

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

WATERBODY:	Middle Fork Crazy Woman Creek - WYPR10090205-153
SEGMENT DESCRIPTION:	Extends from the confluence with North Fork Crazy Woman Creek upstream to its headwaters. (~11 miles)
CLASS:	Class 2AB
DESIGNATED USES:	Drinking water supplies, non-game fisheries, cold-water fisheries, fish consumption, aquatic life other than fish, primary contact recreation, wildlife, industry, agriculture, and scenic values
1996 305(b) REPORT AND 303(d) LIST:	WYPR1090205-153 listed as partially supportive for agriculture and agriculture-irrigation uses. Impairments suspected to be caused by siltation, nutrients, and unknown. Sources of pollutants were reported as municipal point source discharge, rangeland, irrigated cropland, land development, petroleum activities, and highway maintenance.
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INTRODUCTION

Middle Fork Crazy Woman Creek originates in the Big Horn mountain range and flows east/southeast for ~ 11 miles prior to its confluence with North Fork Crazy Woman Creek in northern Johnson County. The Middle Fork Crazy Woman Creek watershed is split by ecoregions with the Middle Rockies Central in the upper-half of the watershed and the Northwestern Great Plains situated in the lower-half (Omernik and Gallant, 1987). The geology of the Middle Fork Crazy Woman Creek watershed is composed primarily of dolomitic/limestone formations and marine shales and siltstones of which the majority is the Cody Shale (KC) (USGS, 1985). The entire watershed is primarily used for livestock grazing, however irrigation, with the use of earthen ditches, is common throughout the middle and lower portions of the watershed.

REPORT OBJECTIVE

The State of Wyoming's 1996 305(b) Report and 303(d) List indicated that Middle Fork Crazy Woman Creek (WYPR10090205) was partially supportive for agriculture and agriculture-irrigation uses. The Wyoming Department of Environmental Quality (WDEQ) conducted assessments at two locations on Middle Fork Crazy Woman Creek in 1996. These two sites with the addition of another site were again sampled in 1998. The purpose of this report is to document the findings of the 1996 and 1998 assessments and provide a determination of whether the agriculture and agriculture-irrigation uses as well as other designated uses assigned to Middle Fork Crazy Woman Creek are supported.

METHODS AND MATERIALS

All collection, analysis, and evaluation of Middle Fork Crazy Woman Creek assessment data was conducted in

accordance with approved assessment procedures as outlined in the following documents:

- _____ 1) Manual of Standard Operating Procedures for Sample Collection and Analysis. (WDEQ/WQD, 2001a).
- _____ 2) Quality Assurance Project Plan (QAPP) for Beneficial Use Reconnaissance Project (BURP) Water Quality Monitoring. (WDEQ/WQD, 2001b).
- _____ 3) A bioassessment method for use in Wyoming stream and river water quality monitoring. (King, 1993).
- _____ 4) Beneficial use reconnaissance project-wadeable stream monitoring methodology. (WDEQ/WQD, 1998).
- _____ 5) Wyoming's method for determining water quality condition of surface waters. (WDEQ/WQD, 2001c).

ASSESSMENT STATIONS

Descriptive information and data collected on Middle Fork Crazy Woman Creek assessment stations (Map 1).

Station ID	Y.S.	Chemical Data	Biological Data	Physical Data	Legal (Sec / T / R)	Latitude	Longitude	Elevation (ft)
^a MRC59	1998	YES	YES	YES	NENE of Sec. 30, T48N, R84W	44° 06' 24.38"	106° 59' 40.03"	8200
MRCI21	1996 1998	YES	YES	YES	SESE of Sec. 7, T47N, R82W	44° 03' 07.89"	106° 45' 07.97"	5440
^b NGPI37	1996 1998	YES	YES	YES	SWSE of Sec. 10, T47N, R82W	44° 03' 05.68"	106° 41' 44.96"	4730

^a Located within the Big Horn National Forest immediately downstream of a road crossing.

^b Located immediately upstream of Old Highway 87 bridge.

Y.S. = Year Sampled

Chemical, physical, and biological data were collected at the above stations on 9/29/98 and/or 10/31/96.

CHEMICAL DATA

(See Table 1 for complete dataset). In 1996, water temperatures at MRCI21 and NGPI37 were <4°C. Water temperature ranged from 9.1°C at MRC59 to 16.1°C at MRCI21 during 1998. The USEPA (1986) suggests a temperature of 32°C as an upper tolerance limit to maintain a balanced benthic macroinvertebrate structure. Ambient water temperature of all stations for both years were below the WDEQ/WQD (2001) standard of 20°C for a cold water fishery. All pH results for both years were below the upper limit of 9.0 (WDEQ/WQD, 2001). Conductivities at stations MRCI21 and NGPI37 in 1996 were 410 uS/cm and 470 uS/cm respectively. Conductivity measurements were 36.6 uS/cm at MRC59, 322 uS/cm at MRCI21 and 515 uS/cm at NGPI37 in 1998. The elevated conductivity at stations MRCI21 and NGPI37 for both years are expected due to stream contact with marine deposits (i.e., Cody Shale) common throughout the middle and lower portion of the watershed. Although unclear at this time, land use activities may contribute (in part) to elevated conductivity in the lower watershed. Dissolved oxygen concentrations at all stations during both years were within the acceptable one-day minimum dissolved oxygen criterion for a class 2AB drainage (WDEQ/WQD, 2001).

The 1998 instantaneous turbidity value of 2 NTU at station MRC59 is likely due to sediment inputs primarily from an blown-out road-crossing less than 0.25 mile upstream of the station and secondarily from localized hoof action and bank sloughing. Turbidity values for MRCI21 and NGPI37 in 1998 were considerably less compared to those in 1996. However, these differences in turbidity at stations MRCI21 and NGPI37 may be due to variation in the frequency and duration of irrigation withdrawals and returns and/or overland runoff from irrigated fields within the middle to lower stretches of the watershed.

The instantaneous TSS value at MRC59 was 5mg/L which may be reflective of the same sources that have caused elevated turbidity at this station. Instantaneous TSS values for stations MRCI21 and NGPI37 during 1996 and 1998 were generally <2 mg/L with one exception of 3 mg/L at NGPI37 during 1996.

Total phosphorous and nitrate-nitrogen concentrations at all stations for both years were below detection at <0.1 mg/l. Generally, for streams that do not directly enter lakes or reservoirs, the target phosphorous concentration considered protective of aquatic life uses is 1 mg/l (King, 1993). The chloride concentration at MRC59 was 44 mg/l. It is unknown what specific source(s) contribute to the elevated chloride at MRC59. Chloride concentrations at stations MRCI21 were below detection at <5 mg/L in both 1996 and 1998. Station NGPI37 had a chloride concentration of <5 mg/L in 1996 and 32 mg/L in 1998. Based on land use characteristics of the lower watershed, inputs of concentrated salts via irrigation returns and/or overland runoff from irrigated fields, may have contributed to the elevated chloride concentration at NGPI37 in 1998. At all stations, chloride concentrations did not exceed the 230 mg/L chronic numeric criteria considered protective of aquatic life.

