UMATILLA RIVER BASIN ANADROMOUS FISH HABITAT

ENHANCEMENT PROJECT

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ABSTRACT

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project continued to identify impacted stream reaches throughout the Umatilla River Basin for habitat improvements during the 2002 and 2003 project periods. Public outreach efforts, biological and physical monitoring, finalization of the Umatilla Subbasin/Willow Creek Subbasin Summary and Meacham Creek Watershed Analysis and Action Plan, and continued development of the Umatilla Subbasin/Willow Creek Subbasin Plan assisted the project in fostering public cooperation, targeting habitat deficiencies and determining habitat recovery measures.

Projects continued to be maintained on 50 private properties, three riparian easements were secured, four new projects implemented and four existing project areas improved to enhance anadromous fish habitat. New project locations included sites on the mid Umatilla River, upper Umatilla River and East Birch Creek. New enhancements included: (1) construction of 4,787 feet of fencing and installation of a cattle guard between River Mile 44.3 and 45.2 Umatilla River, (2) construction of 950 feet of fencing between River Mile 10.3 and 10.5 East Birch Creek, (3) development of a single threaded stream channel, construction of three instream log jams, creation of point bars, stinging approximately 6,000 native willow cuttings into gravel bars and construction of 1,100 feet of fencing between River Mile 87.0 and 87.3 Umatilla River, and (4) construction of a boulder cross vane, three boulder J-vanes, three root wad revetments, two log jams, placement of downed trees in the stream channel and stinging approximately 5,000 native willow cuttings into gravel bars at approximately River Mile 83.0 Umatilla River. Habitat improvements implemented at existing project sites included: (1) redevelopment of a well at approximately River Mile 10.0 Wildhorse Creek, (2) drilling an additional 100 foot depth at a previously developed 105-foot well at approximately River Mile 12.0 Wildhorse Creek for off-stream livestock watering, (3) planting approximately 1,000 native willow cuttings at River Mile 21.5 McKay Creek, (4) repair of 780 feet of eroding stream bank and installation of approximately 4,000 native willow cuttings at River Mile 63.5 Umatilla River, and (5) relocation of 600 feet of overhead power lines out of the Meacham Creek riparian corridor at approximately River Mile 0.6.

A total of approximately $ 346,965 in financial and in-kind cost share funds was obtained to assist with planning, implementation and monitoring efforts. An additional $130,000 in financial cost share dollars was secured from the U.S. Department of Agriculture and National Oceanic and Atmospheric Administration to assist with out-year fish passage improvement projects.

Monitoring continued to quantify baseline conditions and the effects of habitat enhancements in the upper basin. Daily stream temperatures were collected from June through September 2002 and 2003 at 22 sites. Suspended sediment samples were obtained at three gage stations during the 2002 and 2003 project periods to arrive at daily sediment load estimates. Photographs were taken at 99 existing and eleven newly established photo points to document habitat recovery and pre-project conditions. Two longitudinal profiles and two channel cross sections were measured to assist with engineering and design and to obtain baseline data regarding channel morphology. Macroinvertebrate surveys were conducted in existing McKay Creek, Wildhorse Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Meacham Creek project areas to assist in assessing the effects of enhancements on water quality and habitat recovery. Biological inventories were conducted between River Mile 87.0 and 87.3 Umatilla River to determine pre-project fish utilization.

ACKNOWLEDGMENTS

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We would like to acknowledge cooperating landowners, David and Judy Richards, James and Alicia Musolino, Tommy Hartman, Fred Hachler, and Steve Wolfe (Bill Wolfe Ranches, Inc.), who supported our efforts by entering into easements and/or providing their properties for new habitat enhancements.

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TABLE OF CONTENTS

ABSTRACT ..... **I**

ACKNOWLEDGMENTS ..... **II**

TABLE OF CONTENTS ..... **III**

LIST OF FIGURES ..... **VI**

LIST OF TABLES ..... **VI**

LIST OF ACRONYMS AND ABBREVIATIONS ..... **VII**

INTRODUCTION **1**

DESCRIPTION OF PROJECT AREAS **3**

METHODS AND MATERIALS **13**

OBJECTIVE I. MAINTAIN AND CONTINUE IMPLEMENTATION OF HABITAT ENHANCEMENT PROJECTS THROUGHOUT THE UMATILLA RIVER WATERSHED 13

1. Pre-construction Preparation: 13

a. Assess Maintenance Needs 13
b. Project Cost Share 13
c. Clearances and Land Owner Agreements 13
d. Removal/Fill Permits 14
e. Endangered Species Act Requirements 14
f. Cultural/Archeological Monitoring 14
g. Design and Layout 15
h. Contracts and Professional Services Agreements 15

2. Maintain and Implement Habitat Enhancements: 15

a. Instream and Stream Bank Improvements 15
b. Fish Passage Improvements 16
c. Livestock Exclusion and Riparian Corridor Fencing 16
d. Off-stream Livestock Water Developments 16
e. Revegetation 16
f. Noxious Weed Control 17

3. Post-implementation Final Review: 17

OBJECTIVE II. COLLECT BASELINE DATA TO ASSESS PRE-PROJECT CONDITIONS AND CONTINUE POST-PROJECT MONITORING TO IDENTIFY HABITAT LIMITING FACTORS AND TO QUANTIFY SHORT AND LONG-TERM EFFECTS OF HABITAT ENHANCEMENT ACTIVITIES IN THE UMATILLA RIVER BASIN. 18

1. Geomorphologic and Hydraulic Data Monitoring: 18
2. Biological Inventories: 18
3. Aquatic Macroinvertebrate Sampling: 19
4. Water Temperature Monitoring: 21
5. Suspended Sediment Monitoring: 24

OBJECTIVE III: CONTINUE WATERSHED PLANNING, SCOPING AND EDUCATION PROCESS BY

IDENTIFYING AND DEVELOPING CREATIVE SOLUTIONS TO LAND USE PROBLEMS IMPACTING FISHERIES HABITAT IN THE UMATILLA RIVER BASIN. 24
1. Watershed Assessment: 24
2. Community Outreach Efforts: 25

RESULTS AND DISCUSSION 16

OBJECTIVE I. MAINTAIN AND CONTINUE IMPLEMENTATION OF HABITAT ENHANCEMENT PROJECTS THROUGHOUT THE UMATILLA RIVER WATERSHED 16
1. Pre-construction Preparation: 16
a. Assess Maintenance Needs 16
b. Project Cost Share 16
c. Clearances and Land Owner Agreements 18
d. Removal/Fill Permits 18
e. Endangered Species Act Requirements 19
f. Cultural/Archeological Monitoring 20
g. Design and Layout 21
h. Contracts and Professional Services Agreements 21
2. Maintain and Implement Habitat Enhancements: 23
a. Instream and Stream Bank Improvements 23
b. Fish Passage Improvements 27
c. Livestock Exclusion and Riparian Corridor Fencing 28
d. Off-stream Livestock Water Developments 28
e. Revegetation 29
f. Noxious Weed Control 29
3. Post-implementation Final Review: 30

OBJECTIVE II. COLLECT BASELINE DATA TO ASSESS PRE-PROJECT CONDITIONS AND CONTINUE POST-PROJECT MONITORING TO IDENTIFY HABITAT LIMITING FACTORS AND TO QUANTIFY SHORT AND LONG-TERM EFFECTS OF HABITAT ENHANCEMENT ACTIVITIES IN THE UMATILLA RIVER BASIN. 30
1. Geomorphologic and Hydraulic Data Monitoring: 30
2. Biological Inventories: 37
3. Aquatic Macroinvertebrate Sampling: 37
a. Meacham Creek 39
b. McKay Creek 40
c. Wildhorse Creek 40
d. Mission Creek 40
e. Buckaroo Creek 41
f. Conclusions Regarding Comparisons of Control and Restoration Sites 41
g. Relationship Between Water Chemistry and Macroinvertebrate Metrics 42
4. Water Temperature Monitoring: 43
5. Suspended Sediment Monitoring: 48

OBJECTIVE III: CONTINUE WATERSHED PLANNING, SCOPING AND EDUCATION PROCESS BY IDENTIFYING PROBLEMS AND DEVELOPING CREATIVE SOLUTIONS TO LAND USE PROBLEMS IMPACTING FISHERIES HABITAT IN THE UMATILLA RIVER BASIN. 52
1. Watershed Assessment: 52
2. Community Outreach Efforts: 52

REFERENCES CITED 54

APPENDIX A – DAVE RICHARDS' PROPERTY 58

APPENDIX B – TOM HARTMAN'S PROPERTY 59

APPENDIX C – MACROINVERTEBRATE SURVEY DATA 66

APPENDIX D – WATER TEMPERATURE DATA 77

APPENDIX E – SUSPENDED SEDIMENT DATA 100

LIST OF FIGURES

Figure 1 – Maximum summer water temperatures along the length of the Umatilla River. 5
Figure 2 – CTUIR Anadromous Fish Habitat Enhancement Project Vicinity Map. 12
Figure 3 – A longitudinal survey between approximately RM 87.0 and 87.3 Umatilla River. 32
Figure 4 – Cross-section 1 at Richards' property. 32
Figure 5 – Cross-section 2 at Richards' property. 33
Figure 6 – Pre-project longitudinal profile of the Umatilla River through the Hartman Project Reach at RM 83.0. 33
Figure 7 – Flood frequency curve for the Umatilla River above Meacham Creek near Gibbon, Oregon. 35
Figure 8 – Changes in maximum weekly average temperatures and average diurnal flux in Wildhorse Creek project area (RM 9.5) over time. 47
Figure 9 – Changes in maximum weekly average temperatures and averagte diurnal flux in Greasewood Creek project area (RM 0.1) over time. 47
Figure 10 – Turbidity Duration for Umatilla River mainstem sites. 51
Figure 11 – Turbidity duration for Umatilla River tributary sites. 51

LIST OF TABLES

Table 1 – CTUIR Habitat Enhancement Project Table. 3
Table 2 – Thermograph locations for the 2002 and 2003 project periods. 22
Table 3 – Suspended sediment monitoring sites in 2002 and 2003. 24
Table 4 – Regional hydraulic geometry regression equations for west Interior Basin and range streams. (Castro and Jackson, 2001) where A is bankfull cross-sectional area (ft^2), Q is bankfull discharge (cfs), and w is bankfull width (ft). 34
Table 5 – Meander geometry equations (Williams 1986, Leopold 1994) where L_m is meander length, A is bankfull cross-sectional area (ft^2), w is bankfull width (ft), and R_c is radius of curvature (ft). 34
Table 6 – Expected values for channel morphology and meander geometry of the Umatilla River at RM 83. 35
Table 7 – Site locations for macroinvertebrate sampling. 38
Table 8 – Metric values for restoration and control sites. 39
Table 9 – Number of days the average and maximum stream temperatures exceeded 65, 70, 75 and 80 degrees Fahrenheit from June 1 - September 30, 2002 and 2003. 45
Table 10 – Average Daily Mass Unit Load (based on Nov - June monitoring period) 48
Table 11 – Water Column Sediment TMDL Summary. 49
Table 12 - Turbidity Counts for Umatilla River @ Oxbow, below Westland Rd Bridge. 50

LIST OF ACRONYMS AND ABBREVIATIONS

BA	Biological Assessment
BCI	Biotic Condition Index
BIA	Bureau of Indian Affairs
BO	Biological Opinion
BPA	Bonneville Power Administration
cfs	cubic feet per second
cm	centimeters
COE	U.S. Army Corps of Engineers
CPUE	catch-per-unit-effort
CR	County Road
CRITFC	Columbia River Inter-Tribal Fish Commission
CRPP	Cultural Resources Protection Program
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
DBH	diameter at breast height
DNR	Department of Natural Resources
EPA	U.S. Environmental Protection Agency
EP/RP	Environmental Protection/Rights Protection
EPT	a count of the number of taxa belonging to the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies)
EQIP	Environmental Quality Incentive Program
ESA	Federal Endangered Species Act
ESD	Umatilla-Morrow County Educational Service District
ESU	Evolutionary Significant Unit
FFG	function feeding group
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
Forks	confluence of the North and South Forks of the Umatilla River
FY	fiscal year (refers to Bonneville Power Administration's October through September fiscal period)
GIS	Geographic Information Systems
GPS	Global Positioning Satellite
HBI	Hilsenhoff Biotic Index
LWD	large woody debris
m	meters
mg/L	milligrams per liter; same as parts per million
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPPC	Northwest Power Planning Council
NRCS	Natural Resource Conservation Service
NTU	Nephelometric Turbidity Units
NWP	Nationwide Permit
ODEQ	Oregon Department of Environmental Quality
ODFW	Oregon Department of Fish and Wildlife
ODSL	Oregon Division of State Lands (recently changed to Oregon Department of State Lands)
ORS	Oregon Revised Statute
OSU	Oregon State University
OWEB	Oregon Watershed Enhancement Board
OWRD	Oregon Water Resources Department
PCSRF	Pacific Coastal Salmon Recovery Fund

Project	Umatilla River Basin Anadromous Fish Habitat Enhancement Project
Reservation	Umatilla Indian Reservation
RGI	Rural Geographic Initiative
RM	river mile
SHPO	State Historic Preservation Office
SOW	Statement of Work
SWCD	Umatilla County Soil and Water Conservation District
SZAP	Stream Zone Alteration Permit
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
UBNPME	Umatilla Basin Natural Production Monitoring and Evaluation Project
UBWC	Umatilla Basin Watershed Council
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UNF	Umatilla National Forest
USDA	U.S. Department of Agriculture
USFS	U.S. Forest Service
UTM	Universal Transverse Mercator
WHIP	Wildlife Habitat Incentive Program
WQMP	Water Quality Management Plan
WY	Water Year (October through September)

INTRODUCTION

The Umatilla River Basin Anadromous Fish Habitat Enhancement Project (hereafter referred to as project) is funded with Bonneville Power Administration (BPA) funds and is consistent with the 1994 Northwest Power Planning Council's (NPPC) Columbia River Basin Fish and Wildlife Program, Section 7.6 – 7.8, which targets the improvement of water quality and restoration of riparian areas, and specifically the holding, spawning and rearing habitats of anadromous salmonids. This project is also compatible with the Habitat Strategies section of the 2000 NPPC Columbia River Basin Fish and Wildlife Program, in that emphasis in the basin will depend "heavily on protection of, and improvements to, inland habitat as the most effective means of restoring and sustaining fish and wildlife populations". Funding of this project provides partial mitigation for losses of salmon and steelhead (*Oncorhynchus spp.*) populations in the Columbia River Basin from the construction and operation of hydroelectric dams. This Umatilla River Basin Anadromous Fish Habitat Enhancement Project Annual Report covers work accomplished by the Confederated Tribes of the Umatilla Indian Reservation (CTUIR) from February 1, 2002 through January 31, 2004 as part of the Umatilla Basin Fisheries Restoration Program.

Significant effort and funds have been directed at restoration of anadromous fish in the Umatilla River Basin. This habitat project is one element in the comprehensive Umatilla Basin Fisheries Restoration Program that also includes artificial production, adult and juvenile passage improvements (ladders, screens, and trap and haul), instream flow enhancement, and monitoring and evaluation. Emphasis on watershed-wide habitat is needed for protection and enhancement of the natural production capabilities in the basin.

The primary problems continuing to impact water quality and limit available habitat and natural fisheries production capabilities in the Umatilla River Basin include: non-point source pollution due to poor cropland tillage and rotation practices, livestock overgrazing riparian and upland areas, over-appropriation of instream flows to irrigators, and stream channelization, constriction, and floodplain modification from agricultural and road/railroad building and maintenance activities.

The project focused on implementing cooperative instream and riparian habitat improvements on private lands on the Umatilla Indian Reservation (hereafter referred to as Reservation) from April 1, 1988 to March 31, 1992. These efforts resulted in enhancement of 7.45 river miles on lower Boston Canyon Creek, lower Meacham Creek and the upper Umatilla River in the vicinity of Gibbon, Oregon. In 1993, the project shifted emphasis and began to identify upland and riparian watershed-wide causative factors limiting anadromous fisheries habitat and natural fisheries production capabilities throughout the Umatilla River Basin. Riparian and instream enhancement projects continued and were expanded to include tributaries outside of Reservation Boundaries. An additional 12.8 river miles of fisheries habitat improvement projects have been implemented on private properties, both on and off the Reservation, since shifting to a more comprehensive approach. Additional projects have included habitat enhancements in the mid Umatilla River, upper Umatilla River, Meacham Creek, East Birch Creek, Mission Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Buckaroo Creek, Squaw Creek, McKay Creek, Moonshine Creek and Cottonwood Creek drainages. A total of 53 easements have been secured with private landowners since initial 1988 implementation efforts.

The project represents a continuation and evolution of existing efforts to improve natural production in the Umatilla River Basin. A subbasin summary was recently completed and a watershed assessment is currently being developed to assist the project with prioritization of fisheries habitat needs and streamlining of project funds. The project complements fish passage and artificial production projects in the basin by integrating existing on-the-ground management programs on

private and public lands with restoration activities to better justify expenditure of funds and time. Biological and physical surveys, summaries of existing survey information and follow up surveys are coordinated with CTUIR's Umatilla Basin Natural Production Monitoring and Evaluation (UBNPME) Project. Remedial measures will be implemented to reduce or eliminate detrimental land use activities where possible. Continued operations and maintenance of existing enhancement projects are included under this integrated approach.

The restoration of anadromous fisheries resources in the Umatilla River Basin has been a coordinated effort between CTUIR, state and federal agencies, and the local community. Examples include this project, the Umatilla River Subbasin Fish Habitat Improvement Project, the Umatilla Basin Project, the Umatilla Basin Watershed Council (UBWC), the Umatilla River Subbasin Salmon and Steelhead Production Plan and development of the Umatilla Hatchery and associated artificial production plans. This coordination has continued and expanded through stakeholder groups and technical committees, comprised of local landowners, sportsman clubs, special interest groups and resource agencies, formed to identify issues and develop creative solutions to land use problems in the basin.

DESCRIPTION OF PROJECT AREAS

The following CTUIR Habitat Enhancement Project Table illustrates enhancement project locations, number of stream miles enhanced, and number of landowner agreements secured in each drainage:

Table 1 – CTUIR Habitat Enhancement Project Table.

STREAM	RIVER MILE LOCATIONS	NO. OF STREAM MILES ENHANCED	NO. OF LANDOWNER AGREEMENTS
Mid Umatilla River	37.3 – 37.4	0.1	1
Mid Umatilla River	43.0 – 46.5	3.5	3
Upper Umatilla River	63.5	0.05	1
Upper Umatilla River	78.5 – 85.0	3.6	12
Lower Meacham Creek	0 – 4.5	4.5	15
Boston Canyon Creek	0 – 0.3	0.3	1
East Birch Creek	10.3 – 10.5	0.2	1
Wildhorse Creek	10.0 – 12.5	2.0	4
Greasewood Creek	0 – 1.5	1.5	2
West Fork of Greasewood Creek	0 – 0.3	0.3	2
Spring Hollow Creek	3.4 – 4.0	0.6	1
Mission Creek	2.9 – 3.3	0.4	1
Buckaroo Creek	1.0 – 2.6	1.6	6
Squaw Creek	2.0 – 2.9 and 9.8 – 10.1 (Tribal Properties)	1.2	0 (Tribal Properties)
McKay Creek	21.5 – 22.25	0.4	2
Moonshine Creek	@ 1.1	Passage Site	0
Cottonwood Creek	@ 0.5 and 1.3	Passage Site	1
Mission Creek	@ 1.3 and 3.0	Passage Site	0
TOTAL		20.25	53

The Umatilla River has a drainage basin of 2,290 square miles and is a tributary to the Columbia River at RM 289 (Gonthier and Harris, 1977). Elevations in the subbasin range from about 5,800 feet near Pole Springs on Thimbleberry Mountain to 260 feet at the mouth of the Umatilla River. After leaving the Blue Mountains, the North and South Fork of the Umatilla River merge to form the

mainstem, a 90 mile reach of river which flows through a series of broad valleys that drain low rolling lands. All of the primary tributaries of the Umatilla River drain the Blue Mountains and enter the Umatilla River from the south. The North and South Forks (forks) of the Umatilla River and Meacham Creek account for approximately 14% of the Umatilla River subbasin drainage area, yet supply 40-50% of the average flow to the Umatilla River (Saul et al., 2001). The principle aquifer is quaternary alluvium composed of unconsolidated sand and gravel, and some silt. Alluvium may reach a depth of up to 12 feet (Gonthier and Harris, 1977).

Meacham Creek is a major tributary to the Umatilla River, entering at RM 79. It drains approximately 65 square miles and produces 145,000 acre-feet annually at RM 5 near the top of the project area. The average annual discharge for Meacham Creek is 193 cubic feet per second (cfs) (Saul et al., 2001).

Boston Canyon Creek, entering Meacham Creek at RM 2.1, is the largest tributary to Meacham Creek within Reservation Boundaries. It contributes over 4,000 acre-feet annually to Meacham Creek from a drainage basin of approximately 5.5 square miles. It runs over and through large alluvial deposits as it enters the Meacham Creek floodplain.

Elevations in the upper Umatilla River, Meacham Creek and Boston Canyon Creek project areas range from 1,760 to 2,000 feet above sea level, giving the area an unusually long growing season. Stream gradient averages less than two percent. Flooding in project areas usually occurs in late winter and spring as a result of a rain on snow event. The flood peaks tend to be high and the volumes large, but the duration of damaging stages seldom last more than a day or two (U.S. Army Corps of Engineers, 1975).

The upper Umatilla River, Meacham Creek and Boston Canyon Creek project areas lie in a big game winter grazing zone as outlined by the CTUIR Land Development Code (1983). The primary land use is livestock grazing from May to November. Timber harvest is permissible under a conditional use permit. Major portions of these areas have been disconnected from their floodplains. Intensive land uses within floodplains have resulted in dramatic changes in waterway characteristics. Current and historical land use practices, including road and railroad construction and maintenance activities, overgrazing of riparian and upland areas and extensive timber harvests, have led to stream channelization, diking within floodplains, stream bank rip-rapping and elimination of riparian vegetation. These practices have impacted fish habitat by altering natural channel form and function. Loss of stream channel meander from channelization and diking has accelerated runoff velocity due to an increase in surface gradient.

The mid-Umatilla River has been highly altered by human development. Stream channel morphology and flows have been significantly altered by irrigation dams and pumps, channelization, and the development of farms, homes and industry in the riparian area and adjacent uplands (Contor et al, 1997). Modern human activities have loaded the river with agricultural fertilizers, sewage, pesticides, and suspended sediments, as well as urban and industrial pollution (Contor et al, 1997). However, stream temperatures in the Barnhart vicinity (RM 35.0 through 49.0) are positively influenced by cold water releases from McKay Reservoir. These releases elevate flows from about 45 to 250-325 cfs (Yoakum gage), increase turbidity and decrease water temperatures (Zimmerman and Duke, 1996). The gradient in this reach is constant, and the increased flows provided abundant fast water habitat types (Contor et al, 1997). Flows released from McKay Reservoir are from the cooler hypolimnion layer, providing suitable stream temperatures for salmonids. Stream temperatures from RM 35.0 through RM 49.0 are comparable to those found in the Umatilla River's headwaters (RM 80.0 through 90.0) (see Figure 1 on following page).

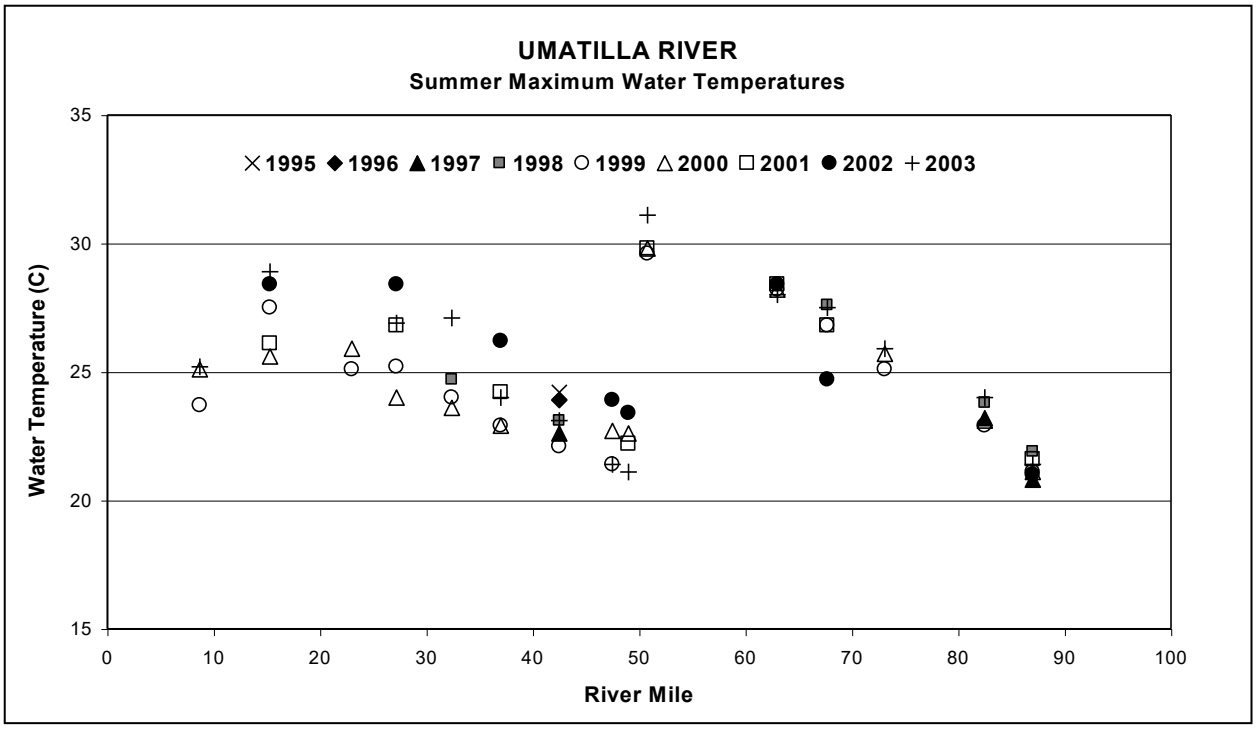


Figure 1 – Maximum summer water temperatures along the length of the Umatilla River.

East Birch Creek originates at a 4,238 foot elevation in the southeast corner of Umatilla County and flows approximately 18 miles northwest to merge with West Birch Creek at the city of Pilot Rock. Gage station data collected near Pilot Rock by the U.S. Geological Survey (http://nwis.waterdata.usgs.gov/nwis/discharge) from 1967 through 1973 indicates that average monthly stream flows in East Birch Creek vary from a monthly average of 0.91 cfs in August to 76.8 cfs in April.

East Birch Creek land use is primarily rural-residential, hay production and grazing with timber production predominating in the headwater reaches. Mid to lower portions of East Birch Creek are characteristically braided, very entrenched, and contain moderate to high width/depth ratio channels that are highly dynamic and provide poor juvenile rearing habitat for salmonids. Many of these channels have lost connection with their historic floodplain and because of their degree of entrenchment are extremely erosive and unstable, producing excessive sediments, which fill in pools, embed spawning substrates and accelerate channel migration.

The East Birch Creek valley bottoms begin to noticeably widen downstream of Pearson Creek. As the valley floors widen, they begin to bare proportionately more features of historic channel mobility. Arcuate depressions can be found within existing floodplains and terraces that are remnant geomorphic features left by historic channels. Historic channels within this basin previously occupied higher base level elevations. Geologic, climatic, and finally human generated influences have caused substantial base level lowering. Contemporary terraces are the remnants of floodplains abandoned by former channels that occupied higher base levels (Bailey, 2001).

East Birch Creek is listed as water quality limited for temperature and habitat modification on Oregon's 1998 303(d) list. The listing for water temperature is based on exceedence of the statewide standard for salmonid rearing (64º F). The listing for habitat modification is based on habitat surveys conducted by the Oregon Department of Fish and Game (ODFW) in 1993 and

deficiencies identified by comparison to ODFW habitat benchmarks for typical Eastern Oregon streams. A Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP) were written for the Umatilla River Basin, including Birch Creek, which should lead to water quality improvements over the long term (ODEQ et al 2000).

Wildhorse Creek is a 34-mile intermittent tributary to the Umatilla River, entering at RM 55 in the city of Pendleton, Oregon. It drains approximately 190 square miles and produces 14,000 acre-feet annually at the mouth. The highest point on the drainage divide of the basin is at an altitude of about 3,800 feet (Gonthier and Harris, 1977). Steep headwater topography of 15 to 35% contributes to rapid runoff rates. The slope in the lower and mid reaches varies from 0 to 3% (USDA, Soil Conservation Service, 1988).

Riparian and water storage capabilities in the upper Wildhorse Creek Watershed have been impacted from past timber harvest practices. Mid and low elevation lands are characterized by dryland crop farming, livestock grazing and residential use. Poor land use practices have significantly impacted upland vegetation communities, reduced riparian vegetation, degraded water quality, and diminished water table elevations and instream flows. Lack of conservation farming practices, such as strip cropping, terrace systems and grass waterways, are common problems in mid and lower watershed areas. Overgrazing of livestock and absence of pasture rotation plans have contributed to poor water quality and loss of floodplain function. The communities of Athena and Adams, county and state highway departments and the Union Pacific Railroad have constrained the mainstem stream channel, resulting in downcutting, loss of floodplain function and water quality impacts.

Greasewood Creek originates approximately 3.25 miles northwest of the town of Helix and flows southeast to enter Wildhorse Creek at RM 9.3, 0.5 miles downstream of Rothrock Road. The West Fork of Greasewood Creek originates 1.75 miles southwest of Helix and enters mainstem Greasewood Creek 1.5 miles upstream of the Wildhorse Creek confluence. The Greasewood Creek Watershed drains approximately 20,452 acres over a 33 square mile area. Annual precipitation ranges from 12 to 15 inches per year with 70% of this moisture being obtained during October through April. Stream flows in mid and upper watershed areas are intermittent during summer and early fall months. However, in the lower watershed, springs provide year-round flows to the Greasewood Creek and West Fork Greasewood Creek project areas. A study conducted by the Natural Resource Conservation Service (NRCS) estimated the ten year peak flow in the upper 9,650 acres of the watershed (upstream of State Highway 334) at 143 cfs (Ray Wilson, personal communication). Elevations in the watershed range from 1,800 feet above sea level in the headwaters to 1,400 feet above sea level at the confluence with Wildhorse Creek. Soils throughout the drainage are predominantly Walla Walla Series, consisting of deep, well-drained silt loams on 1 to 40% slopes.

NRCS personnel estimate that 98% of landuse in the Greasewood Creek Watershed is comprised of cropland practices, primarily winter wheat/summer fallow operations (Ray Wilson, personal communication). The deep soils in this drainage are considered to be some of the most productive agricultural soils in the Umatilla River Basin. However, lack of terraces, grass waterways and contour farming practices, failure to return crop residue to the soil and farming in highway right-of-way areas results in extensive erosion of top soils from steep slopes into roadside ditches and waterways. NRCS staff estimate, as much as 130 tons/acre of topsoil erodes annually from cropland fields in the Greasewood Creek Watershed (Bob Adelman, personal communication).

Spring Hollow Creek originates in sections 29, 26 and 23, T.3N., R.35E. in the northeast corner of the Reservation at elevations ranging from 2,166 feet (West Fork headwaters) to approximately

2,755 feet (East Fork headwaters) and flows northwest to empty into Wildhorse Creek at RM 13.7 at a 1,560 foot elevation upstream of Adams. The Spring Hollow Creek Watershed has a drainage basin of 18 square miles and supplies 1,500 acre-feet annually at its confluence with Wildhorse Creek (Gonthier and Harris, 1977). This system is one of the few streams originating on the Reservation which deliver year-round stream flows. Due to significant spring seepage throughout the drainage, stream temperatures commonly average between 60 and 68 degrees Fahrenheit in lower stream reaches during late summer. Annual precipitation in the upper watershed varies from 18 to 25 inches, while precipitation at lower elevations ranges between 5 and 20 inches annually (USDA, Soil Conservation Service, 1988).

Non-irrigated annual crop farming, typically small grain-pea rotations, is the primary land use in the Spring Hollow Creek Watershed. According to the Soil Survey of Umatilla County Area, Oregon, many of the properties located within this drainage classify as "prime farmlands" because the silt loam soils present have the ability to sustain high crop yields with minimal inputs of energy and economic resources, and farming such soils results in the least damage to the environment (USDA, Soil Conservation Service, 1988). However, failure to leave crop residue, maintain tilth, chisel stubble, contour farm, and construct terraces, diversions and grass waterways in this drainage continue to result in extensive erosion of top soils during wet winter months. Grazing is the second most prevalent land use occurring in the watershed. The majority of grazing occurs within floodplain areas in lower stream reaches. High stocking rates, absence of pasture rotation plans and failure to restrict grazing during wet periods results in compaction of soils, poor tilth and excessive runoff.

Mission Creek originates in the western slope foothills of the Blue Mountain Range at an elevation of about 3,560 feet and flows northwesterly to empty into the Umatilla River at approximately RM 61.5 at an elevation of about 1,270 feet. This watershed is located entirely within Reservation Boundaries and has a total acreage of approximately 3,100 acres. The Mission Creek Watershed is comprised of the following landuse practices:

1) 2,100 acres of rangeland,
2) 670 acres of winter wheat/summer fallow cropland,
3) 180 acres of Conservation Reserve Program (CRP) land,
4) 140 acres of abandoned cropland and
5) 10 acres of residential property.

Average annual precipitation ranges from 16 to 24 inches with most of it falling between October and March as rain. Mission Creek is an intermittent stream with stream flows in the lower reaches and portions of the upper watershed going subsurface by mid-summer.

Conversion of historical, native plant communities to cropland and rangeland combined with realignment and shortening of lower stream channel reaches have altered the hydrologic capabilities of the Mission Creek Watershed, resulting in higher peak runoff rates during storm events, increased channel/stream bank erosion and loss of fish and wildlife habitat. Limited portions of the mid watershed sustain year-round stream flows and provide excellent salmonid habitat. Lack of perennial stream flows and insufficient riparian cover are the primary factors limiting anadromous fisheries production in this system.

Buckaroo Creek is an intermittent stream, originating in the vicinity of Deadmans Pass in the Blue Mountains at an elevation of approximately 3,600 feet. This 15 square mile drainage area is located entirely within Reservation Boundaries and flows northeasterly to enter the Umatilla River at Thorn Hollow (approximately RM 73.2) at an elevation of about 1,600 feet. This tributary has an annual stream discharge of 4,000 acre-feet and an average daily discharge of 10 cfs at the mouth

(Gonthier and Harris, 1977). Soils within the watershed tend to be a mixture of moderately deep, well drained silt loams and shallow, well drained Gwin cobbly silt loams. Forage tends to be limited by the high content of rock fragments and shallow depth to bedrock in the Gwin soils (USDA, Soil Conservation Service, 1988).

Livestock grazing is the primary land use in the Buckaroo Creek Watershed. This drainage is located within Bureau of Indian Affairs (BIA) Range Unit Six. This system continues to be overgrazed due to high stocking rates and extended grazing seasons. The CTUIR is currently coordinating with the BIA in development of a long-term range management plan to address these concerns. Historical land uses in the watershed included timber harvest and sheep grazing. Impacts from these long ago and current events include increased runoff rates, elevated stream temperatures (see stream temperature graph A-12.), and diminished riparian and upland native vegetation communities.

The Squaw Creek Watershed is located approximately 18 miles east of Pendleton, Oregon. Squaw Creek originates in the western flank of the Blue Mountains in the vicinity of Emigrant Springs and flows approximately 12 miles northward to empty into the Umatilla River at approximately RM 76.7. Elevations range from approximately 4,200 feet in the headwaters to 1,670 feet at the mouth (U.S. Soil Conservation Service, 1991). This drainage has a total area of 24,198 acres with 18,398 acres (including approximately 608 acres owned by the Boise Cascade Corporation) lying within Reservation Boundaries. Approximately 1,800 acres lie within Umatilla National Forest Boundaries and an additional 4,000 acres lies on private property outside of Reservation Boundaries (including approximately 2,628 acres owned by the Boise Cascade Corporation).

Squaw Creek is an intermittent tributary with an annual stream discharge of 2,000 acre-feet (Gonthier and Harris, 1977). Average precipitation ranges from about 24 inches near the village of Meacham to 13 inches at the confluence with the Umatilla River (U.S. Soil Conservation Service, 1991). Stream gradient ranges from eight percent in the upper watershed to one percent at the mouth.

The riparian area has distinct storage and transport zones, but no well-defined depositional zone, and presence of young, shrub seedlings is sparse. Soils within the watershed are highly variable. The streambed on the lower five to six miles of Squaw Creek transports materials up to six inches in diameter, and the channel and stream banks are extremely unstable. Extensive areas of bed load and scour are apparent (U.S. Soil Conservation Service, 1991).

Land use practices in the Squaw Creek Watershed have primarily consisted of seasonal (May 1 through October 1) livestock grazing and timber harvest. This drainage is popular for recreational and subsistence hunting, and emphasis of these activities will likely increase with recent tribal land acquisitions.

The headwaters of McKay Creek are located within the Blue Mountains, and the drainage divide at its highest point near Kamela, Oregon is at an altitude of about 4,500 feet (Gonthier and Harris, 1977). McKay Creek flows westward 38 miles to empty into the Umatilla River at approximately RM 51. This stream enters the southernmost portion of the Reservation at RM 23 and exits the West Reservation Boundary at RM 15. McKay Creek drains into the McKay Creek National Wildlife Refuge, which encompasses McKay Creek Reservoir, at approximately RM 10. McKay Creek exits the 1,200 surface acre reservoir (71,500 acre-feet) at McKay Dam, an earth-fill structure with a reinforced concrete upstream slope, located at approximately RM 6 (U.S. Bureau of Reclamation, 2000). Average annual discharge (based on a period of record from 1930 to 1985) upstream of the reservoir is 103 cfs (Alexander et al., 1987).

Historically, it is likely that the McKay Creek Drainage supported abundant summer steelhead populations. Physical stream characteristics within the watershed are representative of preferred steelhead habitat. However, construction of 165-foot high McKay Dam from 1923 through 1927 would have permanently obstructed all anadromous fish passage. Today, McKay Creek Reservoir, managed by the U.S. Bureau of Reclamation, provides habitat to various species of waterfowl, non-native warm-water fish and rainbow trout. Rainbow trout also occur within and upstream of McKay Reservoir.

Primary land uses within the McKay Creek Watershed include, 1) home-site development, 2) livestock grazing of rangeland areas and irrigated pastures, 3) production of non-irrigated small grain crops, 4) production of irrigated crops, such as alfalfa hay and small grains, 5) timber harvesting in upper watershed areas, and 6) outdoor recreational opportunities, including fishing, hunting, boating and water skiing.

Development of homes, farm buildings and roads within the floodplain have resulted in straightened and confined stream channels throughout the mid and lower watershed. These construction activities along with McKay Creek Dam operations and water releases have increased stream velocities, increased in-stream gravel movement, and significantly reduced available fish and wildlife habitat in mainstem McKay Creek. Failure to implement proper stocking rates, pasture rotation and deferred grazing plans, and restrictive grazing during wet periods throughout the drainage has compacted top soils, resulted in poor soil tilth and excessive runoff, impacted upland and riparian native vegetation communities and degraded water quality. Cropland management practices, which conserve soil moisture and reduce wind and water erosion of soil surface layers, are not frequently utilized in lower watershed areas and need to be more widespread. Increased use of soil conservation practices, such as stubble-mulch tillage, limited seedbed preparation tillage, early fall seeding, contour farming, windbreak establishments and grass waterways, would improve riparian and upland conditions. Areas within the upper McKay Creek Watershed have been extensively logged, likely resulting in reduced ground water storage, decreased soil permeability and increased soil erosion rates.

McKay Dam was originally constructed to furnish a supplementary supply of water to Stanfield and Westland Irrigation Districts in the lower Umatilla River Basin (U.S. Bureau of Reclamation, 2000). The Congressional Act of March 11, 1976 (90 Stat. 205, Public Law 94-288) reauthorized McKay Dam and Reservoir for the purposes of irrigation, flood control, fish and wildlife resources, recreation, and safety of dams (U.S. Bureau of Reclamation, 2000). The Act of October 28, 1988 (102 Stat. 2791, Public Law 100-557) was authorized for the purposes of mitigating losses to anadromous fishery resources and continuing water service to irrigation districts (U.S. Bureau of Reclamation, 2000). This cooperative local, state, tribal and federal water exchange effort, known as the Umatilla Basin Project, has served to resolve potential conflict between fishery and irrigation needs in the Umatilla River Basin. The project delivers Columbia River water to three irrigation districts in exchange for leaving in-stream flows in the Umatilla River for anadromous fish passage and rearing. In addition, a large portion of space in McKay Reservoir is devoted to in-stream flow augmentation (Heirs, 1996). While upper McKay Creek is inaccessible to anadromous fish, habitat enhancements in the McKay Creek Watershed are directed at improving water quality conditions for salmon and steelhead downstream in the Umatilla River.

Moonshine Creek is located entirely within Reservation Boundaries and originates in the vicinity of Emigrant Hill at an elevation of approximately 3,720 feet. This stream flows northwesterly to empty into the Umatilla River at approximately RM 67.2 at an elevation of about 1,400 feet. Moonshine Creek drains a total of approximately 5.5 square miles and contributes 2,480 acre-feet annually at

RM 1.1 (a drainage area of 4.62 square miles) near the top of the passage improvement site (just upstream of Umatilla County Road 900 Box Culvert). Summer stream temperatures in the lower portion of this Umatilla River tributary generally range from 50 to 79 degrees Fahrenheit (Shaw and Sexton, 1999). A habitat survey conducted from the mouth to the stream forks (RM 4.4) in late August and early September of 1995 noted that 58% of the stream channel was dry and salmonid habitat was marginal (Contor et al., 1996). Other physical features characterized during this survey indicate that Moonshine Creek is primarily a single channel confined by high terraces, stream channel gradient averages 2.7%, the average wetted width to depth ratio is 8.9:1 in slow water habitat and 20:1 in riffles, the dominant riparian vegetation (51%) is comprised of various grasses, 27 surface springs occur in the lower 4.4 stream miles, and beaver dams are common in the lower watershed (Contor et al., 1996). Annual precipitation varies from 15 to 25 inches throughout the watershed (USDA, Soil Conservation Service, 1988).

The Cottonwood Creek Watershed is located on the Reservation immediately west of Moonshine Creek. Cottonwood Creek originates on Emigrant Hill in the western slope foothills of the Blue Mountain Range at elevations ranging from 3,400 feet (West Fork headwaters) to approximately 3,480 (East Fork headwaters) and flows northwest to enter the Umatilla River at approximately RM 65 at a 1,330 foot elevation. This stream drains an area of approximately 5 square miles and has an average annual discharge of 1,940 acre-feet at RM 1.3 (a drainage area of 4.01 square miles) near the top of the upper passage improvement site (just upstream of Umatilla County Road 900 Box Culvert). Stream temperatures, recorded between June 20 and August 1, 1995, varied from 51 to 80.6 degrees Fahrenheit (Contor et al., 1996). A habitat inventory conducted from the mouth to the stream forks (RM 4.1) during the summer of 1995 noted that 49.2% of the stream channel was dry and salmonid habitat was marginal (Contor et al., 1996). Other physical features documented during this survey indicate that 7% of Cottonwood Creek is comprised of secondary (braided) channels, high terraces and hill slopes are the most common landform, stream channel gradient averages 3.3%, the average wetted width to depth ratio is 8.9:1 in slow water areas and 20.8:1 in riffles, the dominant riparian vegetation (53%) is comprised of various grasses, 23 surface springs were identified throughout the watershed, and beaver dams are common in lower stream reaches (Contor et al., 1996).

Soils throughout the Moonshine and Cottonwood Creek drainages are highly variable. Soils consist of deep and shallow, well-drained loams, including silt loams, silty clay loams, cobbly loams and gravelly silty clay loams. Slopes in these drainages range from 0 to 70%, have rapid runoff rates and potential water erosion hazard is high (USDA, Soil Conservation Service, 1988).

Vegetation found within the upper watersheds of these drainages includes elk sedge, pinegrass, mallow ninebark, prince's pine and myrtle pachystima in the understory, and Douglas fir, ponderosa pine, grand fir and western larch in the overstory. Historically, these areas likely supported extensive communities of native grasses, such as bluebunch wheatgrass, Sandberg bluegrass and Idaho fescue. Remnant populations of these grasses still occur, but have largely been out-competed by cheat grass and medusa head.

Primary land use practices in the Moonshine and Cottonwood Creek drainages include home-site development, livestock grazing (pastures and BIA Range Units Three and Six) and production of non-irrigated small grain crops. Several dwellings have been constructed within floodplains in the lower watersheds of these systems. These structures along with road developments have prevented lateral stream channel movement and disconnected portions of the streams from their floodplains. A culvert, impeding fish passage in lower Cottonwood Creek, was addressed during the project period. This improvement is further described within this report. Decades of season-long grazing and poor livestock distribution has resulted in over utilization of native perennial grasses

and establishment of nuisance annual grasses (primarily cheat grass and medusa head). Overgrazing has also contributed to reduced riparian canopy cover, eroding stream banks, exposed soil surfaces and increased runoff rates. The majority of farming in the Moonshine and Cottonwood Creek watersheds is a grain – fallow cropping system. Soil conservation practices need to be more widely applied to reduce runoff and control erosion in the lower watersheds. Conservation measures applicable to these watersheds include early fall seeding, stubble-mulch tillage and construction of terraces, grass filter strips and grass waterways.

