Clark Fork Non-Point Source Nutrient Sampling Report for Summers of 1999 and 2000

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Submitted to,
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Funding for this study provided by,
Smurfit/Stone Container thru the Missoula County Water Quality District

PURPOSE

The Voluntary Nutrient Reduction Program (VNRP) for the Clark Fork River has set a target of reducing non-point source nutrient inputs by 20%. In-stream target levels are 20 ppb for total phosphorus and 300 ppb for total nitrogen. In order to assess whether this was being worked towards and to identify areas of concern, long-term monitoring was of nutrient input to the Clark Fork River and tributaries of concern was proposed in the spring of 1998. Monitoring began in the fall of 1998, and has continued to the present. In 2000, some sites on the Bitterroot River were added.

STUDY DESIGN

TWQC's contractor Land and Water Consulting is monitoring the mainstem and major tributaries. WQD's intern is monitoring some smaller tributaries in the upper river that look to be significant sources and/or have proposed conservation projects where nutrient reduction may be realized. The sampling dates were chosen by WQD's intern to coincide with Land and Water Consulting's mainstem water chemistry sampling in an effort to compare nutrient loadings from tributaries and mainstem levels. Nutrient sampling from tributaries of the Clark Fork River is intended to assess nutrient levels and loads.

WQD's upper river sampling sites were chosen considering various historical assessments and include: streams identified in Ingman's Section 525 Report (1992), streams impaired for nutrients on the 303d list for TMDL development, and sites identified by UM studies. In addition to sampling near the mouth of the tributaries, several sites were visited to identify specific areas in the watershed of concern. Lost Creek was sampled to assess subdivision development west of the Galen Road and ranching impacts to the lower reach. Outflow from a wetland within the new riverside park in Deer Lodge was sampled to measure its load. Historically, this site, identified by a UM graduate student, caused a sharp increase in N levels in the mainstem, thought to be a result of hydrological modification of the wetland. Gold Creek and its tributaries were also sampled to determine phosphorus levels and loads and to determine whether irrigation practices continue to increase P loads as found by Carey 1991.

METHODS

In the field, two grab samples were taken at each site by wading into the stream and dipping a 250 mg bottle into the water. The bottle was lowered to the streambed so that water collected was a mixture of different levels of the stream. 1+1 sulfuric acid was added to one sample as a preservative. The other sample was run through a .45mm filter. All samples were then placed in a cooler containing dry ice. In addition, rough estimates of stream discharge were made where USGS stream gauges were not present, in order to estimate daily nutrient loading.

The Montana Department of Public Health and Human Services, Environmental Lab in Helena performed all sample analyses. Sampling methods and laboratory analysis conform to DEQ's QAQC specifications. Filtered samples were analyzed for soluble for soluble reactive phosphorus and preserved samples were analyzed for total phosphorus, Kjeldahl N, and nitrite and nitrate.

RESULTS AND DISCUSSION

Summary of the results for the summers of 1999 and 2000 are presented in the attached figures. Figures 1 to 4 show total nitrogen loads and total phosphorus loads with Clark Fork tributaries and the mainstem. To show how tributary loads contribute to the mainstem's loads, tributary loads are "stacked" on top of the main stem sampling site located upstream of the tributary. Figures 5 to 10 show the mean concentrations of nutrient levels in Clark Fork tributaries and the main stem of the Clark Fork. Figures 5 to 10 combine data taken in the summers of 1999 and 2000. Figures 11 to 16 show the mean concentration of nutrient levels in the Bitterroot River for the summer of 2000. Figures 5 to 16 have a dashed line indicating the VNRP target levels, 20 ppb TP and 300 ppb TN. All the figures show sample sites running from upstream to downstream with upstream at the figure's left.

Figures 1 to 4

These figures show a good correlation between tributary loads and loads in the main stem. When the tributary loads are stacked on top of the main stem site upstream of it, this combined level correlates closely with the load of the next main stem site.

The City of Deer Lodge started to land apply its wastewater in the fall of 1999. Figures 3 and 4 show an increase in loading between sampling sites at Deer Lodge and the Little Blackfoot River. The rise in nutrient loading correlates with the load input from the Deer Lodge effluent. In the year 2000 there is no rise in loading between Deer Lodge and the Little Blackfoot River. The nitrogen loading even drops between these to sites. Deer Lodge's effluent loading was estimated from sampling done in 1989, 1990, and 1991.

Figures 5 to 10

Nutrient levels in most sites of the sampled tributaries are below or at the target level for Total Nitrogen (300 ppb) and Nitrate/Nitrite (30 ppb) concentrations. Sites exceeding targets include Racetrack Creek, Dempsey Creek and Arrow Stone Park. Arrow Stone Park is sampled at the outflow of a wetland site and is significantly above the target levels. All sites are at or above total nitrogen concentrations. The only tributary site just below VNRP target levels is the Little Blackfoot River. However, even though the Little Blackfoot River's concentrations are low, it still contributes a significant load to the Clark Fork

River. Other tributaries contributing a significant load of TN include Gold Creek, Lost Creek and Flint Creek.

The only tributaries below the VNRP target levels for soluble reactive phosphorus (6 ppb) and total phosphorus (20 ppb) include Lost Creek, Racetrack Creek and Arrow Stone Park. However, Lost Creek provides a significant load to the Clark Fork River. Gold Creek, Flint Creek and the Little Blackfoot River show high concentrations of total phosphorus and also contribute significant loads to the Clark Fork River.

Figures 10 to 16

All sites sampled along the Bitterroot River were below the VNRP target level for total nitrogen (300 ppb). However, of the seven sites sampled, five sites were above the VNRP target levels for phosphorus. These sites include Hamilton Bridge, Florence Bridge, below the Lolo waste treatment plant, Miller Creek and Buckhouse Bridge. Miller Creek dried up early in the summer and was only sampled once.

Currently it is hard to estimate loading for the Bitterroot River because there are only active USGS gauging stations at Buckhouse Bridge and Darby. However, the average load for the Bitterroot River at Buckhouse Bridge was 1129 kg/day for total nitrogen and 55 kg/day for total phosphorus. Since it was a low flow year, a rough estimate of Lolo Creek's discharge could be measured in July, August and September. The average loads for these months in Lolo Creek were 7.6 kg/day for total nitrogen and .2 kg/day for total phosphorus. This represents .7% and .4% of the Bitterroot's TN and TP load respectively.

Conclusion / Recommendations

Based on the results we conclude that the most significant non-point source nutrient loads in the Upper Clark Fork River come from the Little Blackfoot River, Flint Creek, Lost Creek and Gold Creek. Since Land and Water Consulting are already monitoring the Little Blackfoot and Flint Creek, we propose monthly sampling only on Lost Creek and Gold Creek during spring high flow we will attempt some synoptic sampling on these tributaries and on Dempsey Creek and Cottonwood Creek which have NRCS conservation projects underway. We will also continue sampling the Bitterroot River sites sampled last year.

Carey, Jennifer. 1991. Phosphorus Sources in Gold Creek, a tributary of the Clark Fork River in Western Montana. Masters Thesis, U. of Montana Dept. of Environmental Studies.

Ingman, G.L. 1992b.   Assessment of phosphorus and nitrogen sources in the Clark Fork River Basin. State of Montana, Department of Health and Environmental Sciences. Section 525 of 1987 Clean Water Act Amendments.

