

**WYOMING DEPARTMENT OF ENVIRONMENTAL QUALITY
WATER QUALITY DIVISION
MONITORING AND ASSESSMENT REPORT**

Waterbody: Hams Fork River

Watershed: Green

Hydrologic Unit Code: WYGR14040107

Segment: 020-3, 045-2

Investigators: Jack Smith, Glen Garton, Tavis Eddy, Jules Feck, Brad Pehrson,
1995 data: Kurt King

Author: Tavis Eddy

INTRODUCTION

The entire reach of the Hams Fork River is classified as a Class 2AB, cold water stream (WQD/DEQ 2001a). Class 2AB waters are those known to support game fish populations or spawning and nursing areas at least seasonally, and all their perennial tributaries and adjacent wetlands, and where a game fishery and drinking water use is otherwise attainable. Such waters are also protected for drinking water supplies, nongame fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture, and scenic value. The Hams Fork River originates in the region of the Commissary Ridge in the Wyoming Range in western Wyoming. The creek flows south-southeast before joining the Blacks Fork (Class 2AB), a tributary to Flaming Gorge Reservoir.

The Hams Fork River was included in the WDEQ/WQD Monitoring Program because inconclusive information suggested partial use support for aquatic life and cold water fish due to siltation and habitat loss. Possible causes include pastureland grazing, road development, irrigated crops, and unknown sources (WDEQ/WQD, 1996). Furthermore, the Kemmerer/Diamondville Wastewater Treatment Plant was due for its routine permit renewal under the NPDES program. For the purpose of defining proper Waste Load Allocations, the Hams Fork system therefore merited monitoring. The Kemmerer/Diamondville Wastewater Treatment Plant discharges into the Hams Fork, and under their permit, they are required to meet specific thresholds for the parameters of BOD, total suspended solids, total dissolved solids, pH, fecal coliform bacteria, total residual chlorine, and ammonia. Whole effluent testing (WET) for toxicity thresholds is also periodically conducted.

DESCRIPTION OF BIOASSESSMENT STATIONS

Five bioassessment stations were established along this segment in the period from September 15th 1998 to September 17th, 1998. Two additional water quality stations were also established at this time. All stations are presented on Table 1, including the two stations established in 1995. Photos of the 1998 stations are in Appendix A. The 1995 stations are the two most upstream stations and the Campground station is designated as a least-impacted reference site. For the remainder of this report, the Station ID (for example, MRW53) will be

used to reference the individual station.

The sampler noted that no recent precipitation events (within the previous week) had occurred at the sites above the town of Kemmerer prior to sampling for the 1998 data. For the sites below town precipitation had occurred three days prior to sampling, but did not appear to have a significant influence on the data collected.

METHODS

Water quality samples were taken at each Hams Fork River assessment station on September 15th, 1998. Grab samples were collected, preserved, transported, and analyzed in accordance with procedures outlined in the department's Quality Assurance Project Plan for Beneficial Use Reconnaissance Project WDEQ/WQD (2001) and Manual of Standard Operating Procedures for Sample Collection and Analysis WDEQ/WQD (2004).

The qualitative habitat quality assessment for the Hams Fork covered a reach upstream from the riffle used for macroinvertebrate sampling. The reach length is determined by multiplying the bankfull width by 20, or at a minimum, a 360-foot reach length is used. Thirteen parameters (5 primary parameters, 4 secondary parameters, and 4 tertiary parameters) were evaluated. Evaluation of these parameters allow for a total habitat score ranging from zero to 200 points. High total point scores equate to high quality habitat. Habitat parameters are listed in Table 5 at the end of this report. Physical (habitat quality) data were collected and analyzed according to WDEQ/WQD bioassessment protocols (WDEQ/WQD, 2004).

Pools are assessed in accordance with the Manual of Standard Operating Procedures for Sample Collection and Analysis (WDEQ/WQD, 2004). Four pools within the reach were assessed for depth, overhead cover, subsurface cover, bank condition, and substrate size. Values from these parameters are converted into a summary score for each individual pool.

Macroinvertebrate samples were taken from a riffle habitat. Eight surber samples were randomly located at each station and a composite sample was obtained. Silt covering, substrate size and velocity were also measured at these locations. Samples were collected and preserved according to WDEQ/WQD bioassessment protocols. Macroinvertebrate samples were sent to WDEQ/WQD's contract laboratory (Aquatic Biology Associates, Corvallis, OR) where they were processed and subsampled according to WDEQ/WQD protocol and standard taxonomic effort (WDEQ/WQD, 2004). Results are in Appendix B.

Evaluation of the macroinvertebrate data was conducted through the use of the Wyoming Stream Integrity Index (WSII; Stribling et al., 2000, Jessup and Stribling 2002), the Fine Sediment Biotic Index (FSBI; Relyea et al, 2000), and additional community metrics.

The WSII is a regionally calibrated multi-metric biological index for assessing aquatic life use support in Wyoming streams. Because biological communities of Wyoming streams vary across natural gradients of environmental conditions, a two-tiered site classification scheme was used to group stations into relatively homogeneous units. The primary classification was the level III ecoregions of Omernik (1987); the secondary classification was an aggregation of ecoregions into areas of relative biological similarity (bioregions). Core macroinvertebrate

metrics with pronounced discrimination efficiency (degree of separation between metric value distributions of reference and degraded stations within each bioregion) were incorporated into the WSII. Scoring of individual metric values was based on comparison to the 5th or 95th percentile of bioregional reference stream data for each specific metric. Specific metric scoring formulae are presented in Stribling et al. (2000). The final index score is an average of the individual metric scores.

The Fine Sediment Biotic Index (FSBI; Relyea et al., 2000) is an index used to detect and monitor changes in stream ecosystem health directly due to increases in fine inorganic sediments in the streambed. It was applied to the Hams Fork data to determine if excess fine sediments were affecting the composition of the macroinvertebrate community. Higher scores indicate lower community tolerance to fine sediment. See Relyea et al. (2000) for more details on this index.

Quality Assurance/Quality Control

Environmental data from the Hams Fork River was collected in accordance to the methods, procedures, and techniques listed in the Methods section of this report. Station QA/QC reports for each sample station are attached to this report. All physical, biological and chemical data for 1998 and 2004 were determined to be complete and accurate.

RESULTS AND DISCUSSION

Physical Setting

The stations were identified to monitor the variation of the Hams Fork system, in response to natural and anthropogenic factors, as it descends from the overthrust landscape of the Wyoming Range to the arid context of the central Green River basin. MRW88, MRW89, MRW53 and MRW8 are within the Mid-Elevation Sedimentary Mountains of the Middle Rockies ecoregion (Chapman et al, 2003). Each station is upstream of the Viva Naughton and Kemmerer City Reservoirs.

The geology and soils are highly similar at these stations. The predominant geology at these two sample stations was determined to be the Wasatch Formation (Tw), which is a variegated mudstone and sandstone. The state wide digital soils map of Wyoming (Munn and Arneson, 1998) lists the general soil taxonomy (order/suborder/great group/subgroup) at these upper stations to be Aridic Haplustolls and Ustic Haplocambriids. These soils are on Tertiary-age parent materials along the edges of basins under sagebrush grasslands and are fine, loamy and frigid. Recreation and wildlife habitat was determined to be the primary land use (livestock grazing as a secondary use) for MRW88, and livestock grazing was the primary land use for MRW89.

The remaining three bioassessment stations and two water quality stations are located within the Wyoming Basins ecoregion, traversing three level IV ecoregions prior to joining the Blacks Fork. These ecoregions include the Rolling Sagebrush Steppe, Foothill Shrublands and Low Mountains, and Salt Desert Shrub Basins (Chapman et al, 2003). These unglaciated

ecoregions exist below 5800 feet and have Quaternary alluvium and colluvium geology over sedimentary deposits. Geologically, the Willow Creek sampling location reflects the shales and sandstone of the Hilliard and Frontier Formation. WB64 and WBI25 lie above and below the towns of Kemmerer/Diamondville, respectively. The geology for these two stations is the Frontier Formation, which is a white to brown sandstone and dark grey shale. WQWB09 is on general alluvium and colluvium, and WB65 is on the greenish gray, olive drab sandstone of the Bridger Formation. The geological structure plays a significant role in the general orientation of the Hams Fork. In a relatively elongate drainage pattern, the Hams Fork flows south while following the general strike of the overthrust belt. Southeast of Kemmerer the channel veers east and southeast, flowing across the sediments of the central Green River Basin.

The Hams Fork stations, as shown in the Table 1, are mainly Rosgen C stream types with the most upstream station and the Willow Creek tributary exhibiting E characteristics. The uppermost station, MRW88, exhibited E3 qualities (but was tending toward a C), which are commonly systems with moderate sinuosity, gentle gradients and low width to depth ratios. The sinuosities and meander width decrease with an increase in channel slope. Typically, in an E3 system, the streambanks are composed of materials finer than that of the dominant substrate materials. The riparian vegetation is therefore critical in maintaining bank stability. Hydraulically efficient, these narrow and relatively deep 'E' systems maintain resistance to plan form adjustment, which results in minimal downcutting (Rosgen, 1996).

As the system becomes larger, below the influence of the two reservoirs, it takes on different characteristics. Some braiding is evident immediately below the reservoirs, but the remainder of the stations demonstrated 'C' characteristics. MRW89, WB64, and WBI25 stations were classified as C3 stream types. The C3 system is a slightly entrenched, meandering, riffle/pool, cobble-dominated channel with an established floodplain. Such systems can be susceptible to bank erosion. The C4 nature of the channel at WB65 indicates a fining of channel bottom materials with high erosion potential in the outer cutbanks (Rosgen, 1996).

Photographs taken at each sampling station include upstream, downstream, and panoramic views. These photographs can be found in the Hams Fork River assessment file. The riffles are observable in the photographs, as is the surrounding riparian vegetation. Additional photographs documenting special circumstances can also be found in the assessment file.

Water Quality

Water quality samples were collected at all of the 1998 Hams Fork sampling locations on September 15th, 1998. DEQ personnel collected the 1995 data on October 5th, 1995, and the 2004 data on May 17-18, and September 28-29. Water quality parameters and results for the Hams Fork River stations are found in Tables 3, 13 and 14 at the end of this report.