A map of the mid Umatilla River, upper Umatilla River, Meacham Creek, Boston Canyon Creek, East Birch Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek, Squaw Creek, McKay Creek, Moonshine Creek and Cottonwood Creek project areas is illustrated in Figure 2 – CTUIR Anadromous Fish Habitat Enhancement Project Vicinity Map. on the following page.

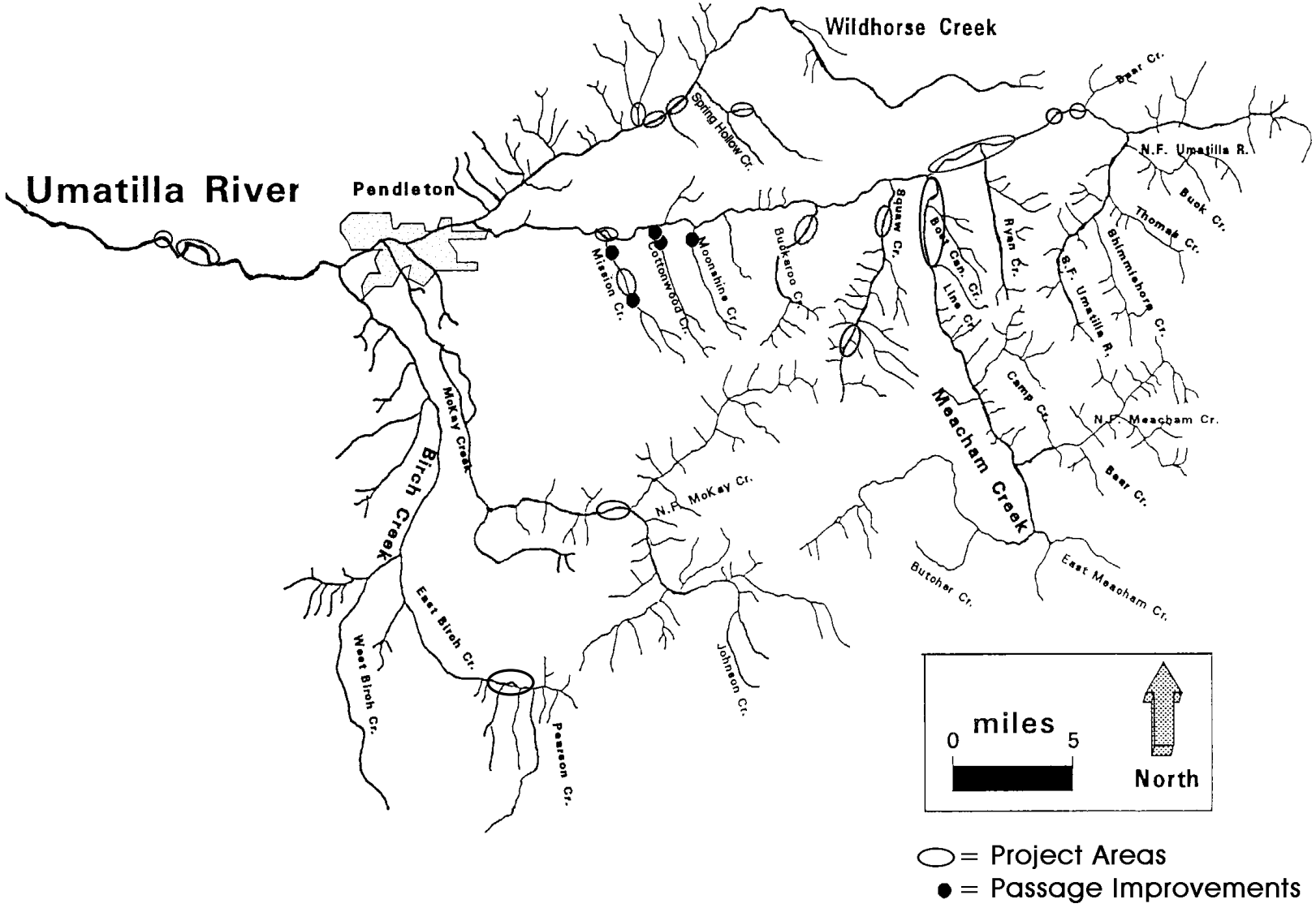


Figure 2 – CTUIR Anadromous Fish Habitat Enhancement Project Vicinity Map.

METHODS AND MATERIALS

Objective I. Maintain and Continue Implementation of Habitat Enhancement Projects throughout the Umatilla River Watershed.

1. Pre-construction Preparation:

a. Assess Maintenance Needs

The physical condition of habitat improvements are annually evaluated in existing project areas, following spring high flow events, to determine effectiveness and prescribe any maintenance to occur during the project funding period.

b. Project Cost Share

Cost share funds are obtained and combined with BPA funds for financial assistance. These efforts effectively forge partnerships between resource agencies and the public and allow BPA funds to go further.

c. Clearances and Land Owner Agreements

Various clearances and landowner agreements must be obtained before CTUIR can initiate habitat improvements on private properties.

The BIA may require a land survey of designated project area boundaries and do require acquisition of right-of-way agreements on private-owned, Indian Allotments (trust lands), prior to pursuit of riparian easements.

Riparian Conservation Agreements restrict landowners from certain land use activities, such as grazing, removal of vegetation and use of weed or insect control measures, within enhanced riparian corridor areas. The term of these agreements varies from 15 years to perpetuity. The landowner(s) accepts the costs of all habitat improvements along with CTUIR's maintenance of these improvements as consideration for participating in project recovery efforts. An attempt is made to address landowner needs (such as livestock water gaps, stream crossing sites, off-stream water developments, etc.) and incorporate these needs into the final agreement. Riparian easements protect habitat improvements and ensure an early recovery period within project areas.

Access, Implementation and Maintenance Agreements are obtained for projects strictly involving instream habitat enhancements. These agreements typically have a five-year term. As with the Riparian Conservation Agreements, the landowner accepts the costs of all habitat improvements and CTUIR's maintenance of these improvements as consideration for participating in project recovery efforts. The purpose of these projects is to improve stream bank stability and increase in-stream habitat diversity. The five-year term provides a period in which to monitor project recovery and perform any necessary maintenance to in-stream structures.

Other necessary clearances may include obtainment of permits from Umatilla County to construct habitat improvements within county road right-of-way areas or burning permits to burn noxious weeds within existing project areas. Considerable effort and coordination is required to secure clearances and landowner agreements.

d. Removal/Fill Permits

Instream work activities on the Reservation require a CTUIR Tribal Stream Zone Alteration Permit (SZAP) and a U.S. Army Corps of Engineer's (COE) 404 Removal/Fill Permit. Any instream work proposed within CTUIR's identified flood hazard sub-district or potential special flood hazard areas require a Tribal Development Permit from the CTUIR Planning Office.

Instream work activities off of the Reservation either require a General Authorization for Fish Habitat Enhancement Permit or a Removal/Fill Permit (dependent upon the scope of activities and scale of the proposed project) from the Oregon Division of State Lands (ODSL) in conjunction with a COE 404 Removal/Fill Permit. Applications for these permits should be completed and returned to the respective agencies a minimum of 90 days prior to anticipated instream work. Permitted instream work activities in the Umatilla River Basin are restricted to specific instream work periods. These instream work periods are based upon when migrating and spawning salmonids are least likely to be impacted by fill and removal activities. Work windows vary throughout the basin.

e. Endangered Species Act Requirements

The Columbia River population of bull trout (*Salvelinus confluentus*) and mid-Columbia Evolutionary Significant Unit (ESU) summer steelhead (*Oncorhynchus mykiss*) are listed as threatened species under the federal Endangered Species Act (ESA). Any proposed instream work activities in areas within the Umatilla Basin, currently supporting these species or providing critical habitat for them, require ESA, Section 7 consultation when federal funding is utilized. Upon receiving a completed 404 Removal/Fill permit application, BPA initiates Section 7 consultation proceedings with the appropriate federal agencies. The U.S. Fish and Wildlife Service (USFWS) is consulted for potential resident fish species (such as bull trout) impacts. The National Marine Fisheries Service (NMFS) is consulted for potential anadromous fish species (such as summer steelhead) impacts. Instream work in critical bull trout and summer steelhead habitat areas generally requires the project proponent to develop Biological Assessments (BA's) to determine the extent of impact, if any, from proposed habitat enhancements. BA's are reviewed by USFWS and NMFS, during consultation proceedings, and assist in determining if an instream project will occur, as proposed, or if modification is necessary to limit potential impacts. Consultation proceedings can considerably delay obtainment of instream permits.

f. Cultural/Archeological Monitoring

The project coordinates with CTUIR's Cultural Resource Protection Program (CRPP) at proposed habitat enhancement sites involving ground disturbance (fence construction, structures keyed into stream banks, etc.), prior to project implementation to obtain cultural clearances. CRPP Staff conduct file and literature searches, pedestrian surveys and/or archeological excavations to determine if cultural resources potentially eligible for inclusion to the National Register of Historic Places are present at proposed enhancement sites. Final reports, documenting their findings, are prepared and submitted to the BIA Umatilla Agency Real Property Management Office (for implementation efforts on the Reservation) and to the State Historic Preservation Office (SHPO) (for implementation efforts, both on and off the Reservation). CRPP Staff may also conduct on-site monitoring of projects during implementation at culturally sensitive locations. All cultural clearances are obtained in compliance with Section 106 of the National Historic Preservation Act.

g. Design and Layout

Design and layout of proposed projects consists of coordinating with the CTUIR Hydrologist to develop hydraulic designs, determining the quantity and type of materials required to build or repair fence and instream structures, and developing heavy equipment access sites, haul roads and boulder storage sites. Proposed fence lines, instream structure sites and stream bank areas are staked and flagged to provide assistance to subcontractors.

h. Contracts and Professional Services Agreements

Proposed implementation activities, requiring rental of operated heavy construction equipment, construction of fencing, and purchase and transport of rock or root wads, are advertised and pre-bid tours provided to potential subcontractors. Subcontracts are awarded to the lowest bidder.

Prior to commencement of a subcontract, the subcontractor meets with CTUIR Habitat Enhancement Project Personnel to discuss subcontract terms, work performance requirements, a work progress schedule, petroleum spill plans, and fire prevention and suppression plans. Notices to proceed are issued in writing to the subcontractor.

The subcontractor provides and maintains an inspection system acceptable to the CTUIR, covering the services under the subcontract. Complete records of all inspection work performed by the subcontractor are maintained and made available to the CTUIR during subcontract performance and for as long afterwards as the subcontract deems necessary.

Equipment is inspected at the work site at the time of delivery. All equipment must be in good working condition, free from excessive leaks in hydraulic, fuel and power systems and clean enough to allow close inspection of these systems. Any equipment that does not meet subcontract specifications and requirements is rejected.

CTUIR Habitat Enhancement Project Personnel monitor the subcontractor's progress and photo document various stages of project implementation.

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

Stream bank revetments, log and boulder weirs, log and boulder deflectors, rock vanes and grade control/sediment retention structures previously placed into the Umatilla River, Meacham Creek, Wildhorse Creek, Greasewood Creek, the West Fork of Greasewood Creek and Spring Hollow Creek project areas are repaired annually as needed. These structures are designed to increase instream habitat diversity, increase pool frequency, stabilize stream banks and stream channels, and recruit and deposit sediments onto stream banks to provide substrate for revegetation.

Newly proposed in-stream and stream bank project designs are determined and developed jointly by the CTUIR Hydrologist and CTUIR Habitat Enhancement Project Personnel. Project personnel place large woody debris (LWD) into areas where natural wood recruitment and habitat diversity is low. Placement of LWD provides additional instream cover for salmonids and organic material for aquatic organisms to feed upon, and assists in

rebuilding stream banks by slowing water velocities and capturing sediments. Hydrological controls (root wad and rock revetments, deflectors, vanes, weirs, etc.) are used sparingly and restricted to stream reaches where benefits (grade control, sediment deposition, stream bank stability, growth of riparian vegetation and increased instream habitat) are immediate. More costly bio-engineering approaches are reserved for areas that will not recover in a timely or natural manner.

b. Fish Passage Improvements

Locations of numerous passage barriers have been identified through the ongoing Umatilla Subbasin/Willow Creek Subbasin Planning process. The project is currently coordinating with CTUIR UBNPME Project Personnel to verify and prioritize these passage concerns. Removal or modification of passage barriers will provide access to currently unavailable or under-utilized stream reaches and improve migration for adult spawning, juvenile rearing, and adult and juvenile holding. The effects of such efforts, in conjunction with continued restoration of riparian and upland areas, will aid in increasing salmon and dwindling ESA listed summer steelhead populations.

c. Livestock Exclusion and Riparian Corridor Fencing

Fencing is constructed to exclude livestock from floodplain and riparian areas. Livestock exclusion provides stream bank protection and allows vegetative recovery to occur within project areas.

The project constructs both, smooth-wire high tensile and barbed-wire fencing for livestock management. Smooth-wire high tensile fencing is utilized in areas where livestock are distributed over vast areas (open range) and tree blow-down is frequent. Barbed-wire fencing is useful when livestock pressure is significant, such as when large numbers of cattle are confined in pastures, there is high potential for fire damage, and tree density is low.

Fences, gates and cross fences in existing project areas are repaired by project personnel as needed. Frequent fence inspections are conducted to ensure continued exclusion of livestock and to allow for continued riparian recovery inside of project areas.

d. Off-stream Livestock Water Developments

Off-stream water sources are developed to prevent stream bank erosion from livestock trailing and eliminate high maintenance costs associated with water gaps in fenced riparian corridors. Existing springs are developed and shallow or deep wells drilled to provide a necessary water source for livestock.

Typically, these projects involve landowner financial and in-kind cost share assistance. The project funds any subcontracted services, electrical hook-ups and installations, and solar panels, pumps, pipe and associated hardware, water troughs and other material items. The landowner pays for electrical costs to operate pumps, and may provide equipment and labor to install plumbing and water troughs.

e. Revegetation

The CTUIR Habitat Enhancement Project utilizes heavy equipment and hand plants native

riparian tree and shrub species along bank revetment structures, sediment retention structures and stream margins to improve bank stability, provide insect drop, shade streams and provide future recruitable LWD. Stream banks, terraces and disturbed sites within project areas are seeded with native grasses and/or close equivalents of native grasses to improve bank stability and to capture and retain sediments during high flow events.

Native plants are acclimated to the local climate, provide natural forage for wildlife and are much more resistant to the area's disease and insect problems. Studies have found that exotic species may out-compete and displace native riparian vegetation (Gordon et al., 1993). In addition to historical and present impacts of disturbance on riparian vegetation connectivity and diversity, plantings of exotic riparian vegetation (e.g. Russian olive) and the potential of hybrid poplar monocultures could disrupt riparian processes (Li, 1998). In Europe, plantations of exotic monocultures have replaced the natural diversity of riparian vegetation along stream banks of various watersheds (Cortes et al., 1994). This has changed the trophic structure of affected streams and influenced the input of terrestrial invertebrates that form the bulk of drifting prey for surface feeding fishes in headwater streams. The timing and quality of litter inputs from single species plantings or exotic species may differ greatly from diverse systems and lead to reduced food resources for aquatic species (Li, 1998). There may also be concerns about pollution of the gene pool of existing plant populations when non-local plants are introduced to a site (Lambert et al., 1995).

Trees and shrubs planted in CTUIR Habitat Enhancement Project Areas are locally obtained, indigenous species grown out as bareroot stock or tublings. Native grass seed and close replicates of native grass seed are currently unavailable locally and continue to be purchased from various grass seed companies.

f. Noxious Weed Control

The CTUIR subcontracts herbicide applicators to chemically treat noxious weeds up to three times per year in existing project areas. Only the most invasive noxious weeds, identified as "A" Pest Weeds on Umatilla County's Noxious Weed List, are treated. All chemical applications are consistent with Oregon Revised Statute (ORS).570.505, Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) Regulations, and NMFS and USFWS recommendations regarding ESA concerns.

When other noxious weed species are identified as detrimental to project success or are of special concern to the landowner, CTUIR Habitat Enhancement Project Personnel treat these weeds as needed.

3. Post-implementation Final Review:

CTUIR Habitat Enhancement Project Personnel visit implementation sites immediately following final construction as indicated by the subcontractor. Subcontracted services are inspected to determine whether they conform with subcontract requirements. If subcontract services are not acceptable, CTUIR may (1) require the subcontractor to perform the services again in conformity with contract requirements, (2) reduce the contract price to reflect the reduced value of services performed, (3) hire another subcontractor to perform the services and charge the original subcontractor any cost incurred by the CTUIR, or (4) terminate the contract for default.

Objective II. Collect Baseline Data to Assess Pre-project Conditions and Continue Post-project Monitoring to Identify Habitat Limiting Factors and to Quantify Short and Long-Term Effects of Habitat Enhancement Activities in the Umatilla River Basin.

1. Geomorphologic and Hydraulic Data Monitoring:

Geomorphologic and hydraulic data is collected to measure changes in channel morphology and vegetative response to habitat enhancements. This monitoring may include the following:

- **Longitudinal survey** - this data provides a graphical representation of the stream-bed contour. From this, stream habitat may be categorized into habitat unit types, such as pools, glides, riffles, rapids, or cascades. By comparing this information to "standards" developed in the literature, the project can better plan restoration strategies and quantify change over time.

- **Cross section survey** - this information is collected at two to ten (depending on total project length) permanent monitoring points at various locations in the stream reach being enhanced. Transects are taken perpendicular to the stream's thalweg and generally continue outward on each shoreline to a point above bank-full width. Transects are established at areas representative of different channel types. Among other things, cross-sectional data generates maximum widths and depths, bank-full widths, bank heights, width to depth ratios, entrenchment ratios, and discharge. By comparing this information to "standards" developed within the literature, the project is better able to plan restoration strategies and understand channel formation changes over time. A trend toward channel narrowing and deepening is most desirable for improvements in salmonid health, channel stability and water quality. These measurements may be repeated in out-years to measure changes in channel morphology and vegetative responses to habitat enhancements.

- **Habitat survey data** - literature searches are conducted and any available habitat inventory data previously collected at the stream reach level will be utilized for project planning purposes and to assist in analyzing recovery trends. In-field measurements of physical attributes, such as pool frequency, pool quality, available LWD, substrate types, water quality, stream flows and potential environmental impacts from current land uses and historical disturbances will be identified.

- **Photo points** - Permanent photo points are established prior to project implementation in conjunction with permanent transects. Standardized photos are taken to provide a visual record of changes in channel morphology and riparian recovery. Photos are cataloged and stored on computer hard drives and back up disks, maintained by the CTUIR Fisheries Habitat Enhancement Project. This information provides a very valuable visual source of restoration progress and public education.

2. Biological Inventories:

Fisheries communities are good indicators of long-term effects and broad habitat conditions because they are relatively long-lived and mobile (Karr et al., 1986). However, the fish population at any location is influenced by activities throughout the stream length because fish use different habitats at various life stages and may migrate long distances (Bauer and Burton, 1993).

Project staff coordinate with CTUIR UBNPME Project Personnel to collect pre-project fish community data. Representative samples of fish species and size classes are collected with a backpack electrofisher in proposed project areas. A single pass with the electrofisher is made to evaluate community composition. All salmonids captured are counted, fork lengths measured and identified to species in the field. All other fish species numbers are visually estimated during sampling. Biological inventories are generally completed during the stable low flow period in mid-summer to avoid spawning migrations and seasonal fish movement (Karr et al., 1986).

Fish collection permits are required in the Umatilla River Basin because bull trout and summer steelhead are listed as threatened under the federal ESA. These permits specify sampling gear types and sampling periods. The UBNPME Project applies for and obtains all collection permits utilized by this project for fish sampling efforts.

Post-project biological inventories will occur in future project periods to assess fish utilization of instream enhancements and assist in evaluation of habitat recovery.

3. Aquatic Macroinvertebrate Sampling:

Macroinvertebrates are components of the aquatic environment that provide a connecting link in the food chain between multicelled periphyton, detritus from terrestrial sources and the fish population. As a food source they are essential to the growth and production of fish and, because of their strict habitat requirements, are very useful as indicators of changes in aquatic habitat (USDA, Forest Service, 1985). The diet of immature chinook salmon has been shown to be 95% insects, and immature coho salmon consume about 99% insects (Johnson and Ringler, 1980). Steelhead diets are largely insect as well (Johnson and Ringler, 1980).

Aquatic macroinvertebrate communities can reveal the quality of habitat components essential to aquatic fauna, such as water quality, substrate composition, riparian habitat quality, ecosystem stability, and past history (U.S. Bureau of Land Management, 1988). Aquatic macroinvertebrate communities are useful for monitoring biological integrity of streams since they function as integrators of pollution over time and are a direct measure of beneficial uses (aquatic life support) (Meyers, 1987). According to Schoen (1991), macroinvertebrates cover the whole range of pollution sensitivity, from highly sensitive stoneflies and mayflies down to very tolerant aquatic worms, so the presence or absence of particular taxonomic groups provides a good yardstick of pollution. Unlike fish, macroinvertebrates are relatively immobile. So, if macroinvertebrates are absent from their normal habitat, it is likely that pollution drove them out. In a healthy stream, one should find a balanced population consisting of many different kinds of organisms. Adverse chemical or physical changes that disrupt any part of the stream ecosystem often decrease community diversity. Macroinvertebrate populations usually recover more quickly than fish populations in response to water quality improvements and thus, appear to provide better subjects for assessing habitat recovery.

The project annually hires entomologists with Oregon State University (OSU) to sample aquatic macroinvertebrate populations in the McKay Creek, Wildhorse Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Meacham Creek project areas. Their study design involves sampling invertebrates at two sites per project area. One site is located within downstream portions of CTUIR habitat enhancement projects (the “Restoration” site).

Water quality is examined at these sites as flows exit the project areas. The second site is located upstream of project areas, within 300 m of the projects' upper boundaries. Water quality is examined at these sites as flows enter project areas (the "Control" site). The general hypothesis is, "restoration will have a positive influence on water quality as reflected by macroinvertebrate community structure".
Four benthic samples are obtained at each sampling site with a 30 cm, 250 micron mesh D-frame net. Samples are collected by firmly placing the net against substrate and disturbing the substrate in a 30 cm by 60 cm area in front of the net for a one minute period. An effort is made to disturb the substrate to a standard depth of 10 cm.

Macroinvertebrates are sorted from detritus, counted and identified to the lowest taxonomic level feasible in the laboratory. Samples are either completely sorted or subsampled when large amounts of sediment are present in the sample. Subsampling involves dispersing the sample evenly across a 20 cm diameter coffee filter, randomly choosing a quarter-section of the filter, cutting away that portion from the remainder of the filter and then sorting all macroinvertebrates from the quarter-section. Data from the four samples taken from a sampling site are pooled to provide a single measure of macroinvertebrate community structure at each site.

To examine the difference in community structure between the paired control and restoration sites for each stream, the following metrics are examined:

1) Taxa richness – a simple count of the number of taxa present at a site. This metric is predicted to decrease with decreasing water quality.
2) EPT richness – a count of the number of taxa belonging to the orders Ephemeroptera (mayflies), Plecoptera (stoneflies) and Trichoptera (caddisflies). Most taxa within these orders are sensitive to pollution and therefore this metric is predicted to decrease with decreasing water quality.
3) Plecoptera richness – a count of the number of taxa belonging to the order Plecoptera. This metric is very similar to EPT; however, it has been found to perform better than EPT in the Pacific Northwest (Karr and Chu 1999). This metric is predicted to decrease with decreasing water quality.
4) Intolerant taxa richness – a count of the number of taxa considered to be intolerant or sensitive to pollution. This metric is expected to decrease with decreasing water quality.
5) Sediment-intolerant taxa richness – a count of the number of taxa considered to be specifically intolerant to sediment. This metric is expected to decrease with decreasing water quality.
6) Tolerant taxa richness – a count of the number of taxa considered to be tolerant or insensitive to pollution. This metric is expected to increase with decreasing water quality.
7) Sediment-tolerant taxa richness – a count of the number of taxa considered to be tolerant or insensitive to sediment. This metric is expected to increase with decreasing water quality.
8) % Predators – the proportion of predators found in a community. In general, this metric is expected to decrease with decreasing water quality.
9) Functional Feeding Group (FFG) structure – the proportion of taxa found within functional feeding groups. Other than the proportion of predators decreasing with decreasing water quality (metric 8), there are few specific predictions about how FFG structure should change with changes in water quality. However, FFG structure can provide information on the diversity of basal resources at a site and

in general this diversity is expected to increase with increasing water quality.

10) Shannon's Diversity Index – a measure that takes into account both the number of distinct taxa at a site and their relative abundances. This measure is expected to decrease with decreasing water quality.
11) Percent Dominance – a metric of the proportion of the community made up of the three most abundant taxa. This metric is expected to increase with decreasing water quality.
12) Hilsenhoff Biotic Index (HBI) – a metric of community structure that is especially sensitive to organic enrichment. Taxa are assigned an index score ranging from 0 (very sensitive taxa) to 10 (highly pollution tolerant). The index is an average score weighted by the abundance of each taxa. Scores ranging from 0-2 are considered indicative of clean water, 2-4 slightly enriched water, 4-7 enriched water, and 7-10 very polluted water (Hilsenhoff 1987).
13) Biotic Condition Index (BCI) – a metric of community structure indicative of pollution. This index measures a site's quality relative to a predicted quality based on physical and chemical parameters. Thus, each site is measured against its own "potential." Each taxa is assigned a score ranging from 2 (very sensitive taxa) to 108 (very tolerant taxa) and the weighted average of all scores are taken and then compared to the predicted score. BCI values greater than 90 are indicative of high quality conditions, 80-90 good conditions, 72-79 fair conditions, and less than 72 poor conditions (Platts et al. 1983).
14) Oregon Department of Environmental Quality's (ODEQ) Grande Ronde Multimetric Index – a single measure of water quality that is comprised of ten individual metrics: taxa richness, Ephemeroptera taxa richness, Plecoptera taxa richness, Trichoptera taxa richness, number of intolerant taxa, number of sediment - intolerant taxa, percent dominance of the three most abundant taxa, proportion of tolerant taxa, proportion of sediment-tolerant taxa, and HBI. Higher values of this index indicate better water quality. This metric was developed by Rick Hafele and Shannon Hubler of the ODEQ specifically for the Grande Ronde Subbasin. It has not been tested in the Umatilla Subbasin, but shall be included in evaluating macroinvertebrates collected under this project.

In addition to the benthic macroinvertebrate samples, the following water quality measurements are made: turbidity, conductivity, pH, dissolved oxygen, and continuous water temperature. Turbidity is measured using a LaMotte 2020 Turbidimeter. Conductivity, pH and dissolved oxygen are measured using a WTW Multiline P4 meter. Continuous temperature is taken using Hobo H8 data loggers.

Macroinvertebrate surveys will continue to be repeated annually at project sites. Macroinvertebrate data will provide an additional element in comparatively detecting trends over time to assist in determining habitat enhancement effectiveness.

4. Water Temperature Monitoring:

Vemco Minilog Thermographs are deployed within selected stream reaches (see Table 2) in the upper Umatilla River Watershed. Several of these instruments are installed upstream, downstream and/or within project areas in the Umatilla River, Meacham Creek, Wildhorse Creek, Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Squaw Creek to monitor the effectiveness of habitat improvements on water temperature cooling. The remaining thermographs are installed in Moonshine Creek, Coonskin Creek, Little Buckaroo Creek, Eagle Creek, and at additional Umatilla River and Wildhorse Creek

sites to obtain data on potential habitat limiting factors and existing water quality conditions.

Thermographs are deployed in May. All instruments are recovered and downloaded into a computer program in October. The thermographs collect one temperature reading per hour. Water temperatures are graphed for warmer months (June, July, August and September) to determine if temperatures are reached which could prove detrimental to salmonids.

Table 2 – Thermograph locations for the 2002 and 2003 project periods.

	Location
1.	Umatilla River - RM 56.0 (West Reservation Boundary)
2.	Umatilla River - RM 76.5 (downstream from mouth of Squaw Creek)
3.	Umatilla River - RM 81.7 (USGS Gage Station No. 14020000)
4.	Wildhorse Creek – RM 0.0 (upstream from confluence with Umatilla River)
5.	Wildhorse Creek – RM 1.4 (Oregon Water Resources Gage)
6.	Wildhorse Creek – RM 9.5 (upstream from mouth of Greasewood Creek)
7.	Wildhorse Creek – RM 18.3 (at Pambrun Road Bridge)
8.	Wildhorse Creek – RM 26.0
9.	Greasewood Creek – RM 0.1 (upstream of confluence with Wildhorse Creek)
10.	Spring Hollow Creek - RM 3.5
11.	Eagle Creek - RM 0.2 (at Umatilla County Road 685 Bridge)
12.	Mission Creek - RM 1.25 (upstream of Umatilla County Road 900 Bridge)
13.	Mission Creek - RM 3.7 (upstream of St. Andrew's Church)
14.	Mission Creek - RM 3.8 (downstream of stream forks)
15.	Moonshine Creek – RM 1.1 (upstream of Umatilla County Road 900 Bridge)
16.	Coonskin Creek – RM 0.2 (upstream of Umatilla County Road 900 Bridge)
17.	Buckaroo Creek – RM 2.0
18.	Little Buckaroo Creek – RM 0.04 (upstream from confluence with Buckaroo Creek)
19.	Squaw Creek - RM 2.0
20.	Squaw Creek - RM 9.0 (at confluence with Little Squaw Creek)
21.	Meacham Creek – RM 1.4 (USGS Gage Station No. 14020300)
22.	Meacham Creek – RM 5.25 (East Reservation Boundary)

5. Suspended Sediment Monitoring:

Siltation, a leading cause of non-point source pollution, is especially harmful to fish and aquatic ecosystems. Sediments harm fish by reducing dissolved oxygen levels and by smothering eggs and newly hatched fry. Sediment deposits also can eliminate aquatic plants that provide cover for fish and the invertebrates they consume (Trout Unlimited, 1994).

Three Isco Model 2700 Wastewater Samplers are deployed to obtain estimates of suspended sediments. These sampling sites include RM 81.7 Umatilla River, RM 56.0 Umatilla River and RM 2 Meacham Creek. Sampling sites are located at USGS Gage Stations (see Table 3 below) and near CTUIR thermographs.

Samples are taken year round at 6-hour intervals to create a composite daily sample. The samples are collected every 21 days and analyzed by Umatilla National Forest Service (UNF) Personnel at the United States Forest Service (USFS) Lab in Pendleton, Oregon to determine turbidity in Nephelometric Turbidity Units (NTU), specific conductivity and total suspended solids (TSS). CTUIR staff correlate suspended sediment data with stream flow data collected from the adjacent gage stations to calculate total sediment load (tons/day).

Table 3 – Suspended sediment monitoring sites in 2002 and 2003.

Location
Umatilla River – RM 56.0 @ USGS Gage Station No. 14020850 (West Reservation Boundary)
Umatilla River – RM 81.7 @ USGS Gage Station No. 14020000 (East Reservation Boundary)
Meacham Creek – RM 2.0 @ USGS Gage Station No. 14020300

Objective III: Continue Watershed Planning, Scoping and Education Process by Identifying and Developing Creative Solutions to Land Use Problems Impacting Fisheries Habitat in the Umatilla River Basin.

1. Watershed Assessment:

Completion of the Umatilla Subbasin/Willow Creek Subbasin Summary and Meacham Creek Watershed Analysis and Action Plan, and continued development of the Umatilla Subbasin/Willow Creek Subbasin Watershed Assessment will assist in subwatershed prioritization of anadromous fisheries habitat needs and determination of future habitat improvements. A prioritization schedule for BPA funded fisheries habitat projects in the Umatilla Basin was last provided in the Umatilla Drainage Fish Habitat Improvement Implementation Plan (Oregon Department of Fish & Wildlife, USFS and CTUIR, 1988), which was produced in 1988. Many of the habitat enhancements, recommended in that document, are no longer biologically valid (in-stream hard structures, rip-rapping, etc).

Furthermore, some of the habitat deficient areas, identified in the plan, have been addressed. The updated documents, mentioned above, include information pertaining to historical watershed conditions, present-day watershed conditions, on-going land use practices, biological data, anadromous fish habitat limiting factors, and identify data gaps, and prove useful in guiding future project activities.

2. Community Outreach Efforts:

The project conducts local outreach efforts. Outreach activities are coordinated with landowners, special interest groups and resource agency personnel. These activities assist the project in obtaining public input and support, identifying detrimental land use practices, and developing site-specific habitat restoration and mitigation measures. Watershed improvement workshops, tours and presentations are provided to area residents, students, agency personnel and other interested individuals.

RESULTS AND DISCUSSION

Objective I. Maintain and Continue Implementation of Habitat Enhancement Projects throughout the Umatilla River Watershed.

1. Pre-construction Preparation:

a. Assess Maintenance Needs

The physical condition and structural integrity of improvements within the upper and mid Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Moonshine Creek, Cottonwood Creek, Buckaroo Creek, Squaw Creek and McKay Creek project areas were evaluated in spring and summer of 2002 and 2003. A well drilled in the vicinity of RM 12.0 Wildhorse Creek during the 2001 project period went dry during mid summer 2002. It was determined that it was necessary to drill to a deeper depth to sustain year-round water. An existing well near RM 10.0 Wildhorse Creek was renovated. The purpose of these wells is to provide off-stream livestock watering and eliminate repairs and associated high maintenance costs of existing water gaps.

A stream bank stabilization project implemented in fall 2001 on the Emma Stroud Property at RM 63.5 Umatilla River failed as a result of two high flow events, which occurred on February 24, 2002 and April 30, 2002. Three boulder J-vanes, which had been keyed into the south stream bank, failed and washed away from the bank. Bank failure at these structures acted as a lateral head cut and eroded upstream to the uppermost of eight previously installed root wad revetments in the vicinity of the mouth of Mission Creek. Soil, surrounding root wad revetments, eroded, and these trees were transported downstream. Flood flows undermined the lower stream bank and eroded approximately 780 feet of the bank. The majority of willows, previously planted at this site, were lost from these events. An extensive amount of bed load was deposited at the project site. Because the Umatilla River channel significantly shifted north at this location and the project site now primarily functions as a high flow channel, project personnel determined that reconstruction of damaged in-stream structures provided very little benefit to salmon and steelhead and was not feasible. However, due to concerns with bank instability and obligations under the existing riparian easement, the project decided that sloping and revegetation of the 780-foot eroded stream bank would prove beneficial.

It was determined that approximately 600 feet of overhead power lines, located at approximately RM 0.6 within the lower Meacham Creek Project Area, should be relocated outside of the riparian corridor and converted underground. This was due to concerns that Umatilla Rural Electric Co-op and Qwest Communications International, Inc. would remove recovering riparian vegetation, previously planted by the project and growing under the lines, at a future date.

Project personnel accomplished minor fence maintenance in project areas during the project periods.

b. Project Cost Share

A combined total of $ 346,965 in financial and in-kind cost share assistance was obtained

from various sources, in addition to landowner and agency in-kind contributions during the 2002 and 2003 project periods.

A total of $ 37,691.95 in CTUIR funds was secured to assist in covering personnel salaries, fringe benefits and associated overhead expenses. BPA monies funded the remaining $ 409,645 in salary, fringe benefit and overhead expense needs.

The BIA Umatilla Agency contributed $ 125,445 in BIA funds, $ 36,328 in Oregon State Weed Board Grant Program dollars and $ 15,000 in Rocky Mountain Elk Foundation grant funds for noxious weed treatments within Reservation watersheds. BPA project dollars provided an additional $ 2,999 to assist with noxious weed control in these areas. The BIA also provided an additional approximate $ 499 to assist the project with various per diem and Geographic Information Systems (GIS) training opportunities.

Trees to construct logjams and rental of an operator and excavator for an instream enhancement project between RM 87.0 and RM 87.3 were funded with $ 7,126 in EPA Rural Geographic Initiative (RGI) Funding. An estimated $ 16,947 in BPA project dollars funded personnel salaries and fringe benefits, travel costs, and indirect expenses associated with this project.

The U.S. Department of Agriculture's (USDA) Environmental Quality Incentive Program (EQIP) provided $ 84,028 and the EPA contributed an additional $ 21,782 in funds for pasture rotational fencing in the Buckaroo Creek Watershed. Approximately $3,868 in BPA dollars under this project were provided for purchase of fence construction materials. The purpose of this project is to better distribute livestock within the Buckaroo Creek Watershed and minimize grazing impacts in the riparian area.

Bill Wolfe Ranches, Inc. supplied a cattle guard, valued at approximately $ 980, to incorporate into a livestock exclusion fence between approximately RM 44.3 and 45.2 Umatilla River. BPA project dollars provided an additional $6,400 for construction of 4,787 feet of fencing and installation of the cattle guard.

Qwest Communications International, Inc. provided approximately $1800 worth of telephone cable and conduit to assist in relocating and converting approximately 600 feet of overhead phone lines at RM 0.6 Meacham Creek underground outside of the riparian corridor. Qwest's also contributed travel, personnel, fringe benefits and overhead expenses towards this project. These expenses are unknown.

The project and CTUIR EP/RP Personnel cooperatively collected daily suspended sediment data from three ISCO Model 2700 Wastewater Samplers at RM 2 Meacham Creek, RM 56 Umatilla River and RM 81.7 Umatilla River. EP/RP contributed $ 8,093 in EPA cost share funds to cover salary, fringe benefits and associated indirect costs for a CTUIR Water Quality Technician to collect data and service the sampling stations. The CTUIR Habitat Enhancement Project provided $ 7,388 in BPA project dollars to finance USFS lab analysis of sediment samples and associated indirect expenses.

OSU contributed $ 8,192 in in-kind support to cover salaries and associated fringe benefits, travel, monitoring equipment, field supplies and related indirect expenses for sampling and analysis of macroinvertebrates in the McKay Creek, Wildhorse Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek and Meacham Creek project areas. BPA monies supplied $ 5,730 to cost share laboratory time and data analysis.

An additional $ 130,000 was obtained for out-year implementation. The project coordinated with local NRCS staff and was awarded a $100,000 grant through the USDA's Wildlife Habitat Incentive Program (WHIP) to address out-year fish passage concerns throughout the Umatilla Basin. CTUIR also coordinated with the Columbia Inter-Tribal Fish Commission (CRITFC) and secured $ 30,000 in National Oceanic and Atmospheric Administration (NOAA) Pacific Coastal Salmon Recovery Funds (PCSRF) to address fish passage impediments. These funds will be cost shared with BPA monies for out-year fish passage improvement projects within the Birch Creek Drainage.

c. Clearances and Land Owner Agreements

A 15-year riparian conservation easement was secured with David and Judy Richards, and James and Alicia Musolino on July 1, 2002 for a property located between approximately RM 87.0 and 87.3 Umatilla River. In-stream enhancements and riparian protection measures were implemented at this site during the 2002 project period. The intent of these improvements is to stabilize the stream channel, increase in-stream habitat diversity, and encourage floodplain, wetland and riparian recovery.

The CTUIR secured a 15-year riparian conservation easement between RM 10.3 and 10.5 East Birch Creek during the 2002 project period. This agreement is with Fred W. Hachler and became effective on September 1, 2002. The easement restricts livestock from the riparian corridor to allow natural recovery and long-term protection of native plant communities.

A 20-year riparian conservation easement was entered into on January 25, 2003 between CTUIR and Bill Wolfe Ranches, Inc. This property is located between approximately RM 44.3 and 45.2 Umatilla River. The purpose of this project is to restrict livestock from the riparian corridor and promote passive habitat recovery.

The CTUIR obtained a Umatilla County Department of Public Works Permit for Installation of Utilities on County and Public Roads to tunnel and install PVC pipe under Umatilla County Road (CR) 973 (Adams Road) approximately 470 feet east of the Umatilla CR 857 (Rothrock Road) intersection. The pipe was routed from a reactivated well south under the roadway to a livestock water trough, located in a pasture adjacent to Wildhorse Creek. The purpose of this project was to provide off-stream water to livestock at approximately RM 10.0 of the existing Wildhorse Creek Riparian Habitat Enhancement Project Area.

d. Removal/Fill Permits

The project submitted a Joint Permit Application to the COE and ODSL to develop a single thread stream channel, construct three instream keyed log jams, create point bars and sting approximately 6,000 native willow cuttings into gravel bars between approximately RM 87.0 and 87.3 Umatilla River. ODSL granted a permit on July 9, 2002 and the COE issued a Nationwide Permit (NWP) No. 27 authorizing implementation of these enhancements.

A Joint Permit Application was submitted to COE and ODSL for construction of a boulder cross vane, three boulder J-vanes, three root wad revetments, two log jams, placement of downed trees in the stream channel and stinging approximately 5,000 native willow cuttings into gravel bars at approximately RM 83.0 Umatilla River. CTUIR experienced numerous delays with ODSL in processing the permit application, and a permit was not issued until

August 7, 2002. This stream reach is highly utilized by adult migrating, holding and spawning spring Chinook salmon. Thus, the instream work window in this reach is considerably shorter than most areas of the basin and concluded on August 15, 2003. In order to complete the project, the CTUIR requested and received an In-Water Timing Extension from ODSL on August 13, 2002. The COE insisted in delaying issuance of a permit until receiving concurrence from SHPO that the proposed project complied with Section 106 of the National Historic Preservation Act. Although, the CTUIR had previously provided the COE and SHPO with a copy of CTUIR CRPP's cultural resource inventory for this property, which indicated that "there will be no effect as per the National Historic Preservation Act". CTUIR proceeded without a permit from COE because of instream time constraints. A permit was eventually provided, after the fact, by COE on June 6, 2003.

A SZAP was obtained from the CTUIR Department of Natural Resources (DNR) - Water Resources Program on June 10, 2003 to repair 780 feet of eroded stream bank at the previously implemented (fall 2001) Emma Stroud Stream Bank Stabilization Project at RM 63.5 Umatilla River. Permitted activities included sloping the 780 feet of vertical stream bank to a 2:1 slope, constructing a trench at the toe of the slope, installing approximately 3,000 native willow cuttings within the trench and stinging approximately 1,000 native willow cuttings into the stream bank. The COE authorized these activities under a NWP No. 13 on September 15, 2003. A removal/fill permit was not required from ODSL for this work because the project was located within Reservation Boundaries.

The project received a SZAP on April 26, 2002 from the CTUIR DNR - Water Resources Program for trenching in approximately 1,000 native willow cuttings at RM 21.5 McKay Creek. This project was accomplished with local students during the Umatilla-Morrow County Educational Service District's (ESD) Watershed Field Day in early May 2002. A removal/fill permit was not required from ODSL for this work because the project was located within Reservation Boundaries.

e. Endangered Species Act Requirements

CTUIR Habitat Enhancement Project Staff prepared BA's in conjunction with removal/fill permit applications for (1) development of a single thread stream channel, construction of three instream keyed log jams, creation of point bars and stinging approximately 6,000 native willow cuttings into gravel bars between approximately RM 87.0 and 87.3 Umatilla River (Richard's Riparian Restoration Project, also referred to as Station 29), (2) construction of a boulder cross vane, three boulder J-vanes, three root wad revetments, two log jams, placement of downed trees in the stream channel and stinging approximately 5,000 native willow cuttings into gravel bars at approximately RM 83.0 Umatilla River (Hartman's Riparian Restoration Project), (3) sloping 780 feet of vertical stream bank to a 2:1 slope, constructing a trench at the toe of the slope, installing approximately 3,000 native willow cuttings within the trench and stinging approximately 1,000 native willow cuttings into the stream bank at approximately RM 63.5 Umatilla River (Stroud Bank Stabilization Project).

The Richards' Riparian Restoration Project BA concluded that implementation of the project at RM 87.0 - 87.3 Umatilla River "may affect, but is not likely to adversely affect threatened Mid-Columbia summer steelhead and bull trout. High summer stream temperatures and low flows will reduce bull trout distribution within the project area during the instream work window. We predict no affect on bald eagle and Canada Lynx because these species have not been found to utilize the project area. The watershed restoration effort is likely to have

overall beneficial effects". This BA was submitted to BPA Environmental Compliance Staff to forward onto the USFWS and NMFS to initiate ESA, Section 7 consultation proceedings for the proposed project. In a September 18, 2001 Biological Opinion (BO), NMFS concluded that "the proposed action is not likely to minimize potential for incidental take associated with this project". The USFWS concurred with CTUIR and BPA on April 8, 2002 that "the proposed action is not likely to adversely affect bull trout".

The Hartman's Riparian Restoration Project BA indicated that implementation of the project at RM 83.0 Umatilla River "may affect, likely to adversely affect Mid-Columbia summer steelhead. Steelhead could be rearing in the vicinity of the project and may potentially be disturbed by increases in sediment resulting from implementation. CTUIR staff also concludes that project implementation may affect, but is not likely to adversely affect bull trout. High summer stream temperatures and low flows will reduce bull trout distribution within the project area during the instream work window. During the summer months, bull trout are typically distributed in the upper reaches of the river on Umatilla National Forest land. We predict no affect on bald eagle and Canada Lynx because these species have not been found to utilize the project area, particularly in the summer months. The watershed restoration effort is likely to have overall beneficial effects". This BA was submitted to BPA Environmental Compliance Staff to forward onto the USFWS and NMFS to initiate ESA, Section 7 consultation proceedings for the proposed project. The USFWS concurred on May 2, 2002 that "the project may affect, but is not likely to adversely affect bull trout or their designated critical habitat". In a July 19, 2002 BO, NMFS concluded that "the proposed action is not likely to jeopardize Middle Columbia River steelhead".