Clark Fork River Figures

Figure 1

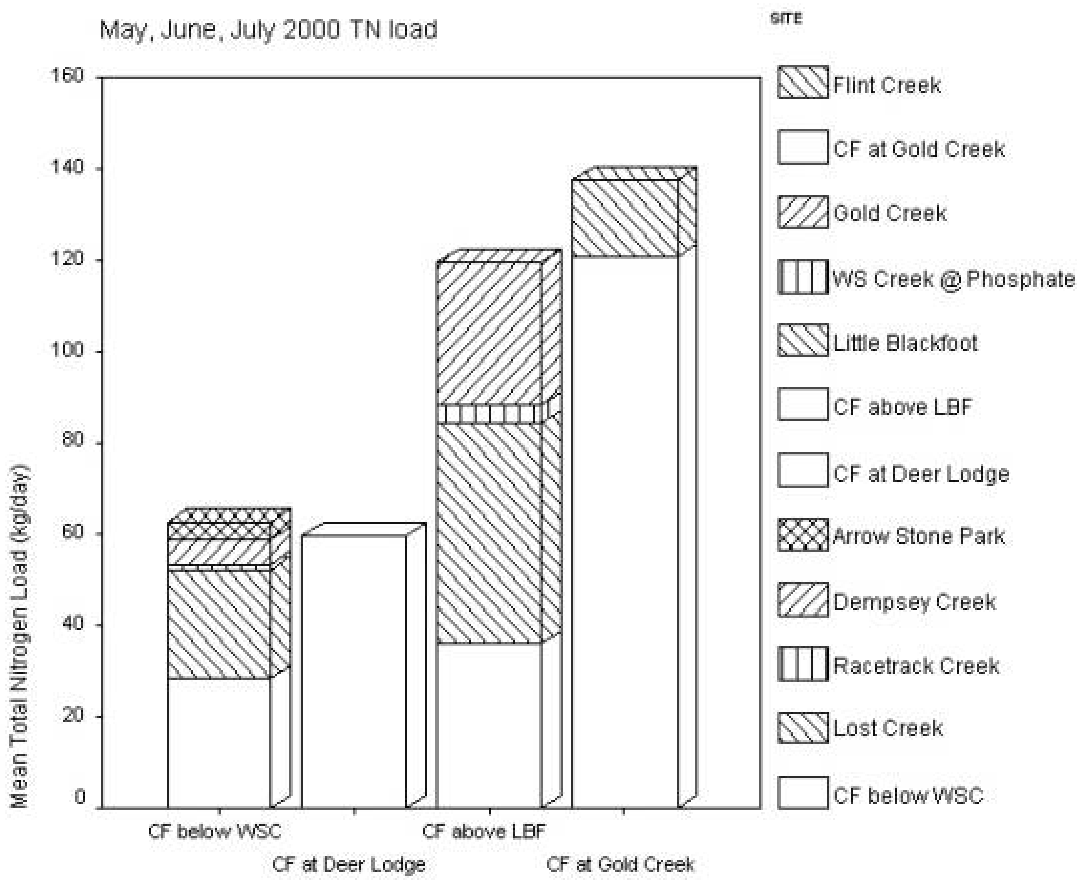


Figure 2

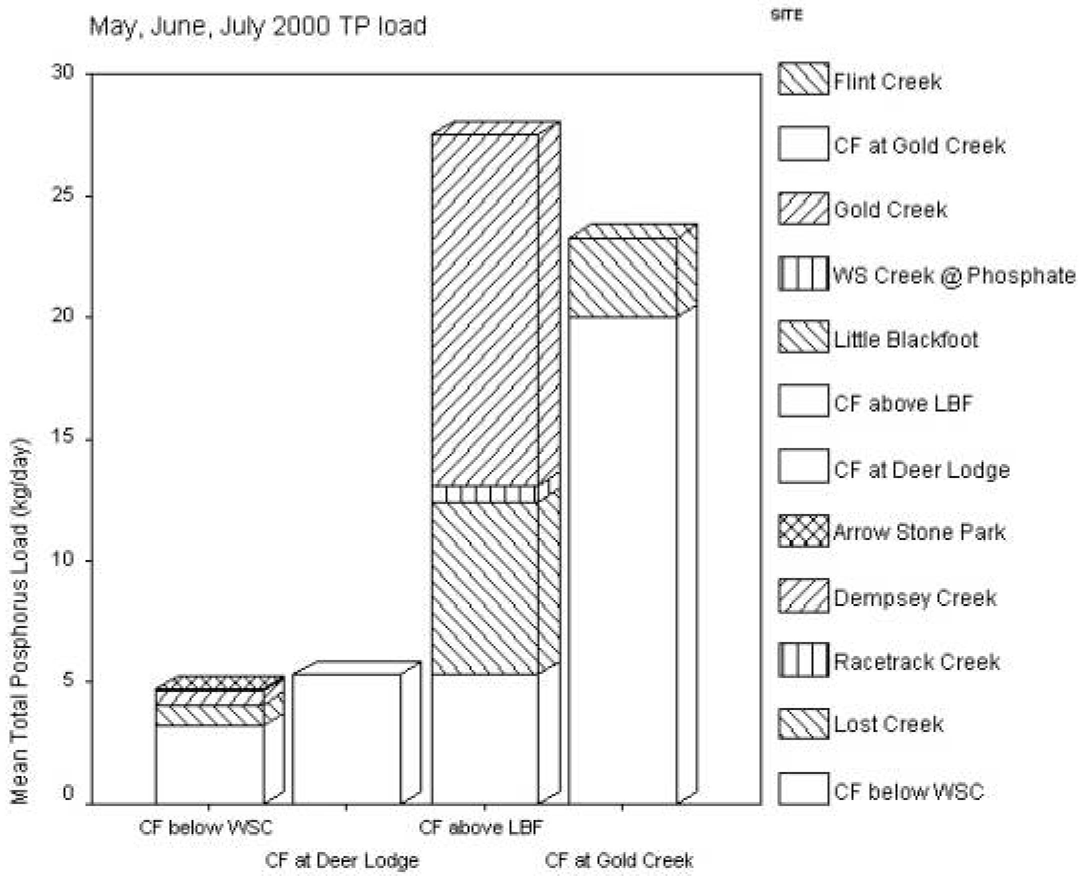

May, June, July 2000 TP load
SITE
Flint Creek
CF at Gold Creek
Gold Creek
WS Creek @ Phosphate
Little Blackfoot
CF above LBF
CF at Deer Lodge
Arrow Stone Park
Dempsey Creek
Racetrack Creek
Lost Creek
CF below WSC
Mean Total Posphorus Load (kg/day)
0
5
10
15
20
25
30
CF below WSC
CF at Deer Lodge
CF above LBF
CF at Gold Creek