PHYSICAL DATA

Stream substrate composition throughout Middle Fork Crazy Woman Creek is primarily a cobble/coarse gravel complex (Table 2). In 1996, weighted embeddedness (silt cover) at stations MRCI21 and NGPI37 were 74.4 and 34.8 respectively (Table 2). In contrast, weighted embeddedness at stations MRCI21 and NGPI37 were 80 and 65 respectively in 1998. Decreased silt cover at these stations in 1998 compared to 1996 seems to indicate that anthropogenic sources of sediment into the system has been reduced. However, the moderate embeddedness at station NGPI37 in 1998 appears to suggest that anthropogenic activities in the lower watershed continue to contribute sediment to the system. Although unclear at this time, sources of sediment to the system may be due to runoff from cultivated fields, localized bank erosion, erosion from intensively grazed areas coupled with decreased sediment transport capability as a result of irrigation diversions and conveyance. The moderate embeddedness (score - 65) at station MRC59 in 1998 appears to be due to sediment contributions from an upstream blown-out road-crossing and secondarily from localized hoof action and bank sloughing.

Habitat condition at all stations in 1998 was evaluated with the use of the fast-water (>10% of stream reach characterized by riffle/run habitats) qualitative assessment procedure (WDEQ/WQD, 2001a). A similar habitat assessment was used to evaluate habitat conditions for stations MRCI21 and NGPI37 in 1996.

Total qualitative habitat assessment scores for stations MRC59, MRCI21, and NGPI37 in 1998 were 161.5, 135, and 143 respectively (Table 3). These scores were 81%, 68%, and 72% of the total maximum score (total-200) for stations MRC59, MRCI21, and NGPI37 respectively. Total qualitative habitat scores for stations MRCI21 and NGPI37 in 1996 were 108 and 81 respectively (Table 3). These scores were 57% and 43% of the total maximum score (total-190) for stations MRCI21 and NGPI37 respectively. Despite some differences in categories used to evaluate habitat condition at stations MRCI21 and NGPI37 in 1996 and 1998 (see Table 3), the final habitat assessment scores suggest habitat conditions have improved at these stations since 1996. In particular, bank stability and bank protection have improved while disruptive pressures on the riparian zone have decreased at both stations (Table 3). In light of these improvements, high embeddedness, low instream cover for fish, low pool/riffle ratio, moderate channelization/alteration, high velocity/depth ratio, rectangular channel shape, high width/depth ratio, and a narrow riparian vegetative zone width continued to reduce overall habitat scores at MRCI21 and NGPI37 in 1998. The moderate habitat score at MRC59 is largely attributed to high embeddedness, high velocity/depth ratio, and high pool/riffle ratio.

The combination of irrigation diversions and conveyance, runoff from cultivated fields, localized bank erosion, upstream culverts, and/or a limited riparian zone width due to intensive grazing or human activities appear to account for the less than optimal 1998 habitat assessment scores at stations MRCI21 and NGPI37. The combination of sediment inputs from an upstream blown-out road-crossing in addition to localized hoof action and bank sloughing likely accounts for the less than optimal habitat assessment score at station MRC59.

The 1998 habitat assessments for stations MRC59, MRCI21, and NGPI37 were 94%, 82%, and 104% comparable to average habitat conditions for selected reference quality streams respectively (Table 4). Habitat assessments conducted in 1996 for stations MRCI21 and NGPI37 could not be compared to selected reference quality streams due to differences in habitat assessment methods. Streams with $\geq 75\%$ comparability in habitat scores with reference streams are assessed as supporting habitat requirements for aquatic life (Plafkin et al., 1989).

BIOLOGICAL DATA

Biometrics developed by Jessup and Stribling (2002) were utilized as a tool to assess the biotic/ecological integrity of Middle Fork Crazy Woman Creek as a means of determining whether designated uses, such as aquatic life, are attained. More specifically, stations MRC59, MRCI21 and NGPI37 were evaluated with the Wyoming Stream Integrity Index (WSII) developed for the Middle Rockies Central (>6500'), Middle Rockies Central (<6500'), and Northwestern Great

Plains ecoregions respectively. Biotic condition at station MRCI21 was rated as 'good' in 1996 and 'fair' in 1998 (Appendix A). WSII ratings for station NGPI37 were 'good' in 1996 and 'very good' in 1998 while station MRC59 exhibited a WSII rating of 'fair' in 1998 (Appendix A).

Station MRCI21 - Considering the overall improvements in the channel and riparian conditions of MRCI21 in 1998 compared to 1996, we would expect the biotic condition to follow a similar pattern. This was not the case with respect to the WSII rating. Although the *ratings* indicate an appreciable difference in biotic condition between 1996 and 1998 exists for MRCI21, closer examination reveals that the difference in ratings was attributed to only a small 4.2 point gap between actual *scores*. According to Jessup and Stribling (2002), streams having WSII scores that rate at or above the 25th percentile of reference conditions for a particular ecoregion are rated as 'good' or 'very good' by the WSII and are deemed supportive of aquatic life uses. Consequently, MRCI21 in 1998 scored only a few points shy of the 25th percentile of the WSII reference condition range for the Middle Rockies Central (<6500') ecoregion and thus was rated as 'fair'.

The macroinvertebrate community of MRCI21 between 1996 and 1998 was overall similar, although small differences were noted. In particular MRCI21 exhibited an increased number of Hydropsychid caddisflies and decreased number of scrapers in 1998 compared to 1996 (Appendices B and C). The effect of these community changes appears to have been offset by positive increases in number of Plecoptera (stonefly) and Trichoptera (caddisfly) taxa as well as an increase in Ephemeroptera (mayfly) abundance in 1998. Macroinvertebrate communities are, to a large extent, shaped by the chemical and physical characteristics of the stream they inhabit. Consequently, temporal variability with respect to chemical and physical conditions of the stream may commonly influence the distribution and abundance of certain macroinvertebrate taxa as well as the entire community structure (Ward, 1992). Aside from the physical and chemical influences, macroinvertebrate communities will also exhibit substantial temporal variation simply due to differences in life history of individual taxa. In light of the improved habitat condition at MRCI21 and the small difference in WSII scores between 1996 and 1998 suggests that natural temporal variation in the macroinvertebrate community rather than excessive environmental perturbations, may ultimately be responsible for the differences in WSII ratings for MRCI21.