Most of these parameters fall within expected ranges, and meet the WDEQ/WQD (2001b) water quality criteria. The values for turbidity and total suspended solids increase in the downstream part of the reach. They are explained below. Willow Creek had the highest values for the parameters of conductivity, alkalinity, chlorides, sulfates and total hardness. This is partially due to the geology and coal mining history in this small watershed. The springs in the

Willow Creek watershed (see historical data section) also are likely factors in the water chemistry.

The Hams Fork River exhibited no surface sheen or odors at the time of the 1998 sampling. The water had a slightly greenish hue at Willow Creek, WB64 and WB65. There was a slightly murky color at MRW88.

High pH readings have been recorded along the Hams Fork River, with an increase below the towns of Kemmerer/Diamondville. The pH values were greater than 9.0 standard units at least twice within a three-year period and have therefore provided reason for some directed monitoring. Further explanation of historical pH readings is provided in the historical data section. The Lincoln County Conservation District, through a 205J project, has monitored this parameter extensively to better understand the spatial and temporal dynamic.

The pH values observed in the Hams Fork River were basic (greater than 7 standard units) but were below the WDEQ/WQD (2001b) upper limit criterion of 9.0 standard units. Elevated pH readings can be a response of increased plant photosynthesis. This pattern is evident in the Hams Fork data. A slight correlation is noted between rising water temperatures and higher pH values. This diurnal fluctuation indicates a degree of photosynthetic activity, possibly due to nutrient contributions.

Turbidity is an optical property of water where total suspended solids (TSS) and some dissolved material cause light to be scattered. An increase in turbidity and TSS has been shown to decrease the production and abundance of plant material, decrease abundance of fish food organisms, and decrease production and abundance of fish (Lloyd, 1987). The WDEQ/WQD (2001b) numeric criterion for turbidity deals with turbidity increases attributable to human activities. The WDEQ/WQD (2001b) narrative criteria for floating and suspended solids states that activities attributable to man shall not cause significant degradation of habitat for aquatic life or adversely affect plant life or wildlife. Lloyd's (1987) literature review of the effects of turbidity on salmonids suggests that turbidities in the 10-25 NTU range and TSS concentrations near 35 mg/l can have deleterious effects on fish. Newcombe and Jensen's (1996) literature review suggest TSS values between 18 and 35 mg/l can result in reduced feeding and abundance, and TSS values in the range of 50 to 66 mg/l can result in reduced rates of weight gain and avoidance behavior in adult rainbow and cutthroat trout.

Turbidity values increased downstream on the Hams Fork River, reaching a value of 31.8 NTU at the most downstream station (WB65). The values for total suspended solids were correlated with turbidity. The factors affecting turbidity and TSS did not appear to be the municipal influences of Kemmerer/Diamondville but the geological setting and land use changes downstream of WBI25. The 1995 TSS and turbidity values were higher than the other stations of the same ecoregion, namely MRW88 and MRW89. The two 1995 stations were sampled later in the season, and the differences in parameter values could likely be attributed to a precipitation event or some activity in a certain tributary that increased the sediment concentrations within the channel.

Chlorides and sulfates are two principal dissolved components in water. Increased

chloride or sulfate levels can have a negative effect on benthic macroinvertebrates. WDEQ/WQD (2001b) water quality standards set aquatic life acute and chronic chloride criteria of 860 mg/l and 230 mg/l, respectively. Chloride concentrations were <5 mg/l for all Hams Fork stations except for the two most downstream stations. For WQWB09 and WB65, the chlorides were 7 mg/l and 8 mg/l respectively. Willow Creek had the highest reading at 46 mg/l, which is still well below a level of concern. Sulfate concentrations for the Hams Fork stations were also below levels that would threaten the macroinvertebrate community. The sulfates concentration at Willow Creek was a relatively high 623 mg/l, but has a minimal influence on the concentration of sulfate in the Hams Fork due to its small size.

Habitat Quality

The Hams Fork River sample riffles were composed primarily of cobble and gravels. The results can be seen at Table 4 at the end of this report. The fines that were present were composed of sand with no silt substrate being noted. The presence of rock and gravel in flowing streams is generally considered the most desirable habitat (Plafkin et al., 1989). The prevalence of sand and silt in the riffle environment will be less stable than larger gravels and cobbles. The invertebrate diversity and abundance tends to increase with substrate stability and the stability generally increases with the mean particle size (Giller and Malmquist, 1998).

MRW88 and WB64 had the greatest degree of silt covering on the riffle substrate. The weighted embeddedness ratings (weighted embeddedness ranges from 20 to 100 with a rating of 100 being relatively sediment free) of 20.63 (MRW88) and 20.25 (WB64) suggest the substrate was significantly covered with silt and the habitat potential for the macroinvertebrate community was limited.

Habitat assessment scores for the 1998 stations are contained in Table 5. Plafkin (1989) suggests that streams scoring >75% of reference sites are fully functioning. The data show that this was the case for all of the stations, however, there were habitat parameters of concern and the individual scores are documented in Table 5 in this report. If these factors were to deteriorate over time, the habitat could be in a state of non-support in the future. The habitat integrity at WB64 was compromised by the high degree of silt cover (scoring 0 out of 20), limited fish cover (11 out of 20), riprap controls and the high human impact to the riparian zone (6.5 out of 10). WB64, where the system enters the town of Kemmerer, is relatively channelized and man-made features control the streams ability to access the floodplain. WB65 had limited fish cover (scoring 5 out of 20), a high width-to-depth ratio (5 out of 15), and unstable, minimally protected banks (3 out of 10). The pools had fine substrate materials, corroborating the possibility that bank failure has resulted in higher total suspended solids and turbidity values due to increased sediment delivery. The historical fish data indicate that cold-water game species have been rare in the reach from Opal to Granger. The amounts of fine sediments, coupled with flow regime, are probable influences.

The pool quality for the two stations in the Middle Rockies ecoregion was the most conducive to fish populations. Fish of various sizes were observed at these locations. For the stations within the Wyoming Basins ecoregion, the pool quality was generally poorer with minimal overhead and subsurface cover for fish.

Macroinvertebrates and Biological Condition

WSII analysis (Middle Rockies sites)

The 1998 stations in the Middle Rockies ecoregion were assessed as being in ‘fair’ condition by the WSII. Five of the nine metrics score moderately well. Metrics scoring low were %Ephemeroptera (minus Baetidae), %Trichoptera (minus Hydropsychidae), %5 Dominant, and %Scrapers. These metrics, and the 1998 results, are explained below.

Ephemeroptera (mayfly) taxa are commonly found in riffle habitats and have relatively low tolerance values. A limited relative abundance of Ephemeroptera taxa typically indicates possible stresses upon the aquatic system. Being more tolerant to stressors, the elimination of the family Baetidae from the %Ephemeroptera metric, estimates the percentage of more sensitive, intolerant mayflies in the sample. What must be noted, since this is a *percent*-oriented metric, is the predominance of the Chironomidae *Cricotopus nostococladius* at MRW88. This single taxa comprises 63.03 percent of the entire sample and strongly influences the percentage metrics and HBI tolerance metric, which is discussed in a following section. *Cricotopus nostococladius* colonized the majority of the available substrate, possibly inhibiting the establishment of other taxa. The scores for the percent Ephemeroptera were some of the lowest for these two stations. MRW88 was 5.13% (score=9.5) and MRW89 was 8.67% (score=16.1).

Taxa of the Order Trichoptera (caddisflies) are found in most aquatic habitats. These taxa should be found in all riffle samples with the exception of streams with very poor water quality. By removing the most commonly occurring family of caddisfly, *Hydropsychidae*, the metric % Trichoptera (no Hydropsychidae) indicates the percentage of less common, less tolerant caddisflies. Being filter feeders, the Hydropsychidae are dependent on suspended food sources and can be more prevalent in turbid streams. The Trichoptera representation was less pronounced (17.48%) at MRW88, with the domination of the Chironomidae *Cricotopus nostococladius*. MRW89 had a higher value of 35.06%, resulting in a score of 75.2.

The percent contribution of the dominant taxa is an indication of community balance. A community dominated by a single taxon or by relatively few taxa indicates environmental stress due to poor water quality or habitat quality (Jessup and Stribling, 2002). The percent five dominant taxa (5th percentile) for the Rockies Bioregion reference condition is 45.7%. Values in excess of this indicate a lower diversity in the community composition and greater environmental stress. The MRW88 station was unique in that 63.03% of the sample is comprised of a single organism, the Chironomidae *Cricotopus nostococladius*. This predominance suggests that the habitat and water quality were favoring this organism. Work by Brock (1960) demonstrates that a strong presence of this organism does not necessarily indicate water quality deterioration but rather suggests that the substrate must be clear enough for the establishment of the nostoc algal colony. Developing through photosynthetic processes, the nostoc colony can only thrive in contexts of significant solar exposure and minimal turbidity within the water column. The five dominant taxa in the Hams Fork at the MRW88 station

comprised 86.82% of the total organisms identified. The MRW89 station had a metric value of 58.12%, and the score was a higher 73.3 with only 9% *Cricotopus nostococladius* present. The 1995 MRW53 and MRW8 stations scored well with this metric (75.4 and 83.9 respectively), indicating a healthy diversity within the macroinvertebrate community.

Scrapers are the functional feeding group of macroinvertebrate taxa that scrape rock, twig, and leaf surfaces for food such as periphyton (King, 1993b). Scrapers increase with an increase in diatoms and decrease as filamentous algae (indicative of organic and nutrient enrichment) increases. Scraper taxa tend to be relatively sensitive to stressors such as sediment that reduce or eliminate their feeding areas or food supply. Minimal percent scrapers were identified within these two riffles. The MRW88 station score was 5.2 (2.85% scraper) and the MRW89 station score was 27.7 (15.12% scraper) suggesting present (or possibly historical) siltation influences or some limitation on their food source. The prevalence of the piercing herbivore, *Cricotopus nostococladius*, further limits the colonization of the scraper feeding group. The 1995 stations had low scores for scraper taxa.