The Stroud Bank Stabilization Project BA determined that project implementation at RM 63.5 Umatilla River "may affect, but is not likely to adversely affect threatened Mid-Columbia summer steelhead. We predict no affect on bull trout, bald eagle and Canada Lynx. The watershed restoration effort is likely to have overall beneficial effects. High summer stream temperatures and low flows will prevent bull trout distribution within the project area during the instream work window". This BA was submitted to BPA Environmental Compliance Staff for review. Upon review, BPA agreed with CTUIR's assessment of potential effects and forwarded the BA onto the USFWS and NMFS to initiate ESA, Section 7 consultation proceedings for the proposed implementation activities. The USFWS determined on May 22, 2003 that "the proposed project will have no effect on the listed species (Canada Lynx, bald eagle and bull trout) and result in no adverse modification of proposed critical habitat". NMFS staff concurred with the CTUIR and BPA determinations "that the proposed Stroud Bank Stabilization Project is not likely to adversely affect Mid-Columbia summer steelhead" in a June 19, 2003 letter to BPA.

ESA clearances were received for all proposed 2002 and 2003 instream habitat enhancements.

f. Cultural/Archeological Monitoring

The CTUIR CRPP previously conducted file and literature searches and cultural resource surveys on the Bill Wolfe Ranches, Inc. property (RM 43.3 to RM 46.5 Umatilla River), Emma Stroud property (RM 63.5 Umatilla River) and David Richards' property (RM 87.0 - 87.3 Umatilla River) in 2001. Information regarding these surveys was included in the 2001 project report.

A cultural resource surface survey was conducted on the Tommy Hartman property (RM

83.0 Umatilla River) on July 2, 2002. The survey was initiated in the downstream area of the proposed project site and proceeded to the upstream boundary along the river's edge and back to the starting point along a transect approximately 15 m from the river. The project site was surveyed in this fashion on both, north and south sides of the river. One isolated find, the remains of a plow share, was discovered on a gravel bar within the stream channel. This object was recorded in a report titled, *A Cultural Resource Inventory of the Tom Hartman Property, Umatilla County, Oregon* (Miller, 2002). The plow share is not eligible for inclusion into the National Register of Historic Places. Therefore, it was determined that that there would be no effect as per the National Historic Preservation Act, and the CRPP recommended that proposed project activities be implemented. The above-mentioned report was submitted to the SHPO.

The CTUIR CRPP surveyed the floodplain adjacent to the existing lower Meacham Creek Project Area at approximately RM 0.6 on October 7, 2003. This survey was conducted because a trench was proposed to be excavated outside of the riparian corridor to covert approximately 600 feet of overhead power lines underground. A Global Positioning Satellite (GPS) reading was obtained at the downstream end of the proposed project site. The reading was 5,061,574 m north and 394,754 m east, Universal Transverse Mercator (UTM) Zone 11. No cultural resources were observed at the site.

Due to the potential of disturbing subsurface archeological resources, a cultural resource monitor was required on site during excavation activities at RM 87.0 - 87.3 Umatilla River, RM 83.0 Umatilla River and RM 0.6 Meacham Creek. The cultural resource monitor's salary was funded with project monies. No subsurface archeological resources were discovered at either of these sites during excavation.

g. Design and Layout

The project's assistant habitat biologist developed designs to stabilize 780 feet of eroding stream bank and improve riparian habitat conditions at RM 63.5 Umatilla River.

Project designs had previously been completed by the CTUIR hydrologist and the project's assistant biologist during the 2001 project for (1) development of a single-threaded channel to decrease stream bank erosion, improve instream salmonid rearing conditions, and restore riparian and floodplain function between RM 87.0 and 87.3 Umatilla River, and (2) increase stream sinuosity and total channel length to achieve a lower channel gradient, increase stream bank and channel stability, provide over bank flow and improve in-stream habitat diversity at RM 83.0 Umatilla River.

CTUIR Habitat Enhancement Project Technicians closely coordinated the layout of fence lines and gate locations with (1) Bill Wolfe Ranches, Inc. for proposed construction of 4,787 feet of four-strand barbed-wire livestock exclusion fencing between RM 44.3 and 45.2 Umatilla River, (2) Fred Hachler for construction of 950 feet of five-strand smooth-wire fencing between RM 10.3 and 10.5 East Birch Creek, and (3) David Richards to build 1,100 feet of four-strand barbed-wire fencing between RM 87.0 and 87.3 Umatilla River.

h. Contracts and Professional Services Agreements

CTUIR Habitat Enhancement Project Personnel met with subcontractors, prior to proposed project implementations, to discuss subcontract terms and work performance requirements, work progress schedules, petroleum spill plans, and fire prevention and suppression plans.

A $ 4,950 professional services agreement was awarded to Thacker Excavating, Inc. on April 10, 2002 to transport 200 cubic yards of rock, stored at the Emma Stroud Project Area (RM 63.5 Umatilla River), to the Tom Hartman Project Area (RM 83.0 Umatilla River) for construction of a boulder cross vane and three boulder J-vanes.

The project hired Thacker Excavating Inc. for $ 1,940 to excavate and backfill a trench located at approximately RM 21.5 McKay Creek for local students to plant approximately 1,000 native willow cuttings during the ESD Watershed Field Day in early May 2002.

W-4 Construction, Inc. entered into a contract with the CTUIR on July 10, 2002 to provide and transport ten large conifer root wads with attached boles and five logs to RM 83.0 Umatilla River and ten large conifer root wads with attached boles to the David Richards project site (RM 87.0 - 87.3 Umatilla River) for construction of root wad revetments and instream log jams. Root wads delivered to the David Richards property were purchased with $ 2,750 in EPA RGI Funds. Root wads and logs delivered to the Tom Hartman property were funded with $ 3,325 in BPA project funds.

A $ 4,376 subcontract was awarded to A. Key Excavating, Inc. on July 22, 2002 for constructing instream log jams, creating point bars from river gravels, moving stream bed materials and stinging native vegetation into stream banks and gravel bars between RM 87.0 and 87.3 Umatilla River. This subcontract was funded with EPA RGI funds. BPA dollars covered personnel expenses for bid processing and contract development.

A. Key Construction, Inc. was subcontracted at $ 9,180 on August 8, 2002 to construct a boulder cross vane, three boulder J-vanes, three root wad revetments, two log jams, place existing downed trees within the stream channel and sting native vegetation into stream banks at RM 83 Umatilla River.

Wallace Drilling was hired for $ 2,700 on September 25, 2002 to re-drill a well, located at approximately RM 12.0 Wildhorse Creek, an additional 100 feet to provide off-stream livestock watering at the upper Wildhorse Creek Project Area. A 105-foot well initially drilled at this site during fall 2001/winter 2002 went dry in early summer 2002.

Van-Dorn East, Inc. bored a total of 120 feet under Umatilla CR 973 and CR 857 with a directional bore and installed 210 feet of PVC pipe and electrical conduit for off-stream livestock watering at approximately RM 10.0 of the existing Wildhorse Creek Habitat Enhancement Project Area on September 9, 2002. These services cost $2,954. The PVC pipe was connected to a well north of CR 973 and to a water trough south of this road way.

Alabar Construction, Inc. was hired at a cost of $2,860 to ditch-witch a trench for installation of a water line from Umatilla CR 973 to a livestock water trough and to pour a concrete base pad for the water trough at RM 10.0 Wildhorse Creek on October 17, 2002.

A $4,567 livestock exclusion fence subcontract was awarded to Calvin R. Hendrickson on November 26, 2002 for construction of 950 feet of five-strand smooth-wire fencing and one metal gate between RM 10.3 and 10.5 East Birch Creek (Fred Hachler property) and 1,100 feet of four-strand barbed-wire fencing and two metal gates between RM 87.0 and 87.3 Umatilla River (David Richards property).

Doherty Fence LLC was subcontracted for $ 4,908 on January 28, 2003 to construct 4,787 feet of four-strand barbed-wire livestock exclusion fencing and two wire gates, and install nine metal gates between RM 44.3 and RM 45.2 Umatilla River (Bill Wolfe Ranches, Inc. Property). An additional $ 2,376 was paid Doherty Fence to remove portions of existing fencing.

Rod Anderson Construction was paid $ 1,500 on January 24, 2003 for installation of a cattle guard in conjunction with the livestock exclusion fencing between RM 44.3 and RM 45.2 Umatilla River.

Thacker Excavating, Inc. entered into a $ 2,680 operated equipment subcontract with the CTUIR on October 1, 2003 to slope approximately 780 feet of vertical stream bank to a 2:1 slope, construct a trench at the toe of the slope, install approximately 3,000 native willow cuttings within the trench and sting approximately 1,000 native willow cuttings into the stream bank at the existing Emma Stroud Stream Bank Stabilization Project at RM 63.5 Umatilla River.

Indian Heaven Construction was hired on January 13, 2003 at a cost of $1,800 to excavate and fill a trench for relocation of 600 feet of overhead phone and electric lines, located at approximately RM 0.6 within the lower Meacham Creek Project Area, for conversion underground outside of the riparian corridor.

Umatilla Rural Electric Co-op was paid $7,778 to relocate the above mentioned 600 feet of overhead electric power lines underground on October 27, 2003.

McLain Spraying was subcontracted for $ 20,420 to eradicate noxious weeds in approximately 8.3 miles of stream corridor within the mid Umatilla River, McKay Creek, Wildhorse Creek, Greasewood Creek, the West Fork of Greasewood Creek, Spring Hollow Creek and Mission Creek project areas. Umatilla County Weed Control was subcontracted for $ 2,999 (combined 2002 and 2003 costs) to address noxious weed problems in 7.4 stream miles of riparian habitat within the Buckaroo Creek, lower Meacham Creek, Boston Canyon Creek and upper Umatilla River project areas.

CTUIR Habitat Enhancement Project Personnel inspected all equipment utilized under the above agreements upon project initiation and determined all equipment was in good working order and free from excessive leaks in hydraulic, fuel and power systems.

2. Maintain and Implement Habitat Enhancements:

a. Instream and Stream Bank Improvements

An instream enhancement project was implemented between approximately RM 87.0 and 87.3 Umatilla River within a three mile stream reach, where instream and vegetative enhancements were previously implemented upstream and downstream of this site by the ODFW. Implementation of this project ensured connectivity, assisted in stabilizing the previous enhancements and extended the total length of the restored stream reach. This project was closely coordinated with ODFW to ensure that all habitat improvements were consistent with their previous work. Project engineering and design were completed by the same hydrologist (now a CTUIR employee) as ODFW had retained for prior implementations.

This reach of the river was determined to be an unstable Rosgen “B-type” channel. The channel form was in dynamic equilibrium with the physical constraints of the local floodplain and unable to maintain its dimension pattern and profile. The project site contained a wide stream channel, lacking channel stabilizing vegetation and LWD, a key component for forming pools. The goal of this project was to utilize meander enhancement to develop a single-thread channel with a low width to depth ratio. Meander enhancement has the advantage of utilizing the floodplain to disperse energy. This is a more desirable flow feature instead of maintaining concentrated flows in an entrenched or braided channel with extraordinarily high velocities.

An overview of pre-project site conditions and an implementation plan can be viewed under “Dave Richards’ Property” in Appendix A. Three logjams were keyed into stream banks and gravel bars to encourage channel meander throughout the project length. The logjams are collectively comprised of ten whole Douglas fir and grand fir trees. The trees have a minimum length of 50 feet, a minimum diameter at breast height (DBH) of 18 inches and a minimum root wad diameter of 4 feet. The constructed logjams are noted as sites 1, 2 and 4 in the implementation plan. These LWD additions will provide multiple benefits including, promotion of point bar stability, provision of instream and overhead cover for fish, provision of shade, detritus, terrestrial insect habitat, and slowing the stream’s hydraulic energy.

Several gravel bars, comprised of approximately 904 cubic yards of gravels, were incorporated into one larger point bar within the upper project area (site 3 in implementation plan) to reduce stream braiding. Approximately 215 cubic yards of streambed gravels were shifted from the south bank to the north bank in the lower project area (site 5 in implementation plan) to assist with meander enhancement. These enhancements are expected to improve channel morphology, instream cover, width to depth ratios, and stream bank stability.

The project also included the installation of 6,000 native willow cuttings in stream banks and gravel bars and construction of livestock exclusion fencing to promote growth of riparian vegetation. Plant reestablishment will provide additional bank stabilization, encourage pool development, increase insect drop for fish, aid in the reduction of water temperatures, improve bank storage, and improve natural floodplain and channel function.

Overall, this project will result in increased pool habitat complexity, regeneration of a healthy and self-sustaining riparian zone, and ultimately improved water quality and increased fish abundance.

An instream project was implemented at approximately RM 83.0 Umatilla River during late summer of 2002. The landowner, Tom Hartman, initially approached the CTUIR requesting assistance in removing LWD from the stream channel to prevent potential flooding of his home. He also indicated that he was extremely interested in improving spring Chinook spawning, holding and rearing habitat. After conducting a hydrological assessment of existing stream channel and instream habitat conditions, the CTUIR determined that aquatic and riparian habitat would benefit from a project, which improved stream bank stability and provided over bank flow.

Floodplain developments, combined with geologic control, had limited available space for lateral channel movement resulting in a constrained stream reach within the vicinity of the project, as well as the reach immediately upstream of the project site. Physical structures in

key locations had also limited access to the floodplain for surface flow during large, channel shaping events. Land management activities had altered riparian vegetation composition and density, promoting downcutting and stream bank instability.

The pre-project channel form was a single, overextended meander bend along a length of 950 feet. The channel morphology demonstrated signs of instability with a bankfull width that varied between 80 and 90 feet and a low sinuosity of approximately 1.1. Meander length was approximately 850 feet, and the radius of curvature was in excess of 400 feet. Channel gradient was 0.7% for the entire project length but varied greatly throughout the reach with the upper portion being a steep riffle (3.3%), while the lower portion consisted of a flat pool and glide (0.3%).

The project reach is relatively secluded from channel bed adjustments, occurring within upstream and downstream reaches, due to bedrock channel features located at each end of the project site that control vertical and horizontal movement. The bedrock controls provided an opportunity to manipulate channel morphology within the project to improve hydrologic conditions and enhance habitat features with a reduced risk of failure. The goal of this project was to improve stream bank and channel stability, while providing over bank flow and enhancing instream and riparian habitat.

An overview of pre-project site conditions, an implementation plan, illustrating new habitat enhancements, and structure specifications can be viewed under “Tom Hartman’s Property” in Appendix B. Project implementation involved utilizing an excavator to increase sinuosity and total channel length, resulting in a lower channel gradient. Meander belt width at the site was limited to 300 feet due to the combination of geology and developments within the floodplain. In order to compensate for a more confined channel configuration and to coordinate the geometry with existing bedrock control points, the meander length was shortened to 450 feet, while the radius of the curvature was constructed to approximately 170 feet with a bankfull width of 80 feet. The new channel realignment involved removing a total of 700 cubic yards of streambed materials from two locations and depositing them into point bars on both the north and south banks to create a new thalweg.

Three root wad revetments with footer logs were placed in parallel into the north stream bank within the upper portion of the project area. The revetments extended an existing stable bank configuration, resulting from the upstream presence of a small community of established alder and locust trees. Root wad revetments consist of a footer log placed parallel to flow, below the elevation of the channel bottom and a root wad with attached bole placed on top and keyed into the stream bank below bankfull level. Each root wad has a minimum total length of 18 feet, a minimum DBH of 18 inches and a minimum root wad diameter of four feet. Each footer log has a minimum length of 18 feet and a minimum diameter at the base of 18 inches.

Two large down trees with attached root wads, lying within the reach, were relocated downstream in their whole form to assist in stabilizing a constructed point bar on the north bank. These trees were placed parallel to stream flows and partially buried into the point bar at and above bankfull level. Two additional logs were utilized to pin the furthest upstream tree into the existing stream bank. A whole tree logjam was also constructed on the downstream point bar, located on the south bank. The logjam is comprised of seven large conifers with a minimum length of 50 feet, a minimum DBH of 18 inches and a minimum root wad diameter of four feet. LWD additions are intended to reduce flow velocity across the point bars and increase sediment deposition along stream banks and inside of meander

bends.

Two types of large boulder structures were constructed to improve vertical stability of the channel throughout the stream reach. Both structure types utilized three to four-foot diameter boulders as a structural base with smaller spoils used for fill and bank armor. A low elevation cross vane, comprised of 180 cubic yards of rock, was constructed across the entire channel at the thalweg crossover location. This double row boulder structure was keyed eight to ten feet into each bank and acts to maintain channel elevation, while providing pool features on the downstream side. Three J-vanes, each comprised of approximately 43 cubic yards of rock, were constructed on the north bank in the downstream portion of the project area. The J-vanes are approximately 35 feet in length and spaced 52 feet apart. Each J-vane consists of a foundation layer of rock buried into the stream channel bed below the substrate elevation and placed upstream at a 30 to 40-degree angle. A second layer of boulders was installed on the upstream portion of each structure and at a slightly higher elevation. The top of each structure resides at approximately two-thirds of bankfull stage. Each structure was keyed approximately eight to ten feet into the stream bank, and the channel end of each structure is hooked downstream to assist in pocket pool formation and thalweg definition. These structures were incorporated into the project to arrest erosion along the toe of the stream bank and halt undercutting, yet allow over bank flow onto the floodplain. They also assist in defining thalweg location and maintaining a deep channel.

Approximately 5,000 native willow cuttings were collected by CTUIR project technicians. Trenches were excavated in the stream channel margin and a stinger was utilized to create holes in instream structures and point bars to insure that the willows were planted at a year-round water table depth. Reestablishment of native plant communities will insure long term stability of the site by promoting vegetative regeneration and succession, reducing erosion potential and sediment deposition, providing recruitable LWD and improving aquifer storage. Biological benefits shall include increased insect drop, stream channel shade and thermal cover for various species of mammals and birds.

Overall benefits achieved from this project included: (1) arresting bank undercutting and mass wasting on the north stream bank, (2) improving channel morphology through increasing channel sinuosity and reducing width to depth ratios, (3) improving floodplain connectivity by improving bank stability and reestablishing native vegetation communities, and (4) improving salmonid habitat by increasing pool habitat and hiding cover.

The CTUIR implemented a stream bank repair project during fall 2003 at an existing project site, located at approximately RM 63.5 Umatilla River. The intent of the initial 2001 project was to arrest bank undercutting and mass wasting along 330 feet of the south stream bank, immediately downstream of the Mission Creek confluence, through installation of instream structures and native vegetation. However, two high flow events on February 24, 2002 and April 30, 2002, eroded behind three boulder J-vanes. Bank failure at these structures acted as a lateral head cut and eroded upstream to the uppermost of eight root wad revetments in the vicinity of the mouth of Mission Creek. Soil, surrounding root wad revetments, eroded, and these trees were transported downstream. Flood flows undermined the lower stream bank and eroded approximately 780 feet of the bank. The majority of willows, previously planted at this site, were lost from these events. An extensive amount of bed load was deposited, shifting the channel north at this location, and the project site now primarily functions as a high flow channel.

Because of the dramatic morphological changes that occurred after the April 30, 2002 event, project personnel determined that reconstruction of damaged instream structures provided very little benefit to salmon and steelhead and was not feasible. The channel at this site now remains puddled or dry during spring and fall months. The landowners insisted that CTUIR repair the bank, primarily out of concern for potential flooding of their residence, and threatened legal action, indicating that no action by CTUIR could be interpreted as "breach of contract". However, it was clearly stated within the easement that, "It is not the intent of this Agreement to control natural flood events.", and "the CTUIR may choose to implement instream work activities during the agreement period". Thus, the CTUIR is not legally obligated to implement instream measures on the property. This property is located within the ten-year floodplain (US. Army Corps of Engineers, 1999) and remains at high risk of flood damage. The project leader encouraged the landowners to explore any and all avenues to relocate their home out of concern for their safety.

Due to concerns with bank instability and obligations under the existing riparian easement (the easement indicates that vegetative measures will be implemented during the first five years of the agreement), the project determined that sloping and revegetation of the eroded stream bank would prove beneficial and necessary. Implementation activities included (1) sloping the 780 feet of eroded stream bank to a 2:1 slope, (2) constructing a trench at the toe of the slope, (3) installing approximately 3,000 native willow cuttings within the trench and (4) stinging approximately 1,000 native willow cuttings into the stream bank. Because this project is enrolled under a perpetual easement, the CTUIR has indefinite management authority of this property. Therefore, the small additional investment to repair and revegetate the stream bank and high flow channel was worthwhile. Reestablishment of native plant communities will promote vegetative regeneration and succession, provide recruitable LWD and improve aquifer storage. Biological benefits shall include increased insect drop and thermal cover for various species of mammals and birds.

b. Fish Passage Improvements

The project's 2003 Statement of Work (SOW) proposed the following new passage improvement and repairs to existing passage improvement sites (1) removal of a passage barrier, located on the Gordon Munct property, at approximately RM 1.0 Mission Creek, (2) repair of a head wall cut upstream of a bottomless arch culvert at RM 3.0 Mission Creek (project implemented in 2001), and (3) installation of two rock control structures downstream of an engineered stream ford at approximately RM 3.0 Mission Creek (project implemented in 2001) to stabilize the ford and prevent future passage issues.

None of these improvements were implemented in 2003 due to the project's assistant habitat biologist resigning, resulting in a shortage of technical staff available to complete necessary environmental and permitting clearances. A BPA Fiscal Year (FY) 2003/2004 Rescheduling Request was submitted to BPA in fall 2003, requesting $ 14,000 in rescheduled funds for completion of these projects during FY 2004. The project's BPA Contracting Officer's Technical Representative indicated early in 2004 that it was unlikely that these funds were obtainable and tasks involving these projects should be removed from the 2004 SOW. Thus, the project leader removed these tasks from the SOW. However, at the time of this writing, BPA has contacted project staff and indicated that we should plan on receiving the requested $ 14,000 in rescheduling funds. The project will attempt to implement these passage improvements in 2004.

c. Livestock Exclusion and Riparian Corridor Fencing

A total of 950 feet of five-strand smooth-wire fencing was constructed and one Hi-Qual Gate installed on the Fred Hachler Property between RM 10.3 and 10.5 East Birch Creek on the south side of the stream, immediately downstream from the mouth of Pearson Creek. The purpose of this fence is to exclude livestock from the riparian corridor to promote vegetative recovery and provide long-term habitat protection. The landowner on the north side of this stream reach had previously fenced off the riparian corridor on his property.

An 1,100-foot four-strand barbed-wire fence was constructed and two Hi-Qual Gates installed on a property, owned by David and Judy Richards and James and Alicia Musolino, between approximately RM 87.0 and 87.3 Umatilla River on the north side of the stream. The purpose of this fence is to provide vegetative recovery via excluding trespass livestock from the riparian corridor and portions of the floodplain. This fencing project complements instream enhancements (previously described under "Instream and Stream Bank Improvements") also implemented at the site during the 2002 project period. Fencing was not required on the south side of the stream because an abrupt hillside prevents livestock entry. Cross section fences were installed at the upstream and downstream project boundaries.

The project constructed 4,787 feet of four-strand barbed-wire livestock exclusion fencing and two wire gates, and installed one Powder River and eight Hi-Qual gates and a cattle guard between RM 44.3 and 45.2 Umatilla River on the south side of the stream (Bill Wolfe Ranches, Inc. Property). This effort linked into 11,264 feet of downstream fencing that was previously constructed during the 2001 project period on the Bill Wolfe Ranches, Inc. Property. The purpose of this fence is to exclude livestock from portions of the floodplain and riparian corridor, encouraging natural vegetative recovery and long-term habitat protection. All fences were built to NRCS specifications.

The CTUIR Habitat Enhancement Project continued to provide fence materials to the CTUIR Department of Natural Resources – EP/RP and BIA staffs to complete construction of 21,300 feet of pasture rotational fencing in the Buckaroo Creek Watershed. The purpose of this project is to better distribute livestock within BIA Range Reservation Units Two and Six and minimize grazing impacts in the riparian area. BPA project funds were cost shared with EQIP and EPA moneys to implement this project.

Minor fence repairs and water gap maintenance were performed by CTUIR Habitat Enhancement Project Personnel in the Umatilla River, Meacham Creek, Boston Canyon Creek, Mission Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Buckaroo Creek, Squaw Creek and McKay Creek project areas.

d. Off-stream Livestock Water Developments

A 105-foot well, drilled during the 2001 project period to provide off-stream livestock watering at approximately RM 12.0 Wildhorse Creek, went dry during mid summer 2002. Wallace Drilling was re-hired to drill this well an additional 100 feet in depth to sustain year-round water. The subcontractor provided a "Water Supply Well Report" to the Oregon Water Resources Department (OWRD) upon completion of well drilling activities.

PVC pipe and electrical conduit were routed from an existing well, renovated by the CTUIR

in 2001, and plumbed into an off-stream livestock water trough. This project involved installing the pipe to a pump within the well's pump house, routing the pipe and conduit south under Umatilla CR 973 and into a pasture for off-stream livestock watering (outside of the riparian enhancement area) at approximately RM 10.0 of the existing Wildhorse Creek Project Area (S&M Farms Property). A trough was installed to provide water, and a concrete base pad was constructed for the water trough. The project also bored under Umatilla CR 857, installed pipe and conduit from the pasture under this road and into another smaller pasture west of the road. Out-year implementation efforts shall include development of an additional off-stream water source in the smaller pasture. A total of 120 feet was bored under Umatilla CR 973 and 857, and a total of 210 feet of PVC pipe and electrical conduit was installed.

e. Revegetation

The CTUIR Habitat Enhancement Project Staff gathered and planted an approximate total of 15,000 native willow (*Salix spp.*) cuttings during the 2002 and 2003 project periods. These were planted at RM 87.0 and 87.3 Umatilla River, RM 83.0 Umatilla River and RM 63.5 Umatilla River during instream project implementation. All willow cuttings were stung into stream banks with a stinger mounted on an excavator bucket or trenched into stream channel margins with an excavator. These planting techniques achieve greater soil depths, insuring that cuttings are placed well within the annual water table, resulting in increased tree survival.

An additional 1,000 native willow cuttings were collected by project technicians and provided to students for planting within the project's existing RM 21.5 McKay Creek Project Area during the 2002 and 2003 ESD Watershed Field Days. Plant source materials for all of these projects were locally obtained from within the Umatilla River Basin.

Stream banks and terraces, disturbed from implementation activities between RM 87.0 and 87.3 Umatilla River and at RM 83.0 Umatilla River, RM 63.5 Umatilla River and RM 0.6 Meacham Creek were seeded with a total of 350 pounds of native bunch grasses or native grass/legume equivalents. The grass seed utilized at these sites was comprised of a mixture which included 25% Sherman big bluegrass (*Poa ampla*), 25% Critania thickspike wheatgrass (*Agropyron dasystachyum*), 25% Whitmar beardless wheatgrass (*Agropyrun inerme*) and 25% Magnar Great Basin wildrye (*Elymus cinereus*). A total of 4,000 native basin wildrye grass plugs was also planted at RM 63.5 Umatilla River and RM 0.6 Meacham Creek. Seeding of native grasses and native grass equivalents assists with stream channel stabilization and sediment filtering during high flow periods.

f. Noxious Weed Control

McLain Spraying was subcontracted to eradicate noxious weeds in approximately 8.3 miles of stream corridor within the mid Umatilla River, McKay Creek, Wildhorse Creek, Greasewood Creek, the West Fork of Greasewood Creek, Spring Hollow Creek and Mission Creek project areas during the 2002 and 2003 project periods. Umatilla County Weed Control was hired to address noxious weed problems on the Reservation in 7.4 stream miles of riparian habitat within the Buckaroo Creek, lower Meacham Creek, Boston Canyon Creek and upper Umatilla River project areas during these periods. BIA - Umatilla Agency Range Management Staff coordinated closely with project personnel and Umatilla County Weed Control to assist in providing cost share and addressing noxious weeds in upland areas within these drainages.

Weeds treatments involved annually applying two to three herbicide applications with a backpack sprayer and hand wand during each growing season. The project prioritized eradicating weeds designated as "A" Pest Weeds on Umatilla County's Noxious Weed List because these weeds are much more evasive and ecologically considered to be more of a threat to native plant communities. Other invasive weed species were treated as deemed necessary.

Following completion of annual treatments, the project supplied BPA with a summary including acres treated, application methods employed, treatment dates, herbicides utilized, percent active ingredient in herbicides, type and percent of each adjuvant used and herbicide application rates per acre. All chemical applications were consistent with ORS.570.505, FIFRA Regulations, and NMFS and USFWS recommendations regarding ESA concerns.

3. Post-implementation Final Review:

All subcontractors maintained a daily log and work progress schedule.

CTUIR Habitat Enhancement Project Personnel inspected all instream and stream bank improvements, including sloped stream banks, constructed point bars, root wad revetments, cross and J-vanes, constructed log jams and willow plantings at mid and upper Umatilla River project sites, immediately following project implementation.

Fencing constructed at mid and upper Umatilla River project sites and at the East Birch Creek project site was inspected to ensure consistency with CTUIR contract specifications and ODFW smooth-wire and NRCS barbed-wire construction specifications.

A well drilled and associated off-stream livestock water developments were inspected in Wildhorse Creek project areas to ensure contract conformity.

Umatilla County Weed Control and McLain Spraying provided annual descriptions and summaries of all noxious weeds identified and treated in project areas. Project personnel coordinated closely with these subcontractors and individual landowners to assure that nuisance weeds were adequately identified and eradicated.

All subcontract services, implemented during the 2002 and 2003 project periods, met subcontract requirements and were completed in a satisfactory and timely manner. CTUIR Habitat Enhancement Project Personnel photo documented various stages of project implementations.

Objective II. Collect Baseline Data to Assess Pre-project Conditions and Continue Post-project Monitoring to Identify Habitat Limiting Factors and to Quantify Short and Long-Term Effects of Habitat Enhancement Activities in the Umatilla River Basin.

1. Geomorphologic and Hydraulic Data Monitoring:

The project funded Jim Webster, the CTUIR Hydrologist, to assist the project's assistant habitat biologist in obtaining baseline physical data and assessing geomorphologic and hydrologic conditions at proposed project sites. This information is included within the following paragraphs.

A longitudinal survey was conducted in conjunction with a cross section survey prior to project implementation between approximately RM 87.0 and 87.3 Umatilla River (see Figure 3 below). Longitudinal survey data provided a graphical representation of the streambed contour. Two cross sections were established in the project area prior to implementation of habitat enhancements (see Figure 4 and Figure 5 on the following page). These measurements will be repeated at three to five year intervals.

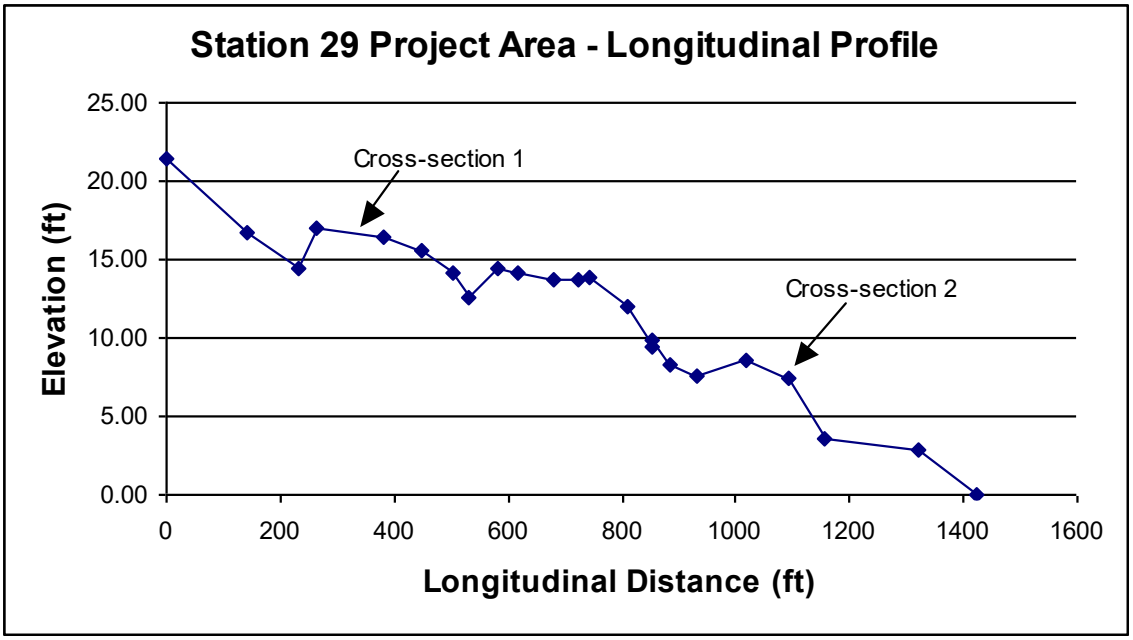


Figure 3 – A longitudinal survey between approximately RM 87.0 and 87.3 Umatilla River.

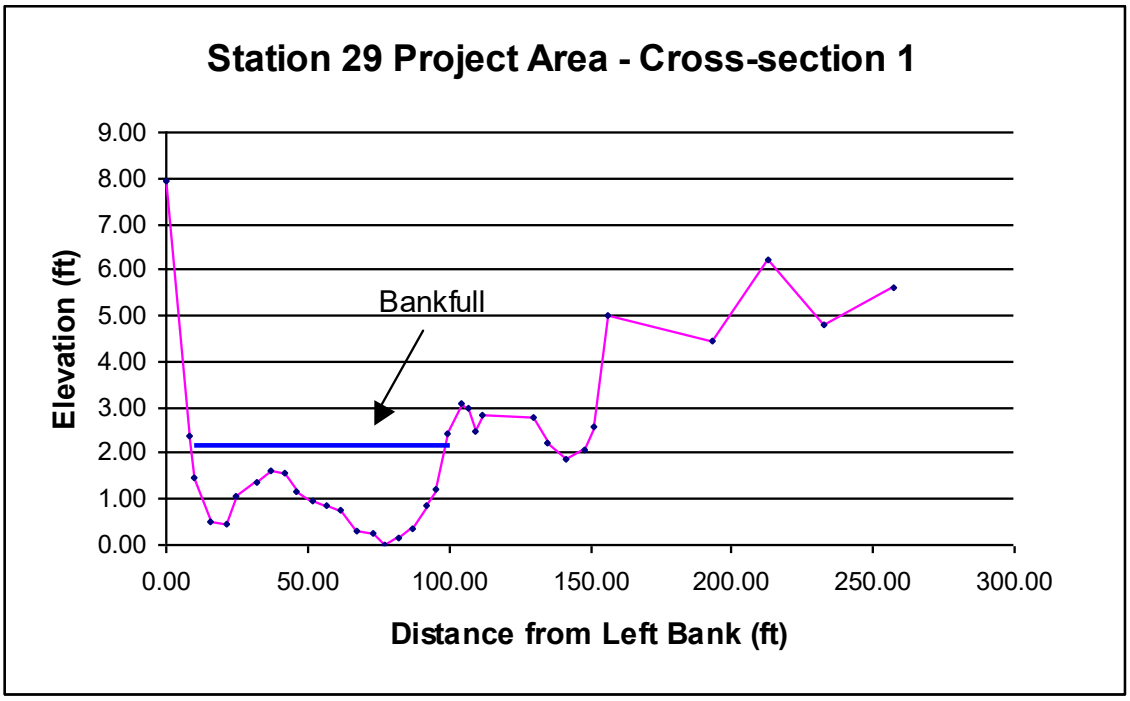


Figure 4 – Cross-section 1 at Richard's property.

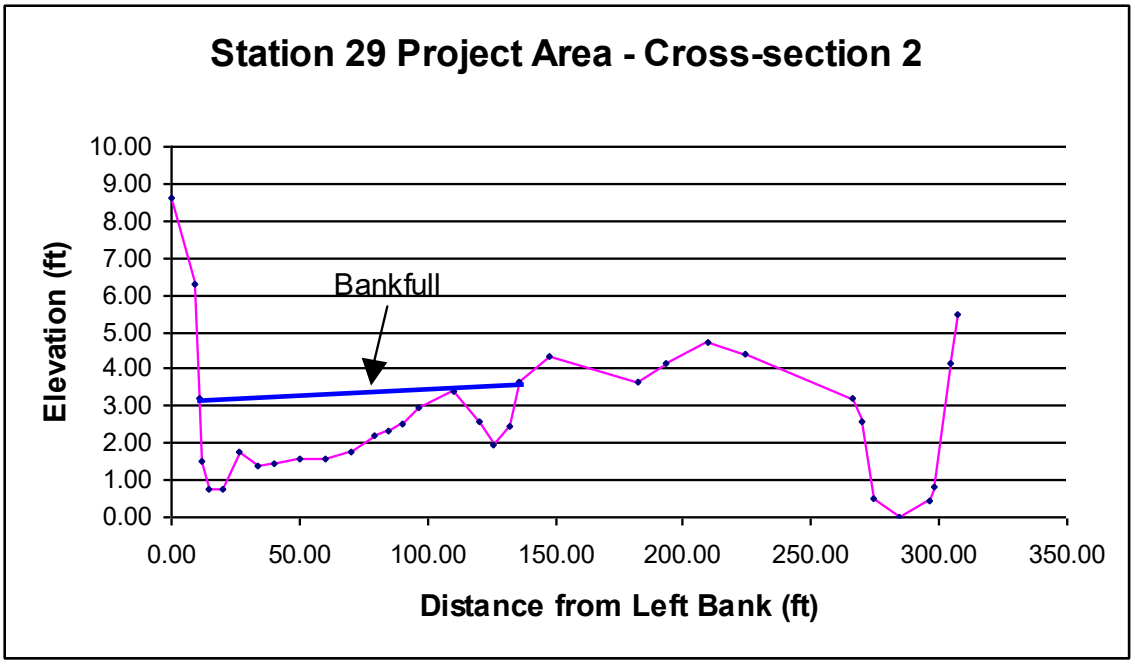


Figure 5 – Cross-section 2 at Richard's property.

A longitudinal survey was conducted prior to project implementation at approximately RM 83.0 Umatilla River (see Figure 6 below).

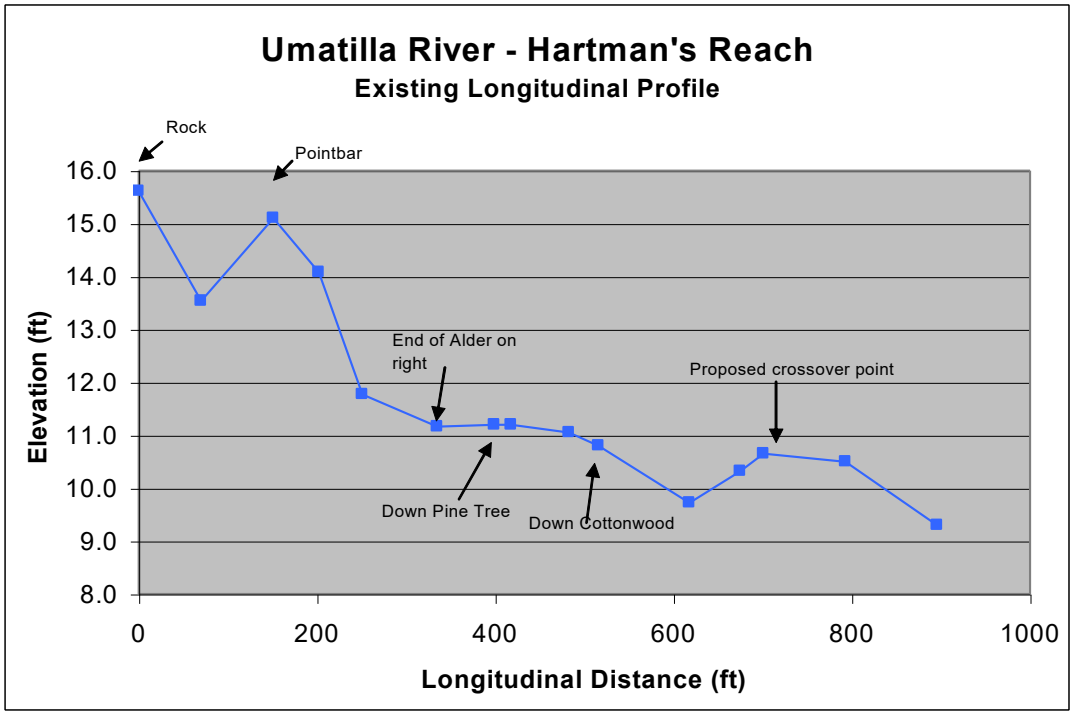


Figure 6 – Pre-project longitudinal profile of the Umatilla River through the Hartman Project Reach at RM 83.0.

The Umatilla River within the proposed project area at RM 83.0 was assessed to determine expected ranges for key morphologic features. A combination of regional hydraulic geometry regression equations, shown in Table 4, and meander geometry equations, shown in Table 5, were used to calculate and develop a range of values for each parameter. Since these equations have been developed on a broad scale for the region and consider a wide range of stream types in various valley settings, a high level of error can be expected when applied at the project scale, even though the R-squared values are relatively high. However, these equations can still provide valuable estimates for planning purposes.

Table 4 – Regional hydraulic geometry regression equations for west Interior Basin and range streams. (Castro and Jackson, 2001) where A is bankfull cross-sectional area (ft^2), Q is bankfull discharge (cfs), and w is bankfull width (ft).

Regression Equation	R-Squared (%)
$A = 0.502Q^{0.86}$	71.0
$w = 0.96Q^{0.60}$	86.8

Table 5 – Meander geometry equations (Williams 1986, Leopold 1994) where L_m is meander length, A is bankfull cross-sectional area (ft^2), w is bankfull width (ft), and R_c is radius of curvature (ft).

Geometry Equation	Applicable Range
$L_m = 21A^{0.65}$	$0.43 < A < 225{,}000$ft
$L_m = 6.5w^{1.12}$	$4.9 < w < 13{,}000$ft
$L_m = 10.9w^{1.01}$	$1.0 < w < 150{,}000$
$L_m = 4.7R_c^{0.98}$	$5.0 < R_c < 50{,}000$
$R_c = 4.1A^{0.65}$	$0.43 < A < 225{,}000$ft
$R_c = 1.3w^{1.12.}$	$4.9 < w < 7{,}000$ft

The parameters used in these equations are based on bankfull channel dimensions and therefore rely on accurate estimates of bankfull discharge. The project site is located approximately two miles upstream from USGS gage station 14020000, Umatilla River above Meacham Creek near Gibbon. A flood frequency curve was developed for this gage and is shown in Figure 7.

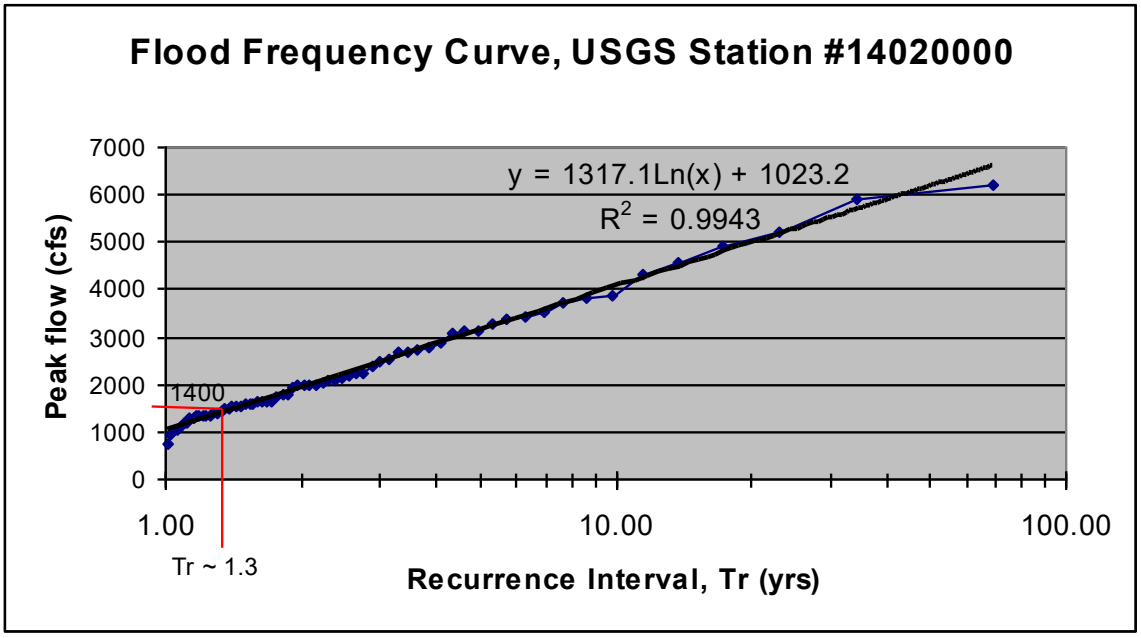


Figure 7 – Flood frequency curve for the Umatilla River above Meacham Creek near Gibbon, Oregon.

A recurrence interval of 1.3 was used, based on assessments completed in other portions of the basin, to determine a bankfull discharge of 1368 cfs at this station or 10.4 cfs per square mile. This bankfull discharge includes flow from the Ryan Creek Drainage, which is located downstream of the project area. Excluding this flow from the bankfull estimate and calculating a discharge for the drainage area of 115 square miles yields a bankfull discharge for the project area of 1200 cfs.

Using the regional equations shown in Table 4 and Table 5, expected values for bankfull width, cross-sectional area, meander length, and radius of curvature were calculated and are shown in Table 6. Given the constraints of the project floodplain and additional development in the floodplain some of these values may be higher than what can be achieved at this site. Changes were made in the channel to accelerate conditions towards an expected range because the project determined it was inefficient to physically manipulate the channel to the exact values calculated.

Table 6 – Expected values for channel morphology and meander geometry of the Umatilla River at RM 83.