Figure 3

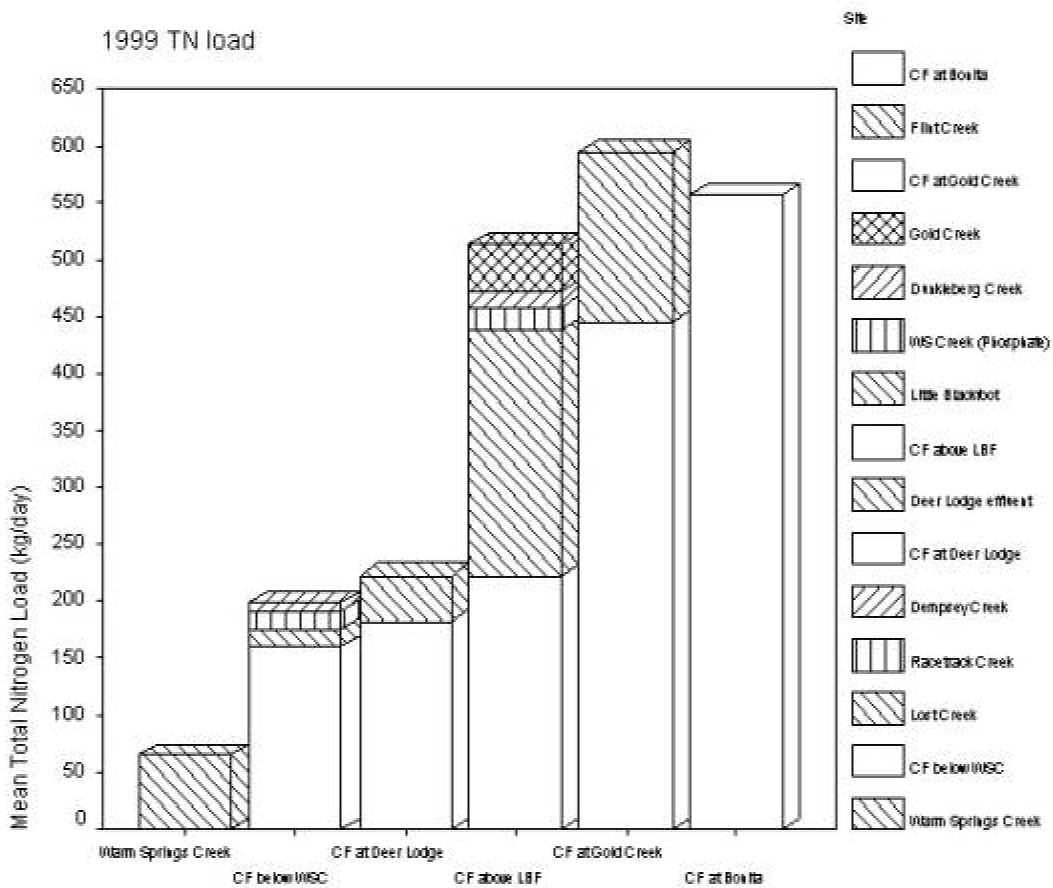
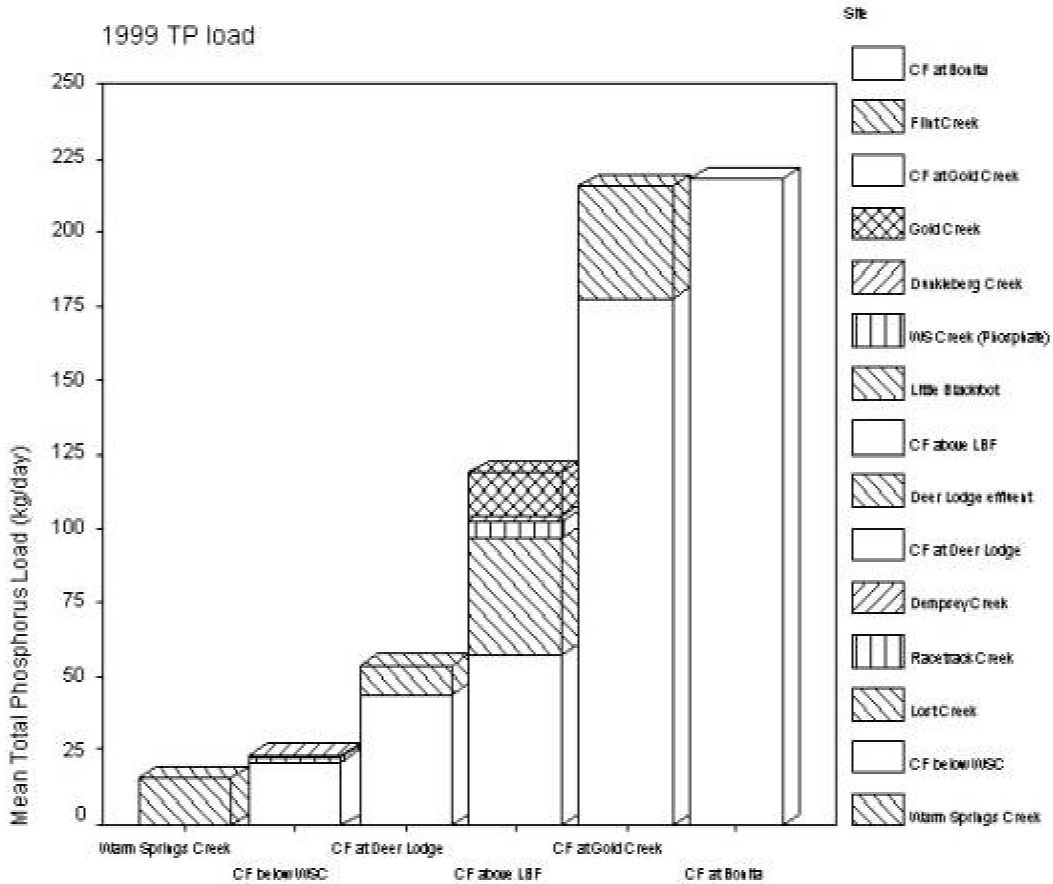

1999 TN load
Mean Total Nitrogen Load (kg/day)
650
600
550
500
450
400
350
300
250
200
150
100
50
0
Warm Springs Creek
CF below WSC
CF at Deer Lodge
CF above LBF
CF at Gold Creek
CF at Bonita
Site
CF at Bonita
Flint Creek
CF at Gold Creek
Gold Creek
Dunkleberg Creek
WS Creek (Phosphate)
Little Blackfoot
CF above LBF
Deer Lodge effluent
CF at Deer Lodge
Dempsey Creek
Racetrack Creek
Lost Creek
CF below WSC
Warm Springs Creek

Figure 4


1999 TP load
Mean Total Phosphorus Load (kg/day)
250
225
200
175
150
125
100
75
50
25
0
Warm Springs Creek
CF below WSC
CF at Deer Lodge
CF above LBF
CF at Gold Creek
CF at Bonita
Site
CF at Bonita
Flint Creek
CF at Gold Creek
Gold Creek
Dunkleberg Creek
WS Creek (Phosphate)
Little Blackfoot
CF above LBF
Deer Lodge effluent
CF at Deer Lodge
Dempsey Creek
Racetrack Creek
Lost Creek
CF below WSC
Warm Springs Creek