Station MRC59 - The 'fair' WSII rating for station MRC59 appears to be largely attributed to low scores in the percent composition metrics: '% Ephemeroptera (no *Baetidae*)', '% Trichoptera (no *Hydropsychidae*)', and '% 5 dominant' (Appendix A). The most distinct characteristic of the macroinvertebrate community at station MRC59 relative to all other stations was the large number of Chironomid (midge) individuals (3265) that comprised 66% of the total macroinvertebrate community (Appendix B). It is generally interpreted throughout the scientific literature that a macroinvertebrate community dominated by Chironomids is indicative of excessive environmental degradation (Merritt and Cummins, 1996). However, upon closer inspection, 39% of the total Chironomid community is comprised of the

taxon *Cricotopus nostococladus* (Appendix B). The larva of this taxa is a common symbiont with the cyanobacterium *Nostoc* which can both be found in large numbers within certain cold-water montane streams (Brock, 1960; Dodds and Gudder, 1995). *Nostoc* is a common blue-green algae of cold-water montane streams of the west, therefore the presence of *Nostoc* and its associated Chironomid symbiont, in large numbers, does not necessarily reflect excessive environmental perturbations, however, it can have a substantial negative influence on percent-based metrics of the WSII. For example, if not for the large presence of *Cricotopus n.* at station MRC59, favorable increases in the ‘% Ephemeroptera (no *Baetidae*)’ and ‘% Trichoptera (no *Hydropsychidae*)’ metrics and a corresponding decrease in the ‘% 5 dominant’ metric would have resulted with an overall ‘good’ rating for MRC59.

Aside from the apparent influence of *Cricotopus n.* on the macroinvertebrate community, percent composition of Chironomidae (no *Cricotopus n.*) is still high at MRC59 relative to stations MRC121 and NGPI37. It appears that the other 27% of the total Chironomid community at MRC59 is largely comprised of the midge taxon *Micropsectra* (15%). According to Merritt and Cummins (1996), *Micropsectra* is a collector-filter known to inhabit both lentic and lotic depositional habitats. MRC59 appears to be influenced to a great degree by deposition of sediment from the blown-out upstream road crossing and localized bank erosion and hoof action.

Station NGPI37 - According to the WSII scores and ratings, biotic condition at station NGPI37 improved from ‘good’ in 1996 to ‘very good’ in 1998 (Appendix A). According to Jessup and Stribling (2002), streams that score at or above the 25th percentile of reference conditions (i.e., rated as ‘good’ or ‘very good’) are deemed to be supportive of aquatic life uses.

Comparison with Selected Reference Sites - Reference quality streams with similar watershed characteristics were used for comparison with Middle Fork Crazy Woman Creek to assess the percent comparability with Middle Rockies Central (>6500'), Middle Rockies Central (<6500') and Northwestern Great Plains WSII scores. In 1996, stations MRC121 and NGPI37 scored 106% and 96% of the average WSII score respectively for the reference streams used for comparison (Table 4). In 1998, stations MRC59, MRC121, and NGPI37 scored 93%, 99%, and 106% of the average WSII score respectively for the reference streams used for comparison (Table 4).

HISTORICAL/ANCILLARY DATA

According to the Wyoming Game and Fish Department Stream and Lakes Inventory Database, the following species were collected at the mouth of North Fork Crazy Woman Creek and Middle Fork Crazy Woman Creek between 1994 and 1997:

Middle Fork Crazy Woman Creek (Sec. 1, T47N, R82W): Black Bullhead (*Ameiurus melas*), Goldeye (*Hiodon alosoides*), Common Carp (*Cyprinus carpio*), Brown Trout (*Salmo trutta*), Brook Trout (*Salvelinus fontinalis*), Rainbow Trout (*Oncorhynchus mykiss*), White Sucker (*Catostomus commersoni*), Stonecat (*Noturus flavus*), Longnose Dace (*Rhinichthys cataractae*), Longnose Sucker (*Catostomus catostomus*), and Flathead Chub (*Platygobio gracilis*).

QUALITY ASSURANCE/QUALITY CONTROL

Environmental data from Middle Fork Crazy Woman Creek 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 were determined to be complete and accurate.

SUMMARY AND CONCLUSIONS

Classification - Middle Fork Crazy Woman Creek is correctly classified as a class 2AB water. Dissolved oxygen concentrations and water temperature among all stations were well within the established criteria for class 2AB waters WDEQ/WQD (2001) at the time of WDEQ's 1996 and 1998 sampling of Middle Fork Crazy Woman Creek. The Wyoming Game and Fish Department Stream and Lakes Inventory database indicated cold-water game fishes were present in at the mouth of Middle Fork Crazy Woman Creek. No fishes were observed at stations MRCI21 and NGPI37 in 1996. Field observations from the 1998 assessment documented the presence of brook trout at MRC59.

Water Quality - Measured water quality parameters did not exceed existing standards protective of class 2AB waters on the dates of sampling. In addition, water quality parameters for which numeric criteria have not been defined, do not appear to be in excessive quantities that would threaten or impair uses associated with Middle Fork Crazy Woman Creek.

Habitat Quality - Information suggests that the moderate degree of embeddedness (silt cover) and moderate habitat condition at station MRC59 is due largely to a combination of sediment inputs from an upstream blown-out road crossing and localized bank erosion and hoof action. It is expected that once the road-crossing has been repaired, silt cover at station MRC59 would be reduced and overall habitat condition would improve.

The results of the 1996 and 1998 habitat assessments conducted at stations MRCI21 and NGPI37 indicate that overall habitat condition has improved at both stations, particularly with regard to reduced embeddedness (silt cover), improved bank stability/cover and a reduction in disruptive pressures to the riparian zone. In light of these improvements,

additional inputs of fine sediment, particularly in the vicinity of station NGPI37, continue to reduce habitat conditions within the lower stretch of Middle Fork Crazy Woman Creek. Although it is not conclusive what specific factors are contributing to additional sediment in the lower stretch of the system, available information suggests that a combination of direct and indirect effects from irrigation withdrawals and returns, runoff from cultivate fields, and localized bank erosion may increase sediment inputs to the lower stretch of Middle Fork Crazy Woman Creek. At this time, the degree of sediment inputs to the system does not appear to compromise the ability of Middle Fork Crazy Woman Creek to support its assigned uses.