Channel Parameter	Independent Variable	Equation Source	Calculated Value (ft)
Bankfull Width, w	Bankfull discharge (cfs)	Castro and Jackson, 2001	67.6
Cross-section Area, A	Bankfull discharge (cfs)	Castro and Jackson, 2001	223.3
Meander length, L_m	Bankfull width (ft)	Leopold, 1994	768.3
Meander length, L_m	Bankfull width (ft)	Williams, 1986	728.2
Meander length, L_m	Radius of curvature (ft)	Leopold, 1994	619.6
Meander length, L_m	Bankfull area (ft^2)	Williams, 1986	706.2
Radius of Curvature, R_c	Bankfull width (ft)	Williams, 1986	145.7
Radius of Curvature, R_c	Bankfull area (ft^2)	Williams, 1986	137.9

Habitat surveys were conducted from RM 81.8 Umatilla River to the mouth of the North Fork of the Umatilla River (RM 89.6) in the summer of 1995 (Contor et al., 1995). This data is relevant to both project sites, located between RM 87.0 to 87.3 and RM 83.0.

The highest water temperature recorded during the habitat surveys was 32° C (89.6° F) at Bingham Hot Springs near RM 86.6. The second highest water temperature recorded was 21° C (70° F) near RM 84.8 while the lowest was 10° C (50° F) near RM 85.6.

In 30 out of 50 reaches surveyed by the UNF, ODFW, and CTUIR above the Meacham Creek confluence, substrate appeared to be a good quality component of spawning habitat (CTUIR et al., 2001). CTUIR habitat surveys show that gravel (2-64 mm) was the most abundant type of substrate, comprising 35% of the wetted streambed area.

The chemical constituents in the Umatilla River above the confluence of Meacham Creek are generally within the natural range of conditions. ODEQ identified aquatic weeds and algae as impairments to mainstem water quality from the confluence of Wildhorse Creek to the Forks

The channel from the Meacham Creek confluence to the headwaters was classified as constrained during habitat surveys conducted by CTUIR. There are approximately two to three miles of road per square mile of area in the upper basin. A valley bottom road running parallel to the river significantly confines the Umatilla River, reducing off-channel habitat, a deterrent to smolt production.

The Upper Umatilla River is listed on the 303(d) List for habitat modification. The listing is based on comparison of in-field measurement of habitat elements (pool frequency, pool quality, pieces of wood per 100 meters, width/depth ratio) to ODFW habitat benchmarks.

Woody debris counts were low in the mainstem Umatilla River channel from the headwaters to the Meacham Creek confluence. Only 1.5 pieces of wood per 100 m met criteria and volume was very low. High flows had deposited the majority of the wood outside of the wetted channel where it was of little value to fish. As a result, instream wood complexity ratings pertaining to fish habitat ranked very low.

During the habitat surveys, fast water habitat accounted for 60.3% of the wetted area surveyed. Riffle habitat comprised the majority of fast water habitat followed by riffles with pockets, rapids over boulders and rapid over bedrock. The average depth of fast water habitat was 0.27 m. Slow water habitat comprised 38.5% of the area. Lateral scour pools comprised the majority of slow water habitat followed by straight scour pools, glides, and isolated pools. The average maximum depth of slow water habitat types was 0.65 m. Dry channel accounted for 0.3% of the area surveyed.

Secondary (braided) channels accounted for 31.4% of the total channel length and 12.8% of the total area surveyed. The average width of the active channel was two times that of the wetted channel width. The average width to depth ratio of the wetted channel was 22.6:1. The width to depth ratio for riffles was 35.4:1. The stream bank was undercut 8.6% and eroded 7.1% (by total length).

The mainstem Umatilla, between the Forks to Meacham Creek receives moderate rates of shading due to a mixture of deciduous trees and conifers. Hardwoods were the most

abundant trees in the riparian zone (71.8%), but tree density was low. Most trees were 3-15 cm in DBH while only 14.9% were 30 cm DBH or more. Riparian canopy ranged 28 to 31%, while percent open sky averaged 49%. The harvest and clearing of trees reduced canopy within this reach.

Geomorphologic and hydraulic data was collected at the RM 63.5 Umatilla River project site prior to initial implementation efforts in 2001. Stream temperatures in this vicinity consistently measure above 27°C (80°F) during summer months. Turbidity in this reach appears to be moderate. A habitat survey conducted by the CTUIR UBNPME Project (Contor et al., 1997) estimated that substrate is predominately gravel and cobble. The large woody debris frequency averages 24 pieces per mile, which is comparatively good. The pool frequency, approximately 25.7 pools per mile (1.6 km) in a channel averaging 8.1 m in width, is relatively low. The average summer pool depth is approximately 0.69 m, which is quite shallow.

Photos were taken during 2002 and 2003 at 99 existing and eleven newly established photo point locations. Photo points are located within the Umatilla River, Meacham Creek, Boston Canyon Creek, Wildhorse Creek, Greasewood Creek, West Fork of Greasewood Creek, Spring Hollow Creek, Mission Creek, Buckaroo Creek, McKay Creek, East Birch Creek, Moonshine Creek and Cottonwood Creek project areas. Photos obtained, document project recovery and provide a visual record of annual changes within riparian and floodplain areas. Photographs indicate an upward, downward, or static trend in woody vegetation, stream bank stability and cover (Meyers, 1987). However, initial vegetation "expression", obvious in photographs, should not be confused with vegetation "succession" required for stream ecosystem health (Elmore and Beschta, 1987).

2. Biological Inventories:

A pre-project presence/absence fish inventory was coordinated with the CTUIR UBNPME Project on July 11, 2002 between RM 87.0 and 87.3 Umatilla River to determine existing salmonid utilization. A single pass with an electrofisher sampled a 217-meter length of the primary channel and a 227-meter secondary channel over a 1,030 second period. A mountain whitefish, one chinook salmon, nine rainbow trout, approximately 300 dace and approximately 400 sculpin were sampled in the project area. The catch-per-unit-effort (CPUE) was 0.58 salmonids per minute of electrofishing time.

These biological inventories provide baseline data that can be compared over time. Post-project biological inventories will be conducted approximately every three years to compare CPUE and to assess fish utilization of instream enhancements. This data will assist with understanding the influence of habitat restoration on species composition, length frequency, and abundance.

3. Aquatic Macroinvertebrate Sampling:

OSU Hermiston Agricultural Research and Extension Center Entomologists, David Wooster and Sandra DeBano, were subcontracted by the project to conduct macroinvertebrate monitoring at existing habitat enhancement sites during the 2002 and 2003 project periods. The following excerpts were pulled from their report titled, *Biomonitoring of Restoration Projects Using Aquatic Macroinvertebrates Report for Winter 2002/2003 Sampling.*

Macroinvertebrate samples were collected during the 2002 project period at the sites and on

the dates indicated in Table 1.

Table 7 – Site locations for macroinvertebrate sampling.

Waterbody	Site	Latitude	Longitude	Elevation (m)	Sampling Date
Meacham Creek	Restoration			548	12/5/02
	Control			580	12/6/02
McKay Creek	Restoration	45°30.55	118°42.60	610	12/10/02
	Control	45°30.59	118°42.32	638	12/10/02
Wildhorse Creek	Restoration	45°44.47	118°36.45	431	1/9/03
	Control	45°45.52	118°33.91	479	1/9/03
Mission Creek	Restoration	45°38.36	118°37.57	508	1/15/03
	Control	45°38.05	118°37.35	529	1/15/03
Buckaroo Creek	Restoration	45°40.11	118°28.27	548	1/29/03
	Control	45°39.68	118°29.34	623	1/29/03

Values for the metrics utilized at each sampling site are given in Table 8. These metrics can be used to draw conclusions regarding differences between control and restoration sites for each stream. These metrics can be broken down into two broad groups. One group is composed of metrics that only provide information about water quality at a specific site in terms relative to other sites sampled in the same area. This group includes metrics 1-11. The other group is comprised of metrics that specifically address water quality and that often place metric scores within a certain water quality "class." These metric scores can often stand alone in an assessment of water quality. This group includes metrics 12-14. Both the HBI and the BCI generate scores for a site that place that site in a water quality class. The ODEQ Grande Ronde multimetric index can do the same thing; however, this index must be "calibrated" for regional macroinvertebrate communities. The ODEQ Grande Ronde metric has been presented here; however, because this metric has not yet been "calibrated" in the Umatilla Subbasin results from this metric must be interpreted cautiously, and the scores generated by this metric have not been placed into water quality classes. A multimetric index has not yet been developed specifically for the Umatilla Subbasin.

Table 8 – Metric values for restoration and control sites.

	Meacham Creek		McKay Creek		Wildhorse Creek		Mission Creek		Buckaroo Creek	
Metric	**Restored**	**Control**	**Restored**	**Control**	**Restored**	**Control**	**Restored**	**Control**	**Restored**	**Control**
Taxa Richness	20	20	18	21	8	8	14	22	16	6
EPT Richness	12	11	13	12	1	0	8	14	8	2
Plecoptera Richness	3	5	4	4	0	0	2	3	4	1
Intolerant Taxa Richness	2	2	1	1	0	0	0	1	1	1
Sediment-Intolerant Taxa Richness	0	1	0	0	0	0	0	0	0	0
Tolerant Taxa Richness	4	2	3	4	4	4	1	2	1	1
Sediment-Tolerant Taxa Richness	2	1	2	3	2	3	1	1	2	1
% Predators	12.5	25	9.1	20	0	0	12.5	8.3	25	0
Shannon's Diversity	1.374	1.658	1.569	1.794	1.287	0.699	1.824	1.528	1.533	0.771
Dominance by 3 Taxa	83	73.8	82.1	88	94.5	95.1	77.4	82.7	82.0	97.4
HBI	5.182	4.899	5.391	5.213	6.614	6.061	5.612	6.131	5.714	5.983
BCI	54.3	57.7	51.8	60.7	74.4	60.5	51.9	75.6	49.8	46.5
ODEQ GR Multimetric	14	20	16	14	10	10	18	18	18	10

a. Meacham Creek

Meacham Creek had relatively high taxa richness with a total of 25 different taxa total collected from the two sites. The abundance of EPT taxa, the presence of intolerant taxa, a fairly high proportion of predatory taxa, and a high diversity of FFG (Appendix C, Figure 1) all indicate that Meacham Creek has fairly good water quality relative to the other creeks sampled. In contrast, three indices of water quality all point to fairly poor conditions in Meacham Creek. The HBI suggests that water in Meacham Creek is somewhat enriched with organic pollutants; the BCI suggests generally poor or polluted conditions, and the ODEQ Grande Ronde Multimetric Index also suggests poor water quality (see Appendix C, Figures 2-4). This non-concordance between relatively simple metrics and more derived metrics is difficult to reconcile. However, the community in Meacham Creek was largely dominated by midges (Diptera: Chironomidae) and Oligochaetes, two taxa known to be very tolerant of pollution including sediment.

A comparison of the control site and restoration sites suggests that the control site has slightly better water quality. The control site had higher Plecoptera richness, lower tolerant taxa richness, higher proportion of predators and scores for HBI, BCI and the ODEQ multimetric index that all suggest slightly better water quality. This slight difference in the restoration and control sites did not, however, lead to the control site being placed in a better water quality "class" for either the HBI or the BCI (Appendix C, Figures 2 and 3).

Small scale differences at the two sites might account for these differences and for the control sight apparently having slightly better water quality. However, there were no obvious differences in water velocity, slope, substrate or riparian vegetation. Water chemistry might also account, in part, for the differences. Water chemistry was similar between the two sites except for pH, which was higher at the restoration site (Appendix C, Figure 5).

b. McKay Creek

McKay Creek also had high taxa richness with 26 species total collected from the two sites. As with Meacham Creek some metrics (EPT taxa richness, Plecoptera richness, and a fairly high proportion of predatory taxa) suggest that water quality was fairly good in McKay Creek relative to the other creeks. However, the HBI, BCI and ODEQ multimetric index all indicate poor water quality conditions similar to those found in Meacham Creek (Appendix C, Figures 2-4). The community at McKay Creek was largely dominated by a few taxa known to be tolerant of pollution. At the restoration site these taxa were Chironomidae and Simuliidae (blackflies) and at the control site these taxa were Chironomidae and Oligochaetes.

A comparison of the control and restoration sites suggests very similar water quality between the two sites with the control site possibly having slightly better quality. The control site had slightly higher taxa richness, a higher proportion of predatory taxa, slightly higher diversity, and a slightly higher BCI score. All these differences are fairly small and they likely do not reveal important differences between the two sites. Water chemistry at the two sites was essentially identical for all four parameters measured (Appendix C, Figure 5).

c. Wildhorse Creek

Wildhorse Creek had the lowest overall taxa richness with only 10 total taxa found. Almost all metrics suggest very poor water quality in Wildhorse Creek. Low taxa richness, the almost complete absence of any EPT taxa, relatively high proportions of tolerant taxa, the absence of predators, high HBI scores, low diversity of FFG (Appendix C, Figure 1), and very low ODEQ multimetric scores all indicate poor or polluted conditions. This apparent poor water quality is supported by the water chemistry data; Wildhorse Creek had the lowest dissolved oxygen levels, the highest turbidity, and the highest conductivity of all five streams. However, the BCI indicated that the conditions in Wildhorse Creek are not as bad as most of the other creeks (Appendix C, Figure 3), suggesting that Wildhorse Creek approaches the conditions one might expect from a stream with the alkalinity, sulfate levels, slope and substrate found in Wildhorse.

A comparison of the restoration and control sites suggests that the restoration site is in better condition than the control. While most of the metrics were very similar to each other, the restoration site had a much higher BCI value than the control site. This high value placed the restoration site in the “fair condition” class, while the control site was in the “poor condition” class (Appendix C, Figure 3). In addition, the diversity was much higher at the restoration site than at the control site.

d. Mission Creek

Mission Creek had the highest overall taxa richness with 28 taxa collected from the two sites. Fairly high EPT richness and fairly high diversity of FFG suggests relatively good conditions in Mission Creek. However, most other metrics suggest poor conditions. This

includes a fairly low proportion of predators and scores for the HBI, BCI, and ODEQ multimetric index, suggesting fair to poor conditions (Appendix C, Figures 2-4). As with Meacham and McKay creeks these scores reflect a community dominated by a few taxa known to be tolerant of pollution; these taxa included Chironomidae, Simuliidae, Oligochaetes, and Harpacticoid Copepoda.

A comparison of the restoration and control sites suggests that the control site is in better condition than the restoration site. Taxa richness and EPT richness were both higher in the control site; in addition, the BCI indicated that the control site was in "fair condition" while the restoration site was in "poor condition." The values of all other metrics were very similar between the control and restoration sites. Water chemistry was also very similar between the two sites.

e. Buckaroo Creek

Buckaroo Creek had fairly low taxa richness with 17 taxa total collected from the two sites. In general Buckaroo Creek appeared to have poor water quality given the relatively low EPT richness, low diversity of FFG (Appendix C, Figure 1), low proportion of predators, and scores for the HBI, BCI and ODEQ multimetric index all indicating poor water quality. These scores resulted from a community dominated by a few taxa tolerant to pollution that included Chironomidae, Simuliidae and Oligochaetes.

A comparison of the control and restoration sites suggests that the restoration site is of better quality than the control site. The restoration site had higher overall taxa richness, EPT richness and Plecoptera richness. In addition, only the restoration site had predatory taxa and it had a higher diversity. However, both the HBI and the BCI placed both sites in the same categories suggesting that both sites are enriched with organic pollutants (Appendix C, Figure 2) and in generally poor or polluted condition (Appendix C, Figure 3). Water chemistry was similar between the two sites (Appendix C, Figure 5). A comparison of these two sites and conclusions drawn regarding relative water quality must be interpreted cautiously. We attempted to sample this site in both mid-November and mid-December of 2002 and on both occasions found the control site dry, while the restoration site had running surface water. Buckaroo Creek was then sampled at the end of January 2003 when both the restoration and the control sites had running surface water. The differences between the two sites might simply reflect differences in the length of time surface water was at the two sites and not differences in water quality per se.

f. Conclusions Regarding Comparisons of Control and Restoration Sites

In general water quality was fairly poor at all ten sites based on macroinvertebrate metrics as indicated by the HBI, the BCI and the ODEQ multimetric index. It is surprising that all sites appeared to be of such low water quality. It is possible that these poor scores reflect factors other than water quality; for example, the surface water at many of the sites dried-up at some point time during summer of 2002 and was not recharged until several weeks prior to sampling. These apparently poor conditions could reflect a macroinvertebrate community that is still recovering from a disturbance and not may necessarily reflect water quality.

The restoration site appeared to be in better condition at two creeks, Wildhorse and Buckaroo. As stated above, this difference might reflect differences in the duration of surface water at the two sites in Buckaroo Creek. At Wildhorse Creek this difference might truly reflect a difference in land use resulting from the restoration project. In two cases,

Meacham and McKay creeks, the control sites appeared to be of slightly better water quality than the restoration sites. However, these differences were small and did not result in the control site being in a better water quality class for either the HBI or the BCI. Therefore, these differences are probably not biologically important. Finally, at the last creek, Mission, the control site was in better condition than the restoration site according to the BCI, but little difference existed among the other metrics.

The project has experienced continual problems with the landowner at the Mission Creek restoration site removing riparian vegetation and sections of livestock exclusion fencing within the upper project area. These disturbances may have contributed to the restoration site demonstrating a lower BCI. The lack of strong differences between the sites might also reflect the season of sampling. In winter, water temperature and flow are less likely to be water quality impairments regardless of sampling site than during other seasons. In a phone conversation Rick Hafele of the ODEQ reported that late summer is the season in which he has found the strongest responses of macroinvertebrates to water quality conditions.

g. Relationship Between Water Chemistry and Macroinvertebrate Metrics

Macroinvertebrates are ideal for assessing water quality because their community structure integrates a variety of water quality impairments over the course of a relatively long period (i.e., the lifespan of the organisms, which is generally about one year). It is useful to understand how different macroinvertebrate metrics appear to respond to variation in water quality as measured through other means. This allows a determination of the likely water quality impairments that influence a given metric. In this study, simple correlations were used between water chemistry measurements and 11 metrics to determine the relationships, if any, between water chemistry and macroinvertebrate water quality metrics.

The 11 macroinvertebrate metrics used in the correlations were: taxa richness, EPT richness, Plecoptera richness, proportion of the community made up of predators, tolerant taxa richness, sediment-tolerant taxa richness, Shannon's diversity index, % dominance of the three most abundant taxa, the HBI, the BCI and the ODEQ multimetric index. These were correlated with turbidity, conductivity, dissolved oxygen, and pH. The pH meter malfunctioned while sampling Wildhorse Creek and Mission Creek, and therefore the sample size is less (n=6) for those correlations than for the others (n=10).

The results revealed that of the 11 metrics, turbidity was significantly correlated with eight of the metrics (Appendix C, Figure 6). The BCI, tolerant taxa richness, and sediment tolerant taxa richness were not significantly correlated with turbidity. Conductivity was correlated with seven of the metrics (Appendix C, Figure 7). The BCI, tolerant taxa richness, sediment-tolerant taxa richness, and Shannon's diversity were not correlated with conductivity. Percent dissolved oxygen was correlated only with the BCI and not any of the other metrics (Appendix C, Figure 8). The pH was not significantly correlated with any of the metrics; however, this might have resulted from low power caused by a reduced sample size.

The lack of a relationship between additional macroinvertebrate metrics and dissolved oxygen might have resulted from the relatively small amount of variation in dissolved oxygen among sites. Dissolved oxygen measures varied only from 88% (near saturation) to just over 102% (super-saturation). These high levels of oxygen at all sites resulted from sampling in riffles and in cold water, two factors known to increase oxygen levels in stream

water (Welch et al. 1998).

The strong correlations found for turbidity and conductivity were driven largely by Wildhorse Creek. Wildhorse Creek had the highest turbidity levels and the highest conductivity and had macroinvertebrate metrics that suggested the poorest water quality.

Of the 11 metrics examined, EPT richness, the HBI, and Plecoptera richness correlated most strongly with turbidity and conductivity. These correlations are very preliminary. The measurements of turbidity, conductivity, dissolved oxygen, and pH only represent a snapshot in time and not necessarily average conditions at a site. More detailed monitoring of these parameters might increase the number of correlations with a variety of macroinvertebrate metrics and the strength of those correlations. There are many other water chemistry and physical measures of stream impairment that would be interesting to correlate with macroinvertebrate metrics. In addition, many water chemistry measures are likely to be confounded and a relationship between one water chemistry measure and a macroinvertebrate metric does not indicate a cause and effect relationship. The correlations presented here represent a beginning in our understanding of the relationships between macroinvertebrates and important water chemistry parameters for the Umatilla Subbasin.

Macroinvertebrates sampled by OSU entomologists during the 2003 project period have not yet been analyzed at the time of this writing. Monitoring data and analysis for this period shall be incorporated into the 2004 annual report. Aquatic macroinvertebrate monitoring will resume at established sampling sites in project out years if the project receives direction, support and necessary funding from BPA. The project believes that project-specific macroinvertebrate monitoring, in combination with other forms of biological and physical analysis, is useful in assessing aquatic habitat and water quality. Information obtained from macroinvertebrate surveys should assist in determining the effects of habitat improvements within project areas over time.

4. Water Temperature Monitoring:

Temperatures in excess of 65°F impair growth and survival in salmonids (USFWS and National Marine Fisheries Service, 1981). Abnormally high temperature conditions during migration can contribute to outbreaks of disease among adult Chinook salmon often resulting in pre-spawning mortality. Temperatures in excess of 68°F have been shown to result in impairment of Chinook salmon. High stream temperatures may also stress juvenile steelhead during warm summer months. Temperatures exceeding 73°F result in direct mortality to Chinook salmon and steelhead (Bell, 1984).

Thermographs were deployed at 22 locations throughout the Umatilla River Basin (see Table 2). Stream temperature data was summarized into tabular form, illustrating maximum, average and minimum daily Celsius and Fahrenheit temperatures during thermograph deployment periods. Digital copies of these water temperature tables are maintained in the CTUIR Habitat Enhancement Project Office. Summer (June, July, August and September) stream temperatures were graphed to determine if temperatures exceeded limits detrimental to anadromous salmonids. Graphed data can be viewed in Appendix D.

Table 9 illustrates the total number of days average and maximum stream temperatures exceeded 65°F, 70°F, 75°F and 80°F between June 1 and September 30, 2002 and 2003 at

thermograph deployment sites. Data from two sites, RM 0.0 Wildhorse Creek and RM 3.5 Spring Hollow Creek, could not be retrieved in 2002. Data from RM 76.5 Umatilla River, RM 0.0 Wildhorse Creek, RM 1.4 Wildhorse Creek, RM 9.5 Wildhorse Creek, RM 18.3 Wildhorse Creek, RM 26.0 Wildhorse Creek, RM 1.25 Mission Creek, and RM 0.04 Little Buckaroo Creek in 2003 was corrupted because of thermograph battery failures.

Table 9 – Number of days the average and maximum stream temperatures exceeded 65, 70, 75 and 80 degrees Fahrenheit from June 1 - September 30, 2002 and 2003.

Thermograph Location	Number of days temp > 65°F		Number of days temp > 70°F		Number of days temp > 75°F		Number of days temp > 80°F	
	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F
Umatilla River (RM 56.0) – 2002	87	114	56	93	19	78	0	46
Umatilla River (RM 56.0) – 2003	94	121	70	110	23	87	0	58
Umatilla River (RM 76.5) – 2002	34	86	3	41	0	14	0	0
Umatilla River (RM 81.7) – 2002	14	60	0	18	0	2	0	0
Umatilla River (RM 81.7) – 2003	20	86	0	29	0	3	0	0
Wildhorse Creek (RM 0.0) – 2002	72	87	30	53	4	31	0	5
Wildhorse Creek (RM 1.4) – 2002	82	95	38	64	7	42	0	8
Wildhorse Creek (RM 9.5) – 2002	71	86	27	29	1	3	0	0
Wildhorse Creek (RM 18.3) – 2002	31	77	1	29	0	24	0	12
Wildhorse Creek (RM 26.0) – 2002	7	31	0	2	0	0	0	0
Greasewood Creek (RM 0.1) – 2002	32	41	3	6	0	0	0	0
Greasewood Creek (RM 0.1) – 2003	45	76	1	13	0	0	0	0
Eagle Creek (RM 0.2) – 2002	7	29	0	4	0	0	0	0
Eagle Creek (RM 0.2) – 2003	3	54	0	27	0	4	0	0
Spring Hollow Creek (RM 3.5) – 2003	22	55	0	6	0	1	0	0
Mission Creek (RM 1.25) – 2002	8	35	0	17	0	8	0	1
Mission Creek (RM 1.25) – 2003	16	57	2	36	0	24	0	4
Mission Creek (RM 3.7) – 2002	0	0	0	0	0	0	0	0
Mission Creek (RM 3.7) – 2003	0	0	0	0	0	0	0	0
Mission Creek (RM 3.8) – 2002	0	12	0	0	0	0	0	0
Mission Creek (RM 3.8) – 2003	0	8	0	0	0	0	0	0
Moonshine Creek (RM 1.1) – 2002	29	83	2	32	0	6	0	0
Moonshine Creek (RM	36	94	0	37	0	1	0	0

Thermograph Location	Number of days temp > 65°F		Number of days temp > 70°F		Number of days temp > 75°F		Number of days temp > 80°F	
	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F	Avg ˚F	Max ˚F
1.1) – 2003								
Coonskin Creek (RM 0.2) – 2002	0	4	0	0	0	0	0	0
Coonskin Creek (RM 0.2) – 2003	0	8	0	0	0	0	0	0
Buckaroo Creek (RM 2.0) – 2002	36	95	11	70	0	43	0	11
Buckaroo Creek (RM 2.0) – 2003	56	94	11	81	0	49	0	13
Little Buckaroo Creek (RM 0.04) – 2002	10	52	1	15	0	4	0	0
Squaw Creek (RM 2.0) – 2002	6	85	0	25	0	1	0	0
Squaw Creek (RM 2.0) – 2003	5	96	0	45	0	11	0	0
Squaw Creek (RM 9.0) – 2002	22	93	3	65	0	41	0	11
Squaw Creek (RM 9.0) – 2003	30	96	0	75	0	38	0	4
Meacham Creek (RM 2.0) – 2002	41	96	3	59	0	23	0	0
Meacham Creek (RM 2.0) – 2003	65	111	1	71	0	33	0	0
Meacham Creek (RM 5.25) – 2002	27	100	0	65	0	31	0	0
Meacham Creek (RM 5.25) – 2003	51	108	0	72	0	50	0	7

Mission Creek and the upper Umatilla River (RM 81.7) exhibited the temperatures most conducive for salmonid survival and rearing. However, a habitat inventory conducted by CTUIR UBNPME Staff during the summer of 1995 documented that 77% of Mission Creek was dry by late summer (Contor et al., 1996). The CTUIR discovered the mean salmonid density in Mission Creek to be 0.0931 fish/m^2 (Contor et al., 1996). The upper Umatilla River, however, maintains flows year round and surveyors found a moderate number of fish (0.45 salmonids/m^2) between RM 81.8 and RM 89.6 (Contor et al., 1996). Based on salmonids densities and low summer instream temperatures, this section of the Umatilla River appears to be an important rearing area for salmonids. Stream temperatures were highest, exceeding 85 F on several days, at RM 56 Umatilla River.

The CTUIR Habitat Enhancement Project has monitored summer water temperatures in the Wildhorse Creek Project Area (RM 9.5) site since 1995 and the Greasewood Creek Project Area (RM 0.1) since 1997. At both sites there appears to be a decreasing trend in the maximum weekly average temperature and in the average diurnal (daily) flux at both sites (see Figure 8 and Figure 9). The trend in diurnal flux decreases is also seen at other thermograph locations in Wildhorse Creek (RM 26.0 and RM 0.0). It is unknown whether CTUIR's habitat improvements have resulted in cooler, more consistent temperatures at this site; however, this trend seems consistent with the improved riparian vegetation and width

to depth ratios observed at the project site over time. Continued out-year monitoring at this location will determine whether this trend is statistically significant.

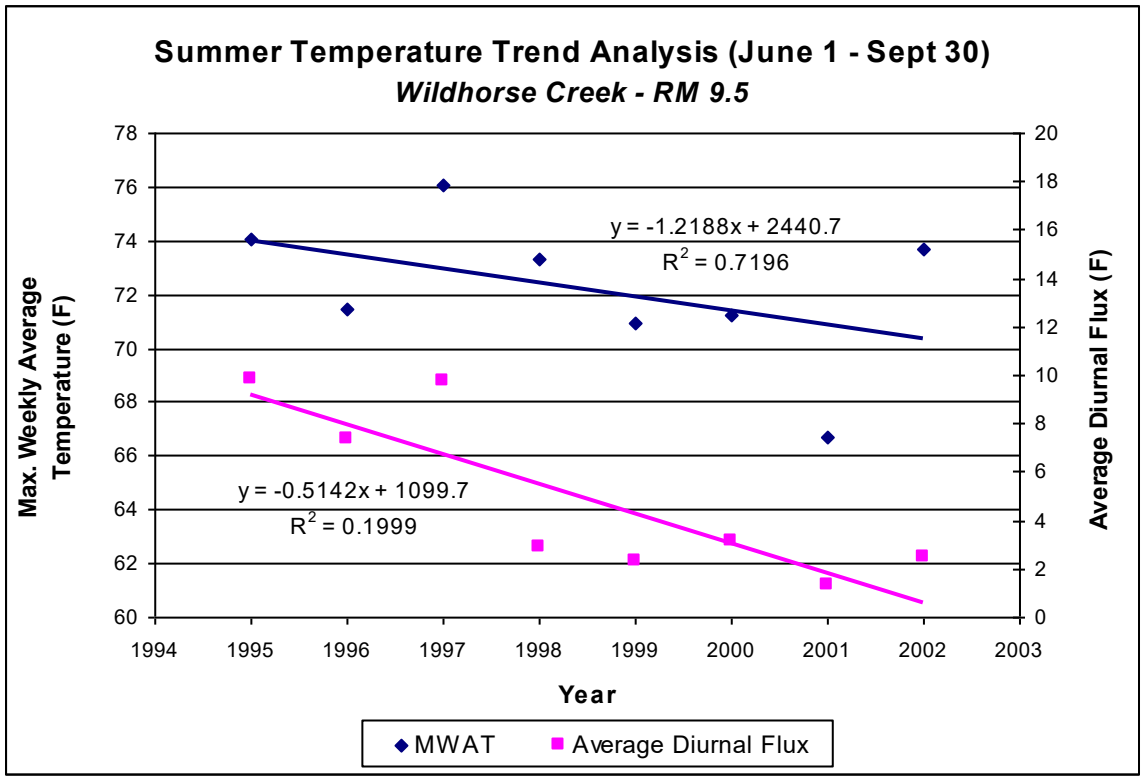


Figure 8 – Changes in maximum weekly average temperatures and average diurnal flux in Wildhorse Creek project area (RM 9.5) over time.

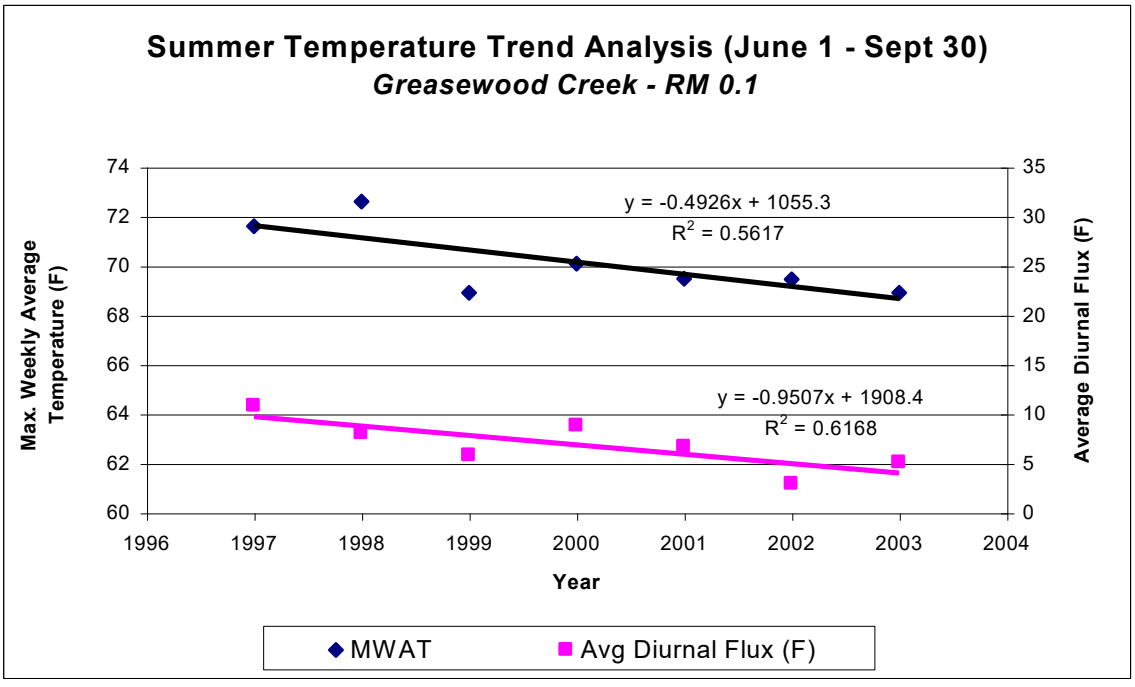


Figure 9 – Changes in maximum weekly average temperatures and average diurnal flux in

Greasewood Creek project area (RM 0.1) over time.

5. Suspended Sediment Monitoring:

CTUIR EP/RP Personnel collected daily suspended sediment data from three ISCO Model 2700 Wastewater Samplers. Data obtained was averaged and combined with gage station stream flow data to arrive at daily estimates of total sediment yield at RM 2.0 Meacham Creek (at USGS Gage Station No. 14020300), RM 56.0 Umatilla River (at USGS Gage Station No. 14020850) and RM 81.7 Umatilla River (at USGS Gage Station No. 14020000. Suspended sediment data was graphed, and this information is presented in Appendix E. Tabular daily sediment yield data and stream discharge data is currently maintained at the CTUIR Habitat Enhancement Project Office.

The Umatilla County Soil and Water Conservation District (SWCD) have completed a thorough analysis of sediment monitoring data for the Umatilla Basin TMDL (King, 2004). The following data summary has been taken from this document. Analysis of sediment data has been completed based on the water year (WY) cycle, not the BPA contract fiscal year.

Laboratory analyses of ISCO™ samples include total suspended solids (TSS), total dissolved solids (TDS), specific conductance, and turbidity. Daily average stream gage discharge values were used to calculate suspended sediment loads and daily unit loads. Calculated sediment loads represent the suspended fraction of the total sediment load and do not represent bedload. Average daily-suspended sediment unit load was calculated for each site to estimate the amount of sediment carried by the stream, normalizing for the watershed areas and the sampling period. This allows for comparison between watersheds when sampled over different periods. Table 10 shows data results for several stations, comparing average daily mass unit loads by WY. Two of the CTUIR's three sampling sites have been identified here as follows: the RM 2.0 Meacham Creek site is referred to as Meacham Cr @ gage and the RM 81.7 Umatilla River site is Uma Rv @east bdy gage.

Table 10 – Average Daily Mass Unit Load (based on Nov - June monitoring period)

		Tons/mi^2/day (estimated)				
Watershed	**Site Name**	**WY 1998**	**WY 1999**	**WY 2000**	**WY 2001**	**WY 2002**
Upper Umatilla	Uma Rv @ east bdy gage	0.05	0.13	0.06	0.04	0.42
Meacham	Meacham Cr @ gage	0.03	0.11	0.03	0.02	0.17
Squaw / Buckaroo	Uma Rv @ west bdy gage (est)	0.03	0.36	0.10	0.06	0.47
Wildhorse	Wildhorse Cr @ mouth / gage		0.15	0.71		0.06
Tutuilla / Patawa	Tutuilla Cr @ Burger King (est)	0.11	0.20	0.12		
McKay	McKay Cr @ Shaw Rd	0.08	0.24	0.43		
Birch	Birch Cr @ gage	0.28	0.19	0.14		
Gulches & Canyons	Uma Rv @ Rieth	0.03	0.02	0.29		
	Uma Rv @ Yoakum				0.07	0.44
	Uma Rv @ Echo	0.07	0.31	0.19		
Butter	Butter Cr @ gage	0.06		0.08		
Lower Umatilla	Uma Rv @ Oxbow (est)		0.19	0.12	0.05	0.30
	Uma Rv @ 3 Mile Dam		0.12			

Table 10 shows that the values at sites monitored appeared to go down slightly during WY2001 (lower precipitation levels and subsequent stream flows during the year). Generally, values increase the further downstream the Umatilla River the site is located. WY2002 saw an increase across the basin, but the cause is not clear. Few sites have many consecutive years of monitoring simply because there hasn't been enough equipment and funds for laboratory analyses to adequately cover all stations across the basin. Consistent and long-term monitoring is a problem.

High levels of suspended solids and turbidity can adversely impact instream conditions. Results can be seen with increased depositional layers in the system. Increased turbidity and suspended solids can impact feeding and respiration functions, and cause damage to spawning sites by limiting oxygen. Although the EPA and the State of Oregon don't have numeric water quality standards for suspended solids or streambed fines, excessive fine sediment is addressed through the applied narrative criteria. Listed water quality impairments were based on streambed percent fines and greater than ten percent increase in mainstem turbidity caused by mid-basin tributaries. A numeric target was identified to evaluate sediment in terms of load reduction. Umatilla fisheries managers determined through basin-specific knowledge and literature review that a maximum of 30 nephelometric turbidity units (NTU) instream turbidity (not to exceed a 48-hour period) to be protective of aquatic species and not detrimental to residential communities (ODEQ, 2001).

Because the TMDL is best expressed as a mass load, total suspended solid (TSS) is used as a surrogate for turbidity. In order to express the water column sediment TMDL in terms of mass load, regressions were calculated to evaluate the association between TSS and turbidity. The TSS correlative to the turbidity target of 30 NTU, not to exceed a 48-hour duration, was calculated as the TMDL target concentration or loading capacity for each of the 14 watersheds in the Umatilla basin – see Table 11 below (Umatilla AgWQMP, 2003).

Table 11 – Water Column Sediment TMDL Summary.

Watershed	Modeled Event Mean TSS (mg/L)	TSS Loading Capacity (mg/L)	Design Storm Total Erosion % Reduction	Upland Component % of Total Reduction	Streambank Component % of Total Reduction
Upper Umatilla	14	76	none	none	none
Meacham	34	60	none	none	none
Reservation Tribs	652	99	85	33	52
Pendleton	279	80	72	39	33
Wildhorse	1694	86	95	22	73
Tutuilla	1599	70	96	38	58
McKay	251	72	72	33	39
Birch	376	110	71*	30*	41*
Butter	1186	110	91	9	82
Gulches/Canyons	2560	80	97	10	87
Stage Gulch	656	80	88	23	65
Sand Hollow	1115	80	93*	10*	83*
Cold Springs	1295	80	94	17	77
Lower	36	77	none	none	none

* estimated by averaging adjacent watershed reduction values

Because the laboratory turbidity value was based on a composite sample, it's not possible to determine the specific hour during the day that turbidity was greater than the target value. Therefore, the TMDL guidance standard can't be monitored directly as stated. A data summary approach for tracking potential turbidity exceedances was approved by the Technical Committee in 2001 and data was recalculated using this methodology. This approach looked at the following conditions: the number of individual analyses (daily samples) that were over 30 NTU, the number of times that 30 NTU was exceeded by two consecutive analyses, and the number of analyses that exceeded 300 NTU (10X the standard). An example using data from Umatilla River at Oxbow, below Westland Road Bridge in Hermiston, is shown below as Table 12.

Table 12 - Turbidity Counts for Umatilla River @ Oxbow, below Westland Rd Bridge.

Turbidity Summary Info	WY1998	WY1999	WY2000	WY2001	WY2002
Maximum Turbidity (NTU) =		317	236	1676	1269
# Daily Composite Samples > 30 NTU =		25	57	42	48
# of Times 30 NTU Exceeded By Two Consecutive Samples =		16	41	27	36
# Samples > 10X Value (300 NTU) =		1	0	1	2

One approach to looking at turbidity data is shown below in Figure 10 and Figure 11. Basin sites are compared from the mainstem Umatilla River and from tributary locations. The standard addressed in the TMDL references exceeding 30 NTU over a 48 hr period, but these graphs show composite turbidity values measured over a one-day (24 hour) period. The period of data used for both figures covers WY 1998 through WY2003. As expected, the percentage of time that a mainstem site exceeds the standard of 30 NTU increases the further downstream that the site is located. The tributary graph shows that Wildhorse Creek exceeds the standard 50% of the time, while Meacham Creek, a mostly forested watershed, only exceeds about 2% of the time.

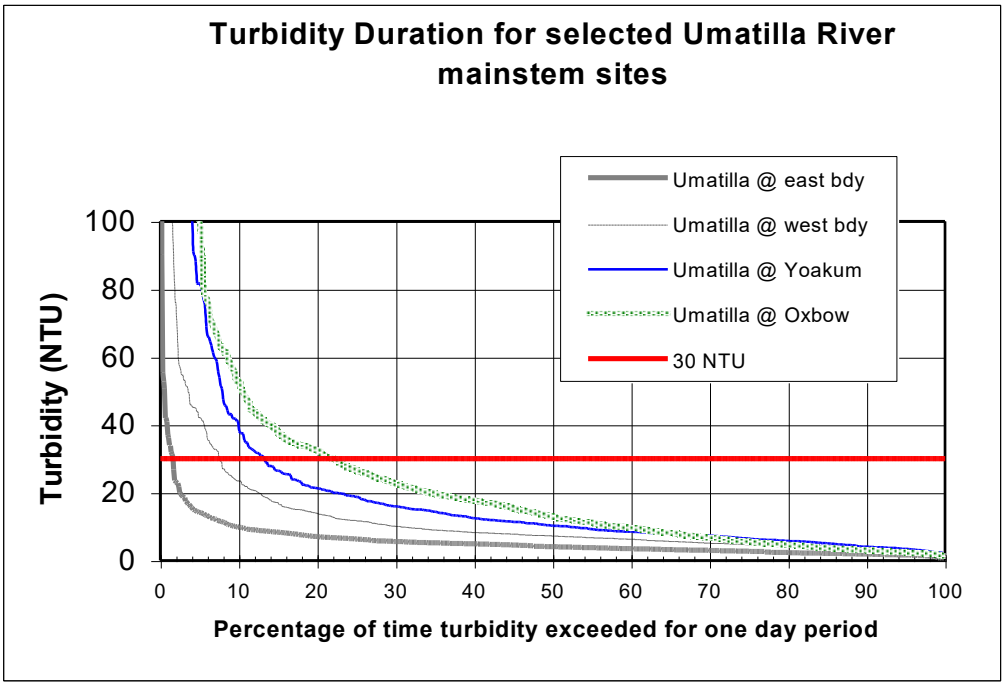


Figure 10 – Turbidity Duration for Umatilla River mainstem sites.

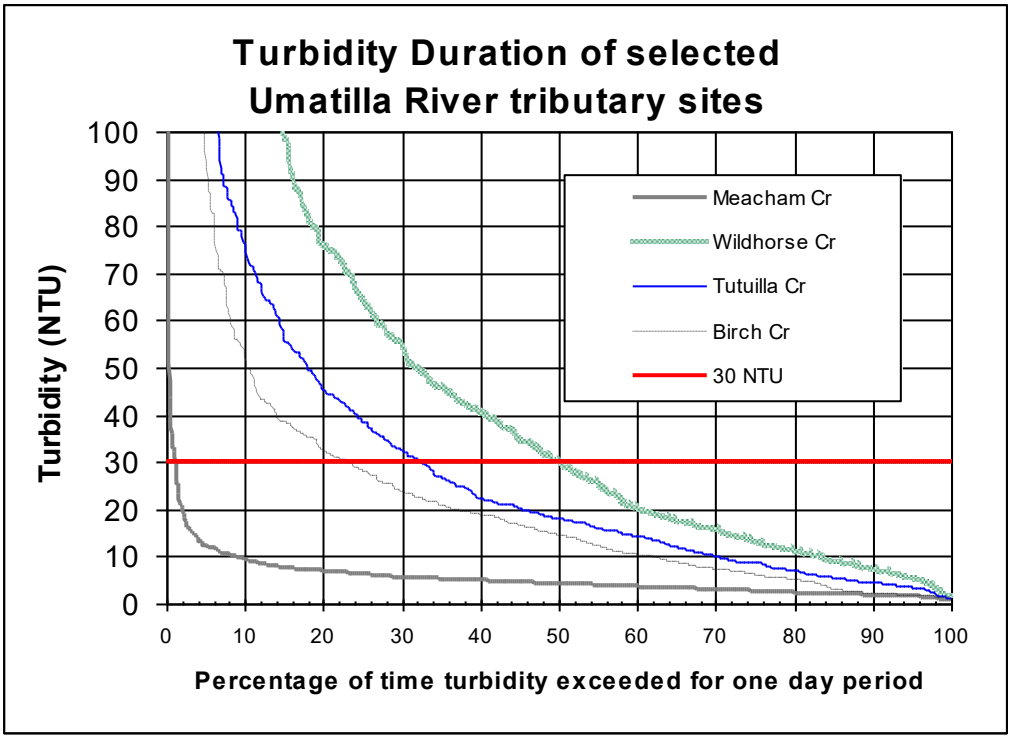


Figure 11 – Turbidity duration for Umatilla River tributary sites.