WSII Analysis (Wyoming Basin sites)

The data indicate a general consistency between the three Wyoming Basins bioassessment stations, from the WB64 station above Kemmerer/Diamondville to the WB65 station, relatively near the confluence with the Blacks Fork (Table 8). Their overall Index Scores (WB64=51.1, WBI25=46.9 and WB65 57.9) are in the 'Fair' category, with the strongest, consistent limitations in Plecoptera representation and percentage of non-Hydropsychida Trichoptera. Variations are noted in the relative scraper presence and the number of distinct semi-voltine taxa.

Taxa in the Order Plecoptera (stoneflies) are found in cool, well-oxygenated streams with good to excellent water quality. These taxa are some of the most sensitive of all aquatic macroinvertebrates to thermal pollution, decreased dissolved oxygen and various chemical stressors. Because of this, the presence of numerous distinct stonefly taxa and a significant stonefly abundance are good indicators of good to excellent water quality (King, 1993b). These three stations have fewer Plecoptera taxa than the Basin Bioregion reference condition upper value (95th percentile) of 5 taxa. The resulting scores were 20 for WB64 (likely influenced by heavy silt cover) and 40 for both the WBI25 and WB65 bioassessment stations.

The Percent Plecoptera was correspondingly low. This metric addresses the relative *abundance*, as opposed to the *diversity*, of the Plecoptera representation within the sample. The scores for WB64, WBI25 and WB65 were, 4.7, 8.0 and 31.2, respectively. These were some of the lowest scores within the core metrics list and corroborate the 'Plecoptera Taxa' metric scores. However, the increase in the relative abundance of Plecoptera taxa for the WB65 station, in comparison to the other two stations, must be noted. The limitations on the diversity and abundance of Plecoptera taxa may be due to influences of siltation and seasonally elevated water temperatures.

Minimal percent scrapers were within two of these three riffles, relative to the Wyoming Basin reference value of 31.8 % scrapers. The WB64 station had a score of 34.8 (11.06%

scraper). The WBI25 and WB65 stations scored 21.8 and 100, respectively. This suggests that the upper two stations have experienced siltation influences, or some limitation on their food source, as corroborated by the silt-cover scores provided earlier in this assessment. Beaver dams were more prevalent at these two sites, and could be contributing periodic flushes of fine sediments to these reaches.

The Biotic Condition Index (BCI), Actual Community Tolerance Quotient (CTQ_a) is the product of values derived from the taxon's tolerance levels of alkalinity and sulfate plus selectivity for or against fine texture substrate materials and low stream gradients. Values range from 2 to slightly greater than 100 with the larger values indicating greater taxon tolerance (Winget and Mangum, 1979; Platts et. al, 1983). The CTQ_a is a mean of the tolerance quotient of the macroinvertebrates collected from any station on any given date. The BCI - CTQ_a values for these three Hams Fork stations were all higher than the Basin Bioregion reference condition (5th percentile) of 62.6. The values were 91.85, 83.85 and 84.25 for WB64, WBI25 and WB65, respectively, resulting in scores of 38.3, 55.2 and 54.3. These values indicate a moderately high degree of BCI tolerance for taxa collected in the Hams Fork.

Community voltinism is a measure of the distribution of taxa with various life cycle requirements. Multivoltine taxa are those that exhibit several life cycles during a single year. Univoltine taxa are those requiring a year to complete a single life cycle, while semivoltine taxa are those that require several years to complete a life cycle. An even distribution of these three assemblages suggests a stable community. The dominance of multivoltine taxa suggests possible seasonal degradation of water quality or periodic pulses of pollutants through the system resulting in limited survival of univoltine and semivoltine taxa. These three Wyoming Basins stations have minimal representation of semi-voltine taxa, relative to a reference value of 7 distinct taxa,. The highest was at the WB64 station, with 4 taxa. Below Kemmerer/Diamondville, the samples have 1 and 2 taxa for the WBI25 and WB65 stations, respectively. These data do not suggest a stable community with respect to life cycle assemblages. The minimal presence of semivoltine taxa suggests that some environmental condition(s) in the Hams Fork are not suitable for survival of long-lived organisms.

Additional Community Analysis

Macroinvertebrate densities decrease, and FSBI scores increase, rapidly below MRW53 (Forest)(Figure 2). The FSBI scores indicate a downstream increase in community tolerance to fine sediment. As fine sediment increases, habitat quality is reduced resulting in reduced density of macroinvertebrates. Taxa richness increases slightly at WB64 (Lions Park), and then decreases at WBI25 and WB65. Initial additions of nutrients often cause a rise in diversity or richness followed by a subsequent decrease in these metrics with additional nutrient contributions.

General Biological Observations:

MRW88 (Ditch): The fish seen were below 2 inches and between 3 and 6 inches in length. Sculpin and trout were seen.

WB64 (Lions Park): The fish seen were below 2 inches and between 3 and 6 inches in length.

WBI25 (Lower Bridge): The fish seen were below 2 inches and between 3 and 6 inches in length.

WB65 (Granger): Red fox and sand hill cranes were seen, and beaver debris was evident on banks. The calm pools had some white surface foams. The water was too turbid to closely identify fish.

SUPPLEMENTAL CHEMISTRY MONITORING IN 2004

In May and September 2004, the Department of Environmental Quality sampled the Hams Fork River at 4 locations to better characterize the diurnal patterns of pH, in association with other related parameters. These sampling locations are listed in Table 9. The sampling was conducted over a 24 hour cycle, and the data are provided in Tables 13 and 14. The NPDES discharge (#20320) at the Kemmerer/Diamondville Wastewater Treatment Plant was also sampled, to assess its relative contributions. The river was sampled above the sewer outfall, and below the mixed influence, at numerous times throughout the day. Discharge was taken at the sites near the wastewater plant. The Hams Fork had a flow of 114.05 cfs on May 18th, 2004 and 13.64 cfs on September 29th, 2004. The intent was to document the degree to which the pH fluctuated throughout the day, and to what extent this fluctuation was associated with nutrient contributions. The elevated pH values that have been documented have mainly been sampled later in the day, at lower flows.

The 2004 monitoring conducted by the DEQ did not document pH values in excess of 9, however, the diurnal fluctuation was evident. The pH and dissolved oxygen increased during the day, with the lowest pH values being recorded in the morning. The nutrient parameters that were sampled at the wastewater treatment plant included total phosphorus, and nitrite-nitrates. The total phosphorus from the permitted discharge point was 2.58 mg/l in May (flow of 0.77 cfs) in September (flow of 0.82 cfs). The nitrate-nitrite levels from the discharge were 22.4 mg/l in May, and 23 mg/l in September. The instream ammonia levels in May were 0.5 mg/l upstream of the effluent location, and 0.2 downstream of the mixing zone. These ammonia levels, for the given temperature and pH, were below the chronic criteria (DEQ/WQD, 2001b).

Diurnal fluctuations in dissolved oxygen were greater below the influence of the wastewater treatment plant relative to the sampling locations upstream. This was particularly true in September where the dissolved oxygen ranged from 6.03 to 11.06 mg/l at the Highway 30 Bridge station (WBI25), and only ranged from 7.07 to 9.61 mg/l at the upstream Lions Park station (WB64). The dense aquatic vegetation upstream of the Highway 30 Bridge station (below the influence of the wastewater plant) is driving this diurnal fluctuation through active daytime photosynthesis. This photosynthesis will elevate the pH in the latter part of the day, as corroborated by USGS data at station #09224050.

These nutrient sources are likely factors in stimulating the growth of aquatic vegetation, which in turn may elevate the pH downstream through photosynthetic activity. The instream values for total phosphorus ranged from 0.04 to 0.1 mg/l in May, and in September all samples were below the detection limit of 0.05 mg/l, except for the sampling location right below the discharge point, which was 0.08 mg/l. The total phosphorus levels suggest that there are multiple sources, in addition to the wastewater plant. The nitrite-nitrate values, however, do

suggest that the wastewater discharge is a significant source to the Hams Fork, which is particularly evident in the September data.

HISTORICAL AND ANCILLARY INFORMATION

Elevated pH readings have been documented by different agencies. The Lincoln County Conservation District has been monitoring the pH at various times and locations to better understand the spatial and temporal dynamic of these higher readings. Their work indicated that pH readings have exhibited diurnal fluctuations, in response to photosynthetic activity. The elevated values have been documented later in the day, with warmer temperatures. The pH values spatially increased along the reach which had a dense cover of aquatic vegetation (Gay, 2001).

Water quality data was collected by the United States Geological Survey at three locations (Table 10). The most upstream of these three stations (09223000), was sampled over three years. Relatively high in the watershed, many of the sampled parameters indicate good water quality. Turbidity samples were relatively low, specific conductance readings were at moderate levels, and the maximum sulfate level was 44 mg/l. This station lies upstream of the Kemmerer City Reservoir. The total phosphorus had been high on certain occasions. Five readings were documented (0.01, 0.23, 0.12, 0.03, 0.04 mg/l) in the time frame of 1975-1978, with the highest levels occurring during elevated flows.

The USGS station near Diamondville (09224050) is located adjacent to the Highway 30 bridge, and corresponds to the DEQ WBI25 station. With monitoring beginning in 1975, this station has the most extensive sampling history on the Hams Fork. The main parameters of note for the historical sampling have been pH, as previously described, as well as fecal coliform bacteria and total phosphorus.

The data indicated that higher pH values have been mainly occurring at the relatively lower flows, later in the day. On 7 occasions the pH has exceeded 9 with the earliest time of day being 15:30. Twice in the year of 2001 a pH value of 9.2 was documented.

The fecal coliform bacteria levels have been considerably elevated in the historical data. Graph 1 provides the data range and general temporal pattern, which is similar to that of the total phosphorus. The fecal coliform data indicate a defined decrease in the colony counts in the early 1980's, largely due to the 1980 establishment of the municipal wastewater facility, which serves the Kemmerer-Diamondville community.

The total phosphorus levels at this USGS station have been as high as 2.40 mg/l, with a mean of 0.21 mg/l (n=143, st. dev.=0.028). This is presented on Graph 2. Out of 143 samples, 105 were greater than or equal to 0.1 mg/l. The elevated phosphorus levels could be influencing the growth of aquatic vegetation and thereby stimulating a diurnal rise in the pH as photosynthesis becomes increasingly active during the day. There has not been a significant correlation with flow nor has there been a marked seasonality to the higher readings. Some of these higher values suggest that possible nutrient threats to the system have been experienced.