Biotic Quality - The results of the 1996 and 1998 biotic and physical assessments in addition to information from available scientific literature, professional judgement, and comparison with selected reference-quality stations, indicated that the aquatic life uses within the middle and lower stretches of Middle Fork Crazy Woman Creek are supported. Although it appears apparent that substantial improvements in habitat condition have improved the biotic integrity of the middle and lower stretches, available information suggests that land-use activities in the watershed may continue to contribute additional fine sediment to the system. Although it is not conclusive what specific factors are causing additional sediment to enter the system, information suggests that the direct and indirect effects of irrigation withdrawals and returns as well as overland runoff from irrigated fields and localized bank erosion may have some influence.

The results of the 1998 biotic and physical assessment in addition to information from available scientific literature, professional judgement, and comparison with selected reference-quality stations, indicate that aquatic life uses also appear to be supported in the upper Middle Fork Crazy Woman Creek watershed, however, localized perturbations do appear to have some influence on the biotic community. In particular, the biotic integrity at station MRC59 appears to be compromised to a small degree by sediment inputs from an upstream blown-out road-crossing and localized bank erosion and hoof action. It is believed that repair of the upstream road-crossing may reduce the amount of additional fine sediment entering the system and in turn improve the biotic condition at station MRC59.

Agricultural Uses - Chapter 1 of the Wyoming Department of Environmental Quality-Water Quality Division Rules and Regulations provides several narrative standards to protect agricultural uses in the absence of a demonstration of a measurable decrease in crop or livestock production (WDEQ/WQD, 2001). Two specific narrative standards are Section 15-Settable Solids, and Section 16-Floating and Suspended Solids (WDEQ/WQD, 2001). Sections 15 and 16 clearly state that settable solids and/or floating/suspended solids shall not be present in significant quantities which can result in degradation to habitat for aquatic life or adversely affect agricultural uses. Excessive bank erosion, formation of mid-channel bars and absence of vegetation on point bars can suggest appreciable inputs of fine sediments which can increase

the amount of suspended and settleable solids into a stream system. However, at all stations, mid-channel bars were not observed, point bars were re-vegetating, and although localized bank erosion was present at some stations, it did not appear excessive. Available evidence suggests that both Sections 15 and 16 of Chapter 1 are being attained in Middle Fork Crazy Woman Creek which suggests that agricultural uses are supported,

In short, available information suggests that continued implementation of best management practices that control the amount of sediment from irrigation returns and overland runoff from irrigated fields as well as localized bank erosion, would help to reduce overall sediment inputs into the system that in turn would likely improve habitat and aquatic life/cold-water fisheries conditions as well as uses associated with agricultural-irrigation activities in the middle and lower stretches of Middle Fork Crazy Woman Creek.

At this time, the weight-of-evidence from the WDEQ 1996 and 1998 assessments of segment WYPR10090205-153 suggests Middle Fork Crazy Woman Creek is supportive of all uses assigned to class 2AB waters.

RECOMMENDATIONS

1) Follow-up monitoring at station MRC59 to assess whether the upstream road-crossing has been repaired and whether the result has been an improvement in the habitat and biotic condition.

SIGNATURES:

----- Author	----- Date
----- Peer Reviewer	----- Date
----- Monitoring Supervisor	----- Date

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Table 1 - Physicochemical results for Middle Fork Crazy Woman Creek stations, September 1998 and October 1996, Johnson County.

	Middle Fork Crazy Woman Creek				
	Segment 153				
Parameter	MRC 59	MRC 121		NGPI 37	
Date	9/29/98	9/29/98	10/31/96	9/29/98	10/31/96
Time	1217	1615	1230	1300	1445
Temperature C	9.1	16.1	3.3	14.1	3.2
pH	7.9	8.5	8.2	8.1	8
Conductivity (uS/cm)	36.6	322	410	515	470
Dissolved Oxygen (mg/L)	9.5	8.4	10.4	9.1	11
Turbidity (NTU)	2	0.68	1.6	0.78	2.9
TSS (mg/L)	5	<2	<2	<2	3
Alkalinity (mg/L as CaCO3)	25	115	115	130	110
Sulfate (mg/L)	54	11	95	38	129
Chloride (mg/L)	44	<5	<5	32	<5
Nitrate (mg/L as N)	<0.1	<0.1	<0.1	<0.1	<0.1
Total Phosphorus (mg/L)	<0.1	<0.1	<0.1	<0.1	<0.1
Total Hardness (mg/L as CaCO3)	49	181	217	223	211
Sheen	N	N	N	N	N
Color	N	N	N	N	N
Odor	N	N	N	N	N
Discharge (cfs)	1.84	21.16	NM	15.42	NM
NM = not measured					

Table 2 - Mean percent stream substrate composition, weighted embeddedness and water velocity at Middle Fork Crazy Woman Creek stations, September 1998 and October 1996, Johnson County.

	Middle Fork Crazy Woman Creek				
	Segment 153				
Substrate Type	MRC 59	MRC121	MRC121	NGPI37	NGPI37
Assessment Year	1998	1998	1996	1998	1996
Cobble	61	70	67	69	49
Coarse Gravel	15	15	18	22	15
Fine Gravel	15	8	8	7	10
Sand	10	6	7	2	14
Silt	0	1	0	0	12
Clay-Hard Pack (solid, slick)	0	0	0	0	0
Organic (fine, black, odor)	0	0	0	0	0
Precipitate	0	0	0	0	0
Weighted Embeddedness	65	80	74.4	65	34.8
Mean Water Velocity (ft/sec)	0.82	1.12	1.38	1.92	1.33

Middle Fork Crazy Woman Creek - Segment 153

Table 3 - Qualitative habitat assessment, pool quality, and biological indicator scores for Middle Fork Crazy Woman Creek stations, September 1998 and October 1996, Johnson County.

Habitat Parameters (Max. Score)	Middle Fork Crazy Woman Creek				
	Segment 153				
	MRC59	MRC121	MRC121	NGPI37	NGPI37
Year	1998	1998	1996	1998	1996
Bottom Substrate-Percent Fines (20)	15	17	17	19	9
Embeddedness (20)	12	15	14	12	4
Instream Cover for Fish (20)	19	11	10	11	9
Velocity/Depth (20)	16	11	11	13	12
Channel Flow Status (20)	18	17		17	
Channel Shape at Bankfull (15)	13	9	8	9	8
Pool/Riffle Ratio (15)	10	9	9	12	9
Channelization/Alteration (15 for >10%)	14	10	10	14	9
Width/Depth Ratio (15)	11	5	5	7	3
Bank Vegetation Protection (Bankfull) (10)	8.5	9	7	8.5	7
Bank Stability (Bankfull) (10)	9	7.5	4	8.5	4
Disruptive Pressures (Riparian Zone) (10)	7	10	6	10	4
Canopy Cover over Stream (10)			1		1
Riparian Vegetative Zone Width (10)	9	4.5	6	2	2
HABITAT ASSESSMENT TOTAL >10% Riffle/Run (200 possible)	161.5	135		143	
HABITAT ASSESSMENT TOTAL >10% Riffle/Run (190 possible)*			108		81
HABITAT ASSESSMENT (Percent of Maximum Score)	80.75	67.50	56.80	71.50	42.63
Average Pool Quality Score (10)	6.75	4	NM	5.5	NM
Estimated Percentage of Pools in Reach at least 1.5' deep	90	0	NM	90	NM
Biological Indicators**					
Periphyton	2	3	4	4	4
Filamentous Algae	0	0	1	1	3
Rooted Macrophytes	2	0	0	2	2
Floating Macrophytes	0	1	1	0	1
Fish	3	2	0	3	0
Slimes	0	0	1	0	0
*Pre-1998 Habitat Assessment Procedure					
** 4-Dominant, 3-Abundant, 2-Common, 1-Rare, 0-Absent					
NM = not measured					