Sediment changes are hard to understand after only a few years of collecting data. There are only a few sites that have continuous and multi-year data. Most sites have been maintained for one or two years, often with a down year in between. Also, due to the small number of samplers available to the program, the locations of the units has typically been at the mouth of the tributary watershed, making it impossible to use for locating more specific locations and causes of sediment contribution into the system. Progress by a basin partner in looking at the feasibility and application of in-situ turbidimeters is slow, but ongoing. If this technology seems to work in our basin, then that might be a way to increase the level of monitoring across the basin.

Objective III: Continue Watershed Planning, Scoping and Education Process by Identifying Problems and Developing Creative Solutions to Land Use Problems Impacting Fisheries Habitat in the Umatilla River Basin.

1. Watershed Assessment:

The Umatilla Subbasin/Willow Creek Subbasin Summary and Meacham Creek Watershed Analysis and Action Plan were completed. Development of the Umatilla Subbasin/Willow Creek Subbasin Watershed Assessment continued during the 2002 and 2003 project periods. A draft version of the watershed assessment will be available for review in May 2004. These documents shall be utilized for guidance in planning and implementing out-year project activities.

Project staff assisted in development of the Umatilla Subbasin/Willow Creek Subbasin Summary and Umatilla Subbasin/Willow Creek Subbasin Watershed Assessment by providing technical input and writing portions of these documents. Project funds previously cost shared for the completion of the Meacham Creek Watershed Analysis and Action Plan continued under a subcontract with Water Works Consulting, Duck Creek Associates and Ed Salminen Consulting.

2. Community Outreach Efforts:

The following public outreach efforts occurred during the 2002 and 2003 project periods:

- Attended and provided input at the UBWC Technical Committee Meetings to assist with development of NPPC's subbasin planning efforts.
- Provided a Power Point presentation to Oregon Watershed Enhancement Board (OWEB) to familiarize them with CTUIR's ongoing habitat enhancement efforts and potentially assist the project in obtaining future cost share funding.
- Participated and provided displays and educational literature to seventh and eight grade students at the ESD Career Showcase.
- Provided a tour to CRITFC of previously cost shared PCSRF sites to familiarize them with project recovery at these sites and attempt to obtain additional PCSRF dollars for cost share.
- Provided the McKay Creek Project Area, native willow cuttings and riparian habitat restoration/recovery instruction to elementary students participating in ESD Watershed Field Days.

- Provided a field trip of the Wildhorse Creek Project Area to Hawthorne Secondary School students as a demonstration of habitat recovery efforts.

- Provided a field trip of the Wildhorse Creek Project Area to Pendleton Alternative School students to demonstrate habitat enhancement and recovery efforts.

- Met with Molly Schmitz, Director of Saturday Academy's Apprenticeships in Science and Engineering Program, to discuss mentoring a Tribal youth under their Apprenticeships in Science and Engineering Program.

- Provided a presentation to students in a career preparation course at Pendleton High School.

- Provided macroinvertebrate sampling equipment and macroinvertebrate monitoring instruction to students participating in CTUIR's Salmon Expedition.

- Provided a tour of the Wildhorse Creek Project Area to UNF, OSU Agricultural Research Station and SWCD personnel to assess the effectiveness of in-channel sediment retention structures in stabilizing and narrowing the stream channel. The UNF and SWCD are implementing similar approaches in the Butter Creek Drainage.

- Participated in a multi-basin two day tour of BPA funded CTUIR habitat enhancement projects to become familiar with other restoration efforts and exchange information.

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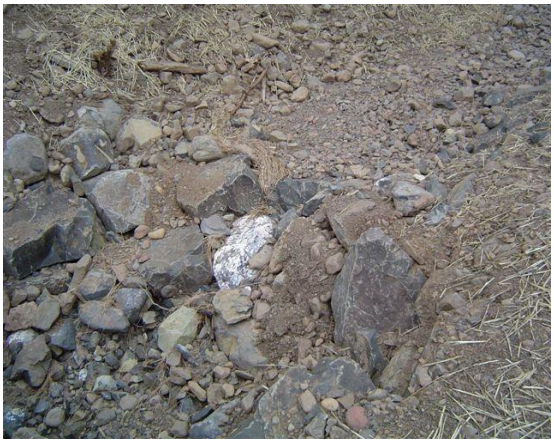
Appendix A – Spring Hollow Cr. Improvements

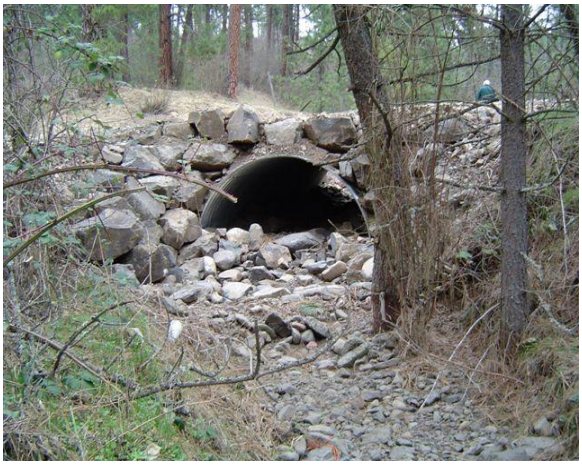




Appendix B – Sears Creek Improvements



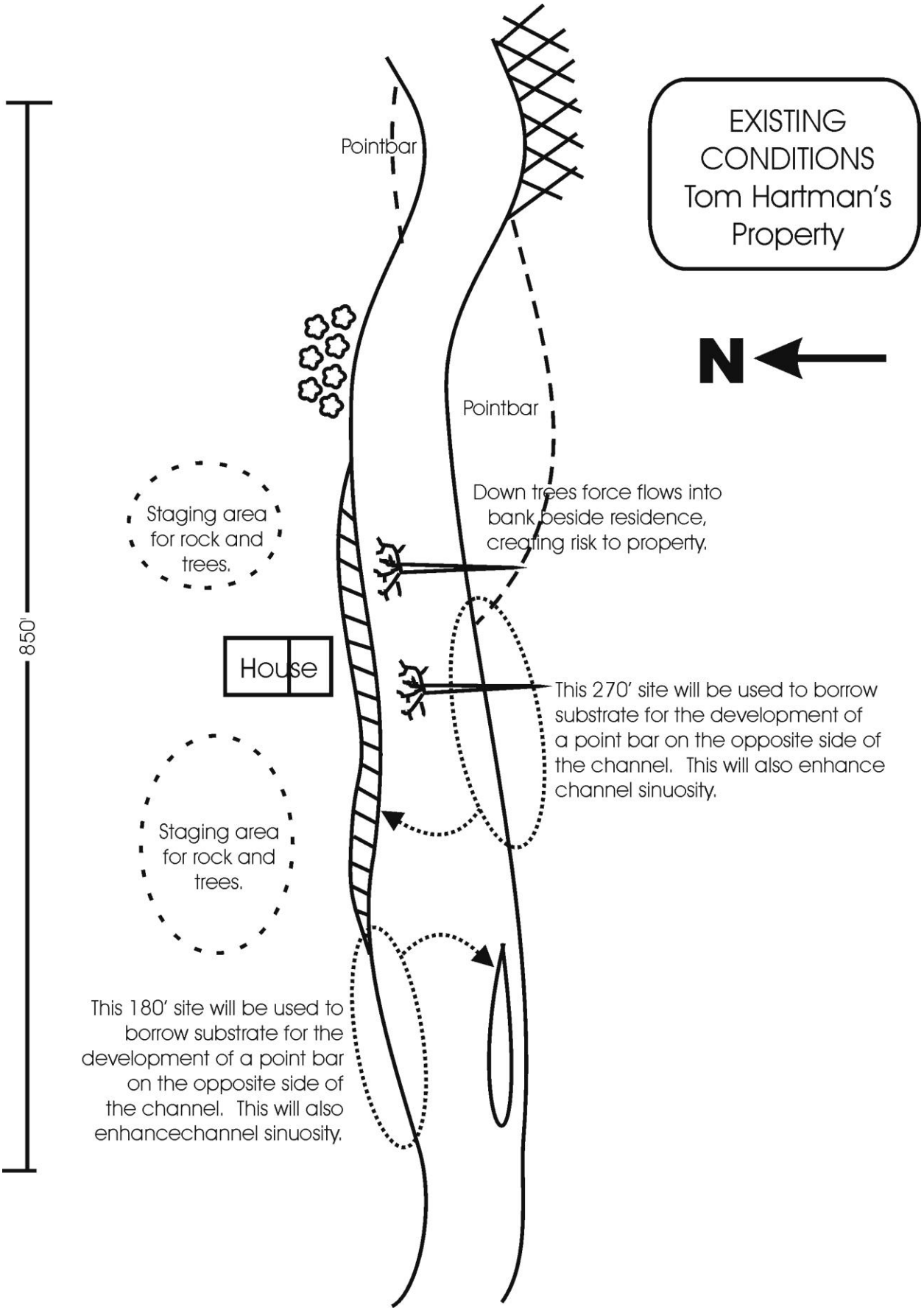


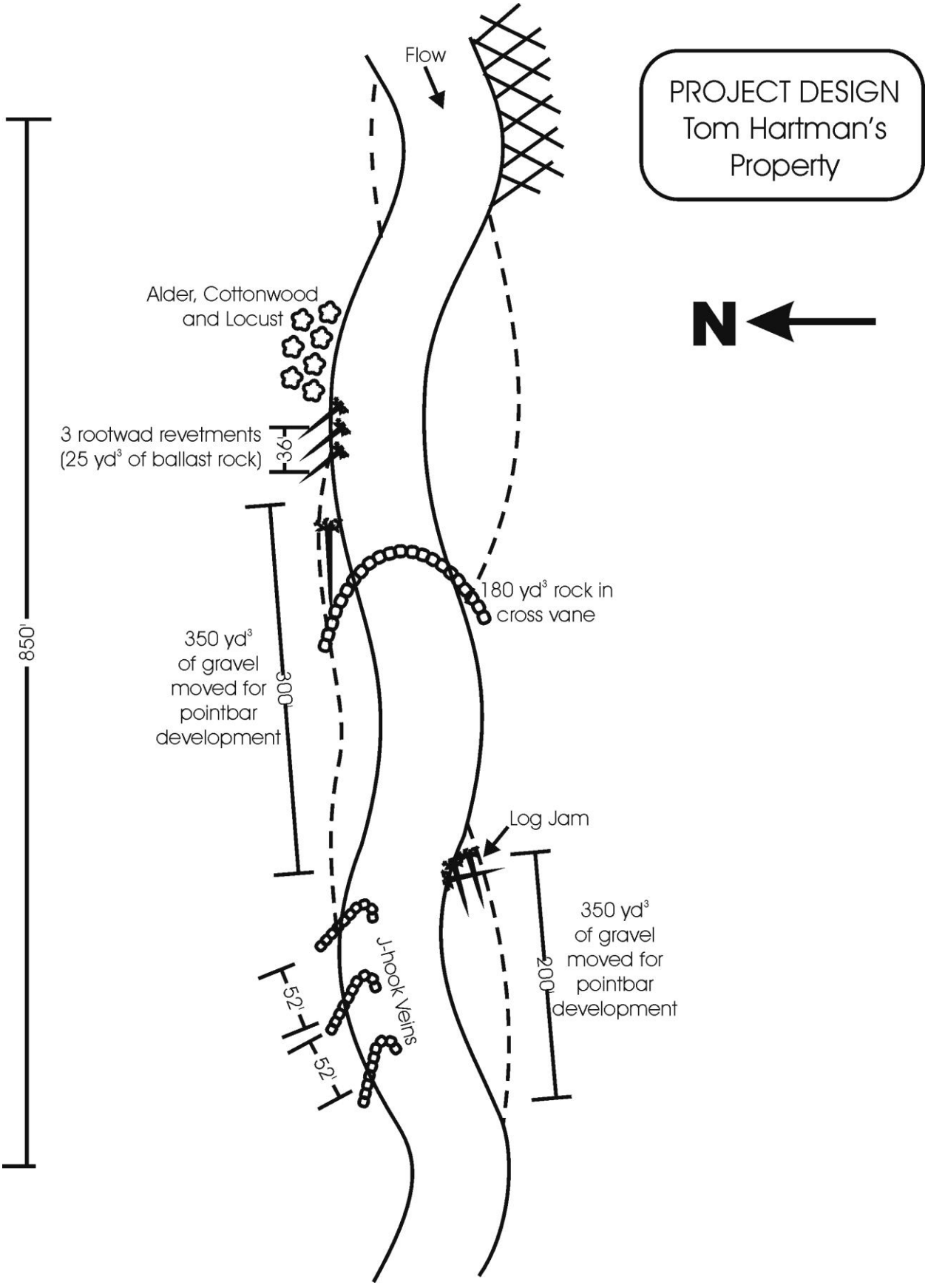




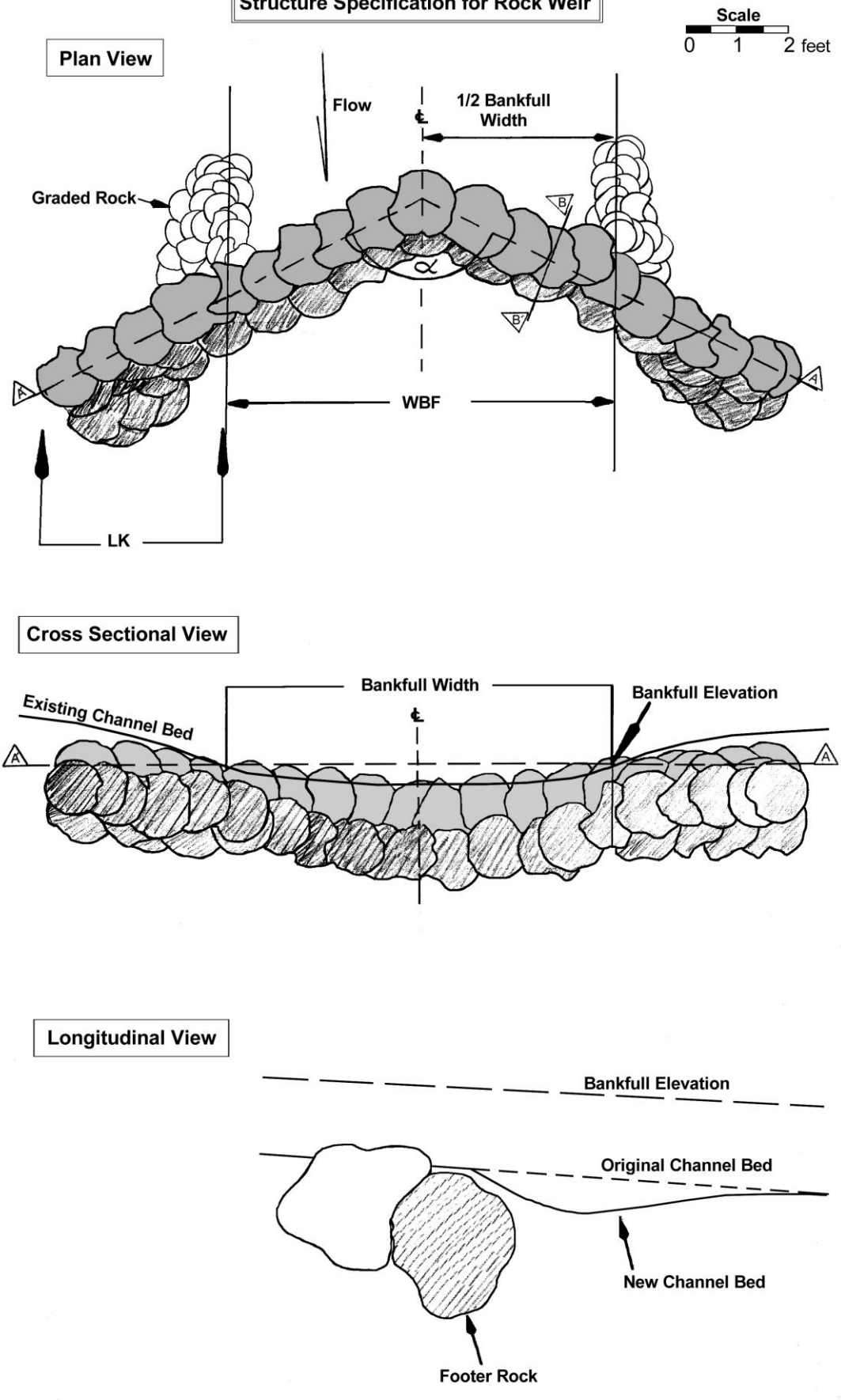





EXISTING CONDITIONS Tom Hartman's Property
N
Pointbar
Pointbar
Down trees force flows into bank beside residence, creating risk to property.
Staging area for rock and trees.
House
This 270' site will be used to borrow substrate for the development of a point bar on the opposite side of the channel. This will also enhance channel sinuosity.
Staging area for rock and trees.
850'
This 180' site will be used to borrow substrate for the development of a point bar on the opposite side of the channel. This will also enhancechannel sinuosity.

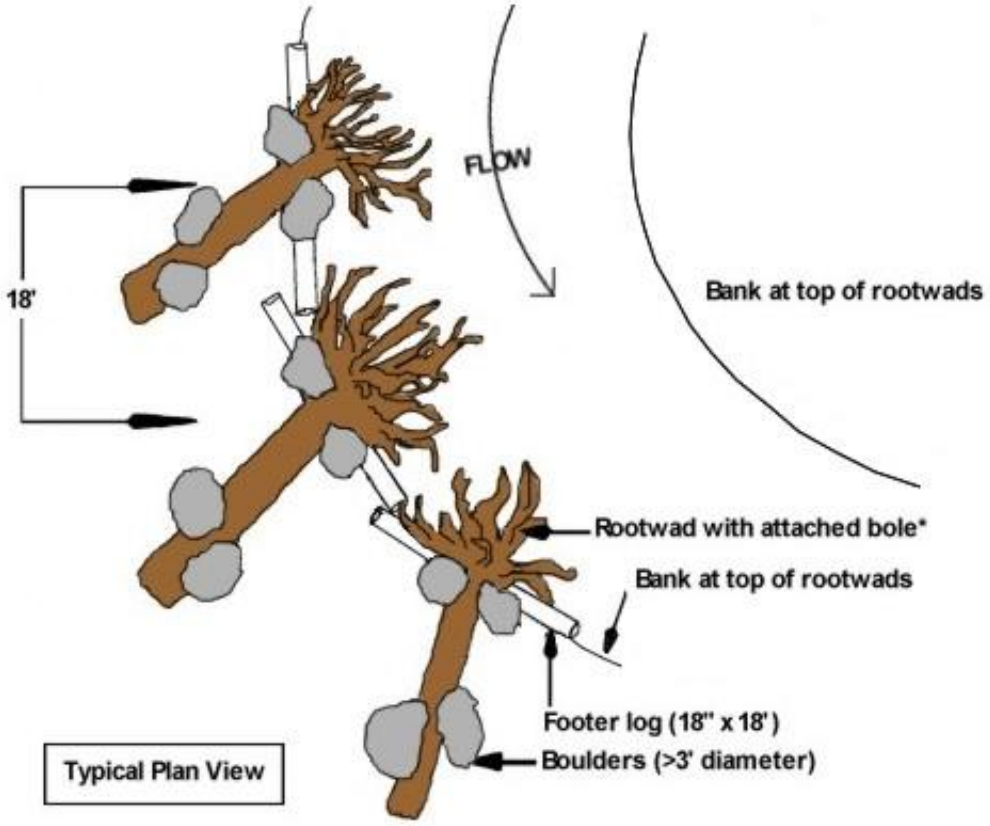

PROJECT DESIGN
Tom Hartman's
Property
Flow
N
Alder, Cottonwood
and Locust
3 rootwad revetments
(25 yd³ of ballast rock)
36'
180 yd³ rock in
cross vane
350 yd³
of gravel
moved for
pointbar
development
300'
850'
Log Jam
350 yd³
of gravel
moved for
pointbar
development
200'
J-hook Veins
52'
52'

Structure Specification for Rock Weir

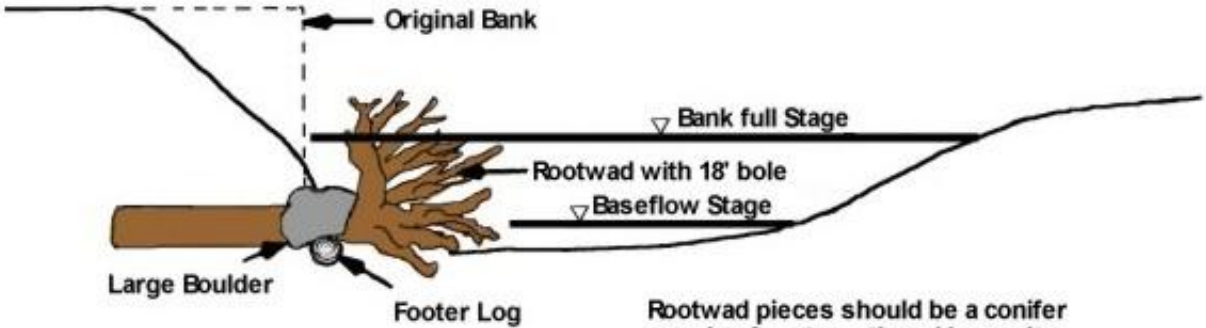


Structure Specification for Rootwad Revetment

Scale 10
5 ft 1 ft



Typical Plan View

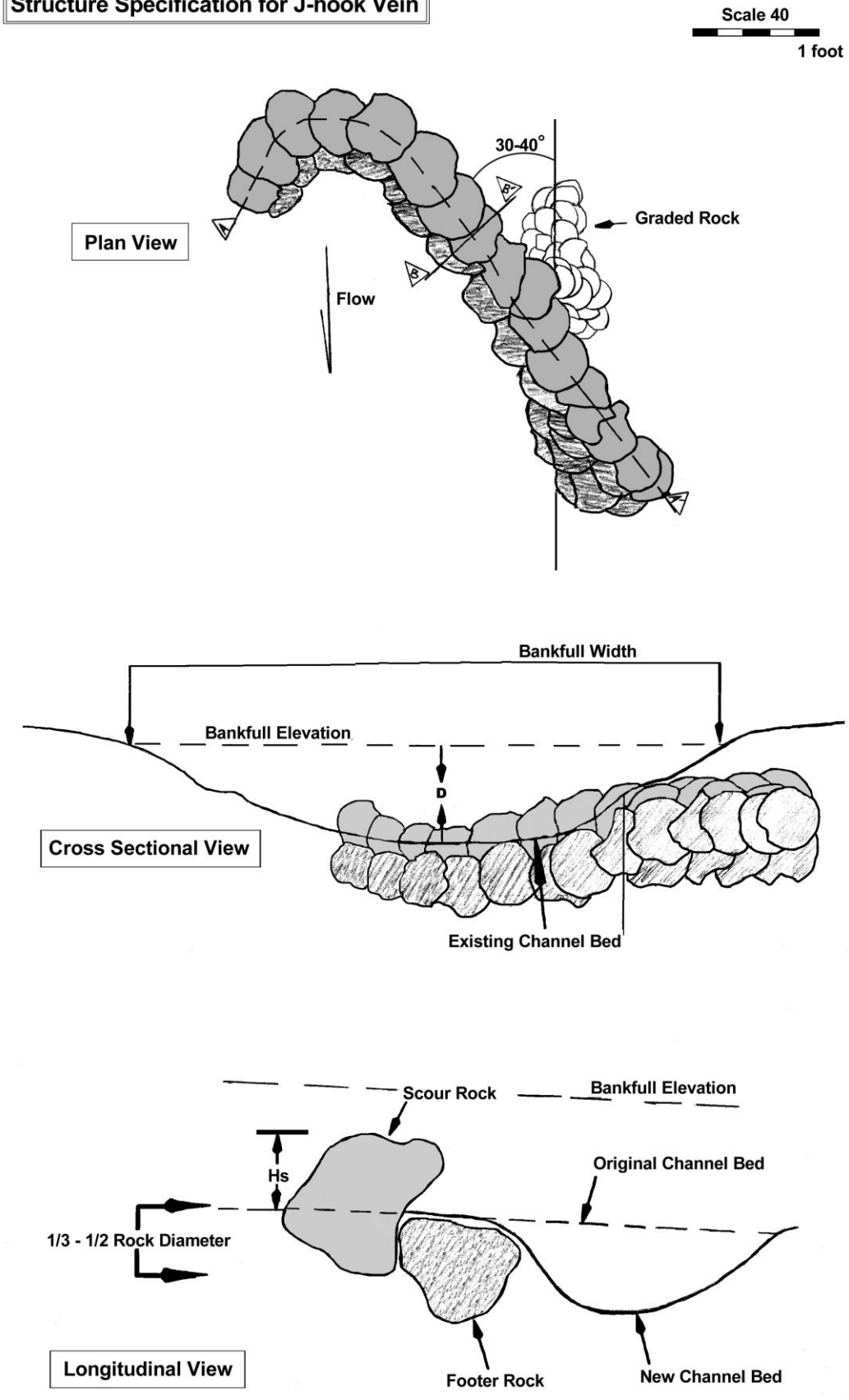


Cross-section View

Rootwad pieces should be a conifer species for strength and longevity.
Rootwad diameter should exceed 6'.
Attached bole should exceed 18" DBH x 18'.

JN 5/25/1999

Structure Specification for J-hook Vein



Appendix C – Macroinvertebrate Survey Data

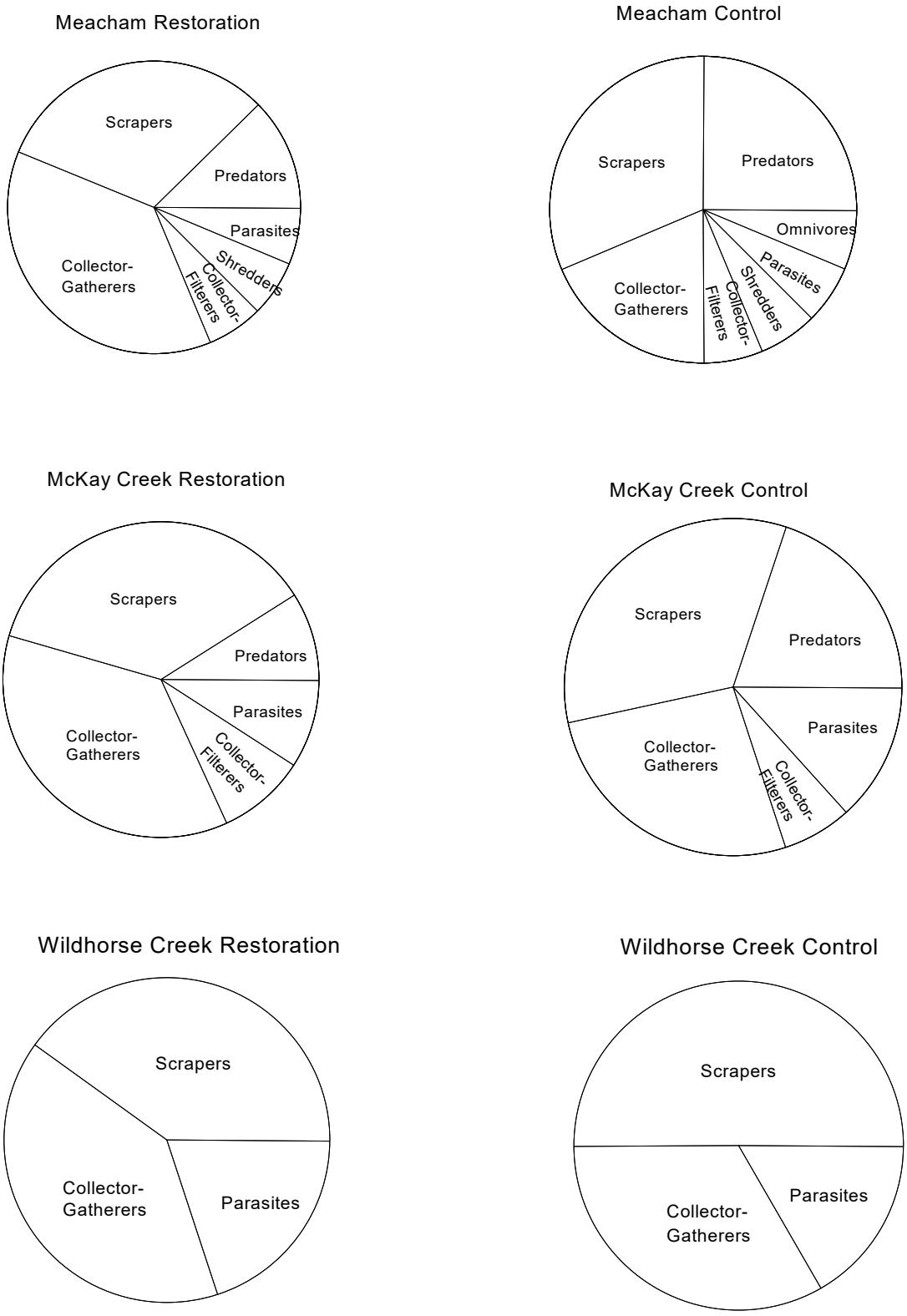
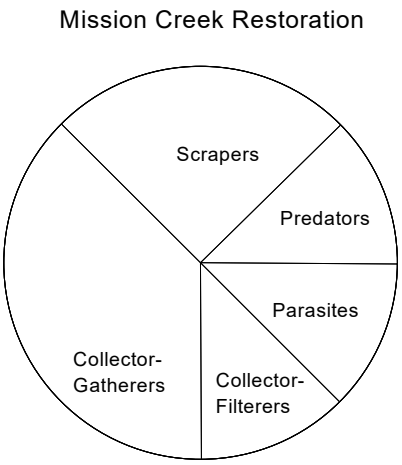
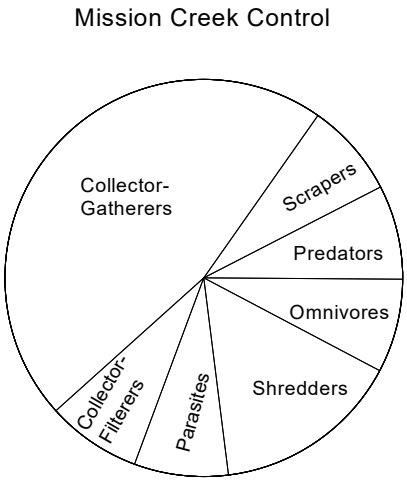
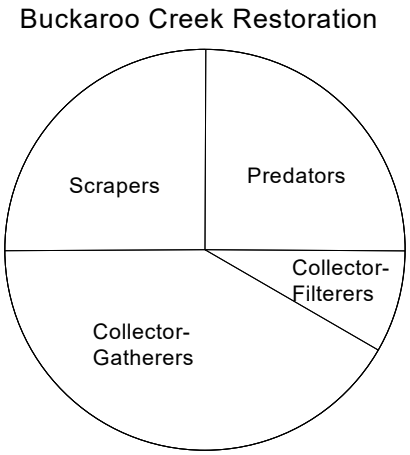


Figure 1. Proportions of different Functional Feeding Groups (FFG) for each site.







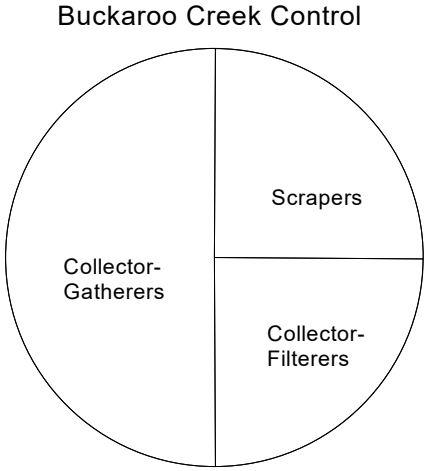


Figure 1 continued.

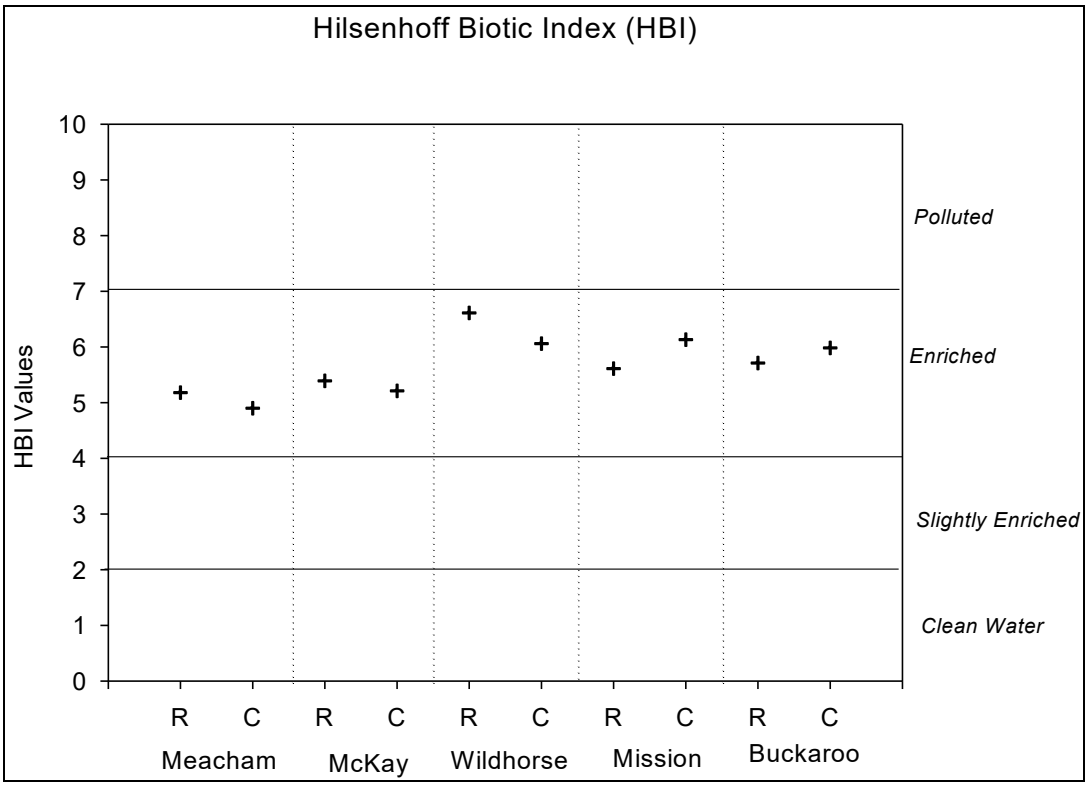


Figure 2. Hilsenhoff Biotic Index (HBI) values for the ten sites at the five streams. R = Restoration site and C = Control site.

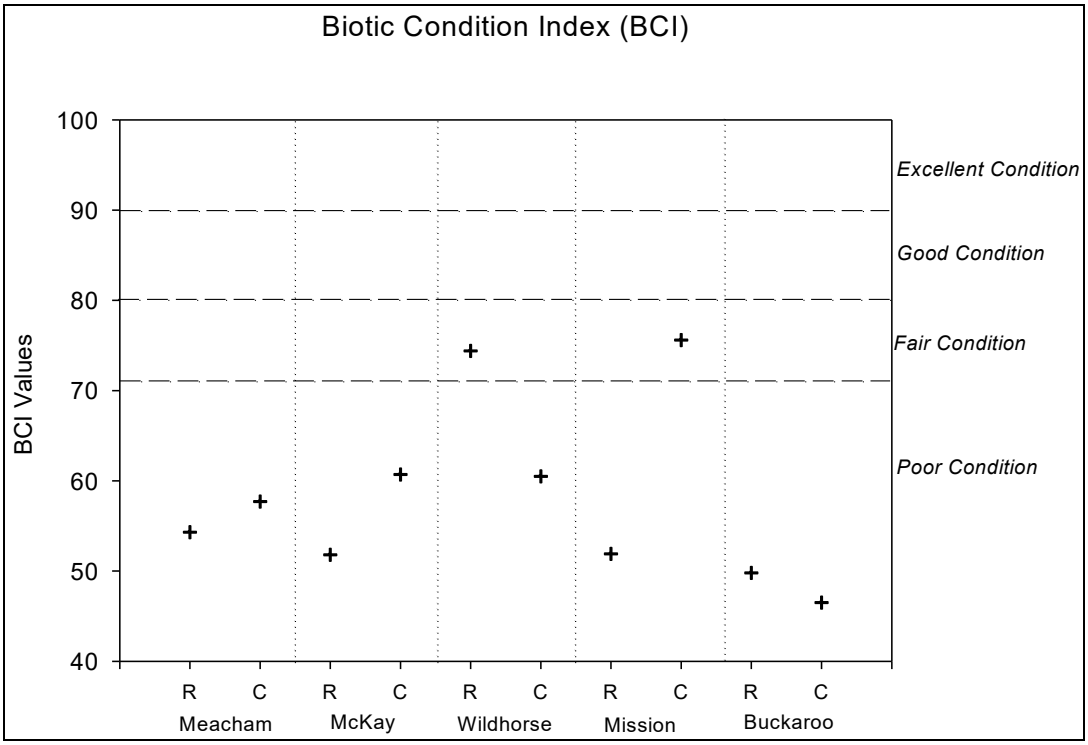


Figure 3. Biotic Condition Index (BCI) values for the ten sites at the five streams. R = Restoration site and C = Control site.

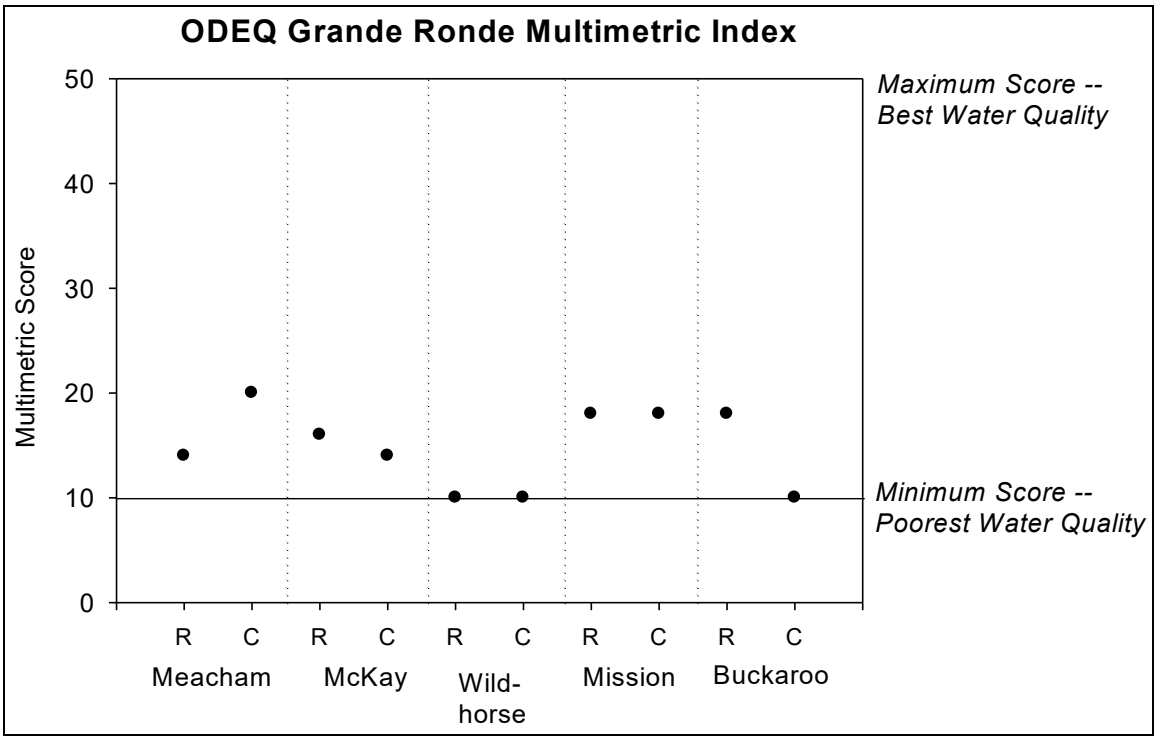


Figure 4. Oregon Department of Environmental Quality (ODEQ) multimetric scores for the ten sites at the five streams. R = Restoration site and C = Control site.

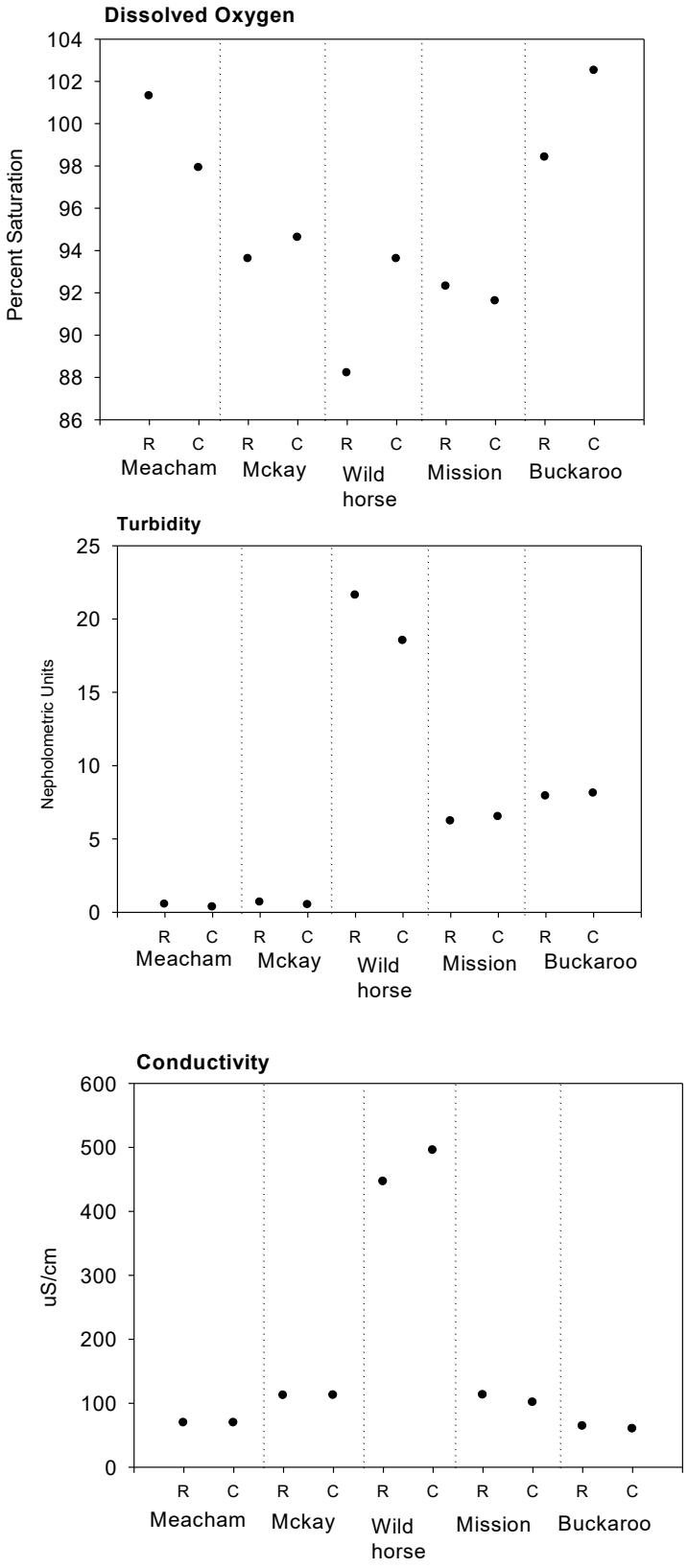


Figure 5. Water chemistry measures for the ten sites at the five streams.

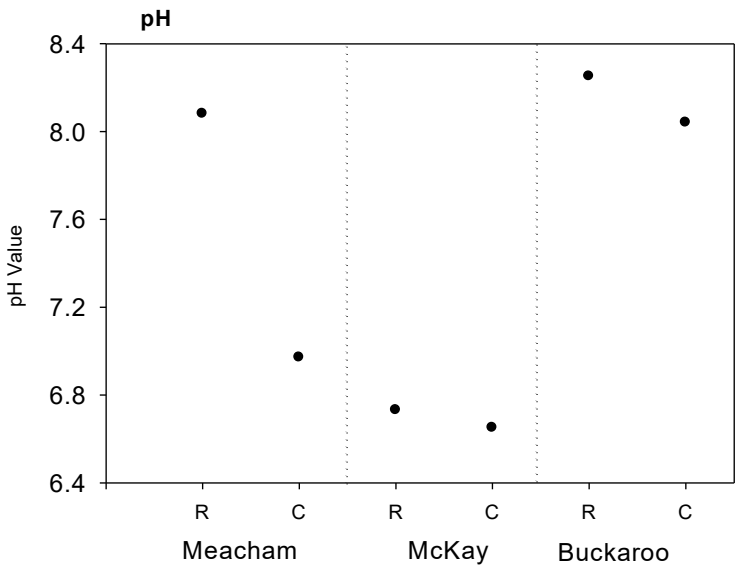


Figure 5 continued. Note: pH was taken at only three streams because of a malfunctioning meter.

