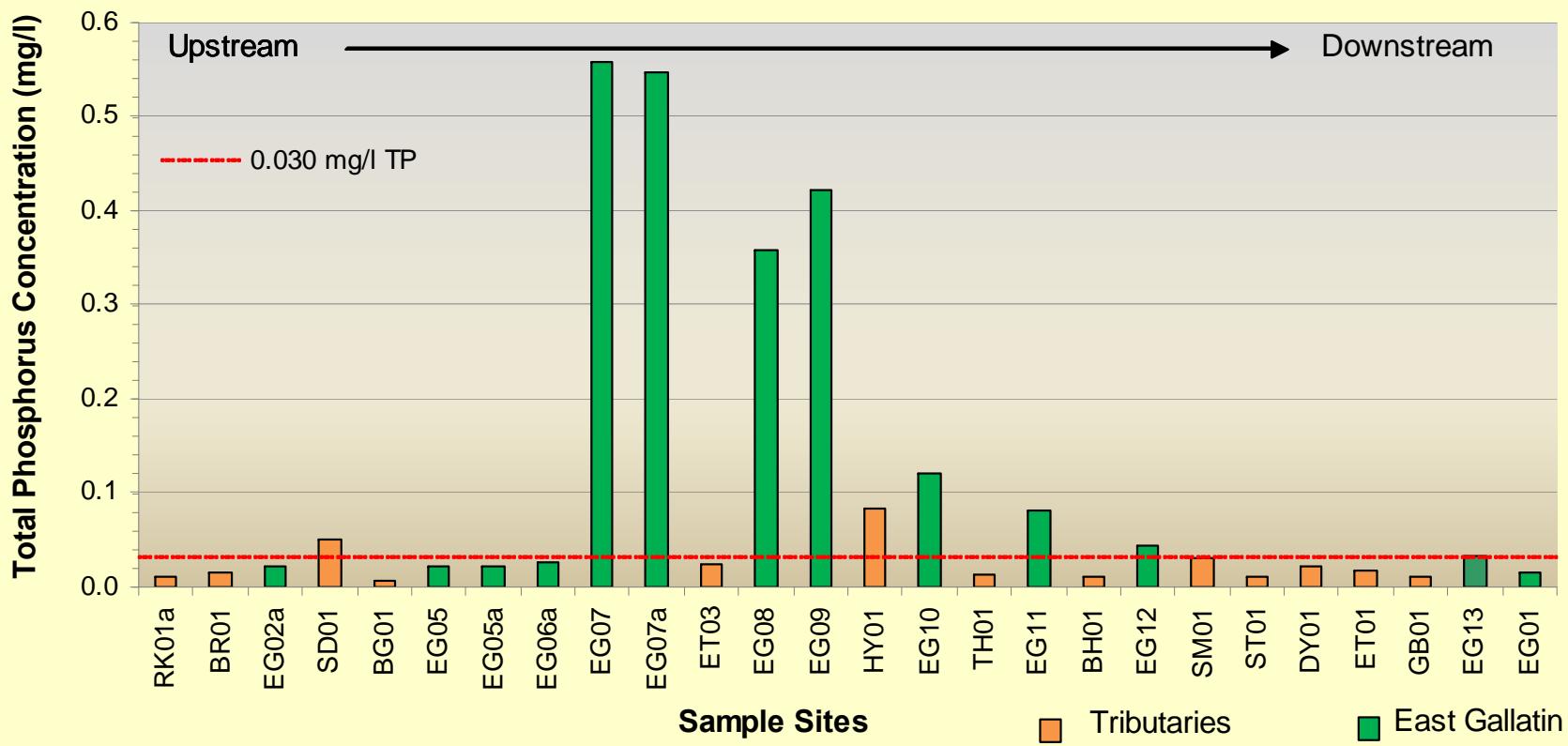
East Gallatin River and Tributaries



# East Gallatin Total Phosphorus Results, Sept 2009

## TP Concentrations

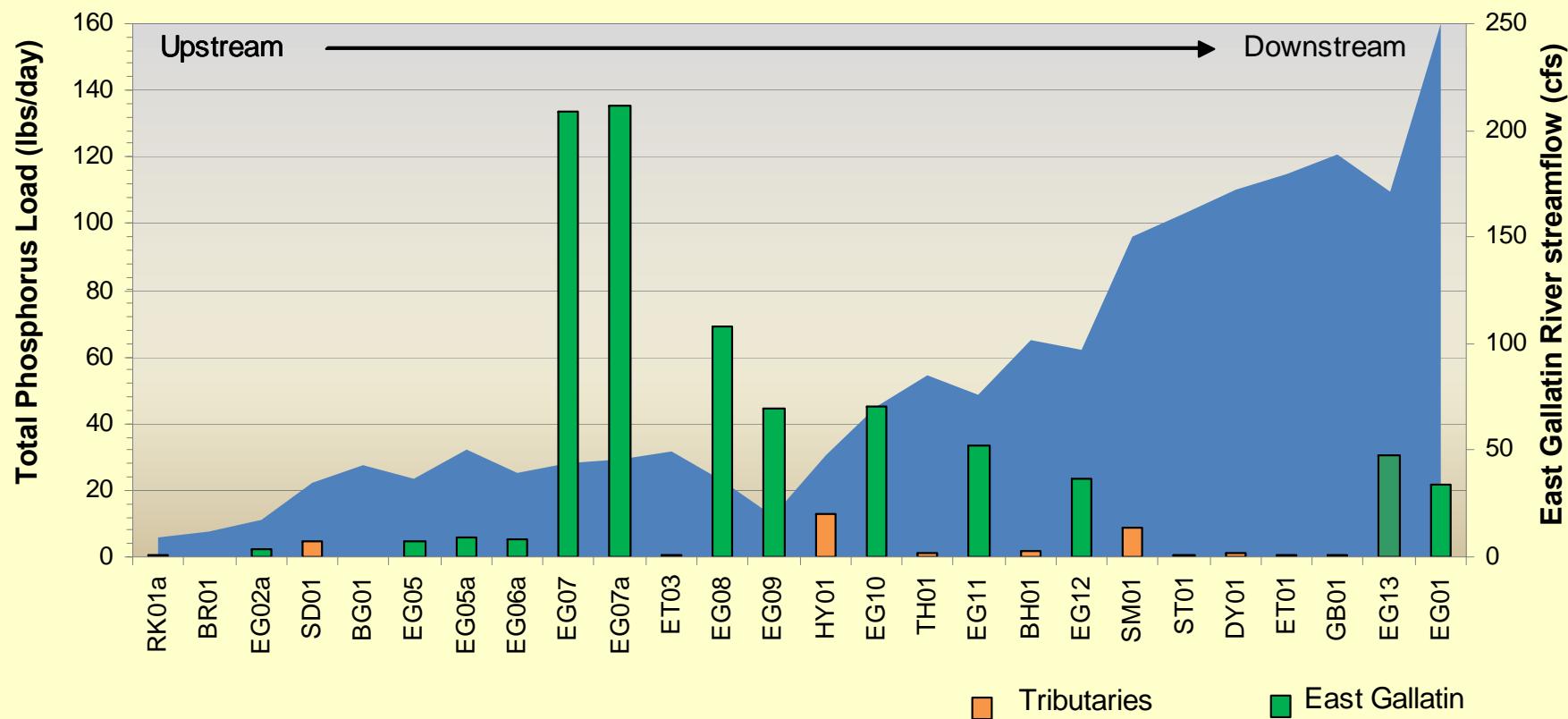
East Gallatin River and Tributaries



# East Gallatin Total Phosphorus Results, Sept 2009

TP Loads

East Gallatin River and Tributaries



# Nutrient Sources & Impacts in the Gallatin Watershed

## WWTP & Septic Effluent

- East Gallatin & some trib(?)