The station near Granger (09224450) and near the confluence with the Blacks Fork River was utilized for water quality data collection from 1967 to 1986. Highly variable flows have been recorded at this location with some very low flows in certain years. Flows of zero cfs have been documented, in some cases for many months in a row. Total phosphorus levels have historically been elevated, but not in a consistent pattern. As with the USGS station near Diamondville, the higher levels were not correlated with the flow patterns. The maximum has been 1.8 mg/l, with a mean of 0.11 mg/l, (st. dev 0.22). Out of 126 total phosphorus samples taken, 49 were greater than 0.05 mg/l and 33 were greater than 0.1 mg/l. Eight samples were below the detection limit. There are geologic factors that could be influencing the phosphorus levels in the Hams Fork System. Further monitoring would be needed to distinguish the geologic influence from other sources. The Wilkins Peak member of the Green River Formation has had flowing springs with values as high as 0.24 mg/l (Eddy-Miller et al. 1996). This formation is dominant between Kemmerer and Opal, as the Hams Fork River curves to the east.

The sulfates exhibit a slight increase with distance downstream from the Diamondville USGS station. Some of the higher values suggest the potential to inhibit the integrity of the benthic macroinvertebrate community. The dissolved sulfate readings (n=192) have ranged from 31 mg/l to 366 mg/l, with a mean of 153 (st. dev 64). The next upstream USGS station, below Diamondville, (09224050) ranged from 26 mg/l to 200 mg/l with a mean of 96.85 mg/l (n=84, st. dev. 42). High temperature readings taken from summer months at the Granger USGS station indicate that possible warm, low dissolved oxygen conditions could be threatening fish abundance and diversity. Of 199 samples taken at this station, 21 occurrences, equal to or greater than the 20.0 degree C criteria, have been documented. These have occurred during the months of June through September, primarily in July and August. (WRDS 1998)

Limited historical water quality data exist for the Willow Creek tributary. The WRDS database (1998) indicates that three contributing springs in the watershed have been monitored. The spring names are Van Gilder, Golich, and Brandley and are all found on the Sublet 7.5 minute USGS quadrangle. The sampling has been limited to one or two day events, conducted by the United States Geological Survey. The flow rates have varied from 1.5 to 9 gallons per minute. The specific conductance values range from 315 to 887 umhos/cm (n=8), corroborating the elevated 1998 values documented in this report. The sulfate levels have ranged from 11 to 170 mg/l, (n=5) suggesting that the elevated sulfates seen in the 1998 sampling previously described have had additional or other sources.

Wyoming Game and Fish reports state that various types of fish have been found in the Hams Fork River at different locations. Table 10 provides information on the type, quantity and location of various species.

The fish data indicate that the river system has had the capacity to support game (trout) species at various locations through the system. For fish surveying, the Wyoming Game and Fish has divided the Hams Fork system into three reaches. The survey results have therefore been categorized into three regions, as can be seen with the abbreviations in the 'watername' field of Table 11. They will be considered from the most upstream reach first.

The upstream reach includes the stretch of river from the headwaters to Kemmerer

Reservoir. Numerous cold water game species have been documented in this reach. Rainbow, brown, cutthroat, brook trout and mountain whitefish have been found in this reach (Remmick, 1981). Non-game species have included mountain suckers, sculpins, and redbreasted sunfish. Creel census reports and electrofishing results have indicated that rainbow trout were the dominant game fish. The stocking of rainbow trout took place on an annual basis up until 1974, at which point it was discontinued.

The next downstream reach covers the section from the Kemmerer Reservoir to the town of Opal. This includes the Hams Fork River as it flows through the cities of Kemmerer and Diamondville. The flow is largely dictated by the release patterns from the reservoir. Brown trout have been the dominant game species (Remmick, 1981). Records indicate that brown trout have been the predominant stocked species and this occurred last in 1975. The Wyoming Game and Fish found that the food grade was excellent in the upper reaches of this section but decreased progressively as the stream approaches Opal. Whitefish, rainbow, brook and cutthroat trout have been observed.

The downstream reach of the Wyoming Game and Fish survey covers the stretch from Opal to the confluence with the Blacks Fork River, near the town of Granger. Much of this reach is markedly sinuous, with livestock grazing and hay production. Trout documentation has been minimal, and the viability of cold water game species abundance has been mainly compromised by variable and low flows. The Wyoming Game and Fish reported in 1981 (Remmick) that, "There is a potential for trout production in the area, but the quality and quantity of water negate this potential." Non-game species that have been documented include suckers, dace, redbreasted sunfish, sculpins, carp and chubs. Brown trout were stocked in 1976, but the 1977 drought desiccated the stocked reach (Remmick, 1981).

The Game and Fish database also indicates that trout have inhabited the Willow Creek tributary, confirming the 2AB stream class designation.

SUMMARY AND CONCLUSIONS

Classification

The Hams Fork River is correctly classified as a Class 2AB, cold water game fish stream. This conclusion is based on data from the Wyoming Game and Fish and in part from findings within this assessment.

Water Quality

Water quality data collected from the Hams Fork River on September 15th, 1998 do not identify any exceeded values of water quality criteria. A pronounced diurnal flux of the pH has been documented below Kemmerer/Diamondville by multiple agencies. These elevated pH values may be due to heavy aquatic vegetation cover in the channel, and the associated photosynthetic activity. The diurnal fluctuation in dissolved oxygen is greater below the influence of the wastewater treatment plant, than it is for those sampling sites located upstream. There is greater primary production downstream of Kemmerer/Diamondville. Nutrient sources

in the system are likely contributing to the dense vegetation cover. Elevated pH values have been documented at lower flows downstream of Kemmerer/Diamondville.

Elevated total phosphorus levels have been recorded at the USGS station below Diamondville. Elevated water temperatures have been documented at the USGS station near Granger. To understand the geologic influence on the sulfate and total phosphorus levels, further monitoring needs to be conducted. Willow Creek contributes water with relatively elevated conductivity and sulfates. The alkalinity, chlorides and total hardness were considerably higher in this system than in the receiving waters of the Hams Fork. The downstream stations near Opal and Granger showed a downstream increase in total suspended solids and turbidity.

Macroinvertebrates and Biological Condition

Bioassessment primary metrics indicate that the Hams Fork River's macroinvertebrate community for the Rockies ecoregion is comparable to that of the reference condition and indicates a stable and healthy system. Wyoming Basin ecoregion stations are in a fair condition relative to that of reference condition. The macroinvertebrate communities for the Wyoming Basin ecoregion were marked by non-diverse, low abundance Plecoptera (stoneflies) populations and taxa of relatively high tolerance values. Among the Trichoptera (caddisflies), there was a predominance of the more tolerant taxa.

Physical and Habitat Quality

The habitat quality of the Hams Fork stations within the Rockies ecoregion was comparable to that of reference condition for three 'overthrust' reference streams. The silt cover was relatively high at the most upstream station, with a relatively high width-to-depth ratio. The stations within the Wyoming Basins ecoregion were comparable to reference condition, with certain habitat limitations. The Wyoming Basins stations exhibited limited fish cover, and relatively high degree of silt cover on the riffle substrate. The most downstream station near Granger had unstable, minimally protected banks.

FINAL ASSESSMENT AND SIGNATURES

Review of the available chemical, biological, physical data indicates that the Hams Fork River is partially supporting of its designated uses for cold water fish and aquatic life, from Kemmerer downstream to the confluence with the Black's Fork River. This decision is based on the following items (in order of strength):

1. pH values at USGS station 09224050 have been in excess of 9.0 on more than one sampling event, within a three year period. These pH values were documented in 2001, and are therefore not historical data.
2. DEQ sampling in 2004 documented strong diurnal fluctuations in dissolved oxygen downstream of Kemmerer/Diamondville, as influenced by heavy aquatic vegetation, corroborating the fluctuations in pH that have been documented at the same location.
3. Elevated total phosphorus levels have been documented at USGS station

#09224050,

suggesting nutrient threats to the Hams Fork system downstream from the municipalities of Kemmerer and Diamondville. Such nutrient sources could be influencing a strong diurnal fluctuation in pH values.

4. The support of cold water game fish has been limited in the reach from Opal downstream to Granger due to elevated pH values, and physical habitat condition
5. Elevated temperatures have been documented at USGS Station 09224450, near Granger.
6. Habitat condition at the Granger station is limited by unstable banks, fine sediment contributions, and minimal fish cover.

The reach from Kemmerer upstream to the headwaters is in full support of Class 2AB designated uses, based on the following factors:

1. No water quality criterion was exceeded.
2. The benthic macroinvertebrate community indicates at least a fair condition for all stations.
3. Trout populations have been supported in the upper reaches of the Hams Fork system.
4. Physical habitat for the stations assessed indicated a stable condition, relative to reference condition.