Clark Fork River Figures summers of 1999 and 2000

Figure 5

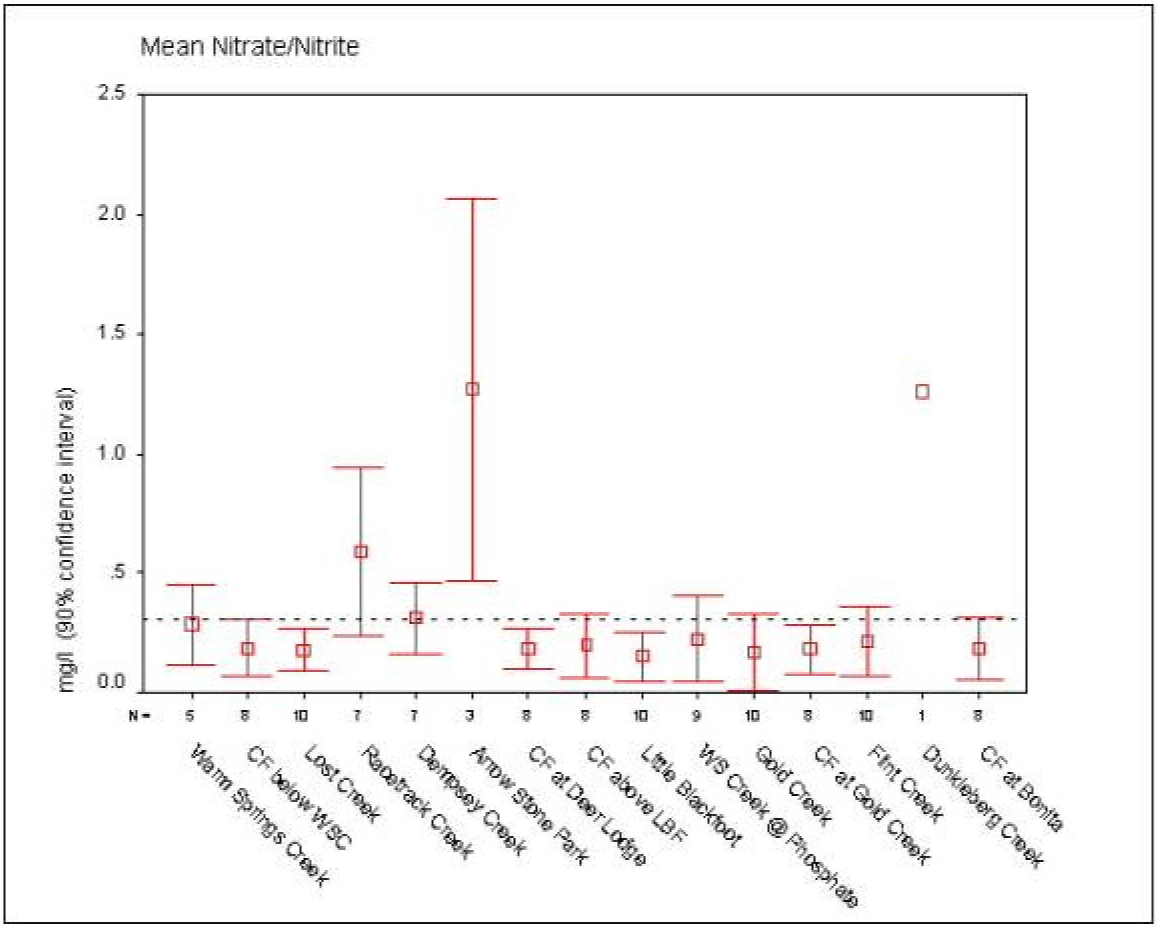


Figure 6

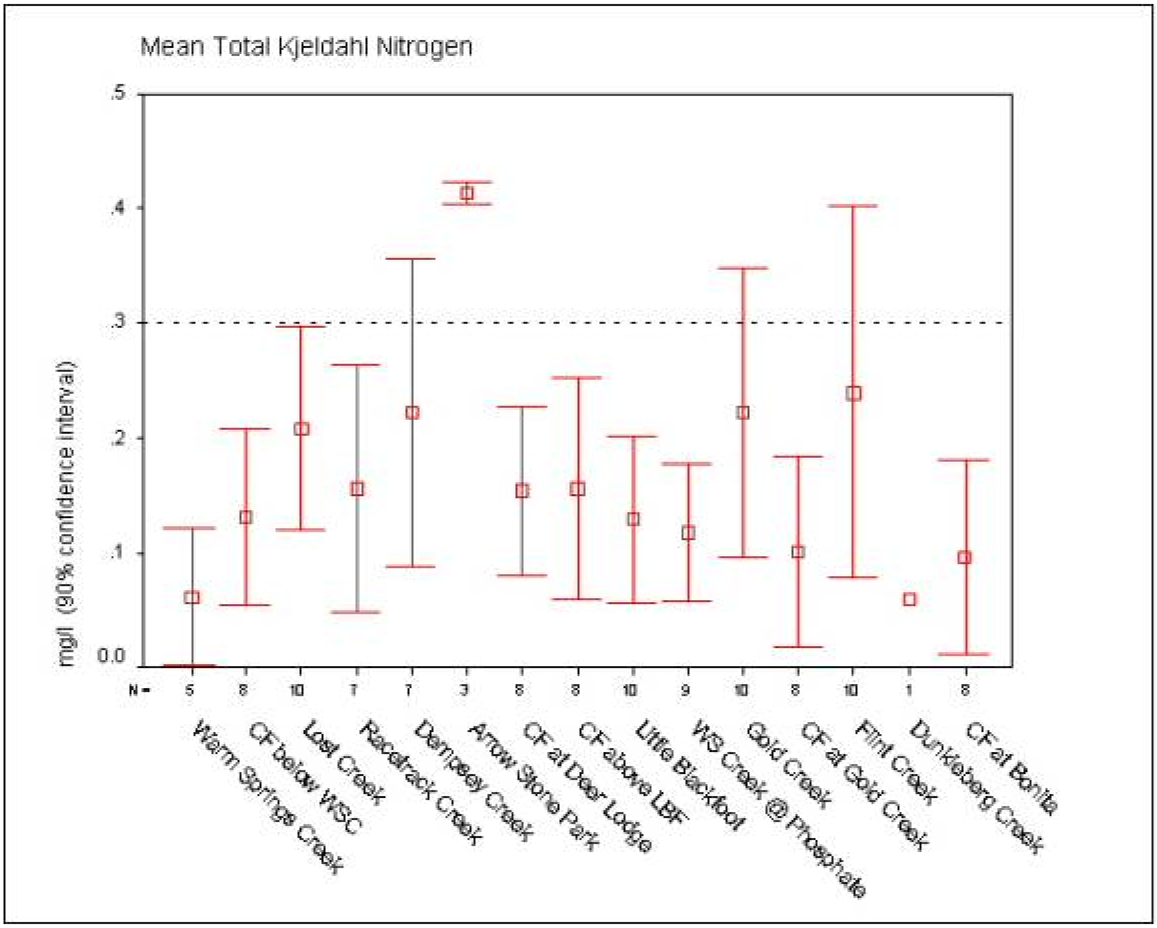
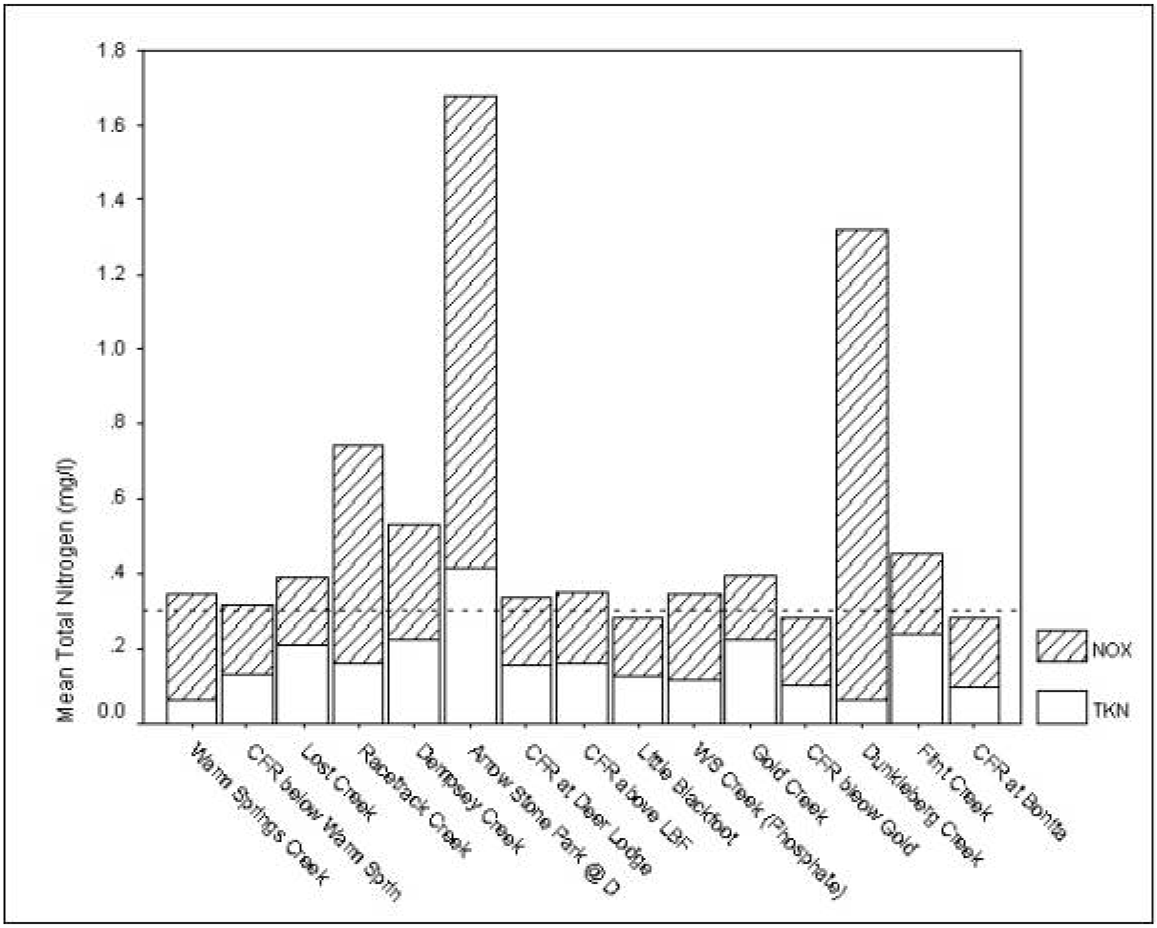

Mean Total Kjeldahl Nitrogen
mg/l (90% confidence interval)
.5
.4
.3
.2
.1
0.0
N =
5
8
10
7
7
3
8
8
10
9
10
8
10
1
8
Warm Springs Creek
CF below WSC
Lost Creek
Racetrack Creek
Dempsey Creek
Arrow Stone Park
CF at Deer Lodge
CF above LBF
Little Blackfoot
WS Creek @ Phosphate
Gold Creek
CF at Gold Creek
Flint Creek
Dunkleberg Creek
CF at Bonita

Figure 7



Mean Total Nitrogen (mg/l)
1.8
1.6
1.4
1.2
1.0
.8
.6
.4
.2
0.0
Warm Springs Creek
CFR below Warm Sprin
Lost Creek
Racetrack Creek
Dempsey Creek
Arrow Stone Park @ D
CFR at Deer Lodge
CFR above LBF
Little Blackfoot
WS Creek (Phosphate)
Gold Creek
CFR blow Gold
Dunkleberg Creek
Flint Creek
CFR at Bonita
NOX
TKN