## Reservoir Operations

- upper Hyalite

## Agriculture & Livestock

- Camp, Godfrey, Dry, Reese, Smith,

## Urban/Residential runoff & infiltration

- Bozeman, East Gallatin

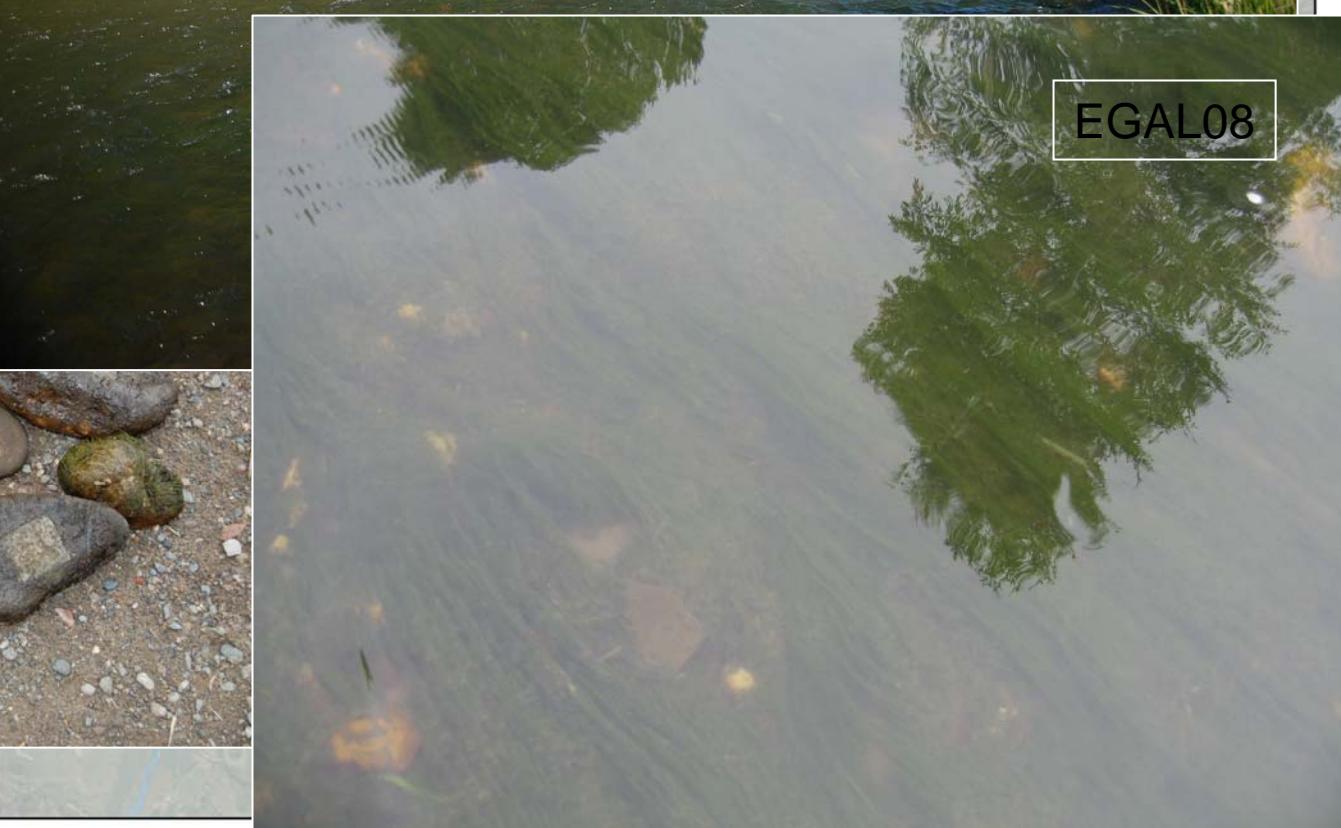
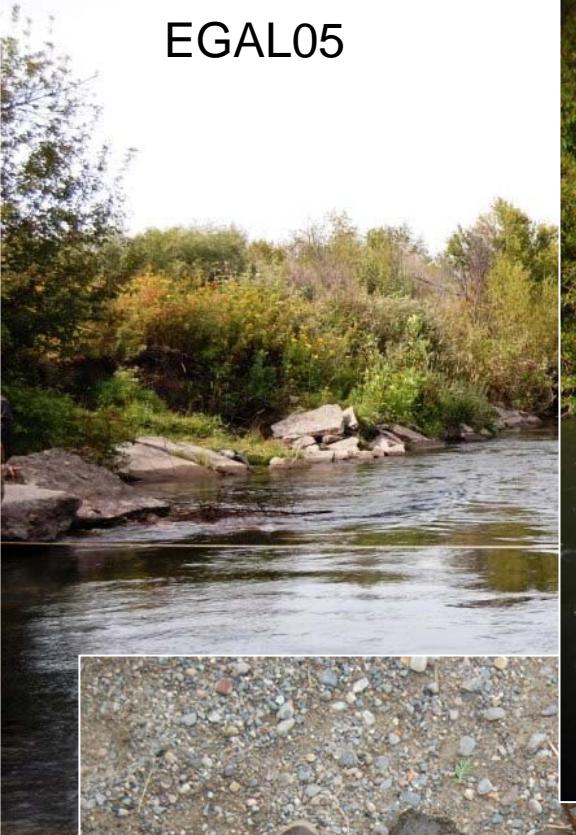
## Unpaved Roads