Middle Fork Crazy Woman Creek - Segment 153

Table 4 - Comparison of watershed characteristics and selected physical and biological assessment results between Middle Fork Crazy Woman Creek stations MRC59, MRC121, and NGPI37 and selected reference-quality streams for each of three ecoregions.

		Middle Rockies Central (~8500')					Middle Rockies Central (~8500')						Northwestern Great Plains								
		Boyle Creek - Upper (MRC59)	Soundough Creek - Upper (MRC71)	Average Reference Station Scores	Middle Fork Crazy Woman Creek - Upper (MRC59)	Station MRC59 - percent of average	South Fork Piney Creek - (MRC37)	Mediterranean Lodge Creek - Lower (MRC37)	Average Reference Station Scores	Middle Fork Crazy Woman Creek - Creutz Road (MRC121) 1998 Assessment	Station MRC121 - percent of average - 1998 Assessment	Middle Fork Crazy Woman Creek - Creutz Road (MRC121) 1996 Assessment	Station MRC121 - percent of average - 1996 Assessment	WJTCreek - (NGP05)	French Creek - Buffalo (NGP21)	Average Reference Station Scores	Middle Fork Crazy Woman Creek - Old Hwy 88 (NG P07) 1998 Assessment	Station NG P07 - percent of average - 1998 Assessment	Middle Fork Crazy Woman Creek - Old Hwy 88 (NG P07) 1996 Assessment	Station NG P07 - percent of average - 1996 Assessment	
Watershed Description	Location	NWNW of Sec. 13, T47N, R85W	SESE of Sec. 4, T49N, R84W		NENE of Sec. 30, T48N, R84W		NW of Sec. 23, T53N, R84W	SWSW of Sec. 15, T50N, R89W		SESE of Sec. 7, T47N, R82W		SESE of Sec. 7, T47N, R82W		NESE of Sec. 11, T56N, R85W	SESE of Sec. 26, T51N, R82W		SESE of Sec. 10, T47N, R82W		SESE of Sec. 10, T47N, R82W		
	Elevation (ft.)	8330	7940		8200		883	820		844		844		4000	4560		4730		4730		
	Drainage Area (sq. miles)	5.25	7.3		4.75		88.3	38.4		84.9		84.9		4000	4560		4730		4730		
	County	Johnson	Johnson		Johnson		Johnson	Big Horn		Johnson		Johnson		Sheridan	Johnson		Johnson		Johnson		
	Geology (USGS, 1985)	Lgn	Lgn		Lgn		Wug	RM		KC		KC		Gs	Qt		KC		KC		
	Land Uses	Livestock Grazing & Rec./Wildlife Habitat	Livestock Grazing & Rec./Wildlife Habitat		Livestock Grazing & Rec./Wildlife Habitat		Livestock Grazing & Rec./Wildlife Habitat	Livestock Grazing & Rec./Wildlife Habitat		Livestock Grazing & Irrigated Hayland		Livestock Grazing & Irrigated Hayland		Livestock Grazing & Irrigated Hayland	Livestock Grazing & Urban		Livestock Grazing & Irrigated Hayland		Livestock Grazing & Irrigated Hayland		
	Major Basin	Powder	Powder		Powder		Powder	Big Horn		Powder		Powder		Tongue	Powder		Powder		Powder		
	Ecoregion	MRC	MRC		MRC		MRC	MRC		MRC		MRC		NGP	NGP		NGP		NGP		
	Substrate Composition	Cobble (%)	46	74		61		83	89		70		67		67	14		69		49	
		Coarse Gravel (%)	1	10		15		9	8		15		18		18	12		22		15	
Fine Gravel (%)		17	3		15		4	2		8		8		12	8		7		10		
Sand (%)		36	13		10		4	1		6		7		3	66		2		14		
Silt (%)										1									12		
Weighted Embeddedness		100	98		89		65	88		80		80.4		74.4	74.8		90		100		
Habitat		Qualitative Habitat Assessment Score (total 200)	171	171		171		167	163		166		135		81.8	--		158		116	
WBI Biomtic	Reference Condition *	Reference	Reference				Reference	Reference						Reference	Reference						
	WBI Score	43.9	48.8		48.4		43.2	83		62.7		52.3		67.6	57.1		96.3		61.3		107
	WBI Rating	Fair	Good		Fair		Good	Fair		Good		Good		Good	Good		Very good		Good		88.8

*Reference condition obtained from Jessup and Stribling (2002)

Appendix A - WSII metric values, scores, and site ratings for Middle Fork Crazy Woman Creek stations, September 1998 and October 1996, Johnson County.