Figure 8

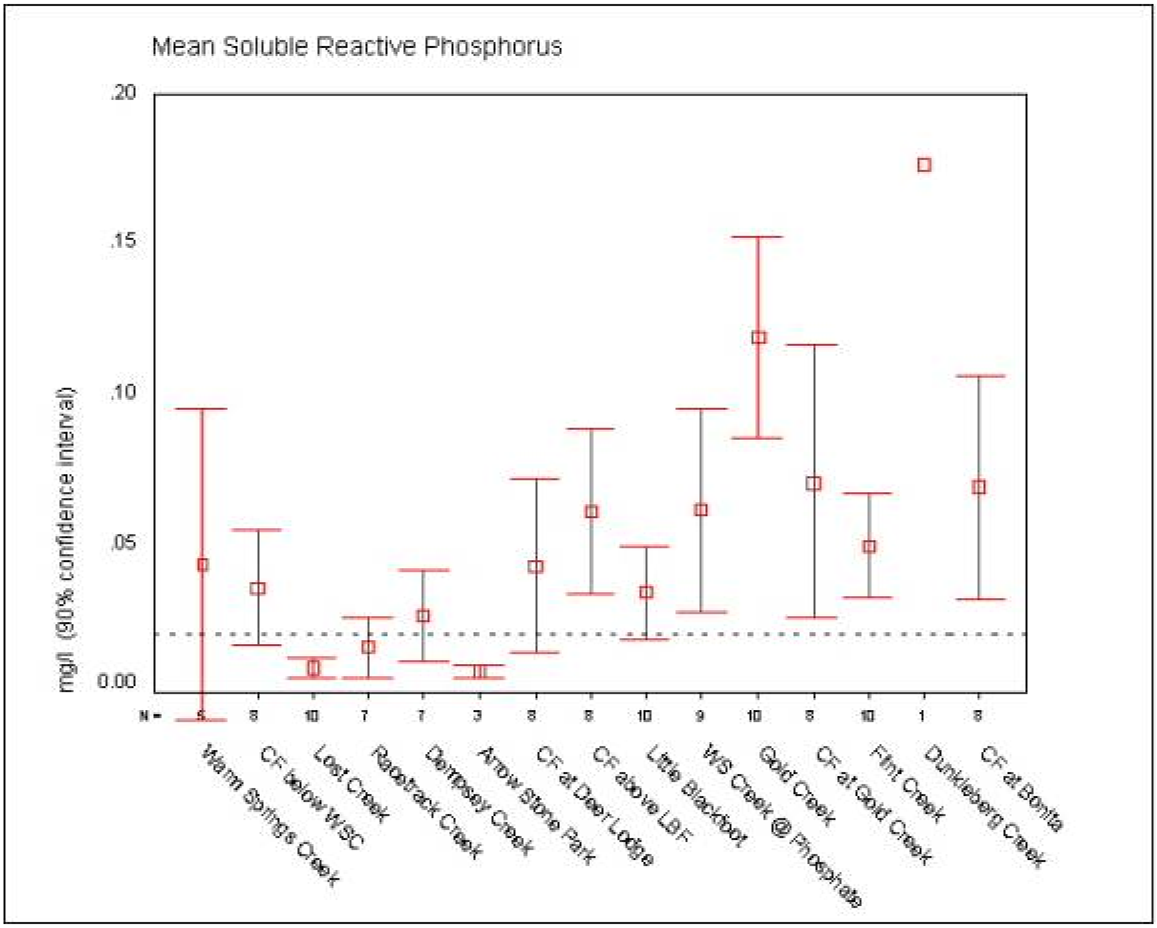

Mean Soluble Reactive Phosphorus
.20
.15
.10
.05
0.00
mg/l (90% confidence interval)
N =
5
8
10
7
7
3
8
8
10
9
10
8
10
1
8
Warm Springs Creek
CF below WSC
Lost Creek
Racetrack Creek
Dempsey Creek
Arrow Stone Park
CF at Deer Lodge
CF above LBF
Little Blackfoot
WS Creek @ Phosphate
Gold Creek
CF at Gold Creek
Flint Creek
Dunkleberg Creek
CF at Bonita

Figure 9

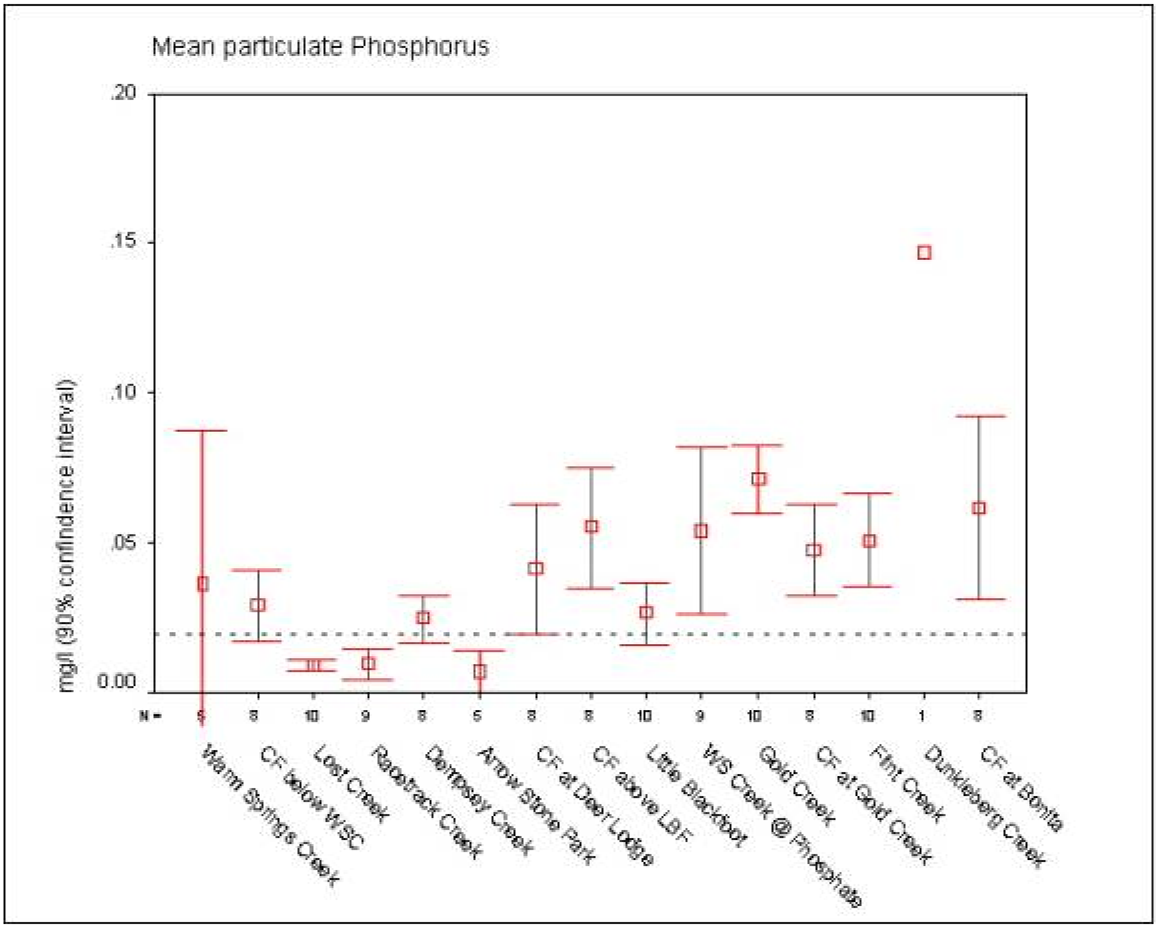
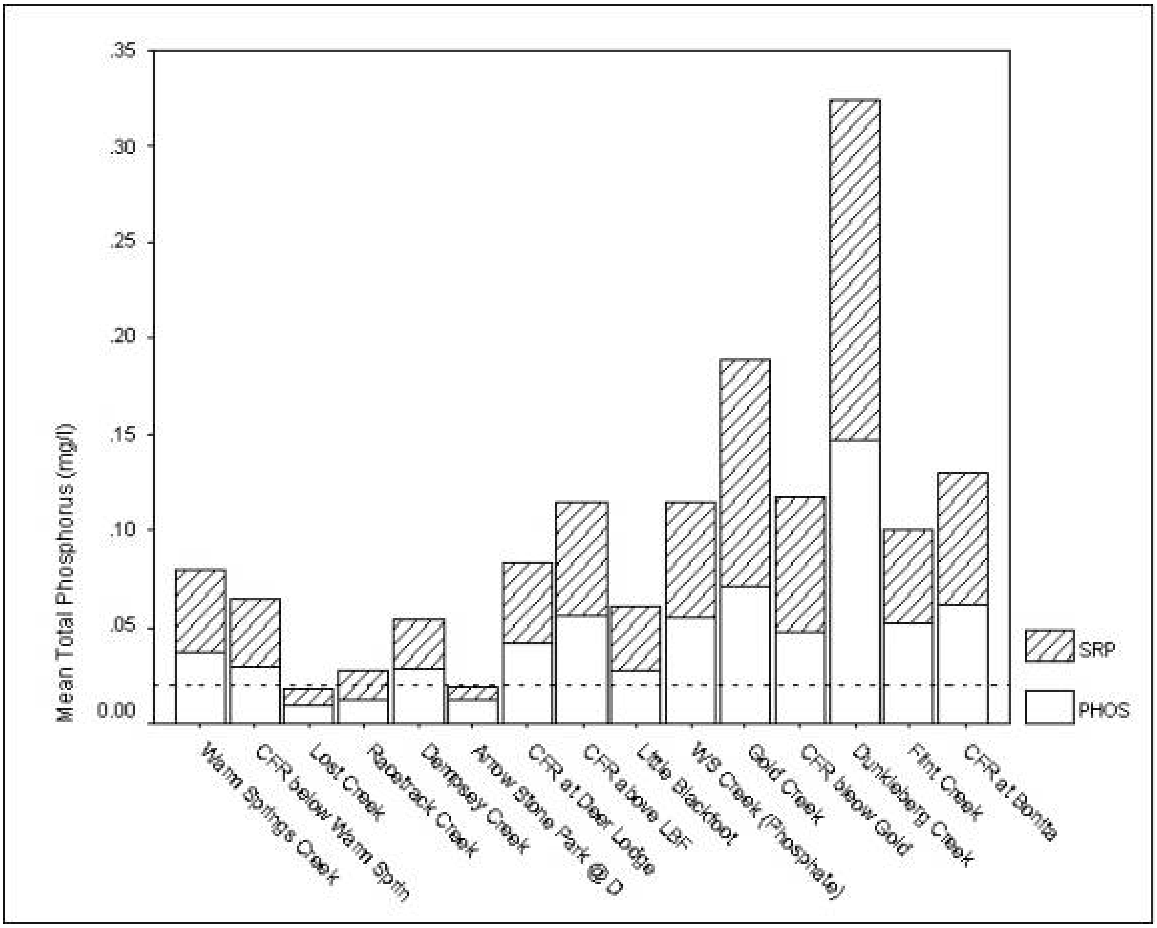