- Bear, Jackson

# East Gallatin Nutrients & Algal Growth

EGAL05

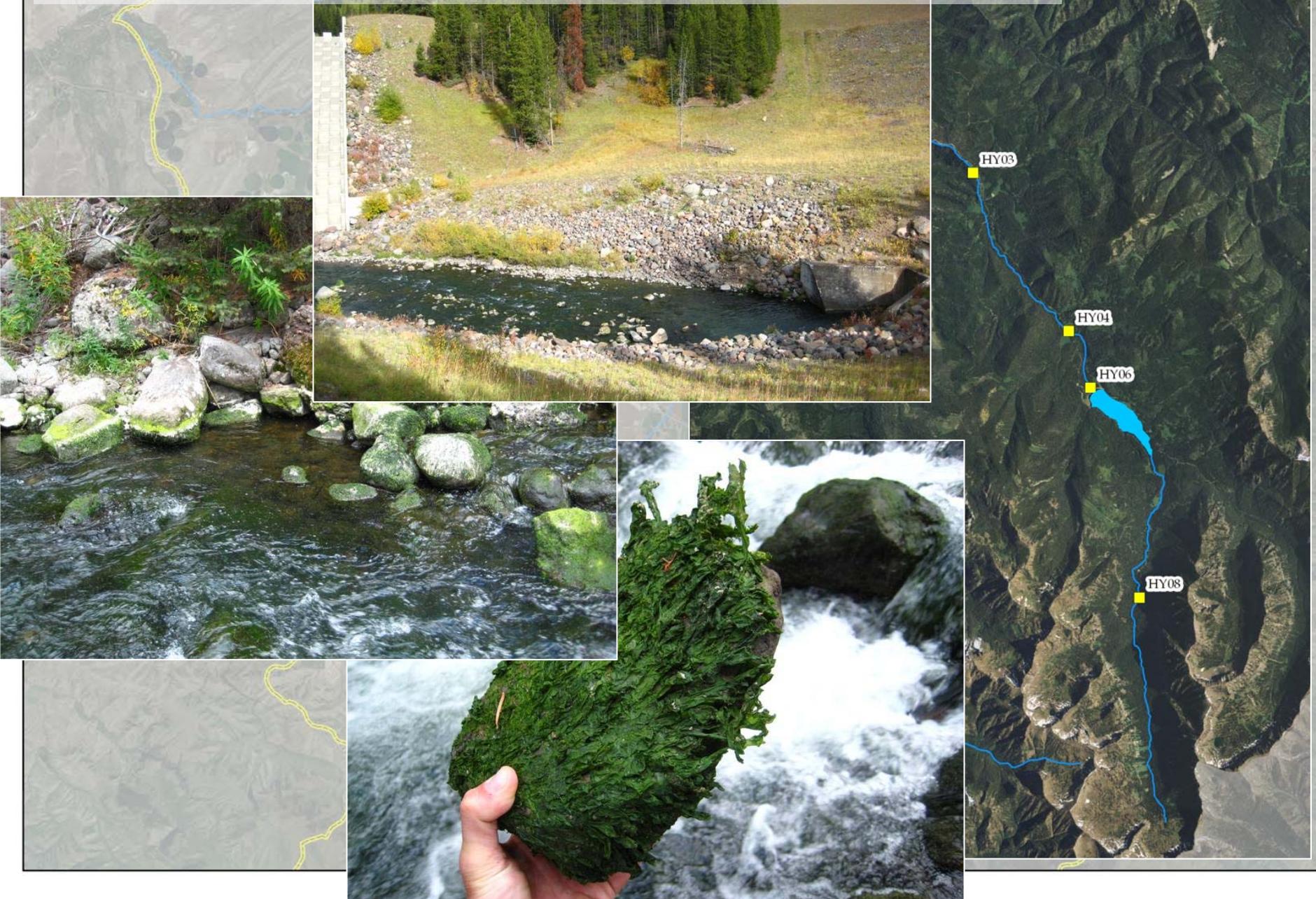
EGAL07



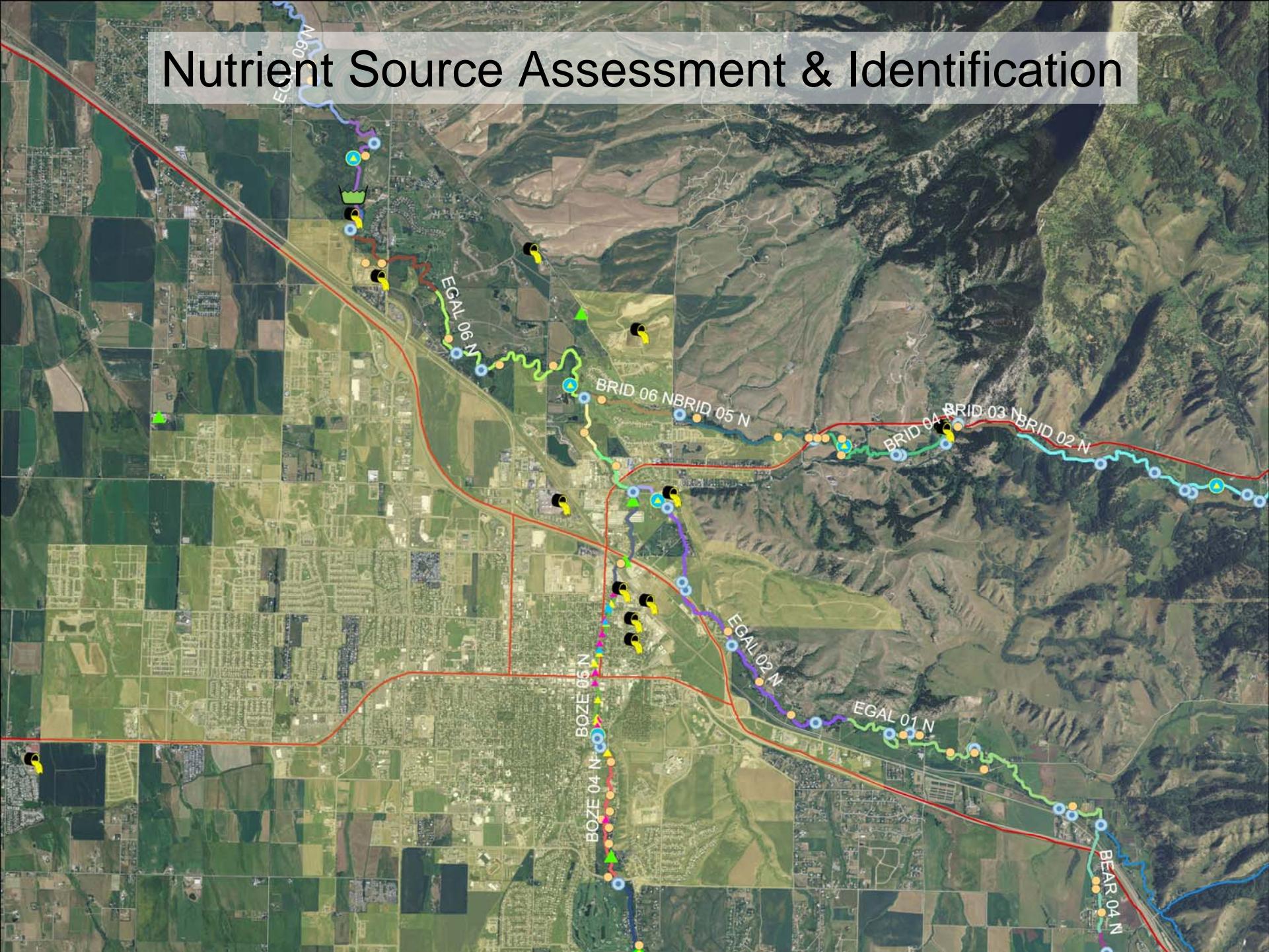
EGAL08



# Hyalite Reservoir Nutrients & Algal Growth



# Nutrient Source