Assessment Report Author (signature and printed name)

Date

Reviewed by (signature and printed name)

Date

Reviewed by (signature and printed name)

Date

Figure 1. Sampling Locations On the Hams Fork River

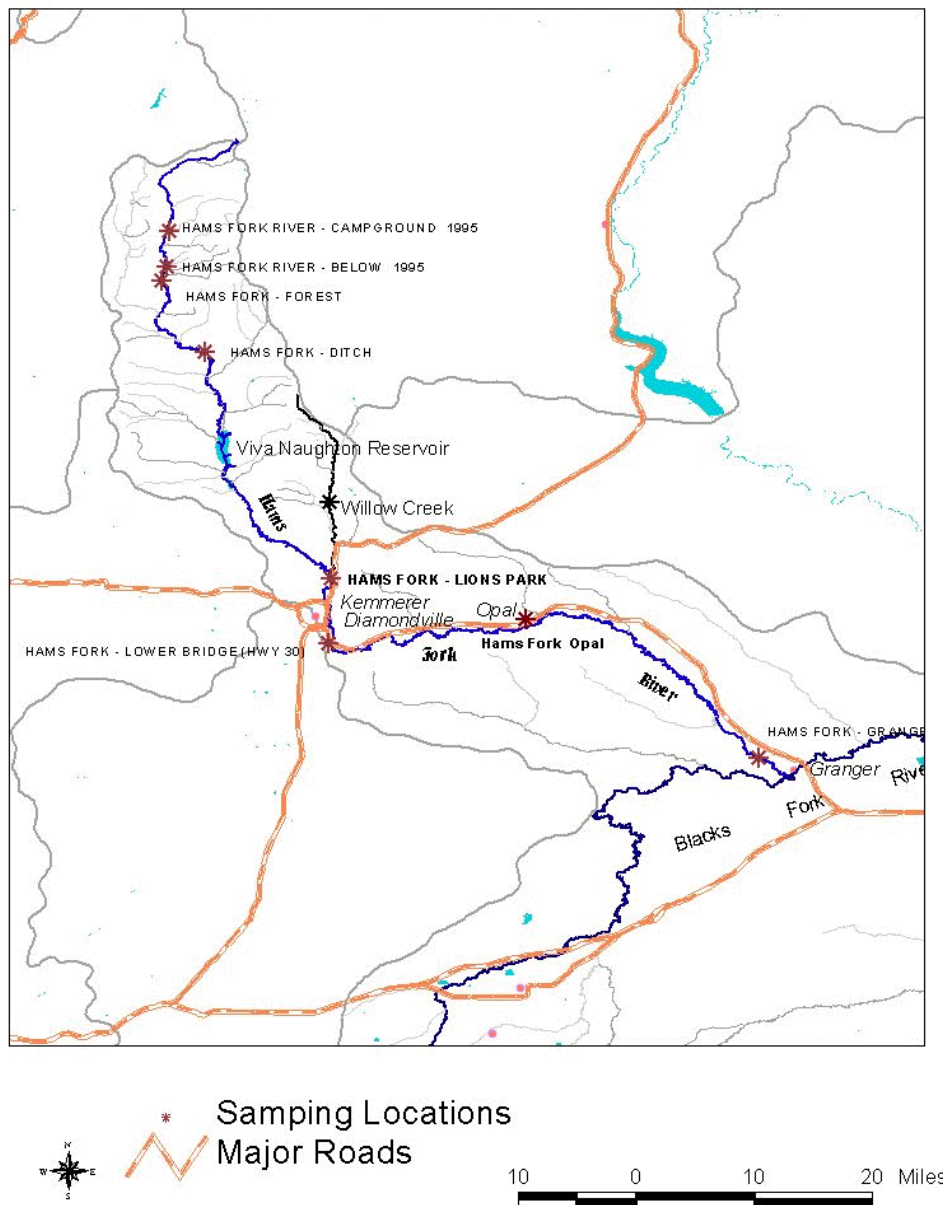
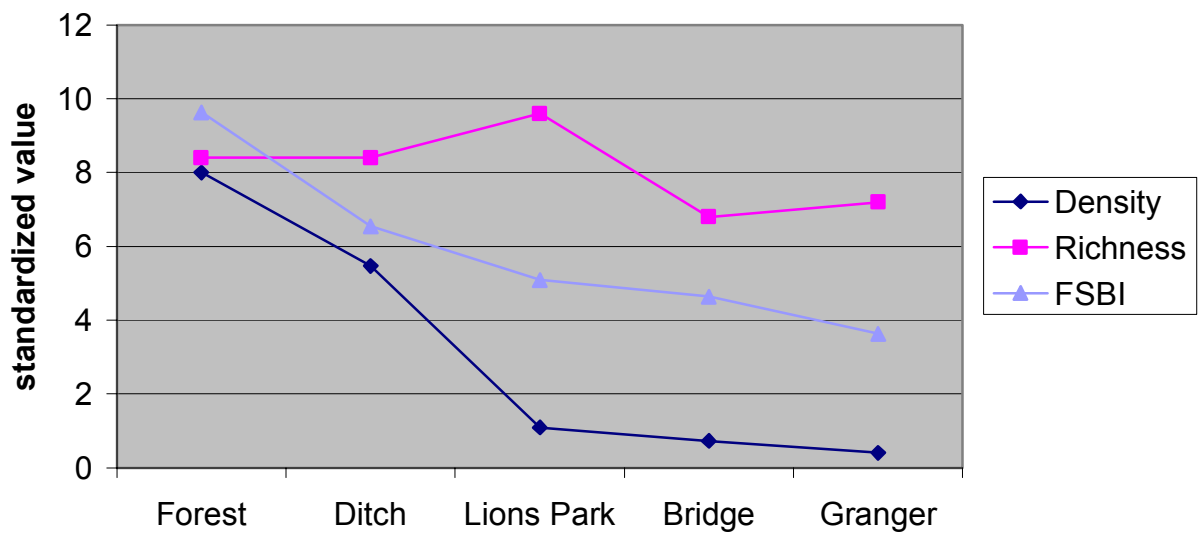


Figure 2. Macroinvertebrate density, taxa richness, and FSBI scores at Hams Fork bioassessment stations, 1998. Parameter values are standardized to a 1 to 10 scale.



*Density values are divided by 4000; Richness values are divided by 5; FSBI scores are divided by 11.

Table 1. Hams Fork monitoring stations (in order of upstream to downstream).

<i>Station Name</i>	<i>Station ID</i>	<i>Year Sampled</i>	<i>Section, Township, Range</i>	<i>Latitude</i>	<i>Longitude</i>	<i>Elevation</i>	<i>USGS Map</i>
Campground	MRW53	1995	SW1/4 Section 9 T26N R117W	42°15' 14.9"	-110° 43' 46.99"	7920	Devils Hole Creek
Below	MRW8	1995	SW1/4 Section 28 T26N R117W	42° 12' 33.99"	-110° 43' 46.99'	7760	Pole Creek
Forest	MRW88	1998	SE1/4SE1/4 Section 32 T26N R117W	42° 11' 34.01"	110° 44' 15.10"	7650	Devils Hole Creek
Ditch	MRW89	1998	NW1/4SE1/4 Section 36 T25N R117W	42° 06' 21.7"	110° 41' 09.04"	7440	Wilkinson Creek
Willow Creek (water quality only)	WQWB01	1998	SE1/4SW1/4 Section 36 T22N R116W	41° 50' 15.49"	110° 31' 53.73"	6960	Kemmerer
Lions Park	WB64	1998	SE1/4NW1/4 Section 1 T21N R116W	41° 49' 41.37"	110° 31' 51.06"	6960	Kemmerer
Bridge/ Highway 30	WBI25	1998	SW1/4SW1/4 Section 36 T21N R116W	41° 44' 59.82"	110° 32' 01.03"	6880	Kemmerer
Opal (water quality only)	WQWB09	1998	SE1/4SE1/4 Section 21 T21N R113W	41° 46' 51.31"	110° 13' 49.42"	6600	Cow Hollow Creek
Granger	WB65	1998	SW1/4SE1/4 Section 24 T19N R112W	41° 36' 34.28"	110° 00' 29.61"	6300	Verne

The latitude-longitude coordinates were determined from GPS readings for the 1998 data. All stations are within Lincoln County except for the WB65 station, which is in Sweetwater County. Figure 1. indicates the locations of these stations.

Table 2. Stream characteristics for each station.

<i>Station Name and ID</i>	<i>Discharge (C.F.S.)</i>	<i>Drainage Area (square miles)</i>	<i>Stream Order</i>	<i>Reach Length (ft)</i>	<i>Rosgen Classification Rosgen, 1996</i>
1995 Data					
Campground (MRW53)	7.0	26.6	4	not measured	C3
Below (MRW8)	25.0	51.1	4	not measured	C3
1998 Data					
Forest (MRW88)	17.59	61.4	4	920	E3*
Ditch (MRW89)	34.64	131.59	4	980	C3 (with some entrenchment)
Willow Creek (WQWB01) (water quality only)	<1.0 (Visually estimated)	NA	NA	NA	E6
Lions Park (WB64)	138.59	348.15	5	986	C3
Bridge/Highway 30 (WBI25)	173.16	368.23	5	780	C3
Opal (WQWB09)	not taken	492.33	5	NA	NA
Granger (WB65)	98.75	594.19	5	1230	C4

* Station was given an E characterization; the width to depth component of the physical assessment indicates a C type stream.

Table 3. Water quality parameters and results, Hams Fork River, October 5th 1995 and September 15th 1998.

Parameter (units)	Camp-ground <i>MRW53</i>	Below <i>MRW8</i>	Forest <i>MRW88</i>	Ditch <i>MRW89</i>	Willow Creek <i>WQWB01</i>	Lions Park <i>WB64</i>	Bridge/H-way 30 <i>WBI25</i>	Opal <i>WQWB-09</i>	Granger <i>WB65</i>
Date	10/5/95	10/5/95	9/15/98	9/15/98	9/15/98	9/15/98	9/15/98	9/15/98	9/15/98
Time (hours)	15:15	17:10	09:10	08:10	10:40	07:40	09:00	13:00	11:30
Temperature (°C)	7.3	8.5	9.0	12.0	12.8	13.8	13.7	18.6	17.3
pH (Standard Units)	8	8.3	8.15	8.17	8.19	8.37	8.29	8.42	8.43
Conductivity (µS/cm)	322	331	418	343	1668	336	352	380	408
Dissolved Oxygen (mg/l)	7.5	7.3	8.82	6.77	8.18	7.1	7.16	7.45	7.94
Turbidity (NTU)	2.4	4.8	1.66	1.44	1.99	2.7	2.94	15.2	31.8
Total Suspended Solids (mg/l)	2.0	7.0	<2.0	<2.0	2.0	4.0	4.0	17.0	47.0
Alkalinity (mg/l)	130	136	165	190	295	145	150	140	140
Chlorides (mg/l)	<5.0	<5.0	<5.0	<5.0	46	<5.0	<5.0	7	8
Sulfates (mg/l)	<10	<10	72	24	623	36	42	55	62
Total Hardness (mg/l)	164	156	220	184	382	168	192	183	199
Total Phosphorus (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrate Nitrogen (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1

Table 4. Mean substrate composition, weighted embeddedness, and water velocity at the Hams Fork River sample riffle.

Stream Station	Cobble (2.5-10")	Coarse Gravel (1 - 2.5")	Fine Gravel (0.3 -1")	Silt* (<0.3", fine)	Sand (<0.3", gritty)	Weighted Embeddedness - Silt Coverage (Range 20 to 100)	Mean Water Velocity (ft./sec.)
Forest <i>MRW88</i>	84.75	11.63	3.63	0	0	20.625	1.71
Ditch <i>MRW39</i>	28.75	61.25	8.13	0	1.88	100	1.69
Lions Park <i>WB64</i>	63.75	18.13	4.13	0	14	20.25	3.63
Lower Bridge <i>WB125</i>	8.75	76.88	8.13	0	6.25	43.5	2.83
Granger <i>WB65</i>	39.38	28.75	20.63	0	11.25	63	2.25

* Silt substrate is where the silt covering is greater than 1/4 inch deep.