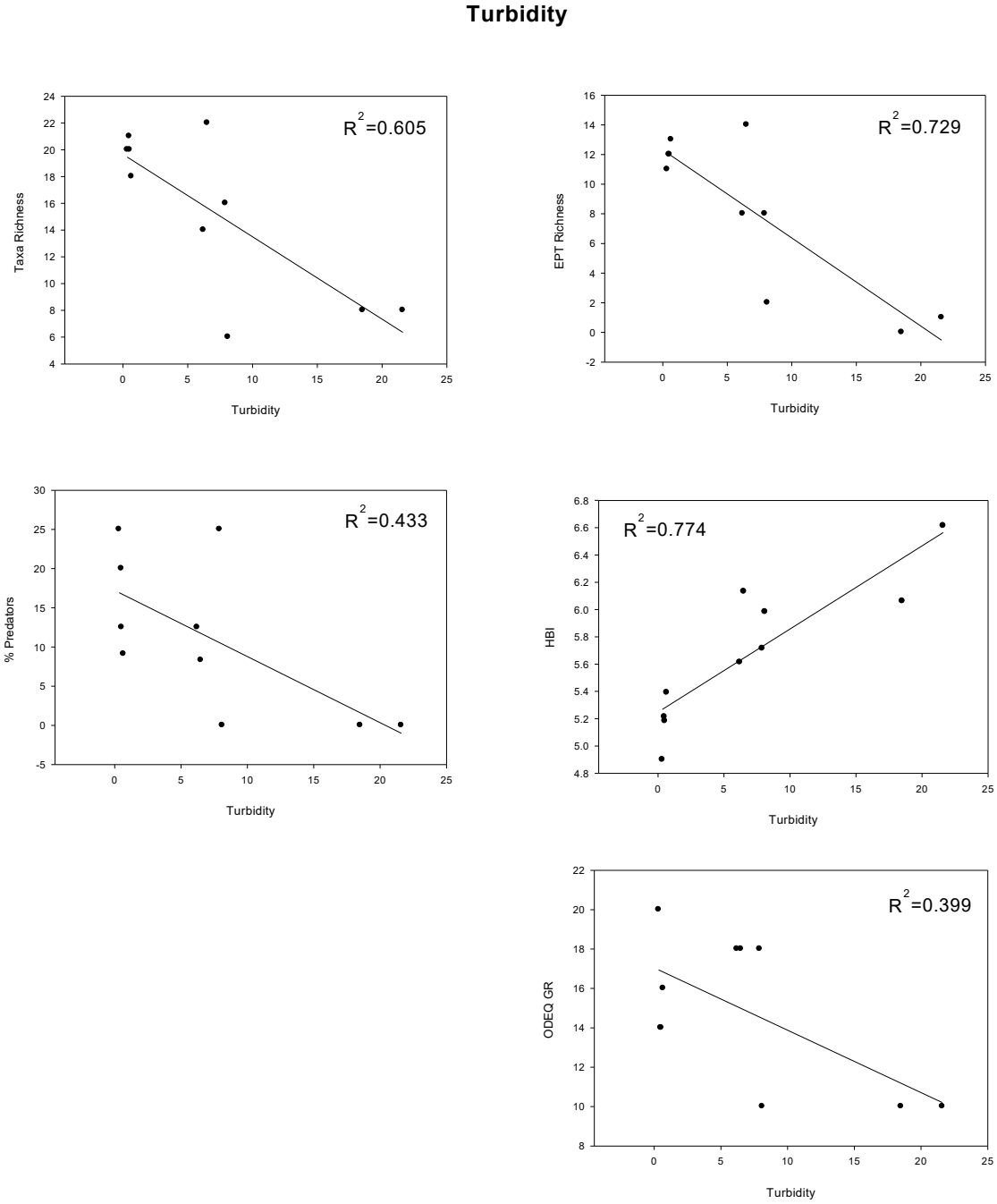
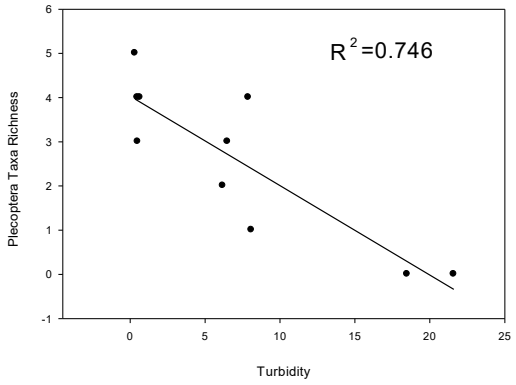
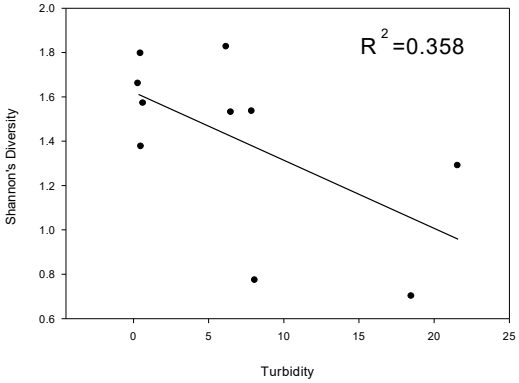


Figure 6. The relationship between turbidity and macroinvertebrate metrics of water quality. Only significant relationships are shown.

Turbidity





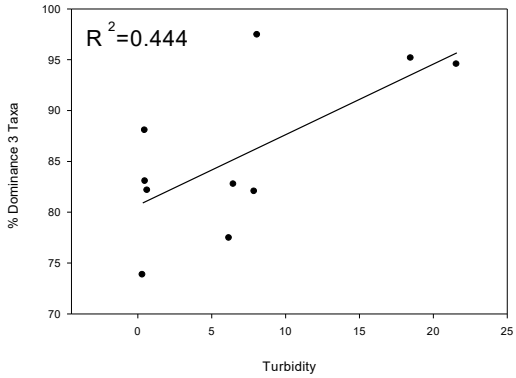


Figure 6 continued.

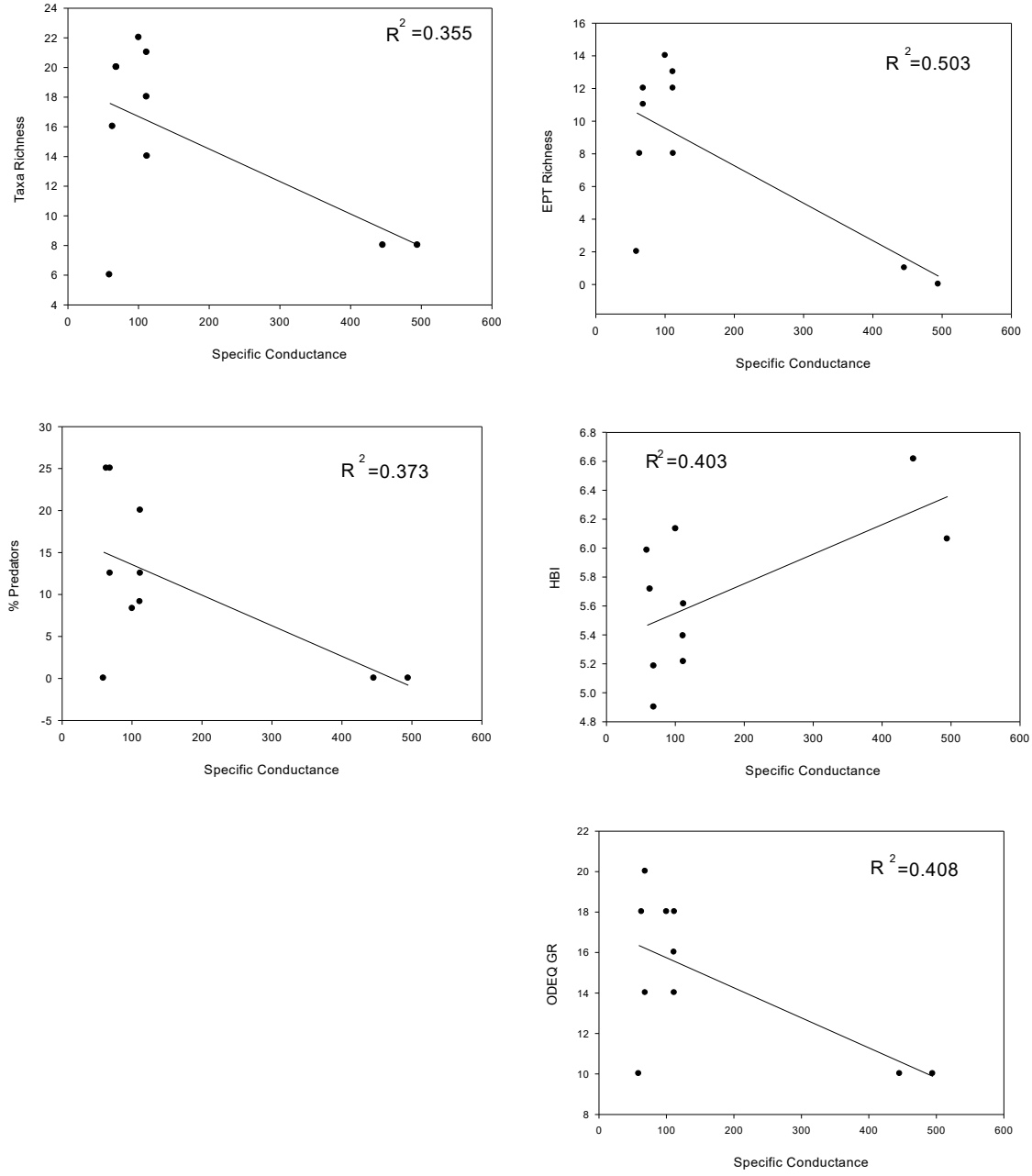


Figure 7. The relationship between conductivity and macroinvertebrate metrics of water quality. Only significant relationships are shown.

Specific Conductance

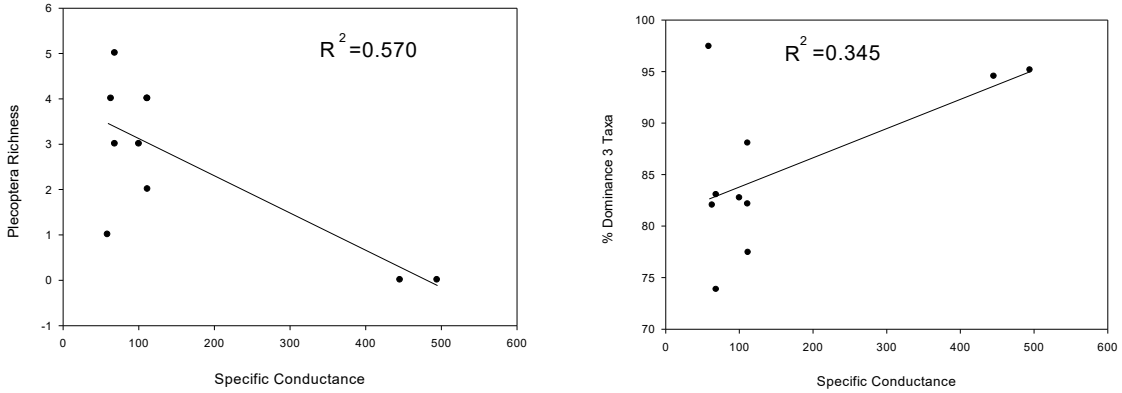


Figure 7 continued.

Dissolved Oxygen

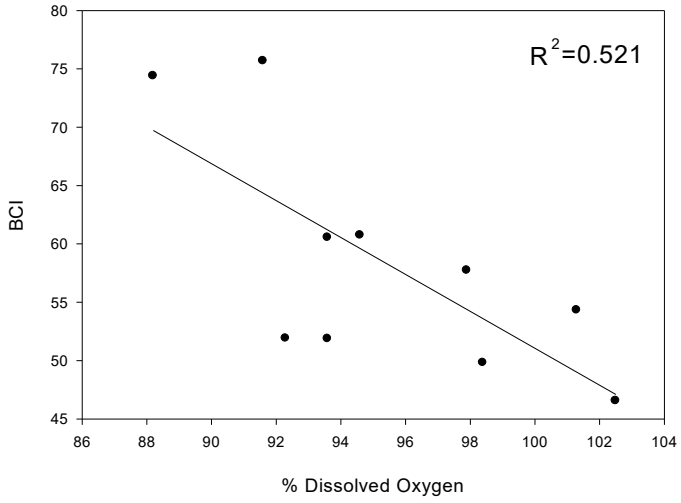
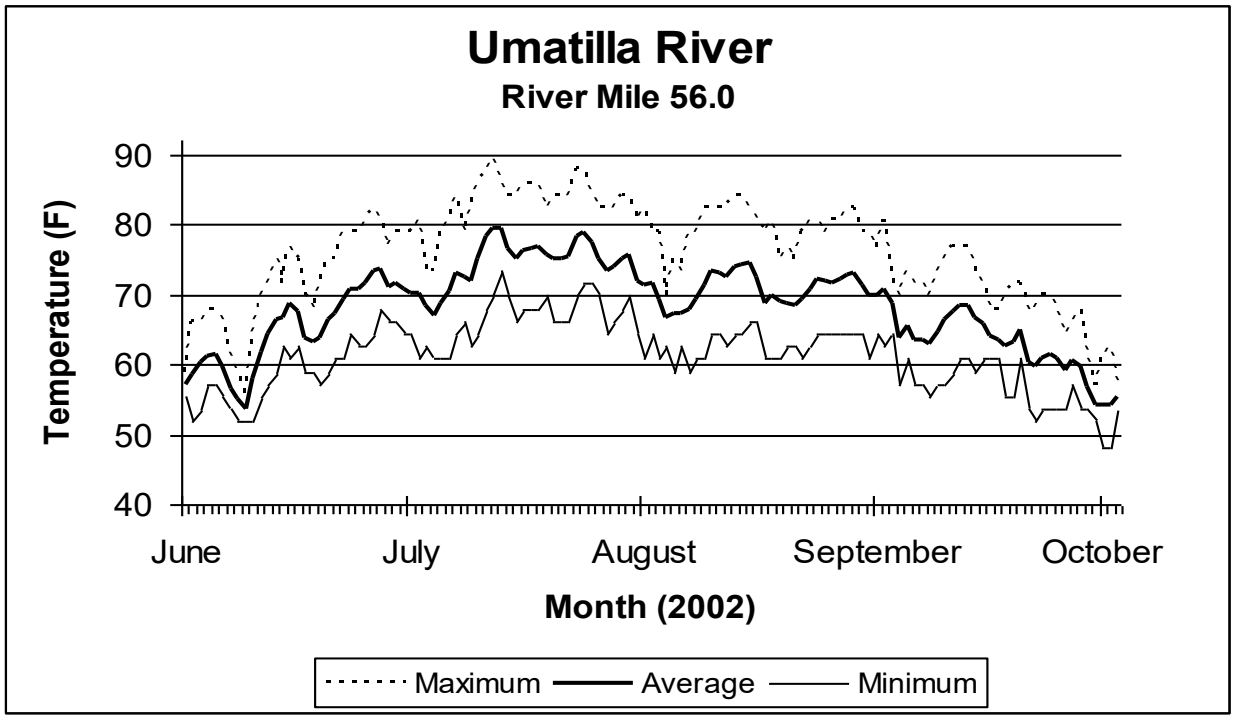
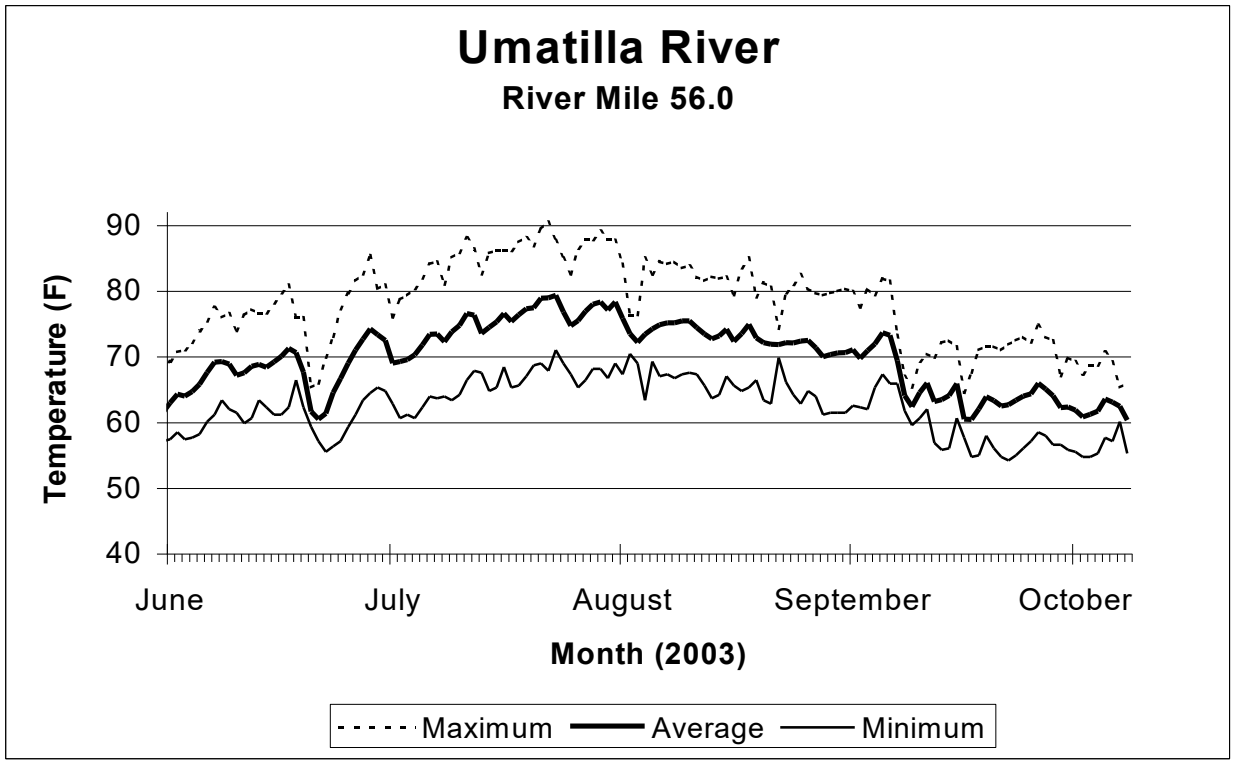


Figure 8. The relationship between dissolved oxygen and the Biotic Condition Index (BCI). Only significant relationships are shown.