Assessment & Identification

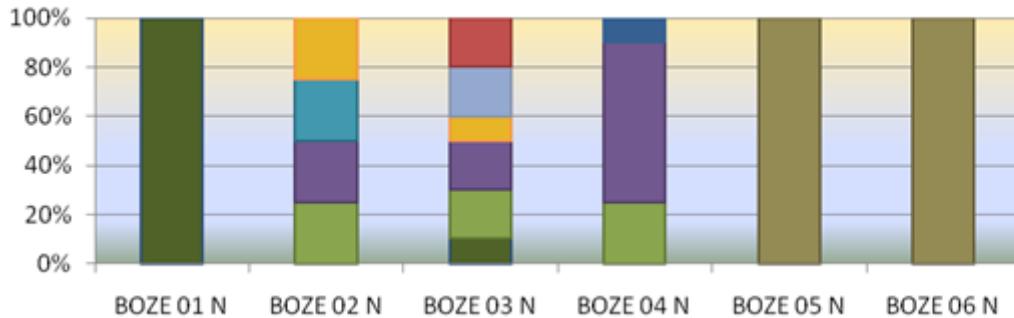


# Bozeman Creek Example



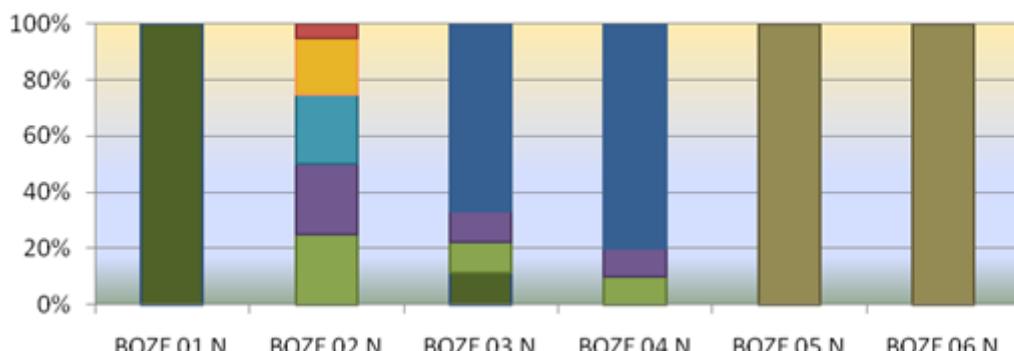
Reach ID N	Reach length (mi)	Ecoreg.	Ord.	Dom. LU	Nat.	# UP Rd xing	Rd. Encr. (ft)	Bank Ero.	Rip. Width	BMP*	Septic/ mi 150	Septic/ mi 1000
BOZE 01 N	7.64	17g	2	FOREST	Y	1	2500	L	150	NA	0.0	0.1
BOZE 02 N	2.58	17w	2	HAY	N	1	0	L	150	NA	0.0	5.8
BOZE 03 N	2.27	17w	2	RESIDENCE/HAY	N	3	0	L	130	NA	7.0	55.1
BOZE										OSW,		