Table 5. Hams Fork habitat parameters and biological indicators (1998).

	Forest	Ditch	Lions Park	Bridge	Granger
	MRW88	MRW89	WB64	WBI26	WB65
Ecoregion	<i>MRW</i>	<i>MRW</i>	<i>WB</i>	<i>WB</i>	<i>WB</i>
Bottom Substrate- Percent Fines (20)	20	20	13	17	15
Embeddedness (20)	1	20	0	6	11
Instream Cover for Fish (20)	14	17	11	11	5
Velocity/Depth (20)	17	17	18	20	16
Channel Flow Status (20)	8	14	17	18	17
Channel Shape at Bankfull (15)	9	8	12	11	8
Pool/Riffle Ratio (15)	12	13	13	13	12
Channelization/Alteration (15 for >10%)	15	15	8	11	14
Width/Depth Ratio (15)	6	7	8	5	5
Bank Vegetation Protection Bankfull (10)	9	7.5	7.5	9	2
Bank Stability (Bankfull) (10)	8	7.5	6.5	9	3
Disruptive Pressures (Riparian Zone) (10)	8	9	6.5	10	9
Riparian Vegetative Zone Width (10)	10	10	5.5	5	9
HABITAT ASSESSMENT TOTAL >10% Riffle/Run (200 possible)	137	165	126	145	126
HABITAT ASSESSMENT (Percent of maximum score)	68.5	82.5	63.0	72.5	63.0
HABITAT ASSESSMENT (Percent of mean reference site scores) MRW n=6, WB n=3	90.7	100	94	100	94
Average Pool Quality Score (10)	6.8	5.5	5.0	5.8	2.3
Estimated Percentage of Pools in Reach at least 1.5 ft deep	100	100	100	100	100
Biological Indicators*					
Periphyton	4	2	2	1	1
Filamentous algae	2	2	3	0	0
Rooted Macrophytes	3	2	2	0	0
Floating Macrophytes	0	1	1	0	0
Fish	2	3	3	2	1
Slimes	1	0	0	0	0

*0-absent, 1-rare, 2-common, 3-abundant, 4-dominant

Table 6. Rockies ecoregion core biometrics (for the upstream 1998 stations: MRW88 and MRW89).

Core Metric	Rockies Bioregion Reference Condition (95 th or 5 th Percentile)	MRW88 Metric Value	MRW88 Metric Score	MRW89 Metric Value	MRW89 Metric Score
Ephemeroptera Taxa	11	6	54.5	5	45.5
Plecoptera Taxa	8	5	62.5	6	75
Trichoptera Taxa	11	8	72.7	7	63.6
% Ephemeroptera (no Baetidae)	54	5.13	9.5	8.67	16.1
% Trichoptera (no Hydropsychidae)	46.6	17.48	37.5	35.06	75.2
% 5 Dominant*	45.7	86.82	16.3	58.12	73.3
% Scrapers	54.5	2.85	5.2	15.12	27.7
HBI*	1.4	2.75	84.3	3.3	77.9
BCI CTQa*	44.1	61.52	73.6	77.71	49
Index Score (Σ /10)			46.2		55.9
Rating			Fair		Fair

* Metric where the trend increases with increasing stress. Higher values indicate a negative response. Reference Condition 5th percentile is utilized to calculate the score for positive metrics

Table 7. Core metrics for two 1995 stations; MRW53 and MRW8

Core Metric	Rockies Bioregion Reference Condition (95th or 5th Percentile)	MRW53 Metric Value	MRW53 Metric Score	MRW8 Metric Value	MRW8 Metric Score
Ephemeroptera Taxa	11	10	90.9	11	100
Plecoptera Taxa	8	6	75	6	75
Trichoptera Taxa	11	10	90.9	9	81.8
% Ephemeroptera (no Baetidae)	54	38.65	71.6	14.82	27.4
% Trichoptera (no Hydropsychidae)	46.6	9.38	20.1	37.13	79.7
% 5 Dominant*	45.7	57.07	75.4	52.81	83.9
% Scrapers	54.5	21.55	39.5	15.84	29.1
HBI*	1.4	2.57	86.4	2.91	82.4
BCICTQa*	44.1	54.81	83.7	60.94	74.4
Index Score (Σ /10)			70.4		70.4
Rating			Good		Good

* Metric where the trend increases with increasing stress (positive TwI). Higher values indicate a negative response. Reference Condition 5th percentile is utilized to calculate the score for positive TwI metrics.

Table 8. Basins ecoregion core biometric values and scores.

Core Metric	Basin Bioregion Reference Condition (95 th or 5 th Percentile)	Metric Value:	Metric Score:	Metric Value	Metric Score:	Metric Value:	Metric Score:
		<i>Lions Park</i> WB64	<i>Lions Park</i> WB64	<i>Lower Bridge</i> WBI25	<i>Lower Bridge</i> WBI25	<i>Granger</i> WB65	<i>Granger</i> WB65
Total Number Taxa	45	48	100	34	75.6	36	80
Ephemeroptera Taxa	9	7	77.8	8	88.9	9	100
Plecoptera Taxa	5	1	20	2	40	2	40
Trichoptera Taxa	10	7	70	6	60	4	40
% Plecoptera	13	0.61	4.7	1.04	8	4.05	31.2
% Trichoptera (no Hydropsychidae)	31.3	5.95	19	3.12	10	3.68	11.8
% non-insects*	0.5	6.54	88.9	2.93	95.5	4.06	93.5
% Scrapers	31.8	11.06	34.8	6.94	21.8	41.44	100
BCI CTQa*	62.6	91.85	38.3	83.85	55.2	84.25	54.3
Semi-Voltine Taxa	7	4	57.1	1	14.3	2	28.6
Index Score (Σ /10)			51.1		46.9		57.9
Rating			Fair		Fair		Fair

* Metric where the trend increases with increasing stress (positive TwI). Higher values indicate a negative response. Reference Condition 5th percentile was utilized to calculate the score for positive TwI metrics.

Table 9. Sampling Stations for 2004 Monitoring

Hams Fork Sites	Latitude-longitude (DMS)		Number of sampling visits (May 17-18)	Number of Sampling visits (September 28-29)
Lions Park	41 ⁰ 49' 41.26	110 ⁰ 31' 51.58"	6	6
Above 20320	41 ⁰ 47' 39.77"	110 ⁰ 32' 04.47"	1	1
Discharge #20320	41 ⁰ 47' 38.69"	110 ⁰ 32' 03.83"	1	1
Below 20320	41 ⁰ 47' 35.19"	110 ⁰ 32' 03.02"	1	1
Highway 30 Bridge	41 ⁰ 45' 02.45"	110 ⁰ 32' 00.32"	6	6

These stations are listed from upstream to downstream

Table 10. USGS water quality sampling stations, from upstream to downstream.

Station Name	Station Number	Section	Township	Range	Descriptive Location	Water Quality Sampling History
Hams Fork Below Pole Creek, Near Frontier	09223000	35	25	117	2 miles below Pole Ck. Above 1998 Ditch station	1975-78
Hams Fork near Diamondville	09224050	36	21	116	Hwy 30 Bridge	1975-1989 1992-
Hams Fork near Granger	09224450	30	19	111	Near Granger	1967-86

Table 11. Fish data for the Hams Fork River (Remmick, 1981)

Location	Location Descriptor	Date	Trout/Mile	Snake River Cutthroat	Brown Trout	Rainbow Trout	Whitefish	Other
S. 4 T20N R116W	2 miles below Diamondville, where Route 30 turns east	10/11/69	210	0	24	3	0	Mountain Sucker Flannelmouth Sucker Redside Shiner
S. 33 T21N R115W	5 mile below Diamondville, by waterfall	9/11/69	110	0	21	5	24	
S. 3 T23N R117W	Immediately upstream of Viva Naughton Reservoir.	8/1/72	0	0	0	0	1	Mountain Sucker Redside Shiner Dace Sculpin
S. 3 T25N R117W	The first mile within USFS land	8/2/72	110	7	0	4	abundant	
S. 15 T24N R117W	4 sections upstream from Viva Naughton Reservoir.	8/2/72	106	2	0	8	3	Mountain Sucker Redside Shiner Sculpin
S. 36 T22N R116W	Willow Creek, by confluence with Hams Fork.	8/18/75	21	2	0	0	0	Mountain Sucker Redside Shiner Dace Sculpin

Table 12. Wyoming Game and Fish Database (November, 2000) Fish Species Documentation

Section	Township	Range	Water Name	Tributary To	Species Name
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Mountain Sucker
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Speckled Dace
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Brown Trout
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Roundtail Chub
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Redside Shiner
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	White Sucker
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Mountain Whitefish
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Flannelmouth Sucker
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Rainbow Trout
10	19	112	HAMS FORK RIVER	BLACKS FORK RIVER	Utah Chub
11	27	117	HAMS FORK, SOUTH FORK	HAMS FORK RIVER	Rainbow Trout
11	27	117	HAMS FORK, SOUTH FORK	HAMS FORK RIVER	Cutthroat Trout
11	27	117	HAMS FORK, SOUTH FORK	HAMS FORK RIVER	Brook Trout
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Brown Trout
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Longnose Dace
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Speckled Dace
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Redside Shiner
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Carp
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Mountain Sucker
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Mountain Whitefish
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Mottled Sculpin
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Cutthroat Trout
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Brook Trout
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Rainbow Trout
13	21	116	HAMS FORK (OPAL-KCR)	BLACKS FORK RIVER	Utah Chub
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Redside Shiner
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mountain Sucker
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mottled Sculpin
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Cutthroat Trout
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mountain Whitefish
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mottled Sculpin
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mountain Sucker
23	23	117	HAMS FORK (KCR UP)	BLACKS FORK RIVER	Mountain Whitefish
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Brown Trout
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Roundtail Chub
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Redside Shiner
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Bluehead Sucker
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Carp
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Utah Chub
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	White Sucker

32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Speckled Dace
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Channel Catfish
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Rainbow Trout
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Mountain Sucker
32	19	111	HAMS FORK RIVER	BLACKS FORK RIVER	Flannelmouth Sucker

Table 13. Supplemental chemistry monitoring, May 2004. (DEQ)

Hams Fk. Nutrient Monitoring, 2004.