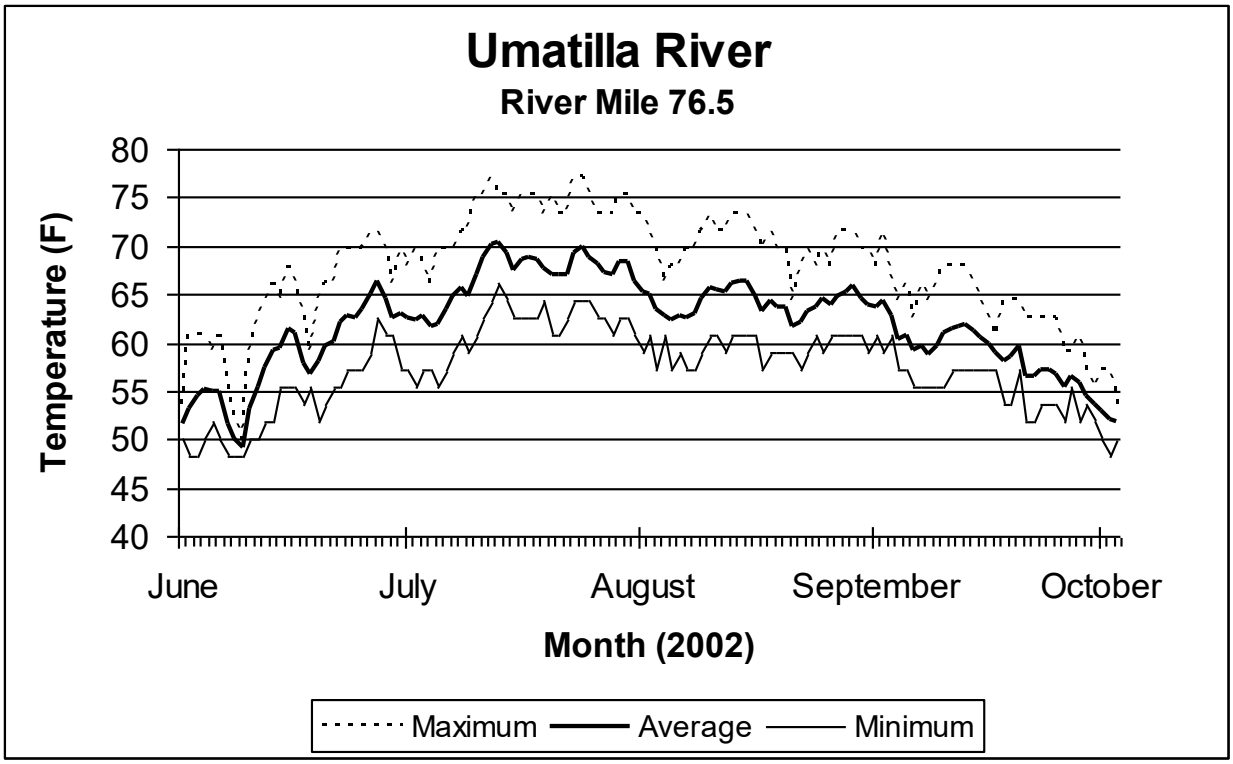
Appendix D – Water Temperature Data



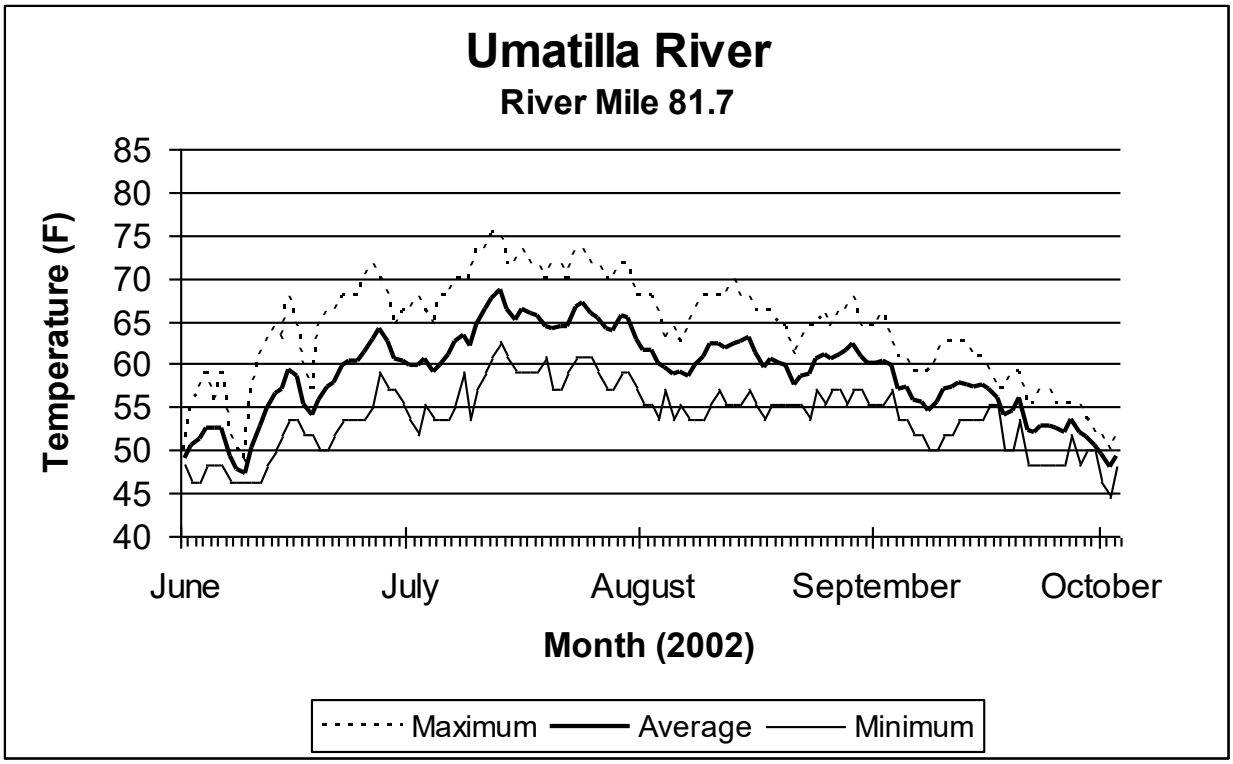
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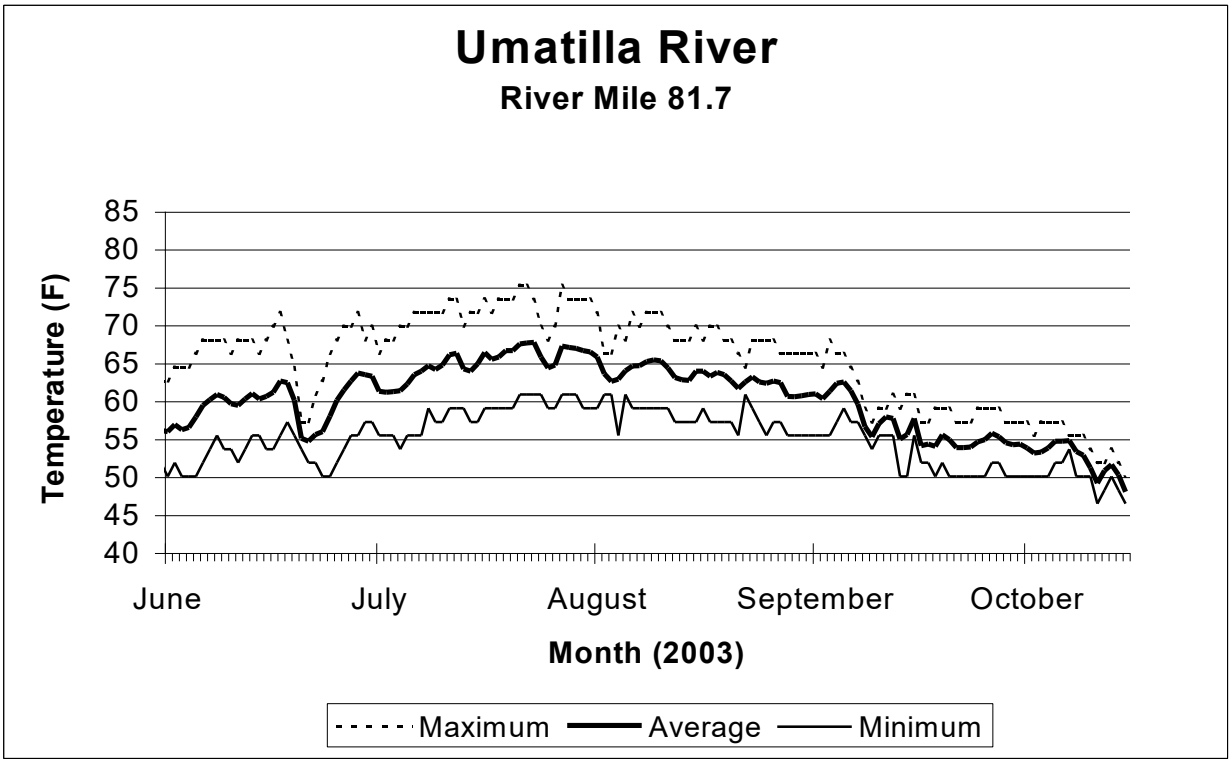
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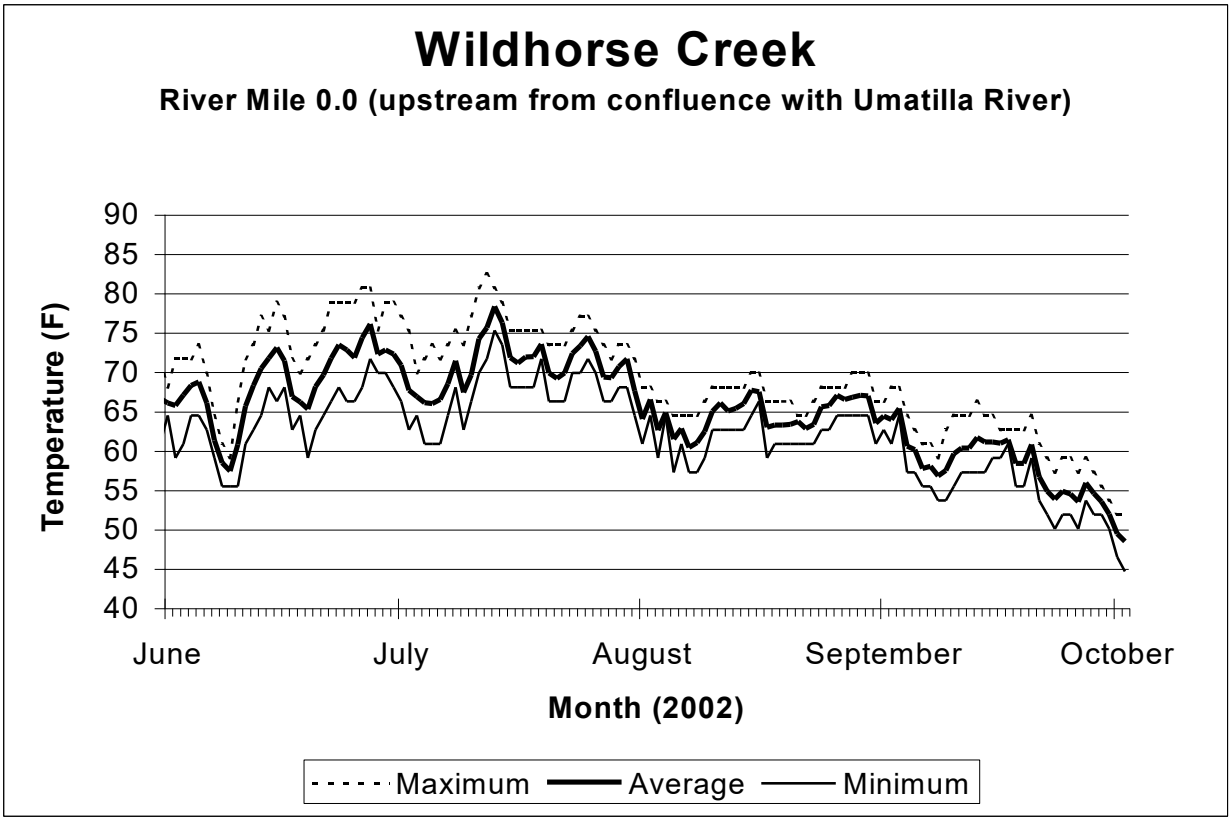
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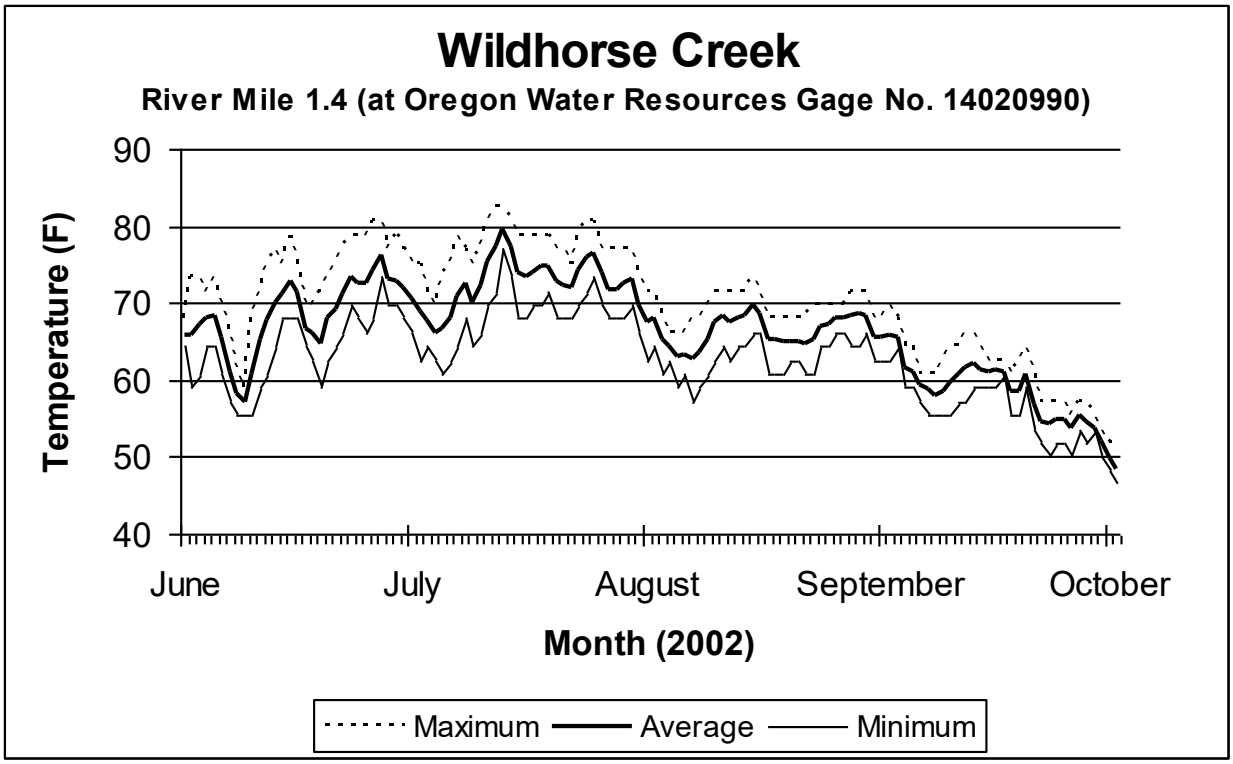
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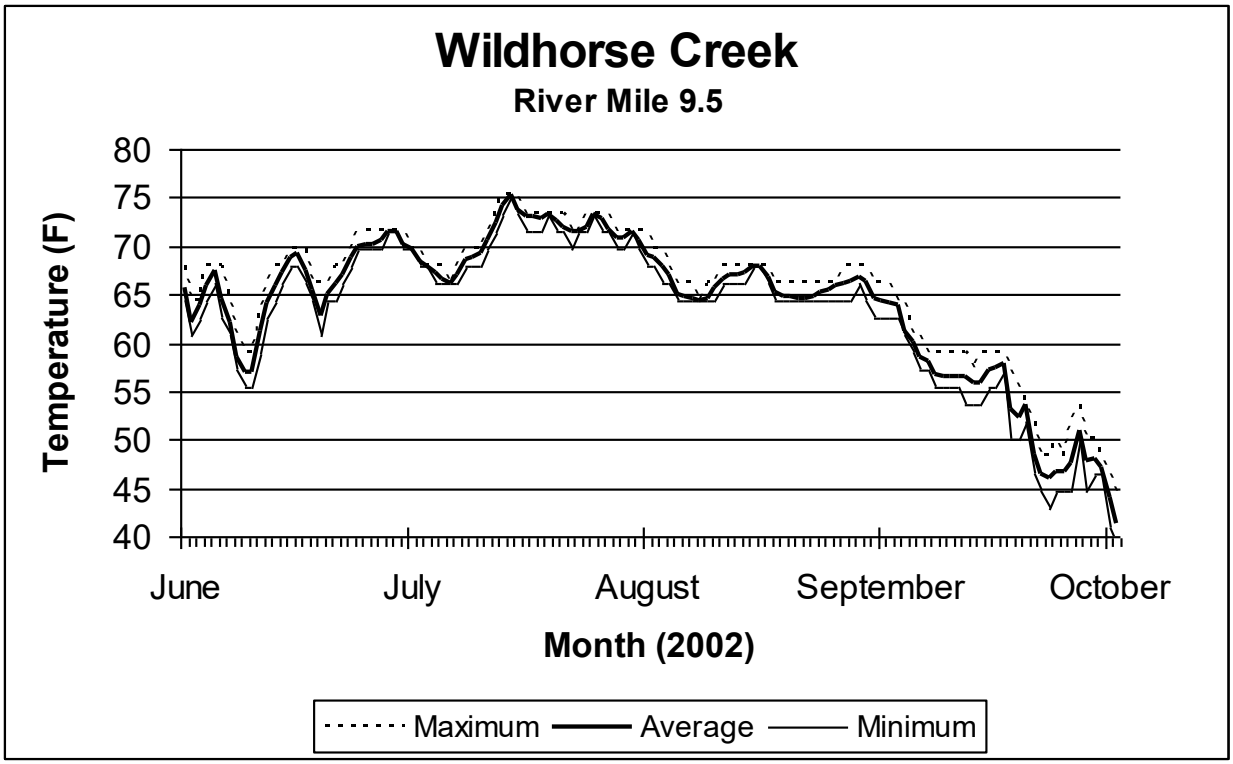
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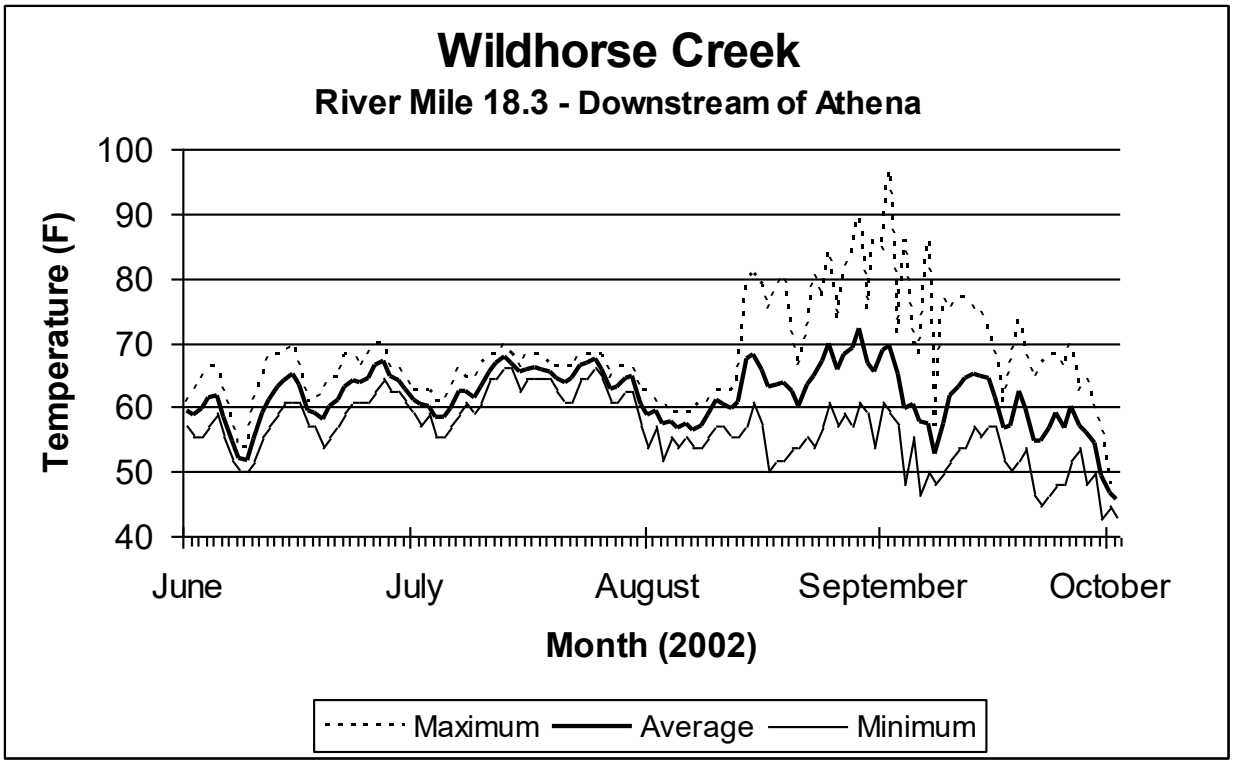
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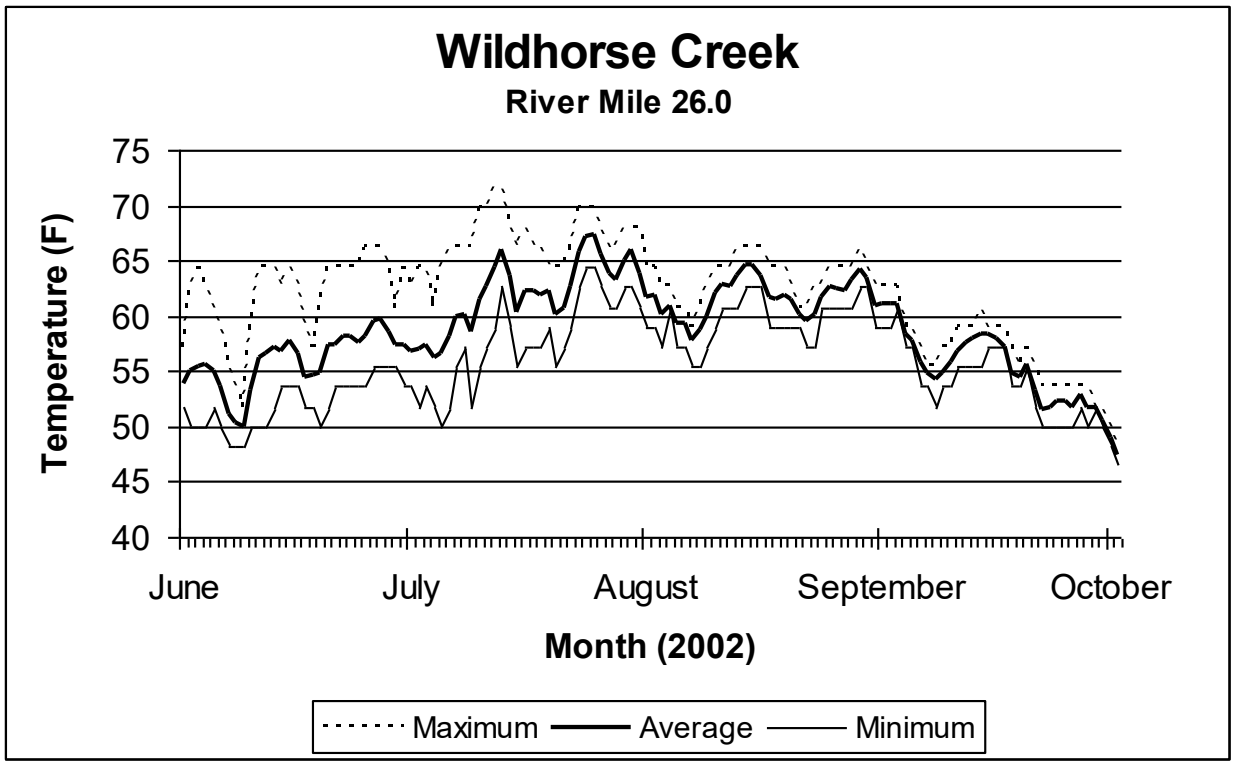
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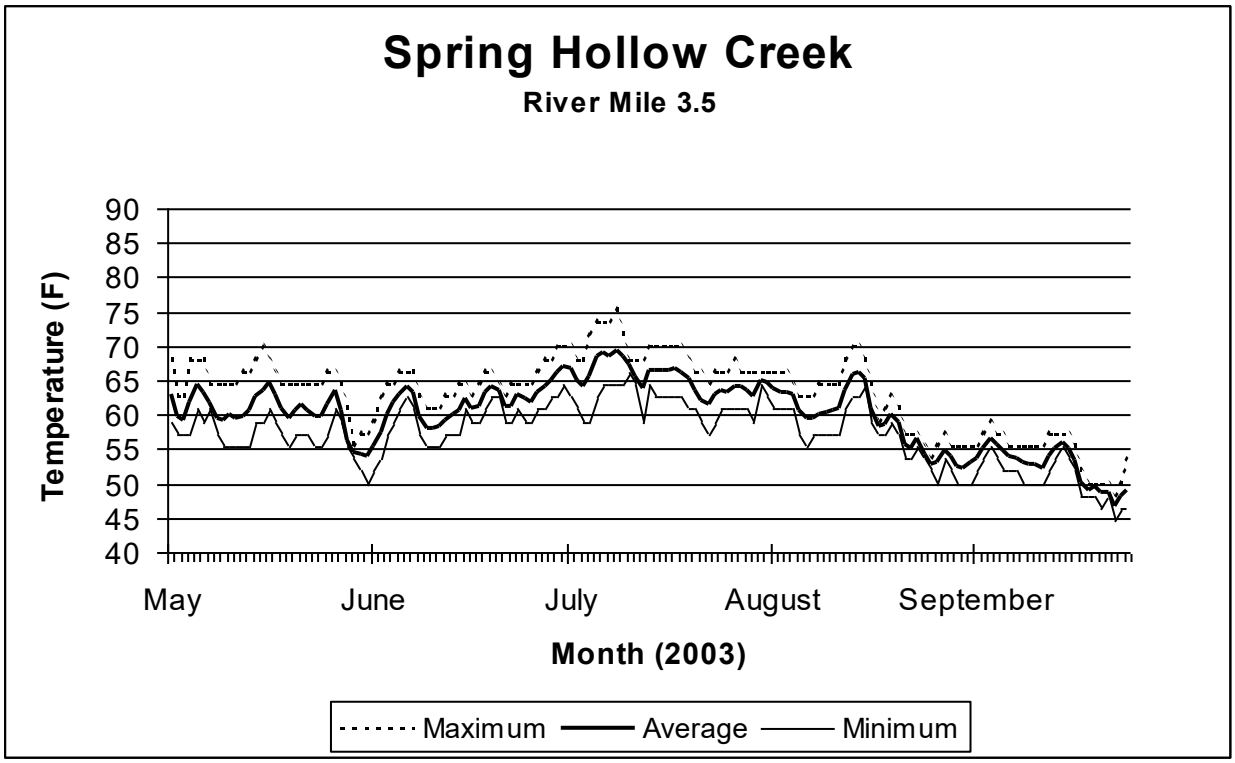
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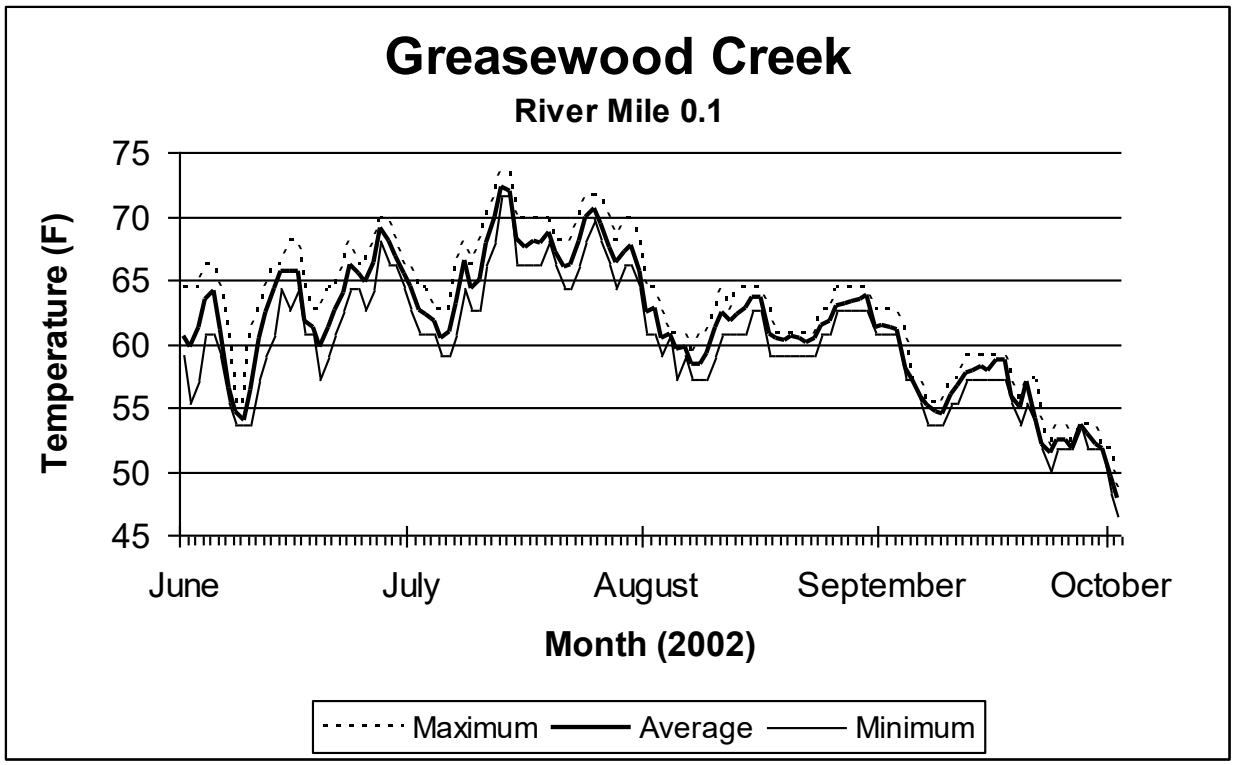
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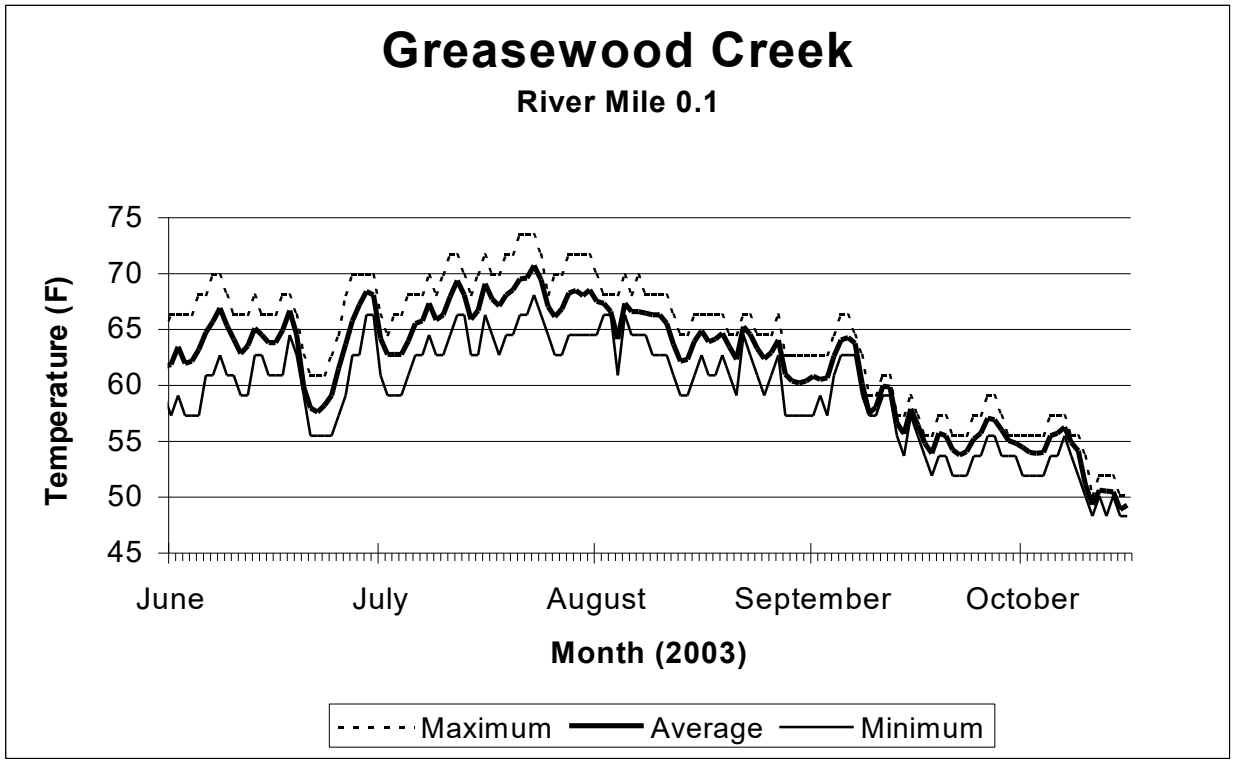
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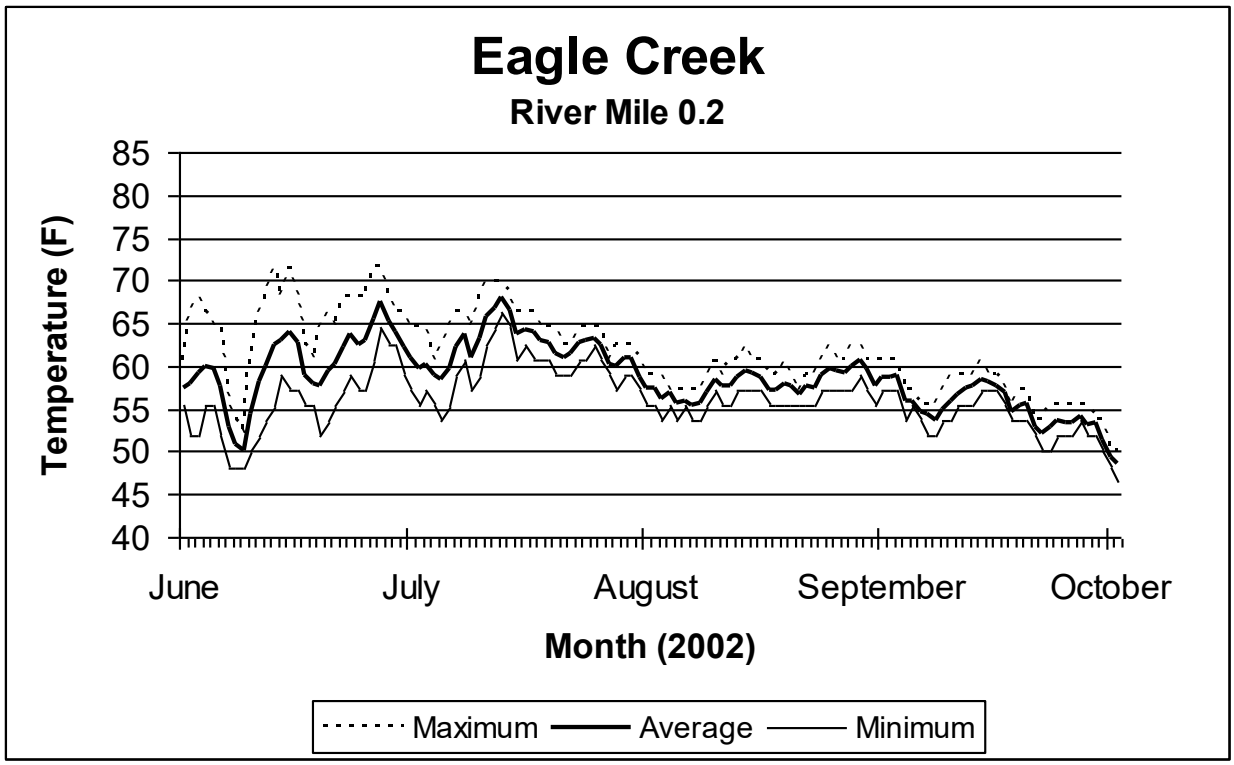
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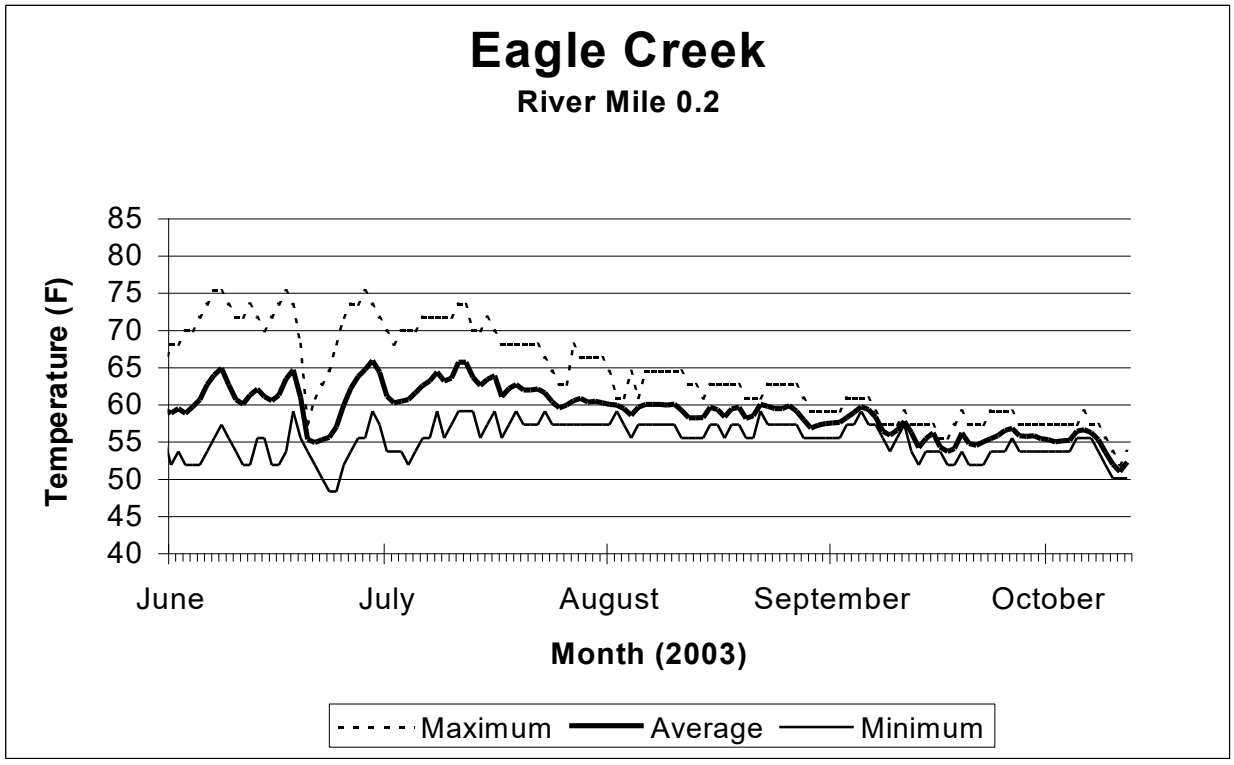
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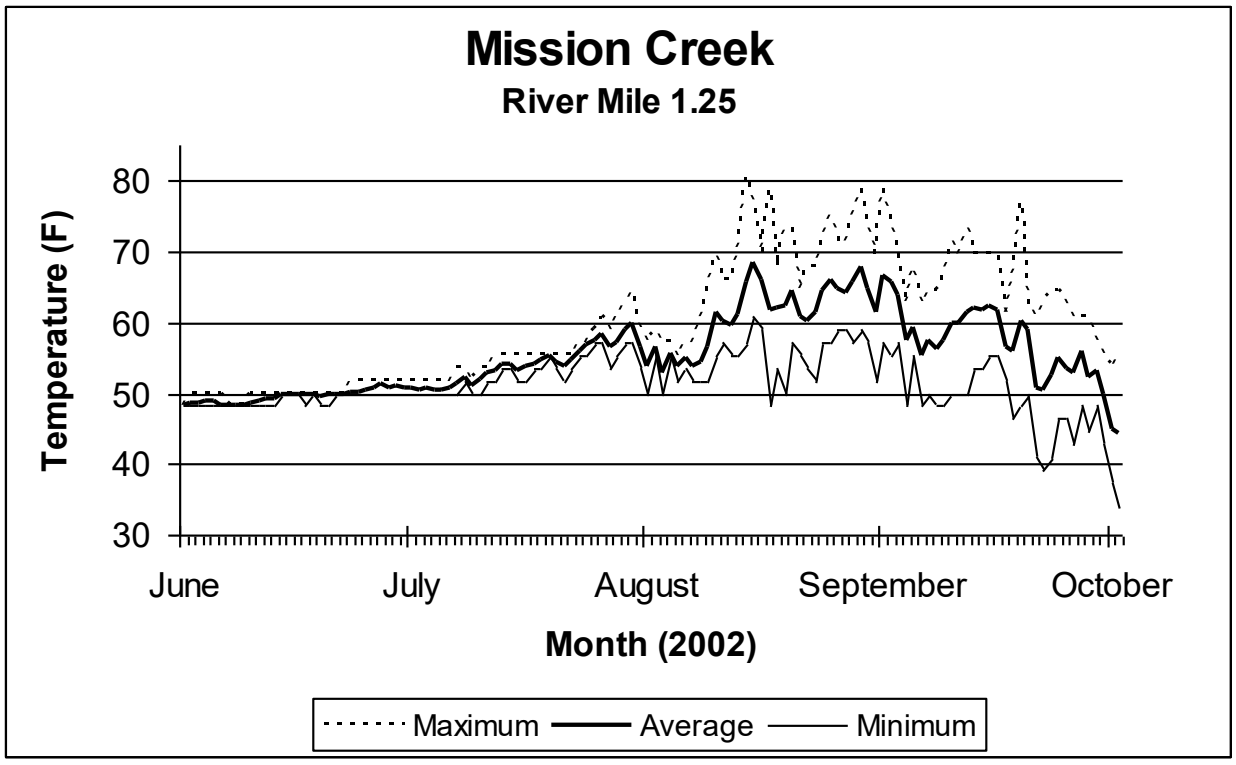
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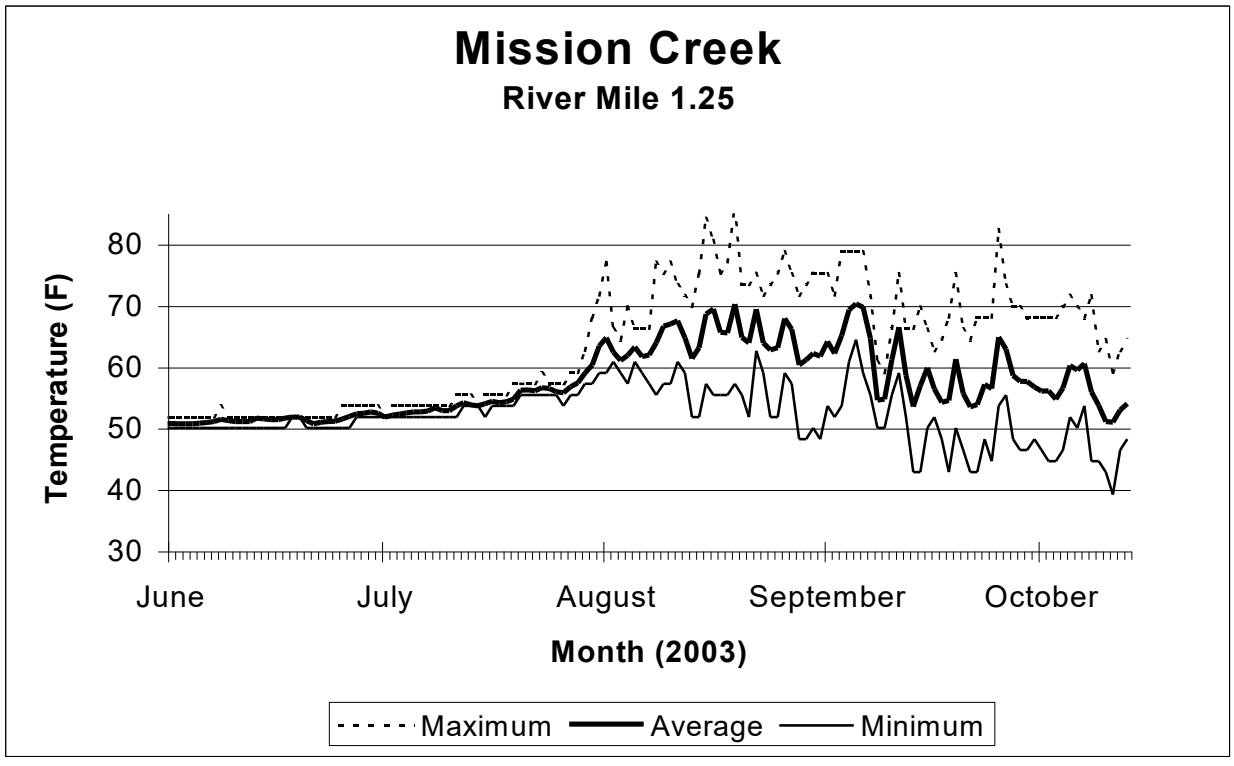
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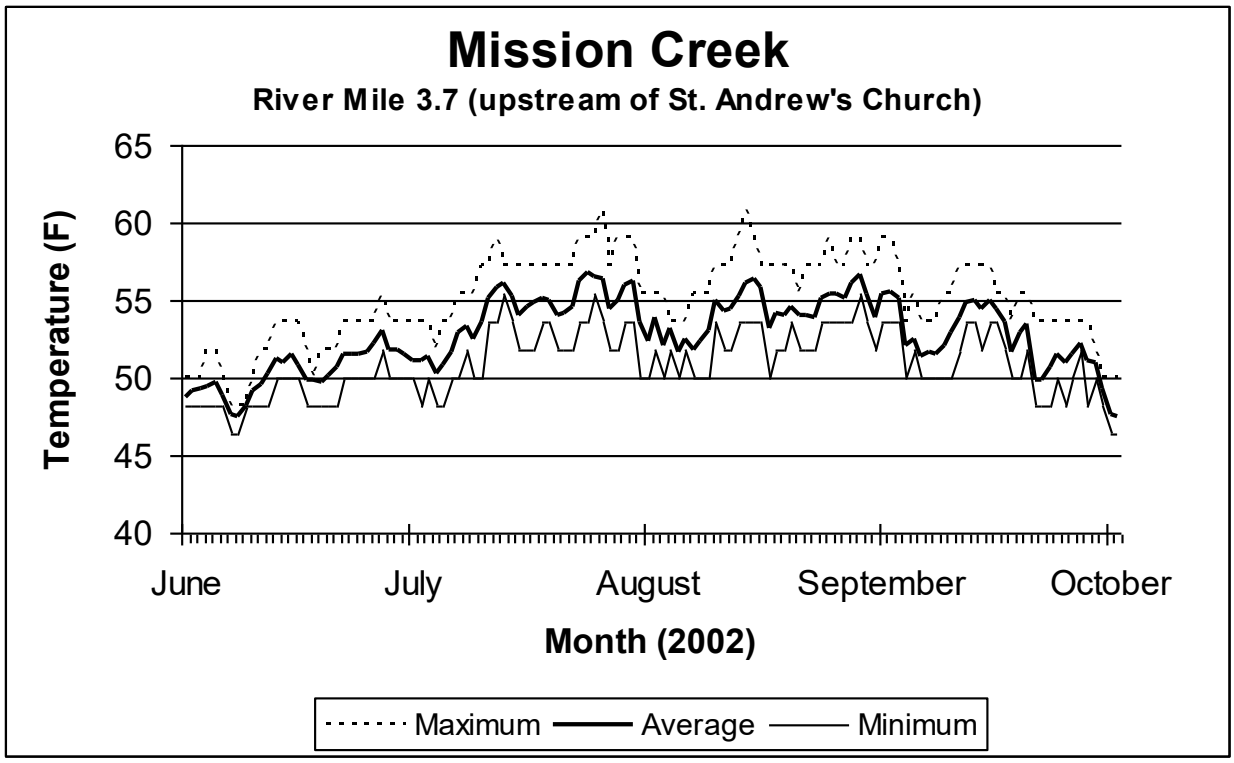
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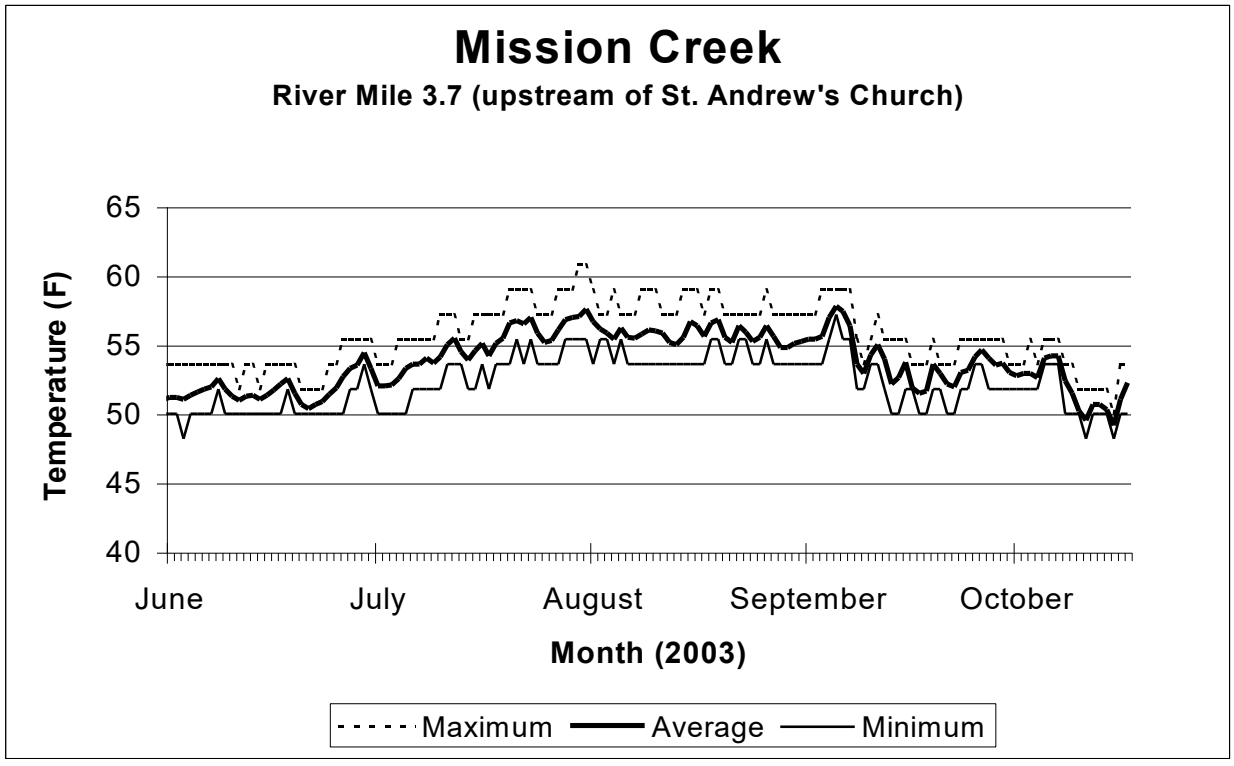
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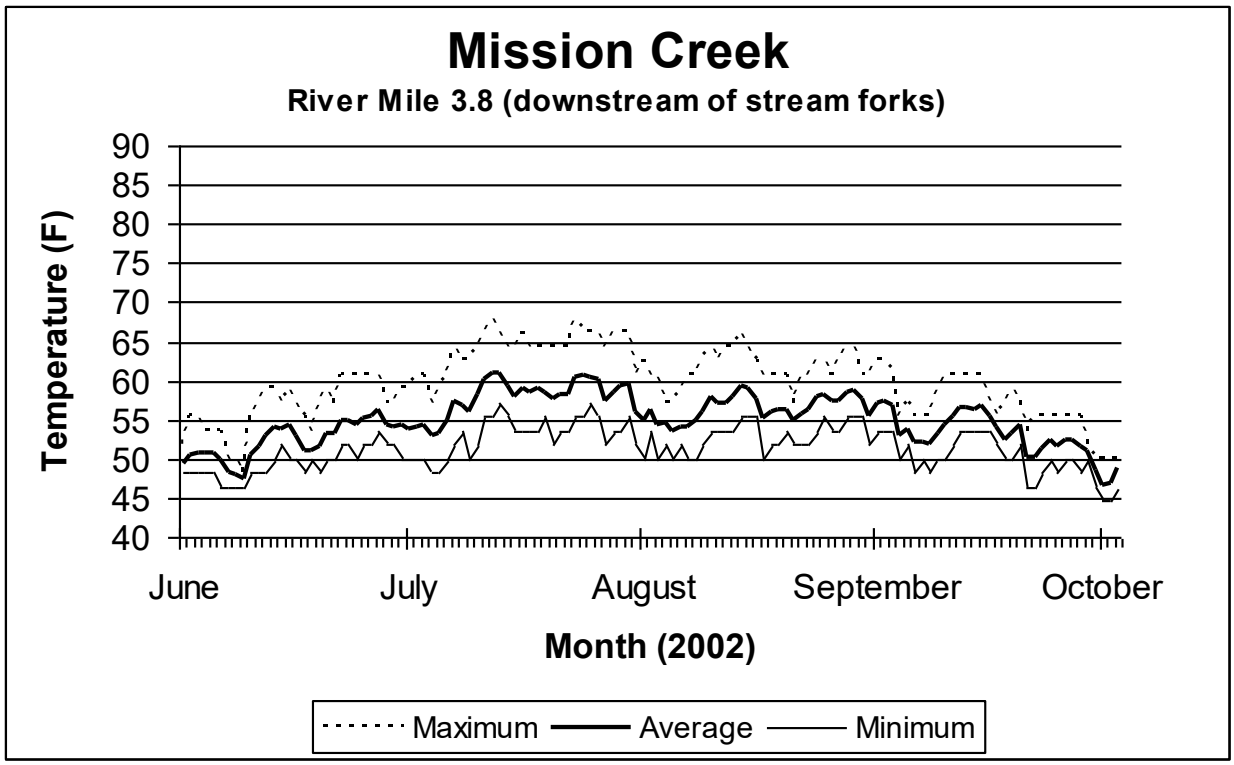
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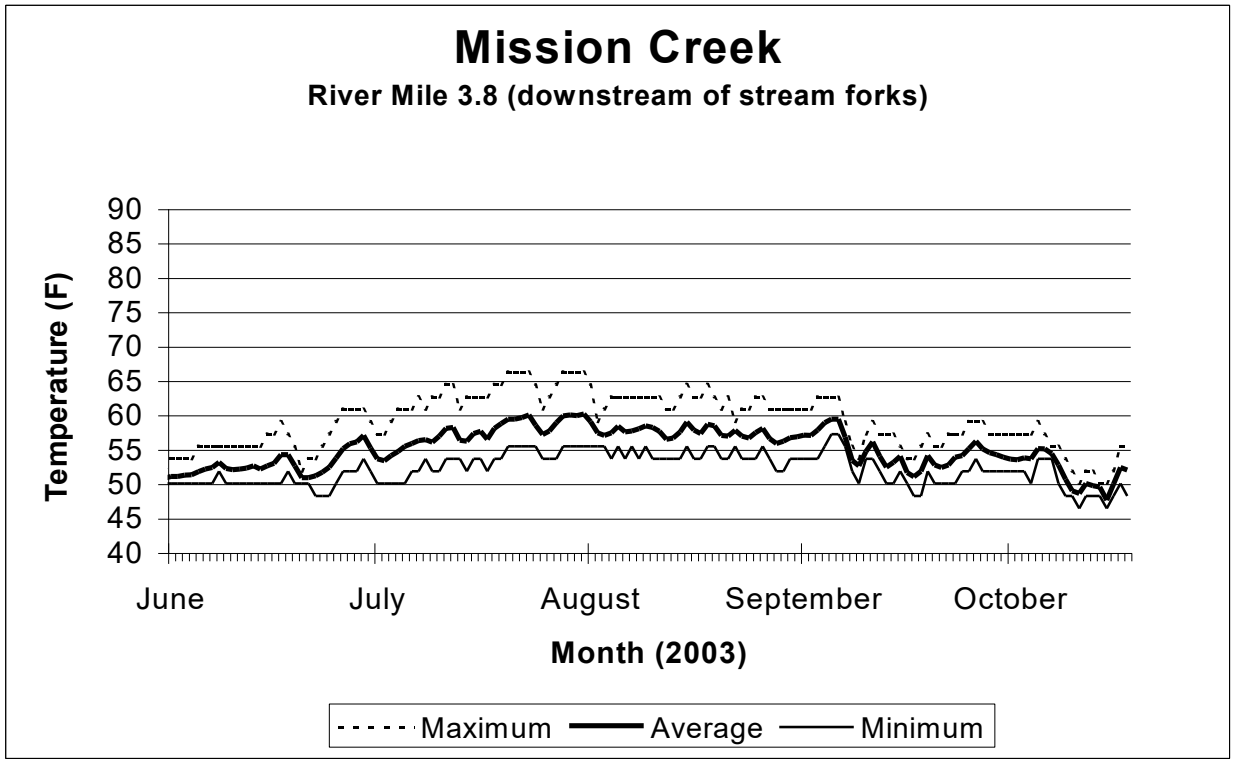
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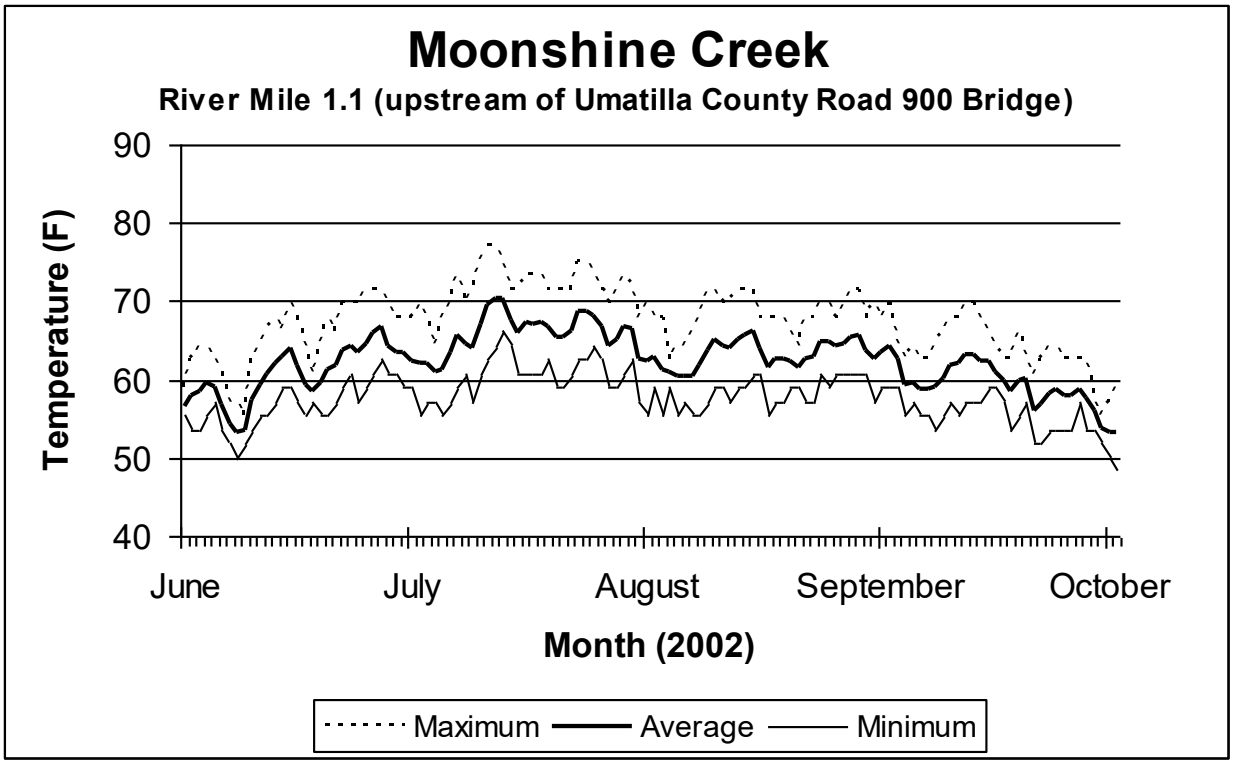
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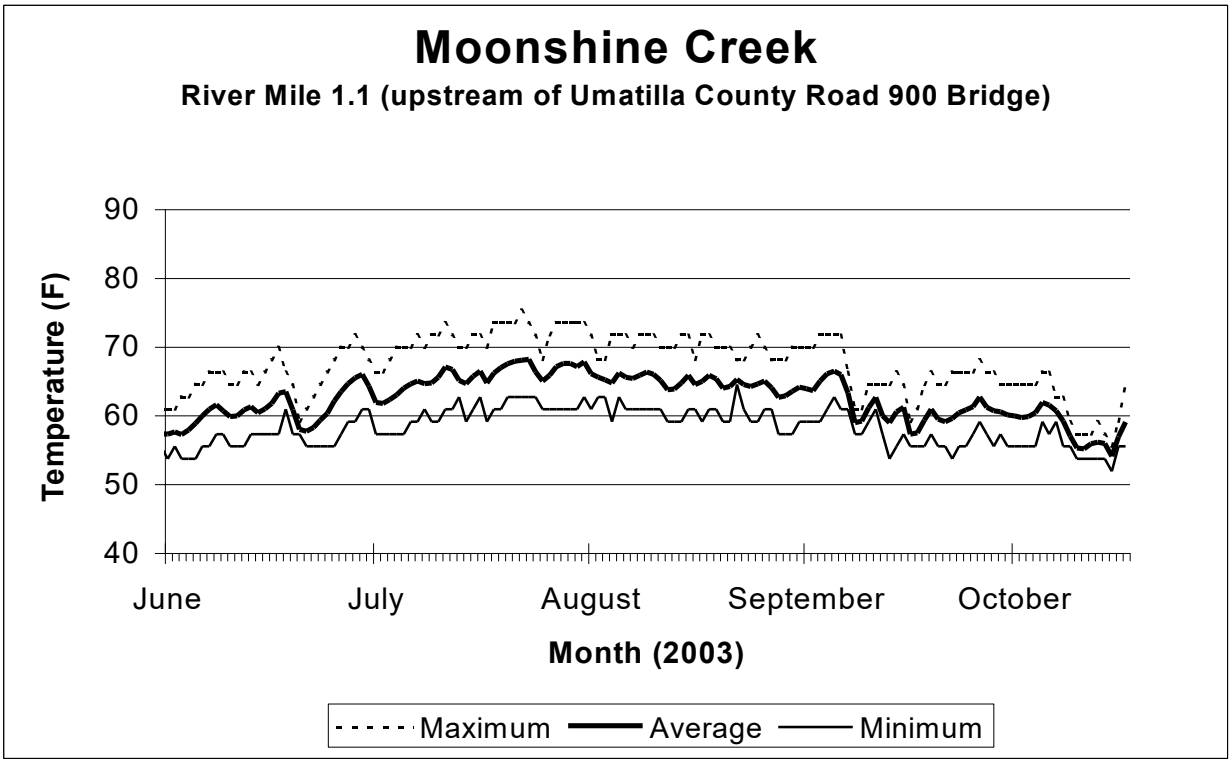
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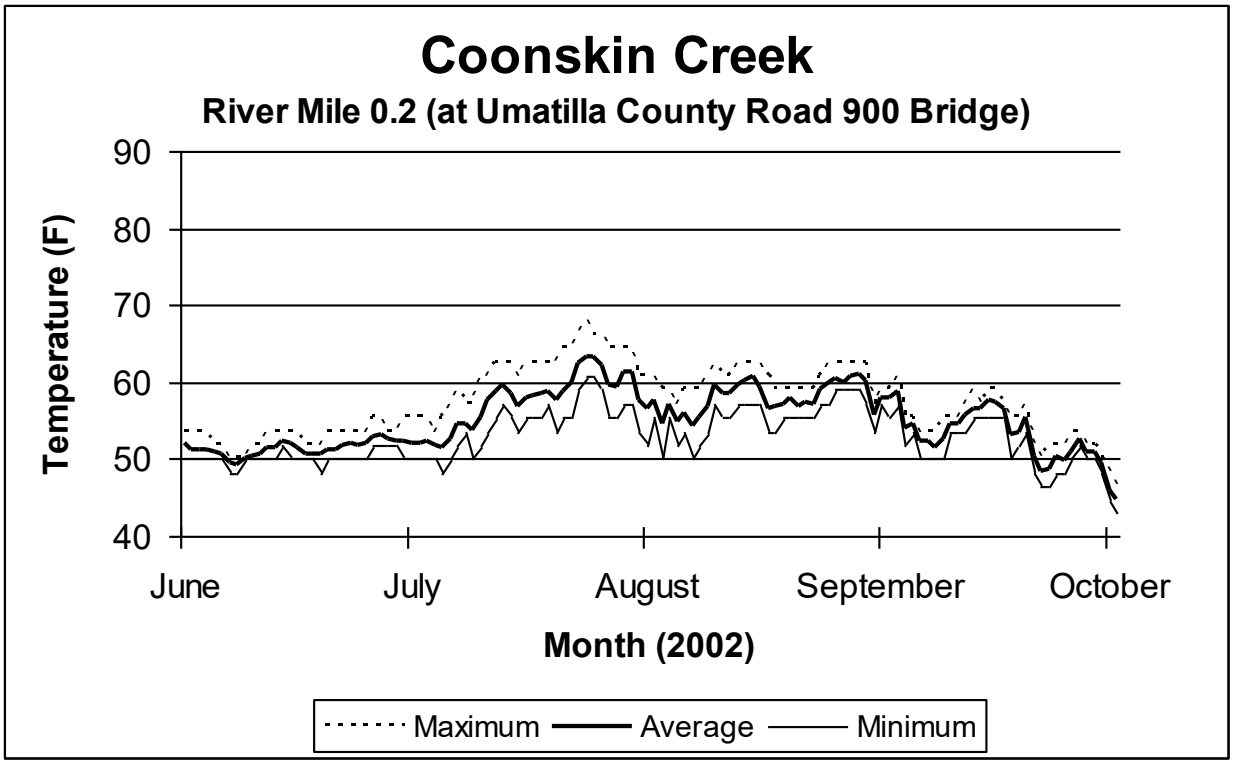
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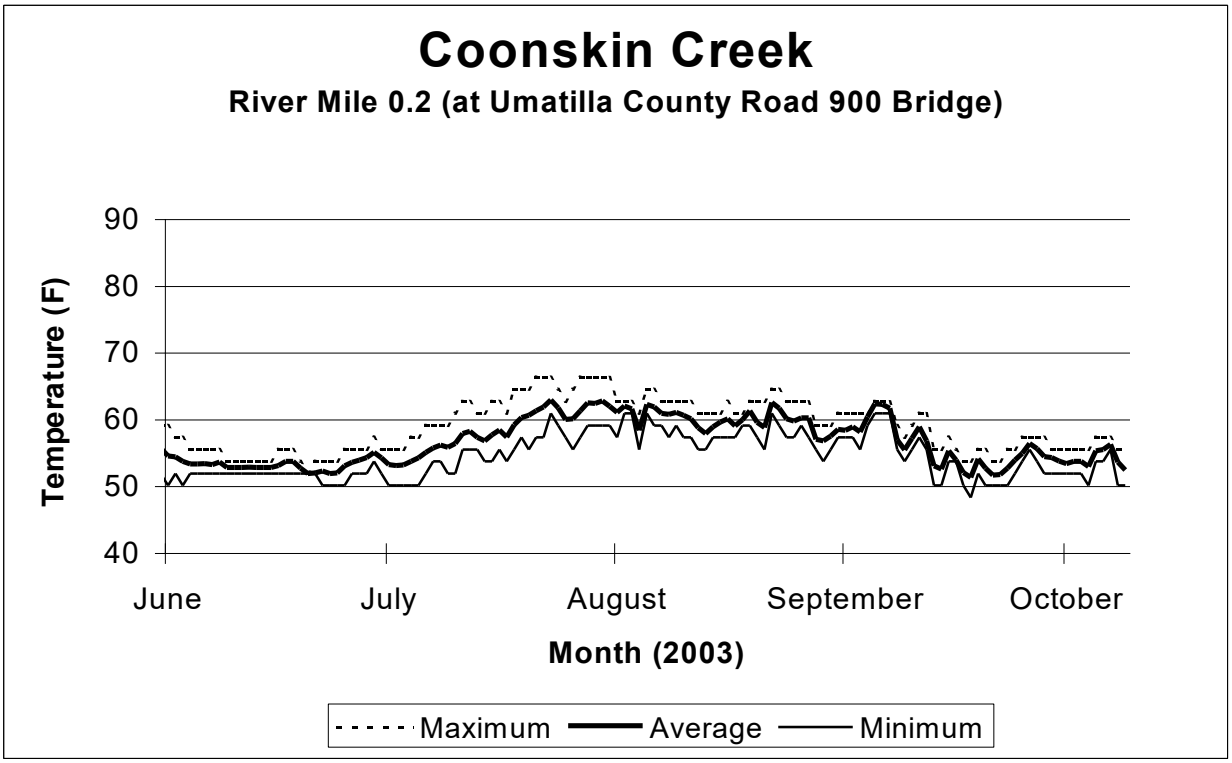
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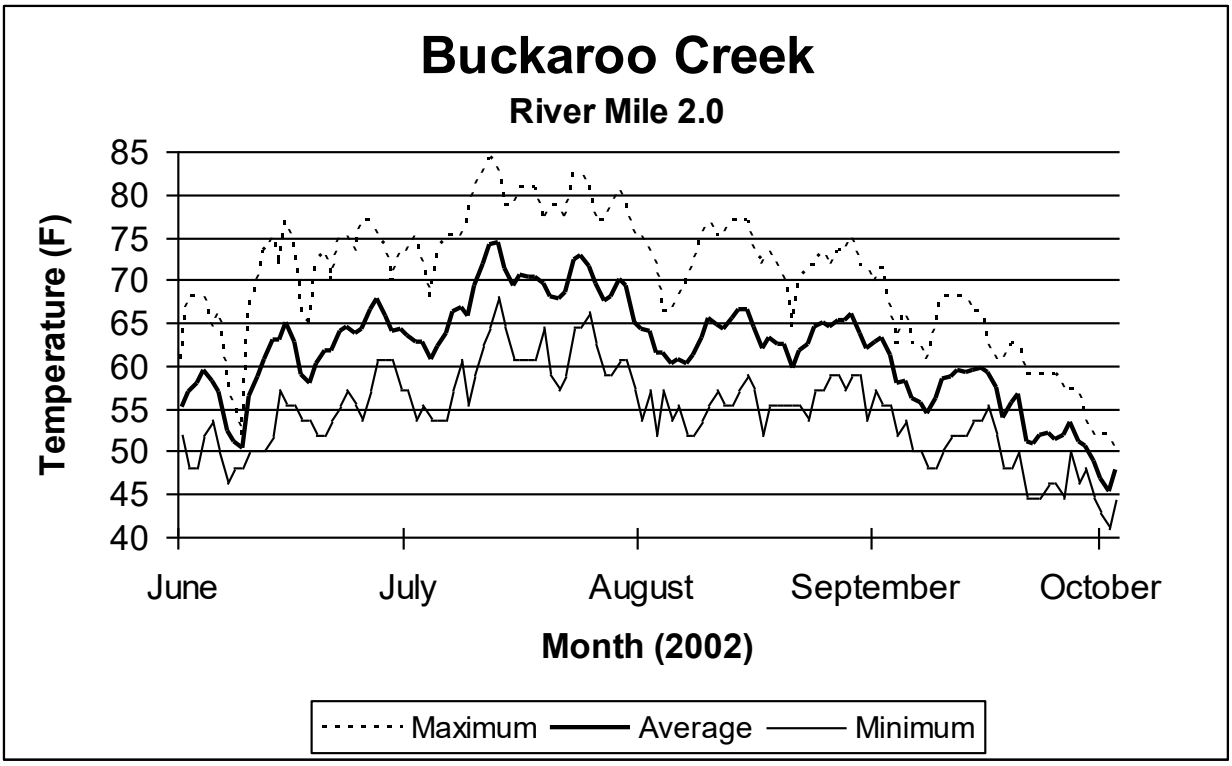
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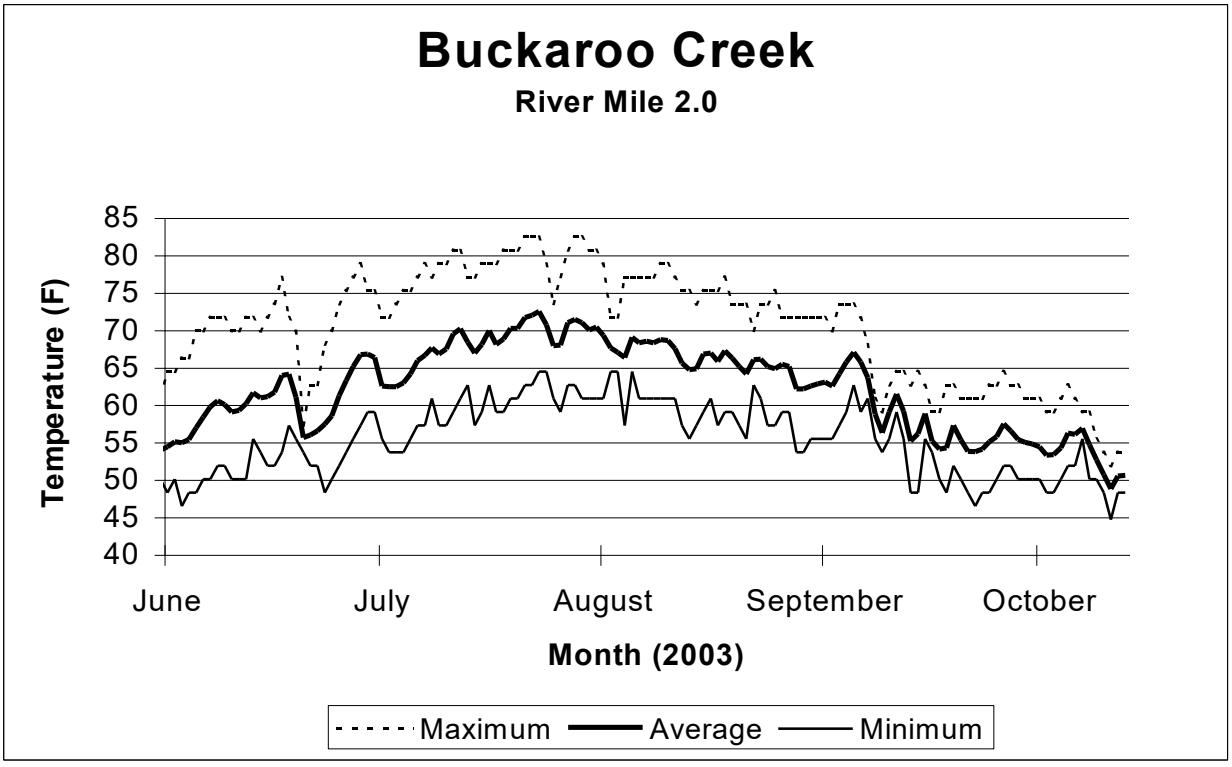
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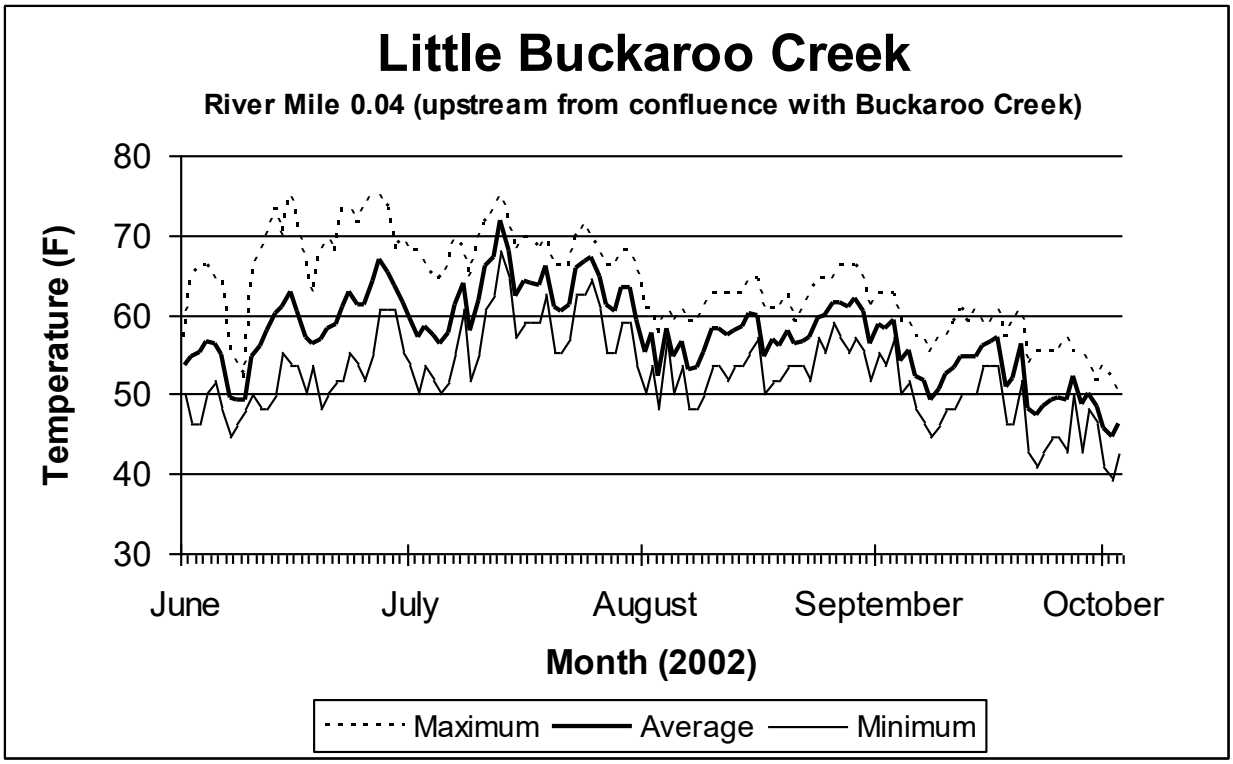
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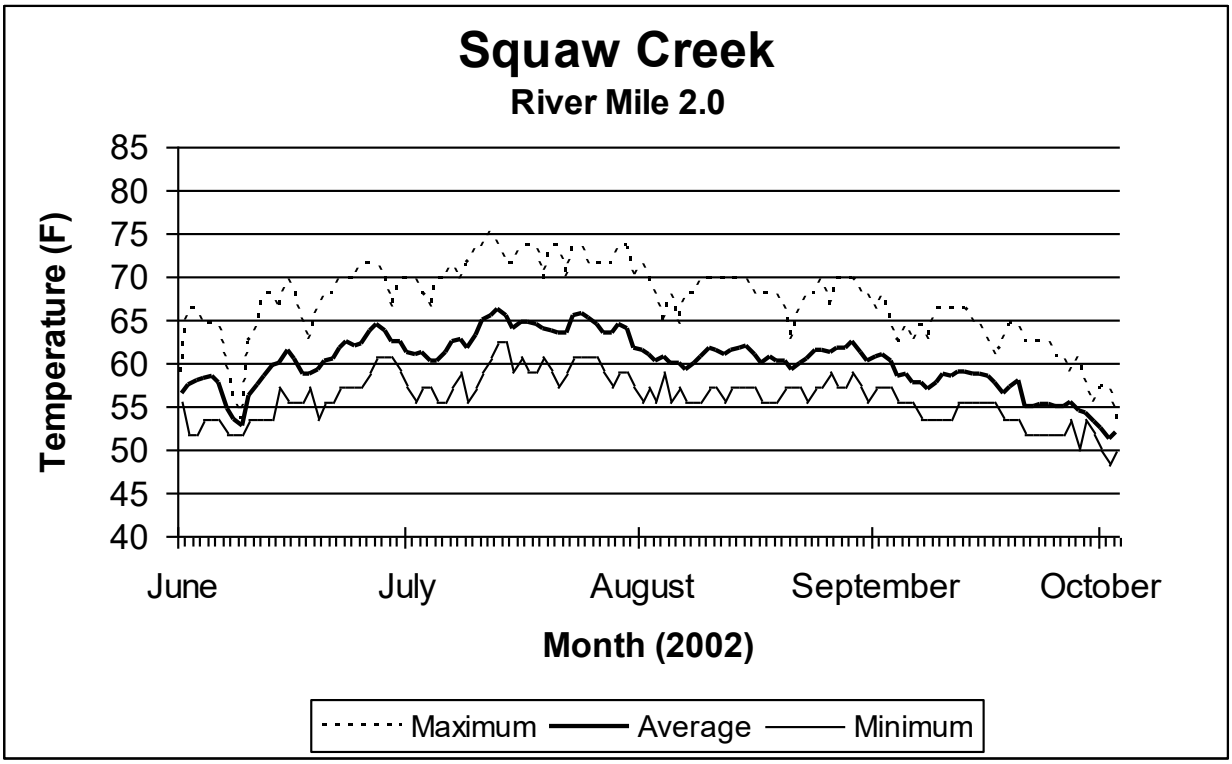
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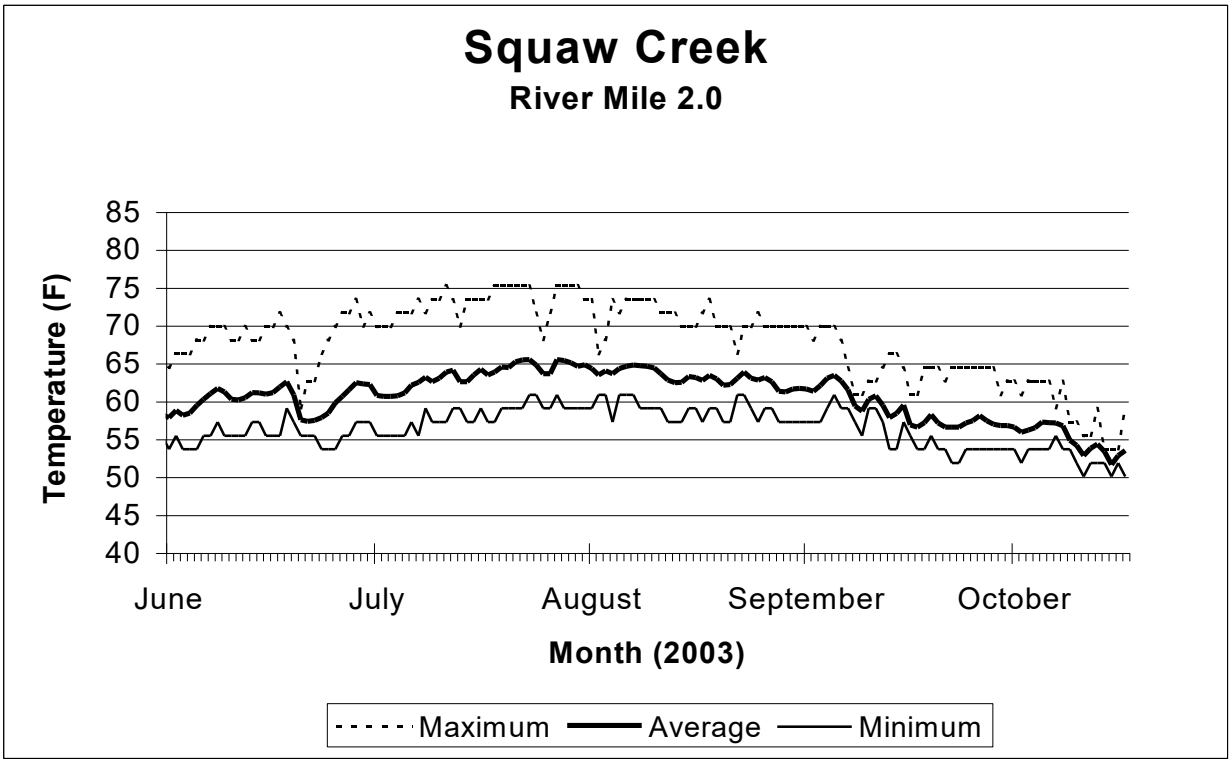
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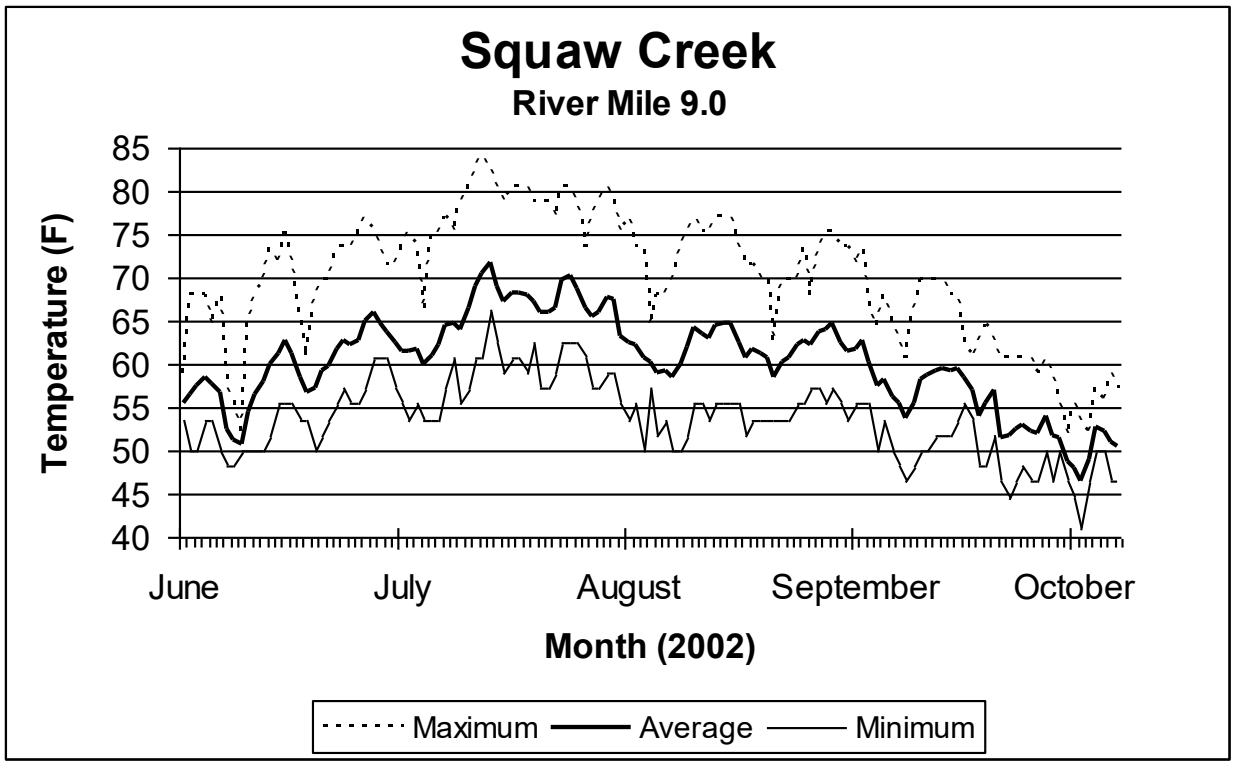
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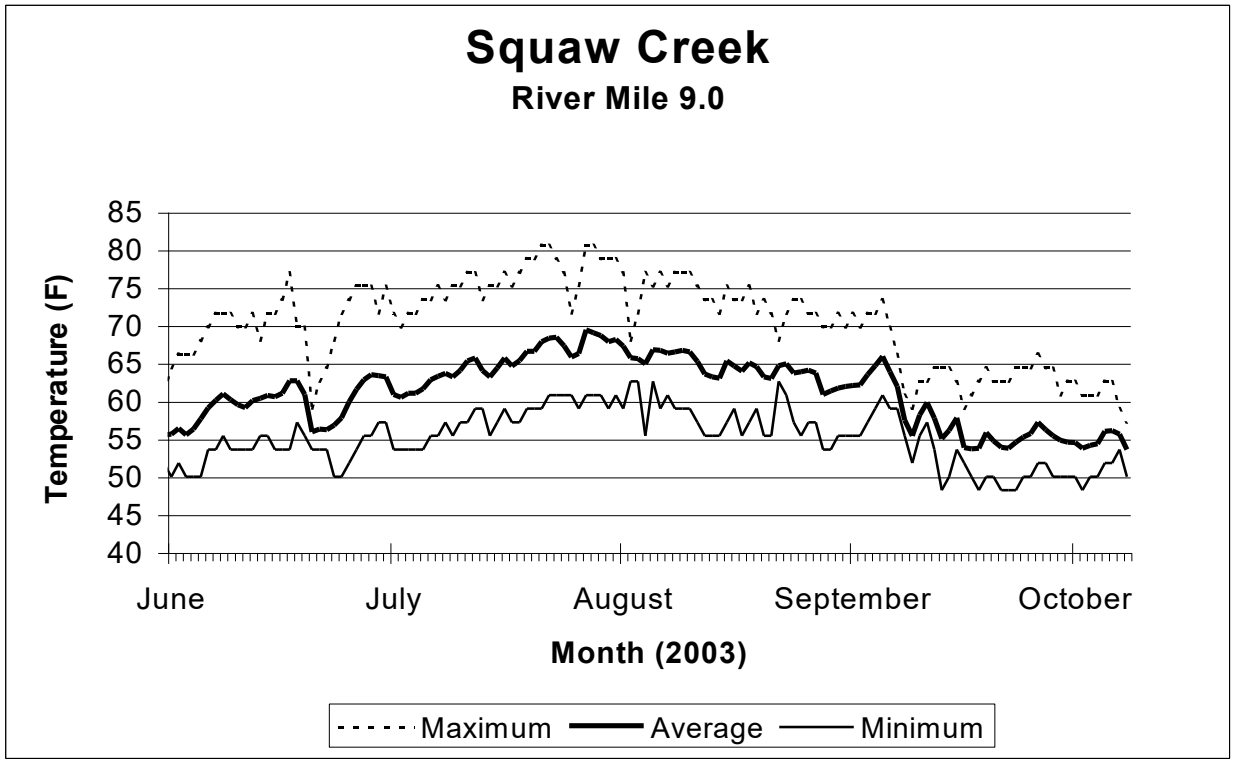
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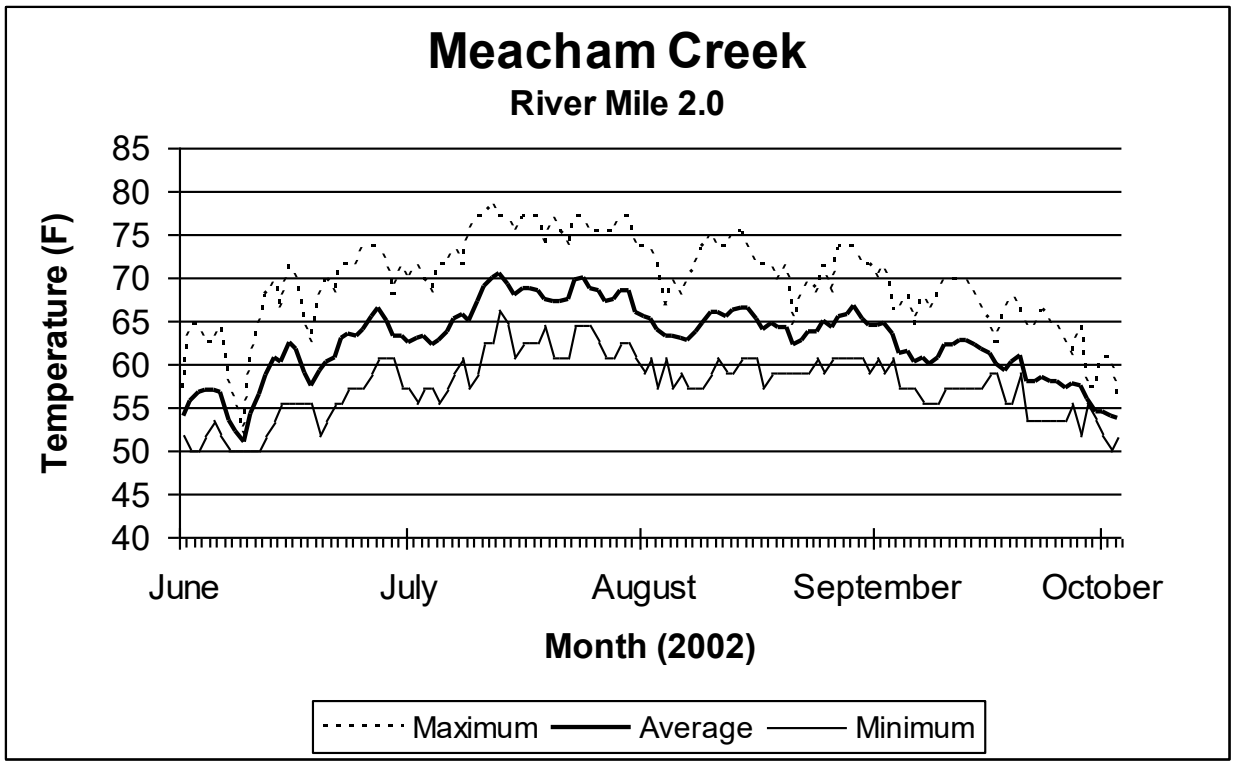
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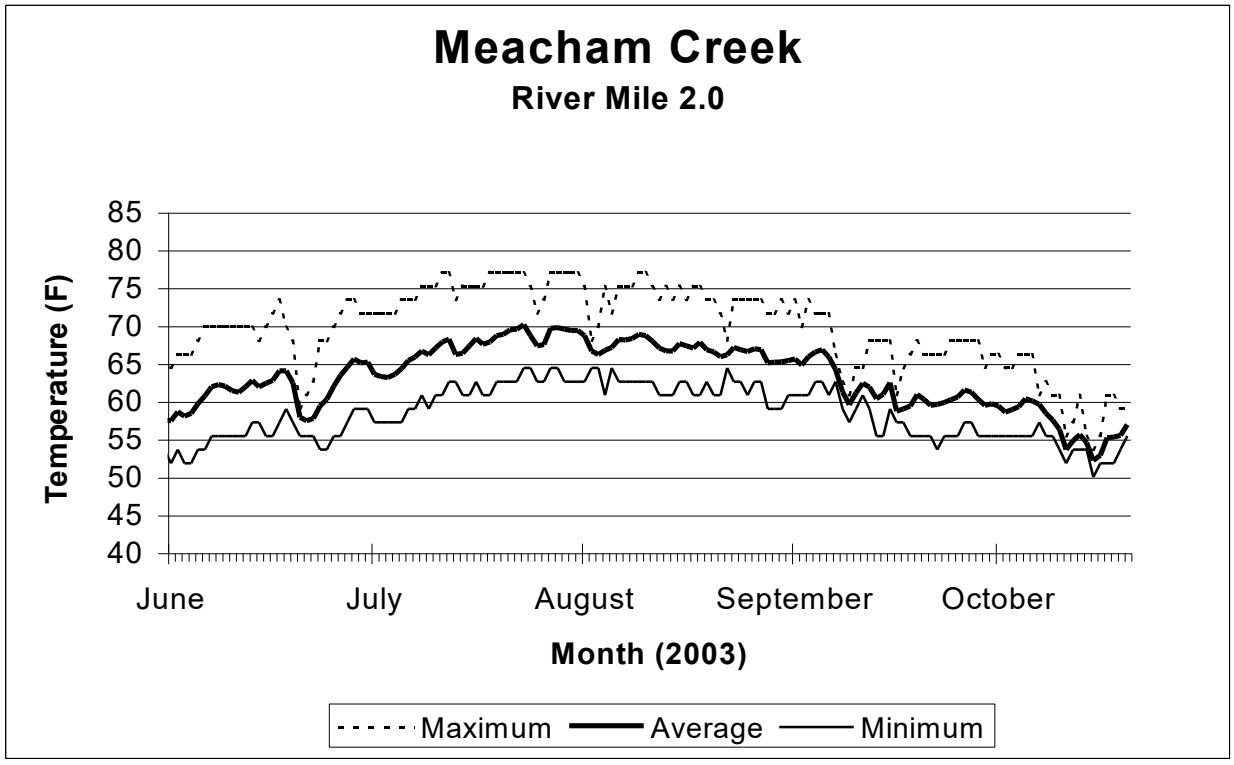
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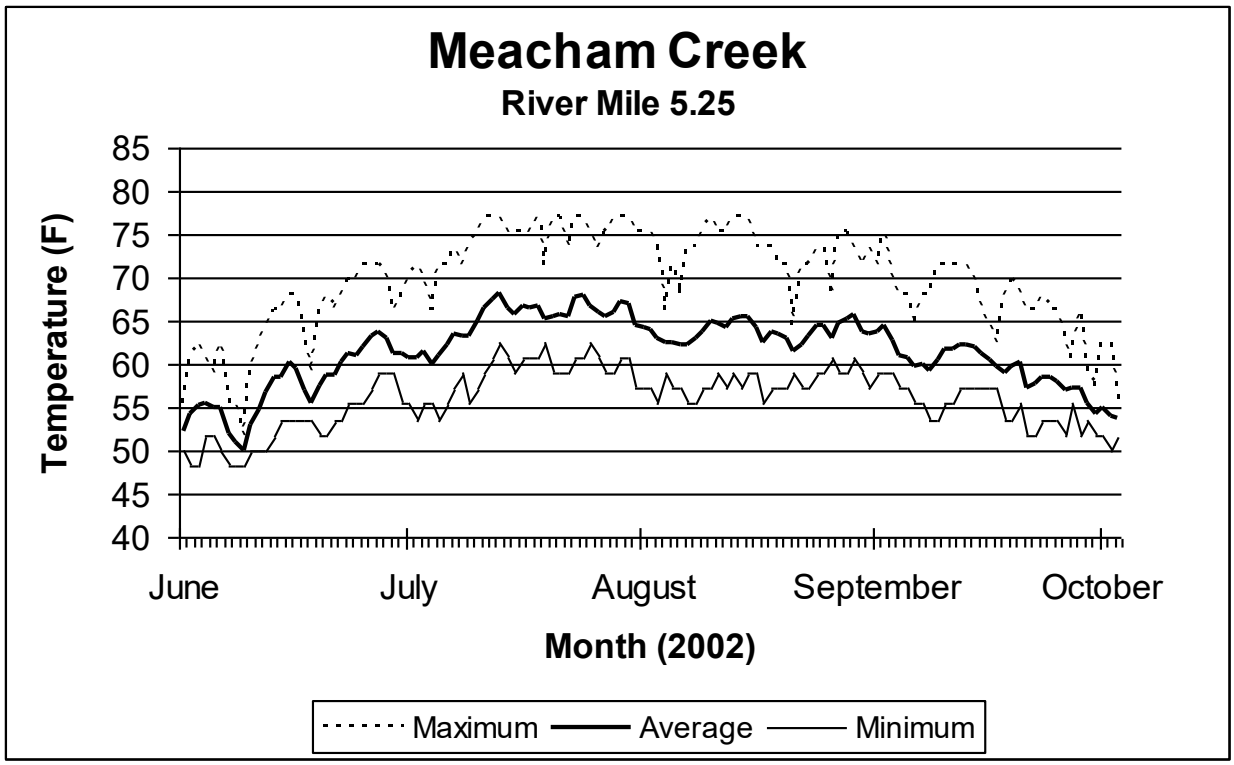
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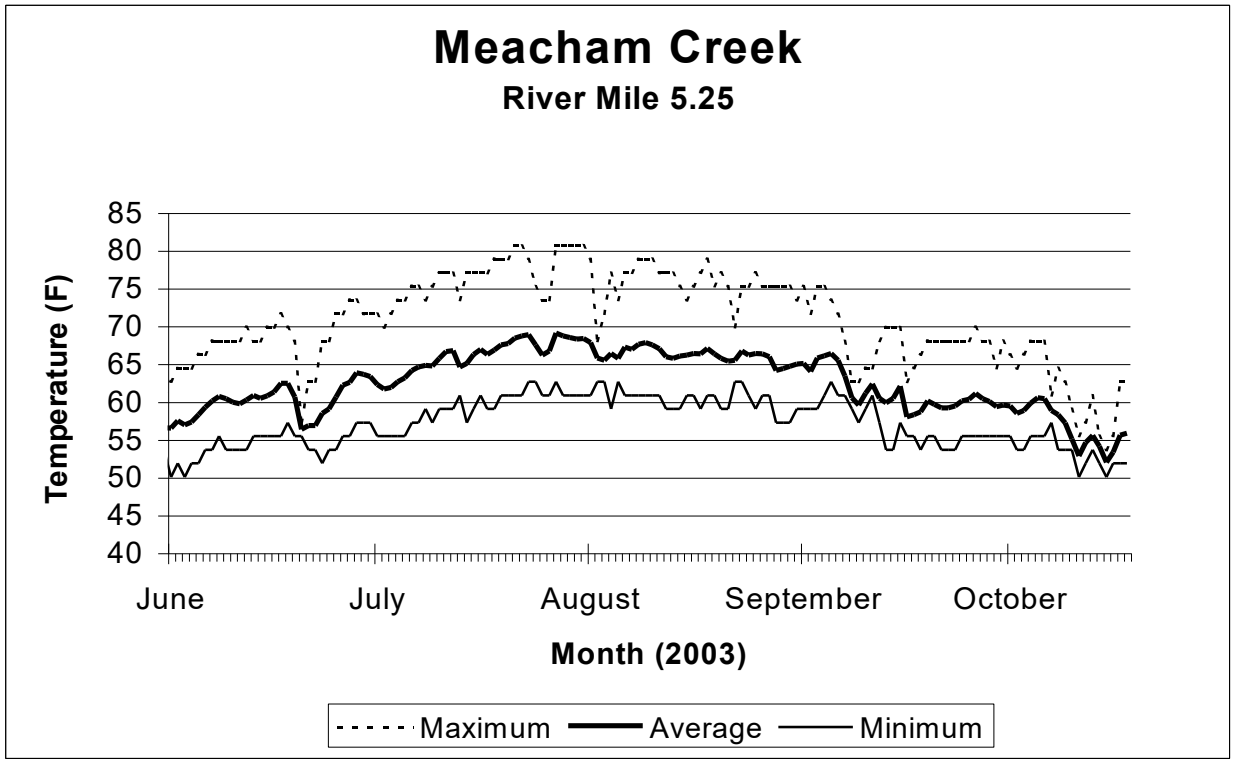
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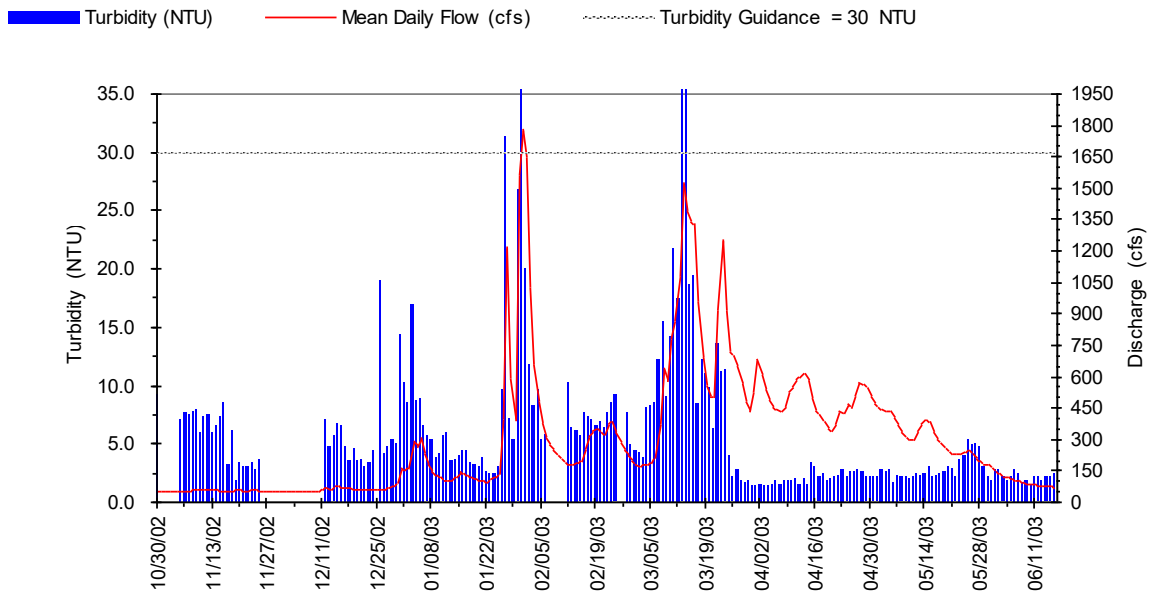