Mean particulate Phosphorus
mg/l (90% confindence interval)
.20
.15
.10
.05
0.00
N =
5
8
10
9
8
5
8
8
10
9
10
8
10
1
8
Warm Springs Creek
CF below WSC
Lost Creek
Racetrack Creek
Dempsey Creek
Arrow Stone Park
CF at Deer Lodge
CF above LBF
Little Blackfoot
WS Creek @ Phosphate
Gold Creek
CF at Gold Creek
Flint Creek
Dunkleberg Creek
CF at Bonita

Figure 10


Mean Total Phosphorus (mg/l)
.35
.30
.25
.20
.15
.10
.05
0.00
Warm Springs Creek
CFR below Warm Sprin
Lost Creek
Racetrack Creek
Dempsey Creek
Arrow Stone Park @ D
CFR at Deer Lodge
CFR above LBF
Little Blackfoot
W/S Creek (Phosphate)
Gold Creek
CFR below Gold
Dunkleberg Creek
Flint Creek
CFR at Bonita
SRP
PHOS

Bitterroot River Figures May to September, 2000

Figure 11

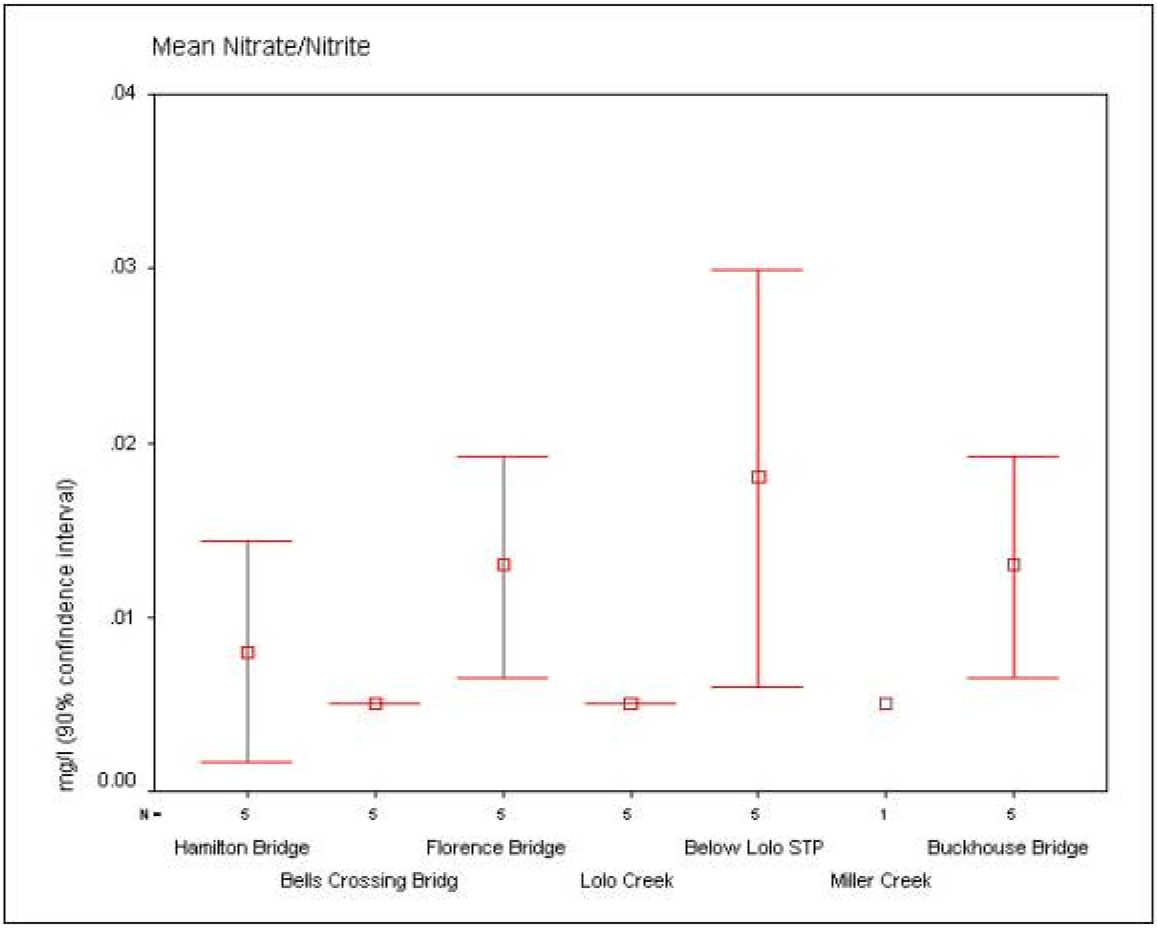