Date	Location	Time	DisCHARGE (Q) cfs	Air Temp	Temp. C	pH (su)	Turb (ntu)	Cond (uS)	DO (mg/l)	PHOS (total)	PHOS (diss)	NO3 (mg/l)	BOD (mg/l)	TSS (mg/l)	NH4 (mg/l)
5/17/2004	Lions Park	12:22:00		27.00	13.10	8.51	3.31	350.00	9.20	0.05	<0.02	<0.1			
5/17/2004	Lions Park	14:11:00		18.00	13.80	8.57		353.00	8.49						
5/17/2004	Lions Park	17:30:00		19.00	14.10	8.58		349.00	8.67	0.04	<0.02	<0.1			
5/17/2004	Hwy 30	13:15:00			13.30	8.68		374.00	9.75	0.08	0.03	<0.1			
5/17/2004	Hwy 30	14:55:00		22.00	13.70	8.55		371.00	9.07						
5/17/2004	Hwy 30	17:10:00		20.00	14.40	8.56		360.00	8.94	0.07	0.03	<0.1			
5/18/2004	Lions Park	7:45:00		9.00	10.80	8.31		358.00	8.01	0.06	<0.02	<0.1			
5/18/2004	Lions Park	11:10:00		23.00	13.80	8.50		357.00	9.05						
5/18/2004	Lions Park	12:45:00		19.50	15.00	8.58	2.92	359.00	8.85	0.05	<0.02				
5/18/2004	Abv Outfall	9:30:00	114.05	13.00	12.00	8.37		382.00	8.84	0.04	<0.02	<0.1	<1.0	19.00	0.50
5/18/2004	Outfall	9:10:00	0.77	14.00	14.40	7.70		1087.00	7.92	2.58	2.39	22.40	4.00	3.00	0.40
5/18/2004	Blw Outfall	8:45:00		13.00	10.70	8.32		372.00	8.29	0.06	0.04	0.2	<1.0	18.00	0.20
5/18/2004	Hwy 30	7:20:00			10.50	8.31	3.05	367.00	7.90	0.10	0.02	<0.1			
5/18/2004	Hwy 30	10:47:00		19.00	11.70	8.49		364.00	9.57						
5/18/2004	Hwy 30	13:15:00		23.00	13.30	8.67		375.00	9.11	0.07	0.03	0.10			

Detection limit for phosphorus = 0.02 mg/l (IML Lab) using EPA method 200.7

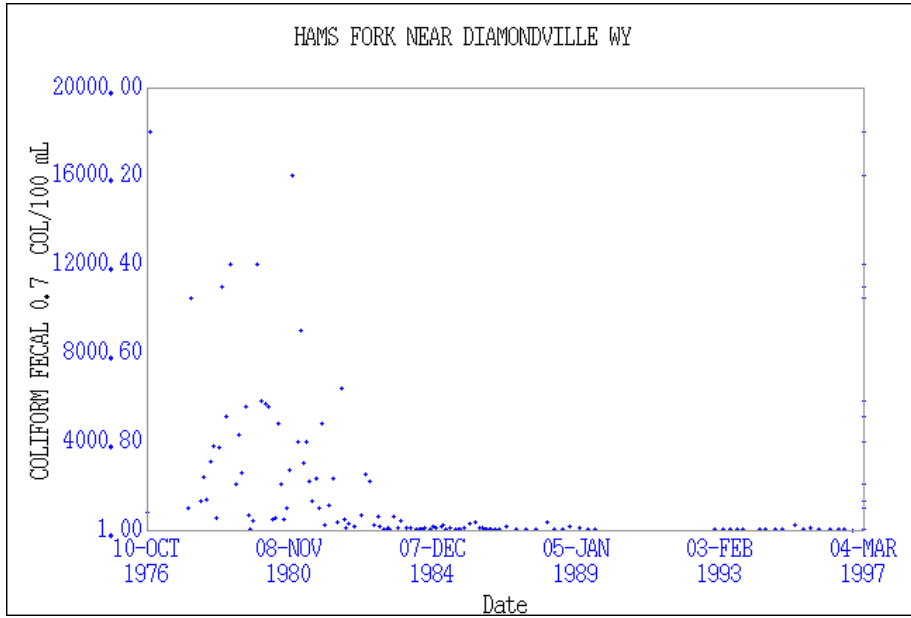
Table 14. Supplemental chemistry monitoring, September, 2004. (DEQ)

Hams Fk. Nutrient Monitoring. 2004.

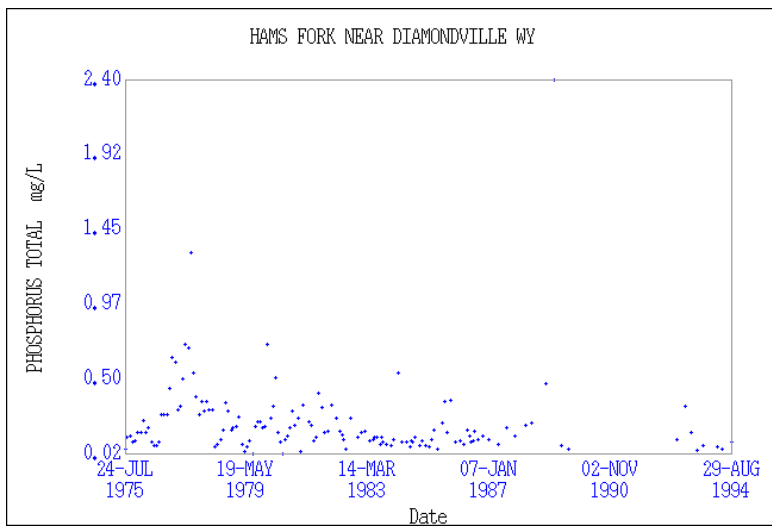
Date	Location	Time	Discharge (Q) cfs	Air Temp	Temp. C	pH (su)	Cond (uS)	DO (mg/l)	PHOS (total)	NO3 (mg/l)
9/28/2004	Lions Park	18:45		16.0	12.9	8.47	441	8.61	<0.05	<0.1
9/28/2004	Highway 30 Bridge	19:10		15.0	13.6	8.90	443	10.69	<0.05	<0.1
9/29/2004	Lions Park	7:45		5.0	8.8	7.96	459	7.07	<0.05	<0.1
9/29/2004	Lions Park	10:15		9.0	9.2	8.17	498	8.55	<0.05	<0.1
9/29/2004	Lions Park	12:43		13.0	10.2	8.26	479	9.12	<0.05	<0.1
9/29/2004	Lions Park	16:24		9.0	11.1	8.50	522	9.61	<0.05	<0.1
9/29/2004	Lions Park	19:00		9.0	10.6	8.37	483	9.61	<0.05	<0.1
9/29/2004	Abv Outfall	11:18	13.64		9.8	8.27	498	8.16	<0.05	<0.1
9/29/2004	Outfall	11:30	0.82	14.0	13.9	7.64	1158	7.08	2.61	23
9/29/2004	Blw Outfall	11:08		11.0	9.9	8.13	536	8.00	0.08	1
9/29/2004	Highway 30 Bridge	7:20		8.0	10.4	8.00	521	6.03	<0.05	0.3
9/29/2004	Highway 30 Bridge	10:37		10.0	10.3	8.01	546	7.04	<0.05	0.4
9/29/2004	Highway 30 Bridge	13:05		13.0	10.7	8.15	544	8.24	<0.05	0.5
9/29/2004	Highway 30 Bridge	16:05		10.0	11.2	8.52	534	11.06	<0.05	0.4
9/29/2004	Highway 30 Bridge	19:22		7.0	10.9	8.61	519	10.93	<0.05	0.3

Detection limit for September sampling = 0.05 mg/l using EPA method 200.7

Graph 1. Fecal coliform colony counts, 1967-1997 USGS Station #09224050



Graph 2. Total Phosphorus (mg/l) 1975-1994 USGS Station #09224050



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Appendix A. Photos of 1998 sampling locations



1. Forest station (MRW88) looking downstream on sample riffle.



2. Forest station (MRW88) panorama, looking downstream.



2. Ditch Station (MRW89), looking upstream on sample riffle.



4. Ditch Station (MRW89) , panorama view, looking downstream.



5. Lions Park station (WB64), looking upstream on sample riffle.



6. Lions Park station (WB64), panorama view, flow is from right to left in photo.



7. Highway 30 Bridge (WBI25), looking upstream on sample riffle.



8. Highway 30 Bridge (WBI25) , panorama view, flow is from left to right in photo.



9. Opal Station (WQWB09), looking upstream.



10. Granger Station (WB65), sample riffle, upstream view.



11. Granger station(WB65), view upstream on sample riffle.



12. Granger station (WB65), View downstream on sample riffle.

Appendix B. 1998 Macroinvertebrate Data.