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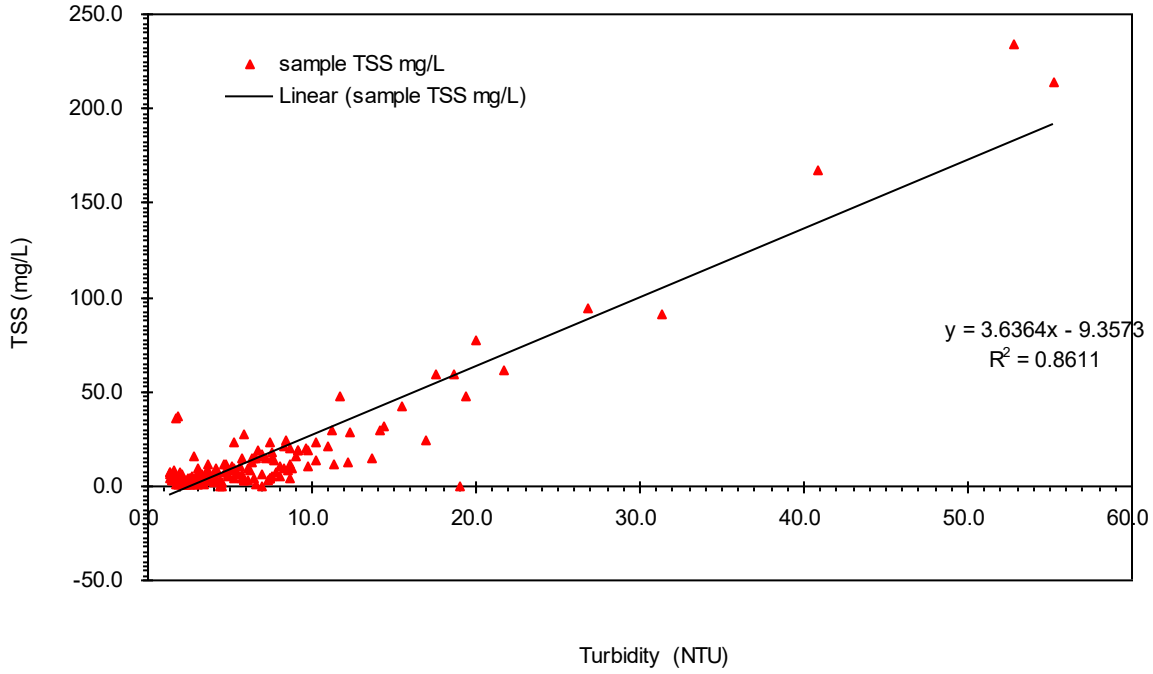
Appendix E – Suspended Sediment Data

Sediment Graphs for the Umatilla River (RM 81.7)

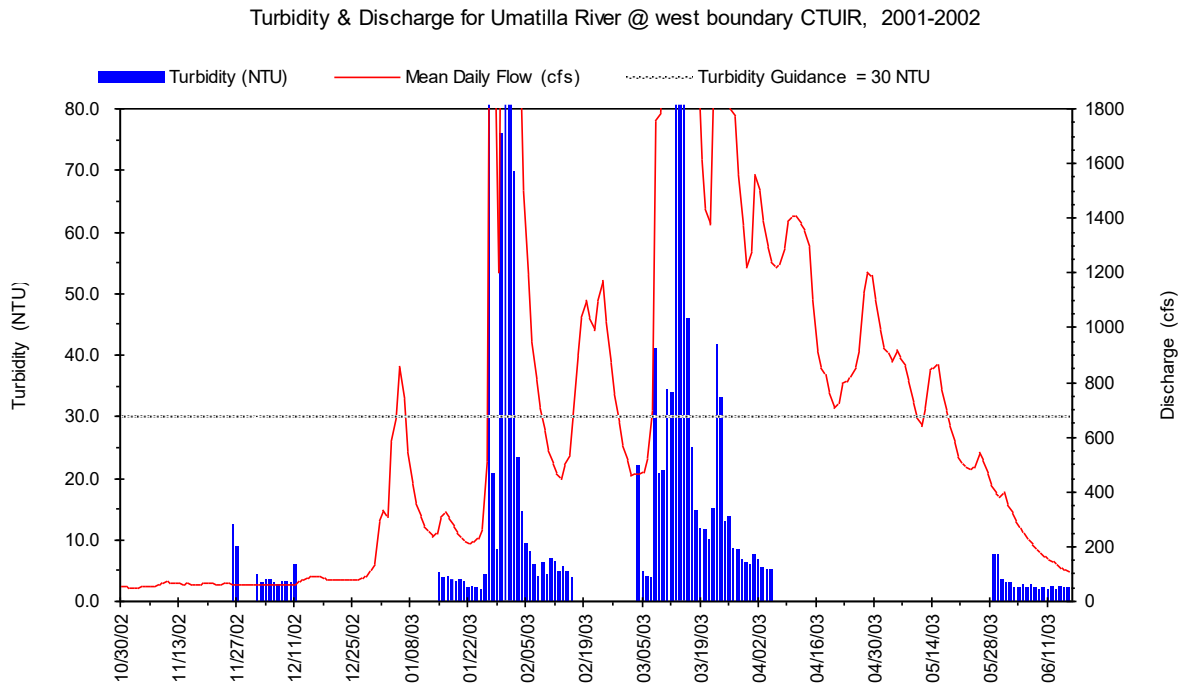
Turbidity & Discharge for Umatilla River above Meacham Cr,
east boundary CTUIR, 2001-2002

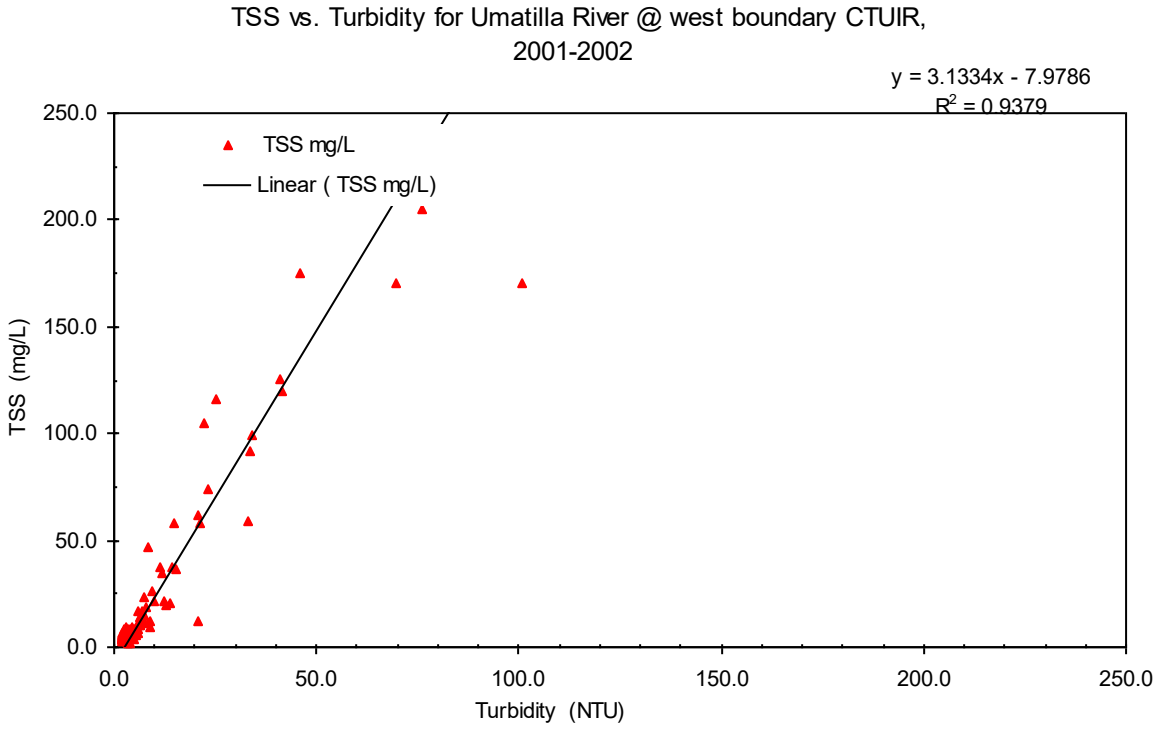


TSS vs. Turbidity for Umatilla River above Meacham Cr,
east boundary CTUIR 2001-2002



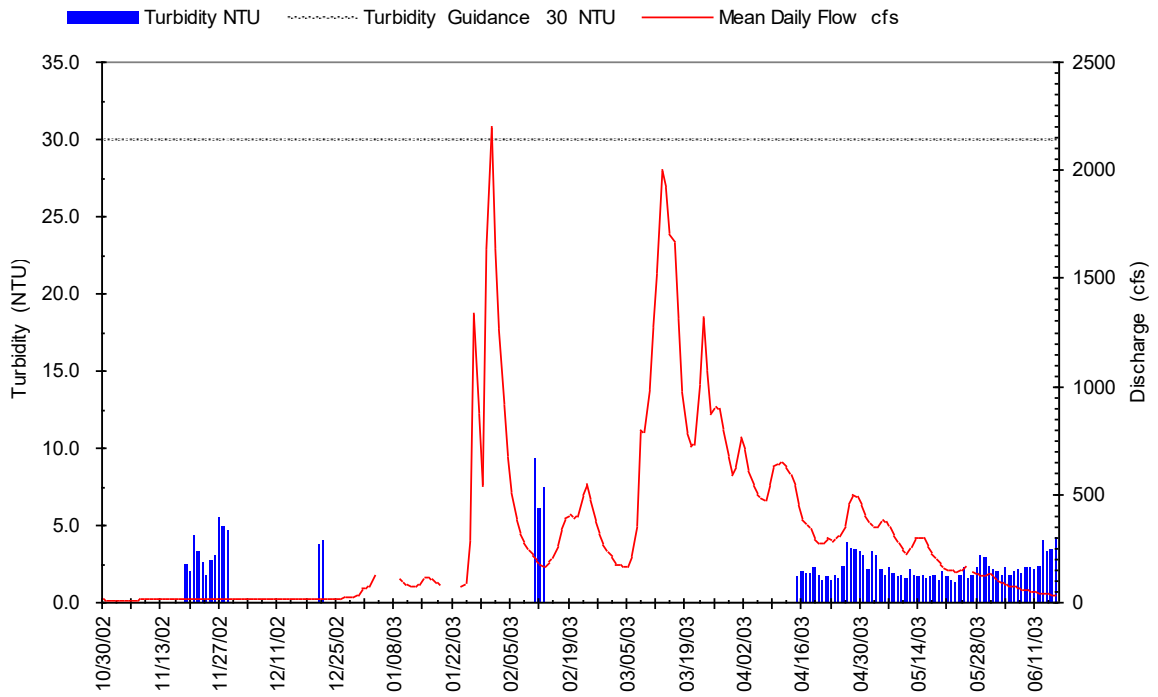
Sediment Graphs for the Umatilla River (RM 56.0)



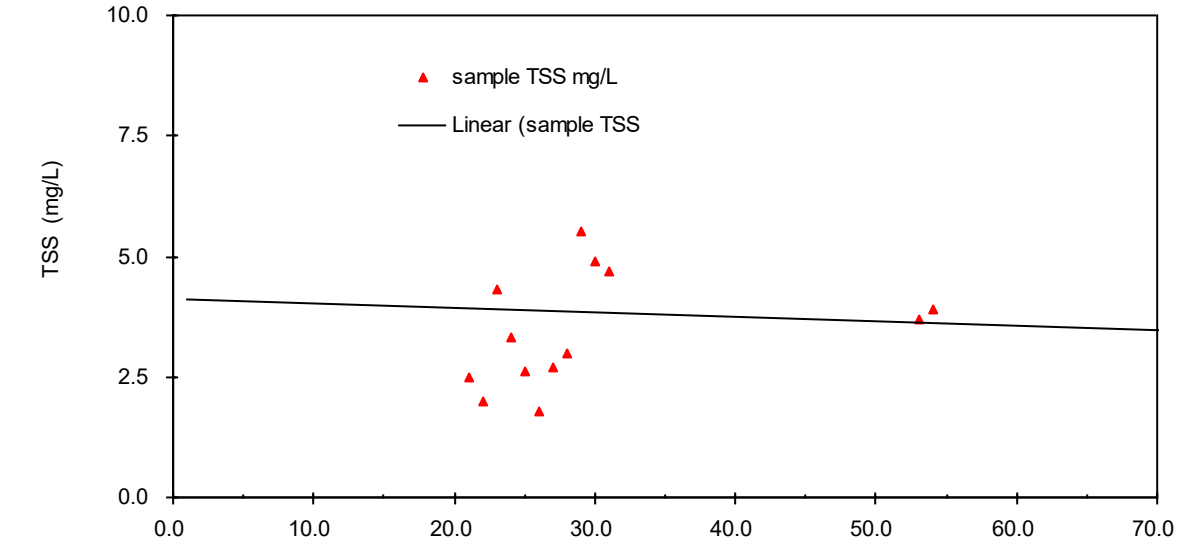


Sediment Graphs for Meacham Creek (RM 2.0)

Turbidity & Discharge for Meacham Creek @ Gibbon USGS gage, 2001-2002



TSS vs. Turbidity for Meacham Creek at Gibbon USGS gage, 2001-2000



y = -0.0092x + 4.117

R^2 = 0.1926