Figure 12

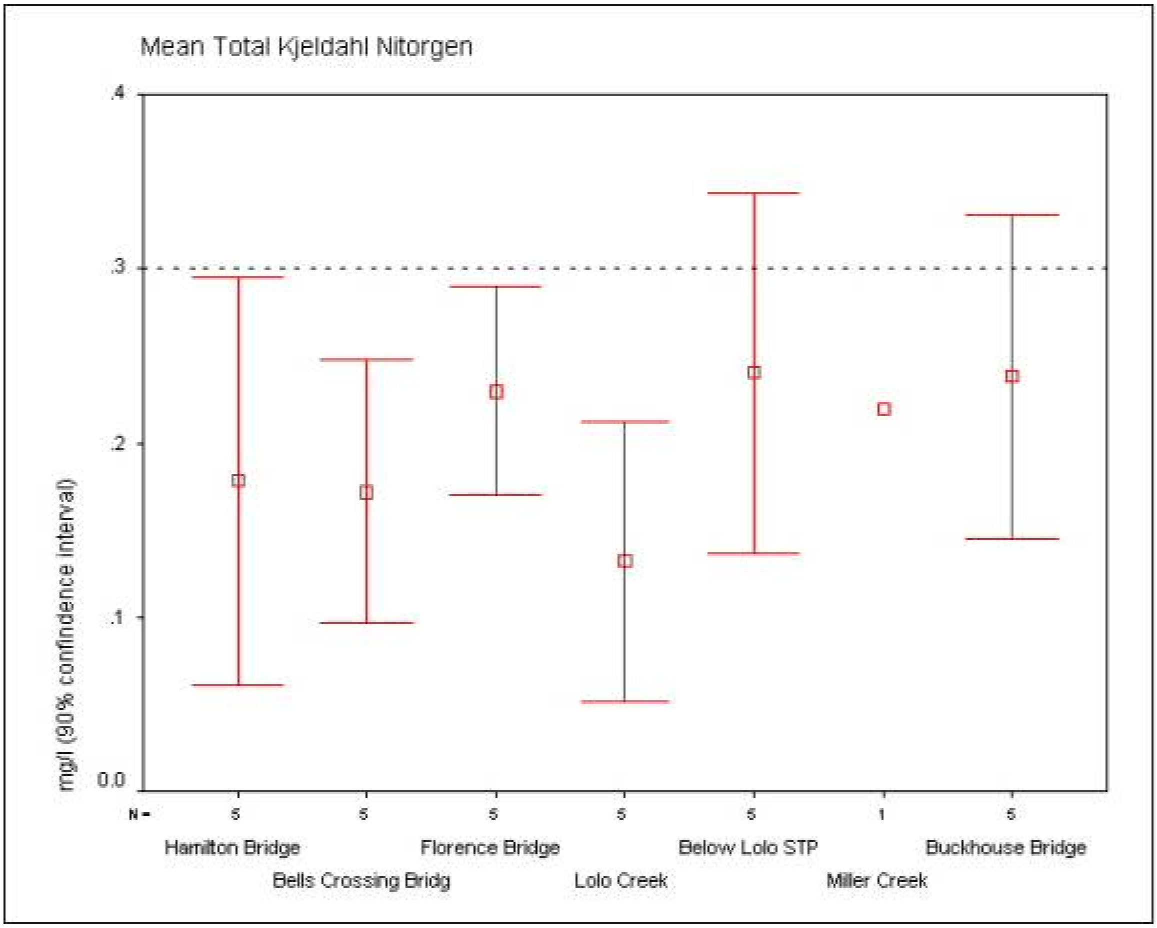

Mean Total Kjeldahl Nitorgen
.4
.3
.2
.1
0.0
mg/l (90% confindence interval)
N =
5
5
5
5
5
1
5
Hamilton Bridge
Bells Crossing Bridg
Florence Bridge
Lolo Creek
Below Lolo STP
Miller Creek
Buckhouse Bridge

Figure 13

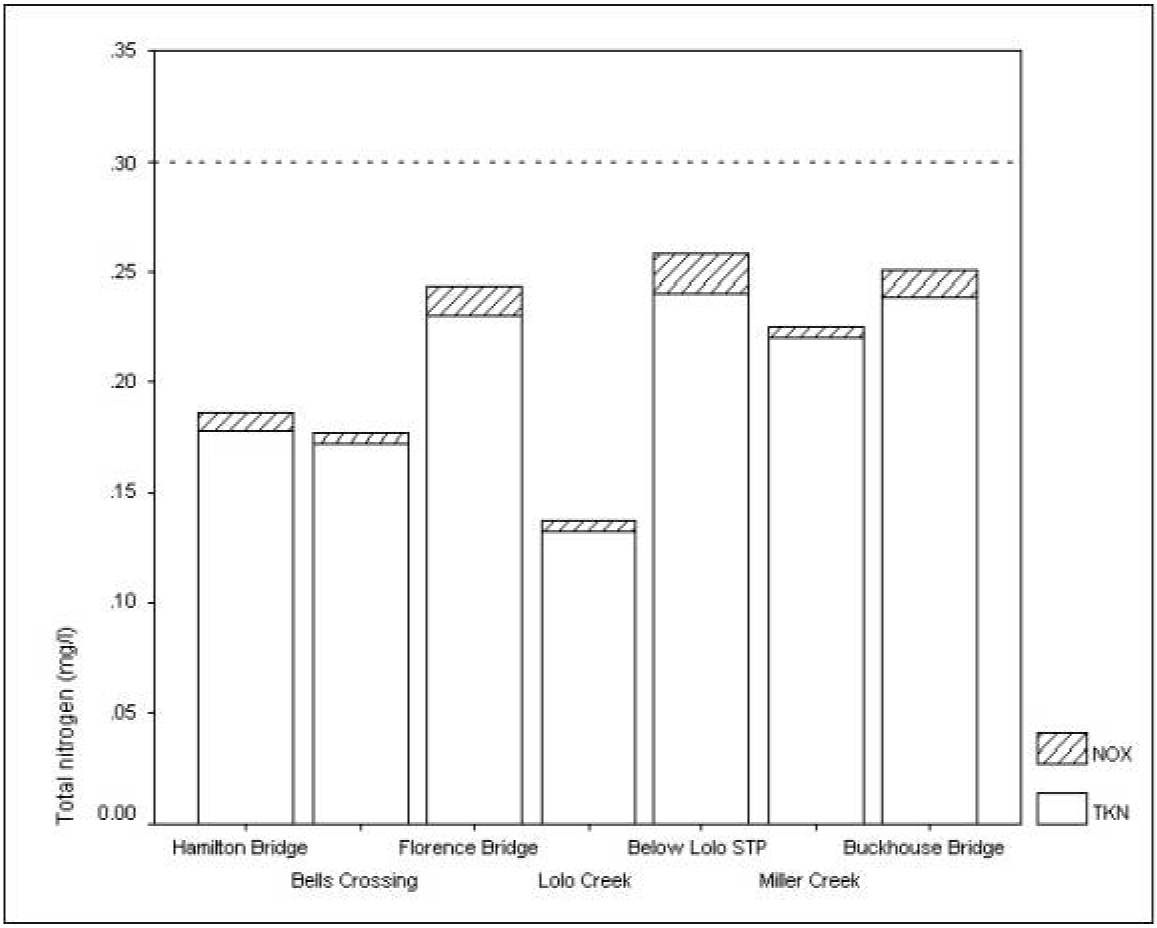

.35
.30
.25
.20
.15
.10
.05
0.00
Total nitrogen (mg/l)
Hamilton Bridge
Bells Crossing
Florence Bridge
Lolo Creek
Below Lolo STP
Miller Creek
Buckhouse Bridge
NOX
TKN

Figure 14

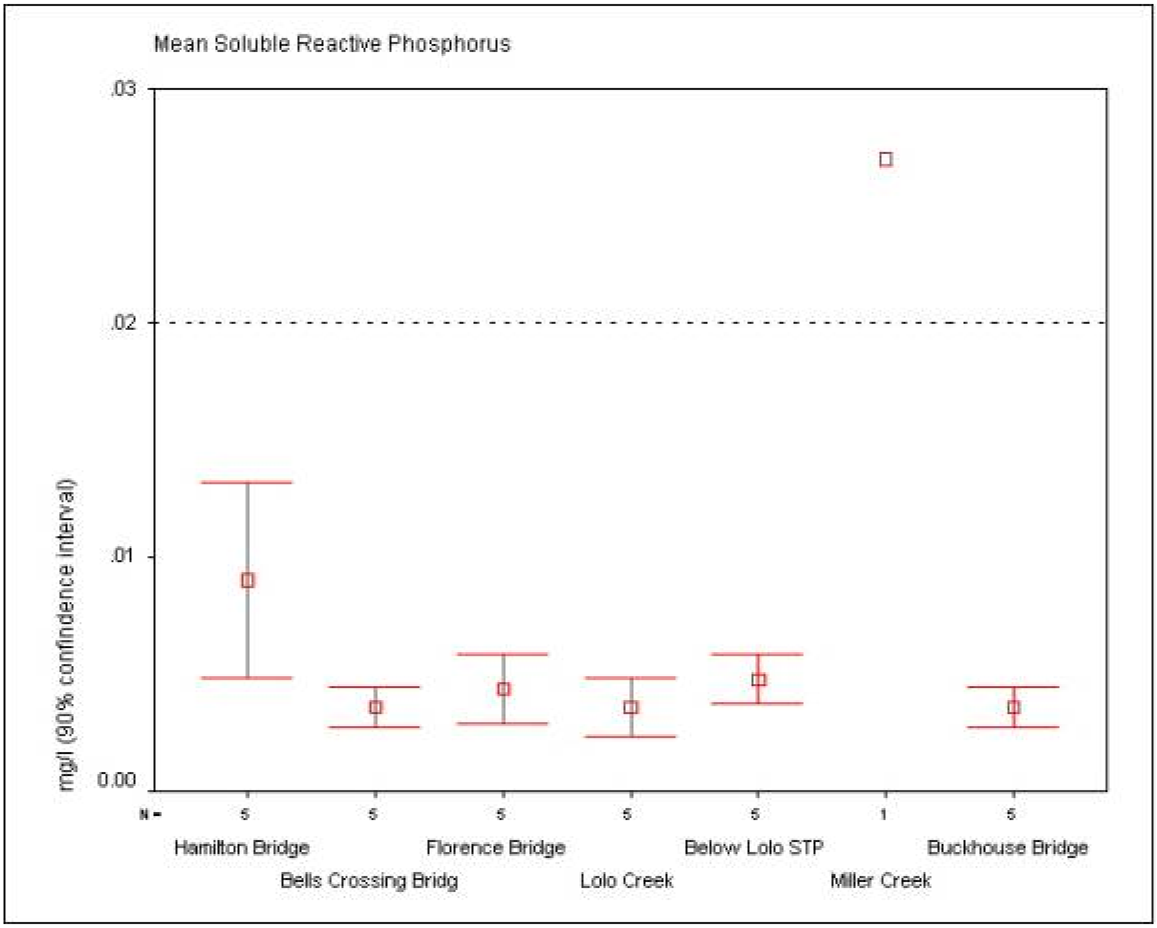

Mean Soluble Reactive Phosphorus
.03
.02
.01
0.00
mg/l (90% confindence interval)
N =
5
5
5
5
5
1
5
Hamilton Bridge
Bells Crossing Bridg
Florence Bridge
Lolo Creek
Below Lolo STP
Miller Creek
Buckhouse Bridge