Middle Fork Crazy Woman Creek (MRC59) - September 29, 1998		ENTER		5th or 95th %ile
Metric	Scoring formula	METRICS	Score	(as per formula)
Ephemeroptera taxa	100*metric / 95th%ile	6	54.5	11
Plecoptera taxa	100*metric / 95th%ile	6	75.0	8
Trichoptera taxa	100*metric / 95th%ile	5	45.5	11
% Ephemeroptera (no Baetidae)	100*metric / 95th%ile	5.21	9.6	54
% Trichoptera (no Hydropsychidae)	100*metric / 95th%ile	9.83	21.1	46.6
% 5 dominant	100*(95-metric)/(95 - 5th%ile)	67.83	54.0	45.7
% scrapers	100*metric / 95th%ile	0.39	0.7	54.5
HBI	100*(10-metric)/(10 - 5th%ile)	3.83	71.7	1.4
BCI CTQa	100*(110-metric)/(110 - 5th%ile)	72.79	56.5	44.1
		index score	43.2	
		Sample Rating	fair	Middle Rockies West
			fair	MRC Elevation >6500
			fair	MRC Elevation <6500
			fair	Southern Rockies
			good	Black Hills
Middle Fork Crazy Woman Creek (MRC121) - September 29, 1998		ENTER		5th or 95th %ile
Metric	Scoring formula	METRICS	Score	(as per formula)
Ephemeroptera taxa	100*metric / 95th%ile	6	54.5	11
Plecoptera taxa	100*metric / 95th%ile	5	62.5	8
Trichoptera taxa	100*metric / 95th%ile	9	81.8	11
% Ephemeroptera (no Baetidae)	100*metric / 95th%ile	24.36	45.1	54
% Trichoptera (no Hydropsychidae)	100*metric / 95th%ile	9.16	19.7	46.6
% 5 dominant	100*(95-metric)/(95 - 5th%ile)	69.42	50.9	45.7
% scrapers	100*metric / 95th%ile	19.41	35.6	54.5
HBI	100*(10-metric)/(10 - 5th%ile)	2.8	83.7	1.4
BCI CTQa	100*(110-metric)/(110 - 5th%ile)	57.41	79.8	44.1
		index score	57.1	
		Sample Rating	fair	Middle Rockies West
			good	MRC Elevation >6500
			fair	MRC Elevation <6500
			fair	Southern Rockies
			good	Black Hills
Middle Fork Crazy Woman Creek (MRC121) - October 31, 1996		ENTER		5th or 95th %ile
Metric	Scoring formula	METRICS	Score	(as per formula)
Ephemeroptera taxa	100*metric / 95th%ile	7	63.6	11
Plecoptera taxa	100*metric / 95th%ile	3	37.5	8
Trichoptera taxa	100*metric / 95th%ile	7	63.6	11
% Ephemeroptera (no Baetidae)	100*metric / 95th%ile	21.96	40.7	54
% Trichoptera (no Hydropsychidae)	100*metric / 95th%ile	28.04	60.2	46.6
% 5 dominant	100*(95-metric)/(95 - 5th%ile)	71.76	46.2	45.7
% scrapers	100*metric / 95th%ile	36.67	67.3	54.5
HBI	100*(10-metric)/(10 - 5th%ile)	2.63	85.7	1.4
BCI CTQa	100*(110-metric)/(110 - 5th%ile)	52.73	86.9	44.1
		index score	61.3	
		Sample Rating	good	Middle Rockies West
			good	MRC Elevation >6500
			good	MRC Elevation <6500
			good	Southern Rockies
			good	Black Hills

Appendix A (cont.) - WSII metric values, scores, and site ratings for Middle Fork Crazy Woman Creek stations, September 1998 and October 1996, Johnson County.

Middle Fork Crazy Woman Creek (NGPI37) - September 29, 1998		ENTER		5th or 95th %ile
Metric	Scoring formula	METRICS	Score	(as per formula)
Total taxa	100*metric / 95th%ile	44	97.8	45
Ephemeroptera taxa	100*metric / 95th%ile	9	100.0	9
Plecoptera taxa	100*metric / 95th%ile	6	100.0	5
Trichoptera taxa	100*metric / 95th%ile	11	100.0	10
% Plecoptera	100*metric / 95th%ile	4.36	33.5	13
% Trichoptera (no Hydropsychidae)	100*metric / 95th%ile	9.8	31.3	31.3
% non-insects	100*(55 - metric)/(55 - 5th%ile)	0.87	99.3	0.5
% scrapers	100*metric / 95th%ile	20.96	65.9	31.8
BCI CTQa	100*(110 - metric)/(110 - 5th%ile)	69.34	85.8	62.6
Semi-voltine taxa	100*metric / 95th%ile	9	100.0	7
		index score	81.4	
		Sample Rating	very good	Western High Plains
			very good	Northwestern Great Plains
			very good	Wyoming Basin
Middle Fork Crazy Woman Creek (NGPI37) - October 31, 1996		ENTER		5th or 95th %ile
Metric	Scoring formula	METRICS	Score	(as per formula)
Total taxa	100*metric / 95th%ile	40	88.9	45
Ephemeroptera taxa	100*metric / 95th%ile	7	77.8	9
Plecoptera taxa	100*metric / 95th%ile	2	40.0	5
Trichoptera taxa	100*metric / 95th%ile	8	80.0	10
% Plecoptera	100*metric / 95th%ile	1.95	15.0	13
% Trichoptera (no Hydropsychidae)	100*metric / 95th%ile	35.58	100.0	31.3
% non-insects	100*(55 - metric)/(55 - 5th%ile)	1.95	97.3	0.5
% scrapers	100*metric / 95th%ile	32.61	100.0	31.8
BCI CTQa	100*(110 - metric)/(110 - 5th%ile)	82.67	57.7	62.6
Semi-voltine taxa	100*metric / 95th%ile	4	57.1	7
		index score	71.4	
		Sample Rating	very good	Western High Plains
			good	Northwestern Great Plains
			good	Wyoming Basin

Appendix B - Summary of September 1998 macroinvertebrate collection results and selected biometrics for Middle Fork Crazy Woman Creek stations. Johnson County.