1. Hams Fork River Forest Station MRW88 9/17/1998

Hams Fork - Forest, 260-1MG, September 17,
1998

CORRECTION FACTOR	26.9	
Taxon	Abundance	%
Nematoda	27	0.08
Acari	1049	3.28
TOTAL: NON INSECTS	1076	3.36
<i>Drunella grandis/spinifera</i>	699	2.18
<i>Ephemerella inermis/infrequens</i>	565	1.76
<i>Timpanoga hecuba</i>	27	0.08
<i>Cinygmula</i>	108	0.34
<i>Rhithrogena</i>	161	0.50
<i>Paraleptophlebia</i>	81	0.25
TOTAL: EPHEMEROPTERA	1641	5.13
Chloroperlidae	27	0.08
<i>Sweltsa</i>	27	0.08
<i>Hesperoperla pacifica</i>	27	0.08
<i>Diura knowltoni</i>	54	0.17
<i>Pteronarcella</i>	27	0.08
TOTAL: PLECOPTERA	161	0.50
<i>Arctopsyche grandis</i>	54	0.17
<i>Brachycentrus americanus</i>	215	0.67
<i>Micrasema</i>	4304	13.45
<i>Glossosoma</i>	54	0.17
<i>Hydropsyche</i>	27	0.08
<i>Lepidostoma</i> -sand case larvae	915	2.86
<i>Rhyacophila Brunnea</i> Gr.	27	0.08
<i>Oligophlebodes</i>	27	0.08
TOTAL: TRICHOPTERA	5622	17.56
Dytiscidae	27	0.08
<i>Cleptelmis</i>	27	0.08
<i>Optioservus</i>	565	1.76
<i>Zaitzevia</i>	54	0.17
TOTAL: COLEOPTERA	673	2.10
Chelifera	54	0.17
<i>Wiedemannia</i>	54	0.17
<i>Pericoma</i>	27	0.08
<i>Antocha</i>	1345	4.20
<i>Dicranota</i>	27	0.08
<i>Hexatoma</i>	27	0.08
<i>Tipula</i>	27	0.08
TOTAL: DIPTERA	1560	4.87
Chironomidae-pupae	215	0.67
<i>Cricotopus Nostococladius</i>	20175	63.03
<i>Micropsectra</i>	54	0.17
<i>Orthocladius</i> Complex	188	0.59
<i>Pagastia</i>	54	0.17
<i>Polypedilum</i>	27	0.08
<i>Rheocricotopus</i>	27	0.08
<i>Rheotanytarsus</i>	404	1.26
<i>Thienemannimyia</i> Gr.	54	0.17
<i>Tvetenia Bavarica</i> Gr.	81	0.25
TOTAL: CHIRONOMIDAE	21278	66.47
GRAND TOTAL	32011	100.00

2. Hams Fork River Ditch Station MRW89 9/17/1998

Hams Fork - ditch, 260-1ME, September 17,
1998

CORRECTION FACTOR	40.35	
Taxon	Abundance	%
Imma. Tubificid with cap. setae	121	0.55
Sphaeriidae	81	0.37
Fluminicola	40	0.18
Physella	81	0.37
Planorbidae	40	0.18
Acari	121	0.55
TOTAL: NON INSECTS	484	2.21
Baetis tricaudatus	121	0.55
Dipheter hageni	323	1.48
Drunella grandis/spinifera	1089	4.98
Epeorus-early instar	40	0.18
Paraleptophlebia	767	3.51
TOTAL: EPHEMEROPTERA	2340	10.70
Capniidae	40	0.18
Chloroperlidae	121	0.55
Doroneuria	40	0.18
Hesperoperla pacifica	40	0.18
Isoperla	40	0.18
Pteronarcella	81	0.37
TOTAL: PLECOPTERA	363	1.66
Brachycentrus occidentalis	202	0.92
Protoptila	404	1.85
Helicopsyche borealis	40	0.18
Cheumatopsyche	646	2.95
Hydropsyche	1089	4.98
Neotrichia	605	2.77
Lepidostoma-sand case larvae	6416	29.34
TOTAL: TRICHOPTERA	9402	42.99
Cleptelmis	161	0.74
Optioservus	2139	9.78
Zaitzevia	404	1.85
TOTAL: COLEOPTERA	2703	12.36
Chelifera	40	0.18
Hexatoma	81	0.37
TOTAL: DIPTERA	121	0.55
Chironomidae-pupae	81	0.37
Corynoneura	40	0.18
Cricotopus Nostococladus	1977	9.04
Eukiefferiella	202	0.92
Micropsectra	202	0.92
Microtendipes	40	0.18
Orthocladus Complex	726	3.32
Polypedilum	605	2.77
Rheotanytarsus	767	3.51
Sublettea	81	0.37
Thienemanniella	81	0.37
Thienemanimyia Gr.	807	3.69
Tvetenia Discoloripes Gr.	847	3.87
TOTAL: CHIRONOMIDAE	6456	29.52
GRAND TOTAL	21870	100.00

3. Hams Fork River Lions Park Station WB64 9/15/1998

Hams Fork River @ Lions Park, 258-1MG, September 15, 1998

CORRECTION FACTOR	8.97	
Taxon	Abundance	%
Nematoda	9	0.20
Nais communis	54	1.23
Nais variabilis	45	1.02
Uncinaiis uncinata	9	0.20
Sphaeriidae	9	0.20
Physella	36	0.82
Acari	126	2.87
TOTAL: NON INSECTS	287	6.56
Ophiogomphus	9	0.20
TOTAL: ODNATA	9	0.20
Baetidae	18	0.41
Acentrella	18	0.41
Baetis tricaudatus	99	2.25
Ephemerella inermis/infrequens	287	6.56
Heptagenia/Nixe	9	0.20
Paraleptophlebia	36	0.82
Tricorythodes minutus	484	11.07
TOTAL: EPHEMEROPTERA	951	21.72
Isoperla	27	0.61
TOTAL: PLECOPTERA	27	0.61
Cheumatopsyche	99	2.25
Hydropsyche	825	18.85
Hydroptila	9	0.20
Ceraclea	18	0.41
Nectopsyche	54	1.23
Oecetis	161	3.69
Psychomyia	18	0.41
TOTAL: TRICHOPTERA	1184	27.05
Petrophila	63	1.43
TOTAL: LEPIDOPTERA	63	1.43
Cleptelmis	9	0.20
Dubiraphia	36	0.82
Optioservus	395	9.02
TOTAL: COLEOPTERA	440	10.04
Atherix	9	0.20
Hemerodromia	18	0.41
Hexatoma	9	0.20
TOTAL: DIPTERA	36	0.82
Chironomidae-pupae	45	1.02
Cladotanytarsus	63	1.43
Cricotopus	9	0.20
Cricotopus Bicinctus Gr.	27	0.61
Cryptochironomus	9	0.20
Eukiefferiella	63	1.43
Micropsectra	27	0.61
Microtendipes	36	0.82
Orthocladus Complex	36	0.82
Parametriocnemus	27	0.61
Pentaneura	81	1.84
Polypedilum	610	13.93
Potthastia Longimana Gr.	9	0.20
Rheocricotopus	9	0.20
Rheotanytarsus	224	5.12
Thienemanniella	27	0.61
Thienemannimyia Gr.	27	0.61
Tvetenia Discoloripes Gr.	54	1.23
TOTAL: CHIRONOMIDAE	1381	31.56
GRAND TOTAL	4377	100.00

4. Hams Fork River Bridge Station WBI25 9/16/1998

Hams Fork @ bridge, 259-11MG, September 16, 1998

CORRECTION FACTOR	5.04	
Taxon	Abundance	%
Nematoda	5	0.17
Imma. Tubificid with cap. setae	5	0.17
Imma. Tubificid w/o cap. setae	20	0.69
Hirudinea	5	0.17
Ferrissia	5	0.17
Acari	45	1.56
TOTAL: NON INSECTS	86	2.95
Acentrella insignificans	126	4.33
Baetis tricaudatus	30	1.04
Ephemerella inermis/infrequens	81	2.77
Heptagenia/Nixe	15	0.52
Rhithrogena	10	0.35
Stenonema	25	0.87
Paraleptophlebia	10	0.35
Tricorythodes minutus	1089	37.44
TOTAL: EPHEMEROPTERA	1386	47.66
Isoperla	20	0.69
Skwala	10	0.35
TOTAL: PLECOPTERA	30	1.04
Protoptila	10	0.35
Cheumatopsyche	20	0.69
Hydropsyche	958	32.93
Hydroptila	35	1.21
Ceraclea	5	0.17
Oecetis	40	1.39
TOTAL: TRICHOPTERA	1068	36.74
Petrophila	30	1.04
TOTAL: LEPIDOPTERA	30	1.04
Optioservus	106	3.64
TOTAL: COLEOPTERA	106	3.64
Chironomidae-pupae	25	0.87
Cardiocladius	5	0.17
Cricotopus	10	0.35
Cricotopus Trifascia Gr.	10	0.35
Microtendipes	40	1.39
Orthocladius Complex	91	3.12
Parametricnemus	5	0.17
Polypedilum	5	0.17
Thienemannimyia Gr.	5	0.17
Tvetenia Discoloripes Gr.	5	0.17
TOTAL: CHIRONOMIDAE	202	6.93
GRAND TOTAL	2908	100.00

5. Hams Fork River Granger Station WB65 9/16/1998

Hams Fork @ Granger, 259-10ME, Sept. 16, 1998

CORRECTION FACTOR	2.99	
Taxon	Abundance	%
Ophidonais serpentina	3	0.18
Uncinaiis uncinata	6	0.37
Imma. Tubificid with cap. setae	12	0.74
Imma. Tubificid w/o cap. setae	33	2.03
Rhyacodrilus coccineus	6	0.37
Acari	6	0.37
TOTAL: NON INSECTS	66	4.05
Ophiogomphus	3	0.18
TOTAL: ODONATA	3	0.18
Baetidae	3	0.18
Acentrella insignificans	27	1.66
Baetis tricaudatus	30	1.84
Ephemera	6	0.37
Heptagenia/Nixe	93	5.71
Stenonema	550	33.89
Choroterpes	15	0.92
Ephoron	6	0.37
Tricorythodes minutus	245	15.10
TOTAL: EPHEMEROPTERA	975	60.04
Isogenoides	3	0.18
Isoperla	63	3.87
TOTAL: PLECOPTERA	66	4.05
Culoptila	21	1.29
Cheumatopsyche	293	18.05
Hydropsyche	99	6.08
Oecetis	39	2.39
TOTAL: TRICHOPTERA	451	27.81
Petrophila	3	0.18
TOTAL: LEPIDOPTERA	3	0.18
Optioservus	6	0.37
TOTAL: COLEOPTERA	6	0.37
Hemerodromia	9	0.55
Simulium	3	0.18
Hexatoma	3	0.18
TOTAL: DIPTERA	15	0.92
Chironomidae-pupae	9	0.55
Cricotopus	3	0.18
Cryptochironomus	3	0.18
Demicyptochironomus	3	0.18
Eukiefferiella	3	0.18
Microtendipes	6	0.37
Orthocladus Complex	6	0.37
Parametriocnemus	3	0.18
Thienemannimyia Gr.	3	0.18
TOTAL: CHIRONOMIDAE	39	2.39
GRAND TOTAL	1624	100.00