Left Bank Land Use on Sourdough Creek

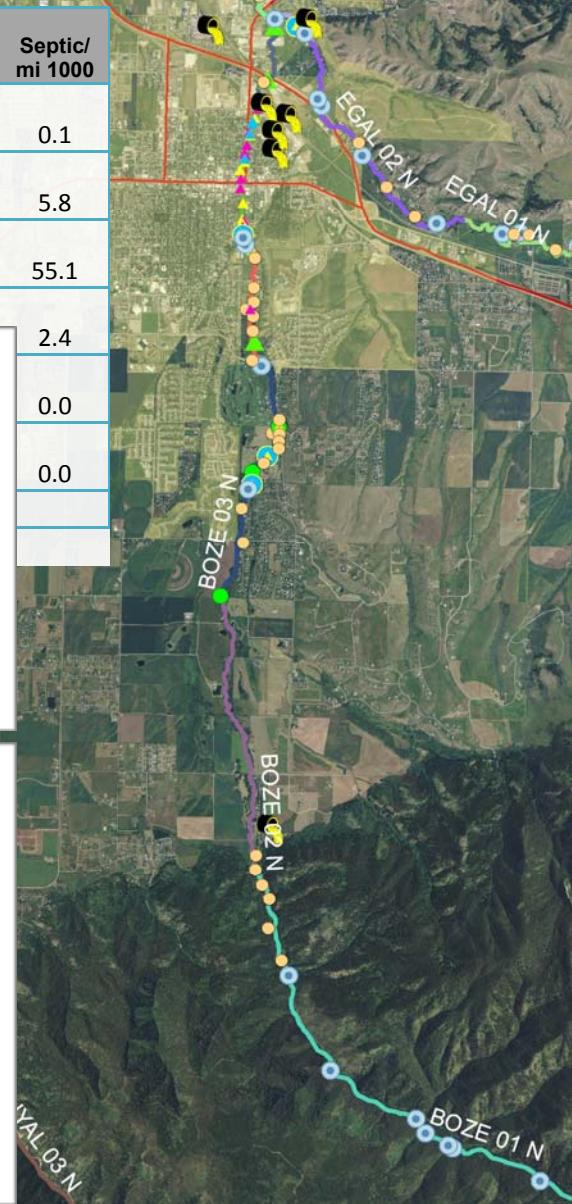


- Rural Res.
- Urban
- Residential
- Golf
- Dry Crops
- Irr. Crops
- Dry Pasture
- Irr. Pasture
- Forest

Right Bank Land Use on Sourdough Creek



- Rural Res.
- Urban
- Residential
- Golf
- Dry Crops
- Irr. Crops
- Dry Pasture
- Irr. Pasture
- Forest



POTENTIAL NUTRIENT AND E. COLI SOURCES WITHIN REACH BOZE 04 N

Pollutant Source	Source Prevalence	Pathway	Riparian Quality	Comments	Potential Significance
Pasture (Ave. % LB/RB)	55%	SW/GW	Good	primarily dry pasture; riparian condition is generally good along pasture areas but potential nutrient/E. coli source	low
Septic system per mi (150 ft/1000 ft)	0.8/2.4	GW	Good		low
Tributaries	1	SW	Good	Mathew Bird Cr is significant; potential nutrient/E. coli source	med/high
Unpaved road crossings (#)	2	SW	Good	Two private bridge crossings in good condition	low
Pipe of unknown source (#)	2	SW	NA	Exit same yard; one under water, one dripping. Likely just drains	low
Pipe (stormwater) (#)	1	SW	NA	Large concrete pipe enters at Manion residence (SDP01 in 2009 LGTPA monitoring). Flowing	med
LCA (#)	1	SW/GW	Fair	observed only one horse but manure on bank	low
Residential lawns (% directly encroaching on stream)	10%	GW/SW	Poor (no riparian where lawn encroaches)	Lawns encroach directly on the stream along South Church St; potential nutrient and E. coli source	med

Nutrient TMDLs and Allocations  
are under development...

## Additional Steps/Assessments

- Stormwater modeling within City MS4 boundary
- Investigation of Hyalite reservoir and “reasonable operation” of dams
- Flow & nutrient monitoring 2010
- Wasteload Allocations and Variance Process (SB 95)
- Public Comment Period & EPA Submittal timeline

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