		Middle Fork Crazy Woman Creek						
		Segment 153						
		MRC59		MRC121		NGP137		
	Taxon	Abundance	% Composition	Abundance	% Composition	Abundance	% Composition	
Oligochaeta	<i>Nais variabilis</i>					32	0.35	
	<i>Imm. Tubificoides w/o cap setae</i>			36	0.37			
Mollusca	Sphaeriidae	9	0.19					
	Physella			18	0.18			
Hydrachnida	Acanth	76	1.54	161	1.65	48	0.52	
	TOTAL - NON-INSECTS	85	1.73	215	2.2	80	0.87	
Insecta	<i>Ophlogomphus</i>					16	0.17	
	TOTAL - ODONATA					16	0.17	
	Baetidae					16	0.17	
	<i>Ephemera inermis/infrequens</i>	133	2.7	502	5.13	404	4.37	
	<i>Drumella oodis</i>			18	0.18			
	<i>Drumella grandis/sp. inifera</i>	66	1.35	1685	17.22	81	0.87	
	<i>Acentrella turbida</i>					145	1.57	
	<i>Baetis tricaudatus</i>	152	3.08	126	1.28	194	2.1	
	<i>Tricoorythodes minutus</i>					420	4.55	
	<i>Rhythrogena</i>	19	0.39	161	1.65	549	5.94	
	<i>Paraleptophlebia</i>	19	0.39	18	0.18	307	3.32	
	<i>Ameletus</i>	19	0.39					
	<i>Heptagenia/Nixe</i>					226	2.45	
		TOTAL - EPHEMEROPTERA	408	8.29	2510	25.64	2340	25.35
		<i>Isoperla</i>	9	0.19	36	0.37	291	3.15
		<i>Skwala</i>			36	0.37	32	0.35
		<i>Claszenia sabulosa</i>					16	0.17
		<i>Chloroperlidae</i>			54	0.55	16	0.17
		<i>Taeniopterygidae</i>	19	0.39				
		<i>Pteronarcys</i>			520	5.31	32	0.35
		<i>Pteronarcys californica</i>			18	0.18		
		<i>Perlidae-early instar</i>	104	2.12				
		<i>Hesperoperla pacifica</i>	9	0.19			16	0.17
		<i>Zapada cinctipes</i>	180	3.66				
		<i>Capniidae</i>	28	0.58				
		TOTAL - PLECOPTERA	351	7.13	663	6.78	404	4.37
		<i>Cheumatopsyche</i>					16	0.17
		<i>Arctopsyche grandis</i>			18	0.18		
		<i>Amblocentrus aspillus</i>			18	0.18		
		<i>Brachycentrus americanus</i>			251	2.56		
		<i>Brachycentrus occidentalis</i>	57	1.16	90	0.92	178	1.92
		<i>Culeptila</i>					16	0.17
		<i>Micrasema</i>	370	7.51				
		<i>Helicopsyche borealis</i>			18	0.18	113	1.22
		<i>Hydropsyche</i>			2725	27.84	3793	41.08
		<i>Proptila</i>			341	3.48	274	2.97
		<i>Limnephiliidae</i>	9	0.19				
		<i>Lepidostoma-sand case larvae</i>	28	0.58	143	1.47	16	0.17
		<i>Apatania</i>			18	0.18		
		<i>Hydroptila</i>	19	0.39			16	0.17
		<i>Psychomyia</i>					48	0.52
		<i>Rhyacophila Brunnea Gr.</i>					16	0.17
		<i>Oecetis</i>					226	2.45
		TOTAL - TRICHOPTERA	484	9.83	3622	37	4713	51.05
		<i>Dubirapha</i>					16	0.17
		<i>Microcylloepus</i>					339	3.67
		<i>Heterelmis</i>	114	2.31				
		<i>Cleptelmis</i>	104	2.12				
		<i>Dytiscidae</i>			18	0.18		
		<i>Zaitzevia</i>	9	0.19	305	3.11	258	2.8
	<i>Stenelmis</i>							
	<i>Optoserius</i>			1363	13.92	81	0.87	
	TOTAL - COLEOPTERA	228	4.62	1685	17.22	694	7.52	
	<i>Petrophila</i>					291	3.15	
	TOTAL - LEPIDOPTERA					291	3.15	
	<i>Ceratopogoninae</i>	9	0.19					
	<i>Atherix</i>			359	3.66			

Appendix B (cont.) - Summary of September 1998 macroinvertebrate collection results and selected biometrics for Middle Fork Crazy Woman Creek stations. Johnson County.

	Taxon	MRC59		MRC121		NGP137	
		Abundance	% Composition	Abundance	% Composition	Abundance	% Composition
Insecta	<i>Antocha</i>			90	0.92		
	<i>Hemerodromia</i>						
	<i>Chelifera</i>	38	0.77	18	0.18		
	<i>Clinocera</i>	9	0.19				
	<i>Wiedemannia</i>	9	0.19				
	<i>Ptychoptera</i>	19	0.39				
	<i>Hexatoma</i>	9	0.19	54	0.55	16	0.17
	<i>Dicranota</i>	9	0.19				
	<i>Simulium</i>					97	1.05
	TOTAL - DIPTERA	104	2.42	520	5.31	113	1.22
	<i>Chironomidae-pupae</i>	9	0.19	90	0.92		
	<i>Orthocopus Notochlaadius</i>	1898	38.54	18	0.18		
	<i>Microsectra</i>	731	14.84				
	<i>Microtendipes</i>					48	0.52
	<i>Rheocricotopus</i>	9	0.19				
	<i>Eukiefferiella</i>	161	3.28	269	2.75	210	2.27
	<i>Orthocopus trifascia gr.</i>					16	0.17
	<i>Orthoclaadius complex</i>	123	2.5	108	1.1		
	<i>Pagastia</i>	85	1.73				
	<i>Orthoclaadius (Euorthoclaadius)</i>			18	0.18		
	<i>Parametrioctenus</i>					32	0.35
	<i>Thienemannimyia Gr.</i>					16	0.17
	<i>Parakiefferiella</i>	9	0.19				
	<i>Polypedilum</i>	85	1.73	18	0.18	97	1.05
<i>Rheotanytarsus</i>	152	3.08	54	0.55	32	0.35	
<i>Tvetenia discoloripes grp.</i>					129	1.4	
TOTAL - CHIRONOMIDAE	3265	66.28	574	5.86	581	6.29	
Selected Biometrics	EPT/Chironomidae		0.38		11.84		12.83
	BCI Ca		72.79		57.41		69.34
	Shannon H (bg1)		2.43		2.51		2.58
	Shannon H (bg2)		3.5		3.62		3.72
	Evenness		0.88		0.69		0.88
	Simpson D		0.18		0.14		0.19
	HBI		3.83		2.8		3.8
	% 5 Dominant		67.83		69.42		59.61
	% 10 Dominant		81.5		84.98		75
	% Multivoltine		53.85		13.97		18.58
	% Univoltine		40.08		59.66		71.02
	% Semivoltine		6.07		26.38		10.4
	Collector-gatherer (%)		32.37		30.03		22.71
	Collector-filterer (%)		3.08		28.39		42.65
	Scraper (%)		0.39		19.41		20.96
	Shredder (%)		4.82		1.47		0.17
	Piercer-herbivore (%)		38.93		0.18		0.17
Macrophyte-herbivore (%)		7.51		0		0	
WSI	WSI Metric Score		43.2		57.1		81.4
	WSI Metric Rating		Fair		Fair		Very Good

Appendix C - Comparative summary of September 1998 and October 1996 macroinvertebrate collection results and selected biometrics for Middle Fork Crazy Woman Creek stations MRC121 and NGP137, Johnson County.