Figure 15

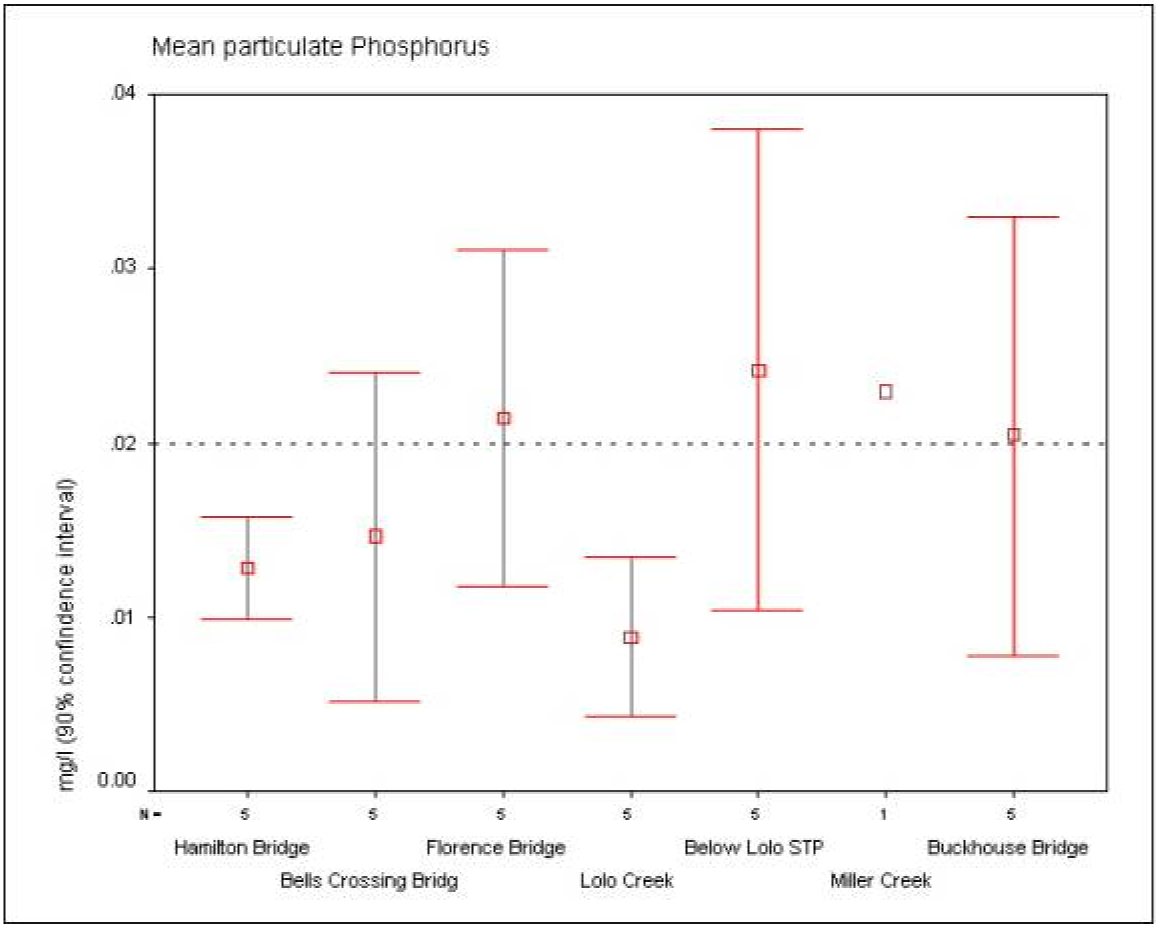
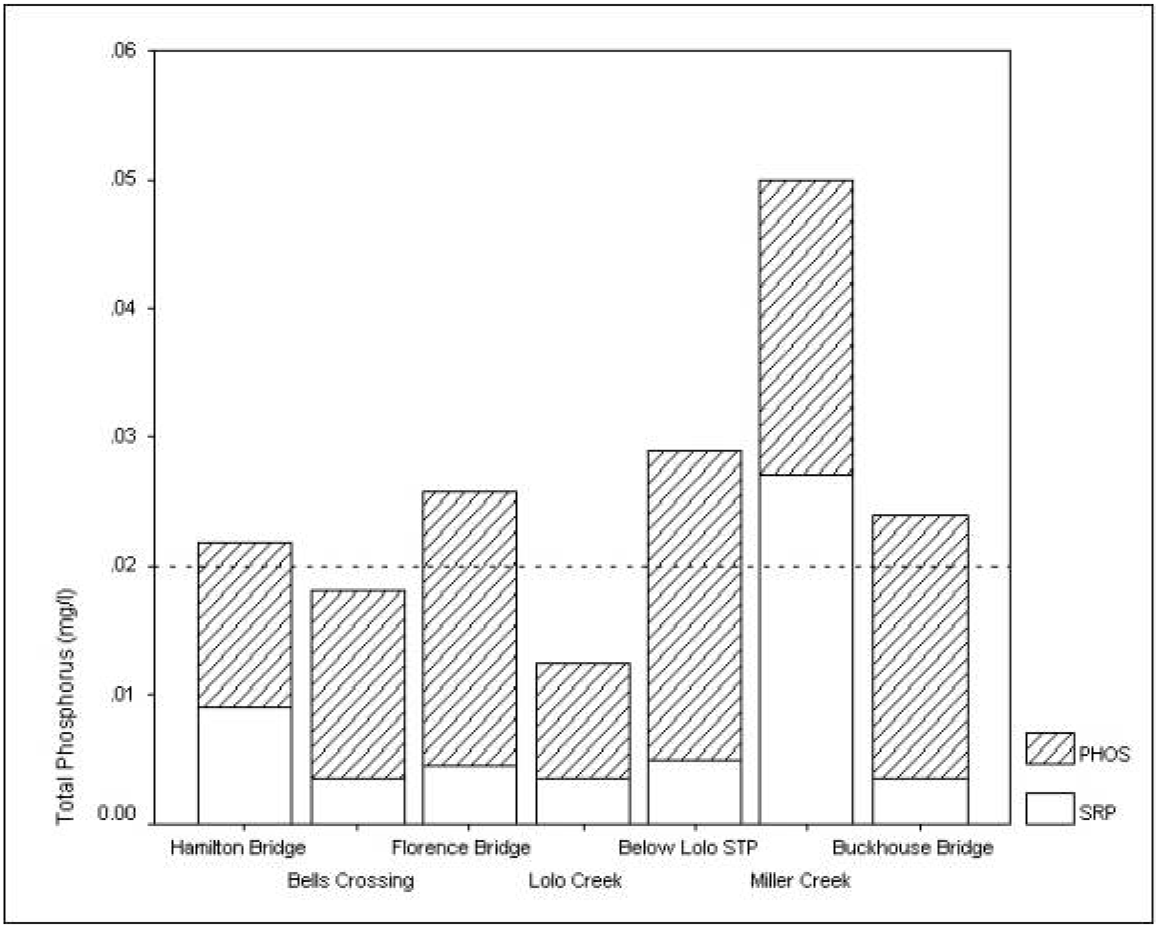

Mean particulate Phosphorus
.04
.03
.02
.01
0.00
mg/l (90% confindence interval)
N =
5
5
5
5
5
1
5
Hamilton Bridge
Bells Crossing Bridg
Florence Bridge
Lolo Creek
Below Lolo STP
Miller Creek
Buckhouse Bridge

Figure 16


.06
.05
.04
.03
.02
.01
0.00
Total Phosphorus (mg/l)
Hamilton Bridge
Bells Crossing
Florence Bridge
Lolo Creek
Below Lolo STP
Miller Creek
Buckhouse Bridge
PHOS
SRP