		Middle Fork Crazy Woman Creek							
		1996		1998		1998		1998	
		MRC121		MRC121		NGP137		NGP137	
Taxon		Abundance	%Composition	Abundance	%Composition	Abundance	%Composition	Abundance	%Composition
Oligochaeta	<i>Nais vertebilis</i>					32	0.35	12	0.18
	<i>Opidonella serpentina</i>							25	0.35
	Enchytraeidae								
Mollusca	Imm. Tubificid w/ cap setae	36	0.37						
	Sphaeriidae							12	0.18
Hydrachnida	Physella	18	0.18					82	0.89
	Aizeni	181	1.85	177.7	2.18	48	0.52	25	0.35
	TOTAL - NON-INSECTS	215	2.2	177.7	2.18	80	0.87	137	1.96
Insecta	Argia							12	0.18
	Ophiogomphus					16	0.17		
	TOTAL - ODONATA					16	0.17	12	0.18
	Epeorus-early instar			16.2	0.2	16	0.17		
	Beetidae							12	0.18
	Ephemerella inermis/frequens	502	5.13	1179	14.31	404	4.37	211	3.01
	Drunella obdoli	18	0.18	16.2	0.2				
	Drunella grandis/splendida	1685	17.22	290.7	3.53	81	0.87		
	Acentrella turbida					145	1.57		
	Beetis tricaudatus	126	1.28	920.6	11.18	194	2.1	845	12.06
	Tricothyodes minutus					420	4.55	944	13.48
	Rhythyogera	161	1.65	242.2	2.94	549	5.94	224	3.19
	Paraleptophlebia	18	0.18	64.6	0.78	307	3.32	211	3.01
	Heptagenia/nivea					226	2.45	25	0.35
	TOTAL - EPHMEROPTERA	2510	25.84	2729.4	33.14	2340	25.56	2472	35.28
	Isoperla	36	0.37	80.8	0.98	291	3.15	87	1.24
	Siknia	36	0.37			32	0.35		
	Claessonia sabulosa					16	0.17		
	Chloroperlidae	54	0.55	113	1.37	16	0.17	50	0.71
	Pteronarcys	520	5.31	43.5	0.53	32	0.35		
	Pteronarcys californica	18	0.18						
	Hesperoperla pacifica					16	0.17		
	TOTAL - PERLOPTERA	663	6.78	242.2	2.94	404	4.37	137	1.96
	Cheumatopagidae					16	0.17		
	Arctopsyche grandis	18	0.18						
	Amiocentrus asplius	18	0.18						
	Brechyntrus americanus	251	2.56	96.9	1.18				
	Brechyntrus occidentalis	90	0.92	113	1.37	178	1.92		
	Nectopsyche							12	0.18
	Ouloptila							16	0.17
	Glossosoma			16.2	0.2				
	Helicopsyche borealis	18	0.18	146.4	1.76	113	1.22	1702	24.29
	Hydropsyche	2725	27.84	1227.4	14.9	3793	41.08	820	11.7
	Protoptila	341	3.48	1792.7	21.76	274	2.97	124	1.77
	Limnephilidae							12	0.18
	Lepidostoma-sand case larvae	143	1.47	145.4	1.76	16	0.17		
	Apelania	18	0.18						
	Hydroptila					16	0.17	37	0.53
	Rhythomyia					48	0.52	75	1.06
	Rhyacophila brunnipes Gr.					16	0.17		
	Oecetis					226	2.45	460	6.56
	TOTAL - TRICHOPTERA	3822	37	3838.8	42.84	4713	51.06	3242	45.28
	Dubirapha					16	0.17	25	0.35
	Microcylepeus					339	3.67		
	Cleptemis							99	1.42
	Zaitzevia	305	3.11	145.4	1.76	258	2.8	137	1.95
	Optiosevus	1363	13.92	791.4	9.61	81	0.87	37	0.53
	TOTAL - COLLEMBOLA	1685	17.22	898.7	11.37	694	7.62	298	4.26
	Petrophila			16.2	0.2	291	3.15	99	1.42
	TOTAL - LEPIDOPTERA			16.2	0.2	291	3.15	99	1.42
Atherix	369	3.66	80.8	0.98					
Antocha	90	0.92	371.5	4.51			12	0.18	
Pericoma			16.2	0.2					
Chellera	18	0.18							
Hexatoma	54	0.55	16.2	0.2	16	0.17	25	0.35	
Dicranota									
Simulium					97	1.05	25	0.35	

Appendix C (cont.) - Comparative summary of September 1998 and October 1996 macroinvertebrate collection results and selected biometrics for Middle Fork Crazy Woman Creek stations MRC121 and NGP137, Johnson County.

		Middle Fork Crazy Woman Creek							
Year		1998		1996		1998		1996	
		MRC121		MRC121		NGP137		NGP137	
Taxon		Abundance	%Composition	Abundance	%Composition	Abundance	%Composition	Abundance	%Composition
Insecta	TOTAL - DIPTERA	520	6.31	484.6	6.88	113	1.22	62	0.88
	Chironomidae-pupae	90	0.92					12	0.18
	Chironomini							25	0.35
	Oricoptus							12	0.18
	Oricoptus Nostococoides	18	0.18	16.2	0.2				
	Dicranodiplos							12	0.18
	Microdiplos			16.2	0.2	48	0.52	385	5.5
	Lopesoides			16.2	0.2				
	Euketterella	269	2.75	16.2	0.2	210	2.27		
	Oricoptus trifascia gr.					18	0.17		
	Orthocladus complex	108	1.1	48.5	0.68				
	Orthocladus (Euorthocladus)	18	0.18						
	Parametocnemus					32	0.35		
	Trichemanningia gr.					18	0.17	12	0.18
	Polypedium	18	0.18			97	1.05	50	0.71
	Tritenia							12	0.18
	Rheotanytarsus	54	0.55			32	0.35	25	0.35
	Tritenia discoloripes sp.					129	1.4		
	TOTAL - CHRITONMIDAE	574	6.88	118	1.37	581	6.28	546	7.8
	Selected Biometrics	EPT/Chironomidae		11.84		57.57		12.83	
BIQ's			57.41		52.75		89.34		82.87
Shannon H (loge)			2.51		2.5		2.58		2.61
Shannon H (log2)			3.62		3.81		3.72		3.77
Bienness			0.89		0.74		0.88		0.71
Simpson D			0.14		0.12		0.19		0.12
HI			2.8		2.63		3.8		4.18
% S Dominant			89.42		71.76		59.81		88.09
% 10 Dominant			84.98		86.68		75		84.75
% Multivoltine			13.97		15.29		18.58		18.7
% Univoltine			86.66		70.2		71.02		76.95
% Semivoltine			26.38		14.51		10.4		4.34
Collector-gatherer (%)			30.03		37.45		22.71		43.83
Collector-filterer (%)			28.39		14.9		42.65		12.4
Scraper (%)			19.41		36.67		20.98		32.61
Shredder (%)		1.47		1.76		0.17		0	
Percen-herbivore (%)		0.18		0.2		0.17		0.53	
Macrophyte-herbivore (%)		0		0		0		0	
WSI	WSI Metric Score	67.1		81.3		81.4		71.4	
	WSI Metric Rating	Fair		Good		Very Good		Good	

Map 1 - Middle Fork Crazy Woman Creek and associated BURP monitoring stations. Johnson County.

