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October 18, 2004

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Christa Dean
Surface Transportation Board
Case Control Unit
1925 K Street NW Suite 715
Washington, DC 20423-0001

Re: Great Northwest Railroad, Inc. – Abandonment Exemption – In Clearwater County, Idaho
STB Docket No. AB-872X

Dear Ms. Dean:

Enclosed is the State of Idaho's Comments on Environmental Assessment. I have included an original and two copies for your files. An additional copy of just the Comments, without the attachments, is included so that you may stamp the file date on it and return it to us for our records. A stamped, self-addressed envelope is enclosed for your convenience.

Thank you very much for your assistance in this matter.

Sincerely,

Patricia Boehm

PATRICIA BOEHM, PLS
Secretary
Natural Resources Division

/pb
Enclosure

**Natural Resources Division**
P.O. Box 83720, Boise, Idaho 83720-0010
Telephone: (208) 334-2400, FAX: (208) 334-2690
Located at 700 W. Jefferson Street, Suite 210

ORIGINAL



BEFORE THE

SURFACE TRANSPORTATION BOARD

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DOCKET NO. AB-872X

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GREAT NORTHWEST RAILROAD, INC.
– ABANDONMENT EXEMPTION –
IN CLEARWATER COUNTY, IDAHO

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# STATE OF IDAHO'S COMMENTS ON ENVIRONMENTAL ASSESSMENT

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Attorneys for: State of Idaho

Dated: October 18, 2004

BEFORE THE

SURFACE TRANSPORTATION BOARD

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DOCKET NO. AB-872X

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GREAT NORTHWEST RAILROAD, INC.
– ABANDONMENT EXEMPTION –
IN CLEARWATER COUNTY, IDAHO

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STATE OF IDAHO'S COMMENTS ON
ENVIRONMENTAL ASSESSMENT

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On September 10, 2004, the Section on Environmental Analysis ("SEA") served on the parties its Environmental Assessment ("EA") of Great Northwest Railroad, Inc. ("GNR")'s petition for exemption from the requirements of 29 U.S.C. § 10903 in abandoning 27.5 miles of the Jaype Branch rail line located in Clearwater County, Idaho.

Idaho Department of Environmental Quality ("IDEQ"), Idaho Department of Lands ("IDL"), and Idaho Department of Water Resources ("IDWR"), by and through their attorney, Deputy Attorney General Emily Kane, respectfully urge the Surface Transportation Board ("STB") to take into account the following comments in considering the recommendations of the SEA as set forth in the EA.

Specifically, IDEQ requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDEQ, and report to the SEA, on environmental quality-related protocol, regulations, and potential permitting requirements prior to the commencement of salvage activities. IDEQ further requests that the STB, pursuant to 49 C.F.R. §§ 1105.10(f) and 1152.50(d)(5), and notwithstanding the SEA's contrary recommendation, require GNR to remove any and all trestles and bridges from the entire abandoned right-of-way, if and when abandonment is consummated. Finally, IDEQ requests that the STB expressly condition abandonment on GNR's removal of all rails and ties.

IDL requests that the STB, pursuant to 49 C.F.R. §§ 1105.10(f) and 1152.50(d)(5), and notwithstanding the SEA's contrary recommendation, require GNR to remove any and all trestles and bridges from that portion of the abandoned right-of-way traversing State land, if and when abandonment is consummated. Further, IDL requests that the STB expressly condition abandonment authority on GNR's removal of all rails and ties from that portion of the right-of-way traversing State land.

IDWR requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDWR, and report to the SEA, on water quality-related protocol, regulations, and potential permitting requirements prior to the commencement of salvage activities.

## I. STATE OF IDAHO'S INTEREST

As set forth in GNR's Petition for Exemption, GNR proposes to abandon a rail line located between milepost 3.5, near Orofino, Idaho, and milepost 31.0, near Jaype, Idaho. The line to be abandoned traverses, in part, land belonging to the State of Idaho and managed by IDL; that portion of the land underlying the rail line will revert to the State of Idaho upon abandonment. Several of the railroad structures are situated in, over, or near Orofino Creek and/or its tributaries, over which IDEQ and IDWR have regulatory authority.

## II. FACTS DEMONSTRATING A SPECIFIC FLOOD RISK

As set forth in the State's Comments on the Petition for Exemption, the trestles, culverts, rails, ties, abutments, and concrete barriers on the railroad right-of-way to be abandoned are approximately eighty years old, and throughout their existence have been exposed to the stresses of regular use and constant exposure to harsh elements. Most of the trestles and culverts are already in various states of deterioration.

Counsel was recently made aware of the following information that was not considered in preparation of the EA. Had it been available to the SEA before completion of the EA, perhaps the SEA would not have made the finding that "no specific support of a flood risk resulting from the abandonment is included in the State's submission." EA at 3. Given these new facts, the State asserts that a supplemental ea and possibly an environmental impact statement may be appropriate. *See* 49 C.F.R. § 1105.10(b); *Idaho v. I.C.C.*, 35 F.3d 585, 595-596 (1994).

Orofino Creek is particularly susceptible to floods, having flooded in 1933, 1948, 1964, 1965, and 1996. In the spring of 1996, the Orofino Creek flood resulted in vast and severe property damage caused by debris and landslides along the steep valley slopes. Roads and bridges were significantly damaged, and over 100 residences were lost or damaged due to water and landslides.

In response to the 1996 flood, Clearwater County was selected to join a partnership with the Federal Emergency Management Agency ("FEMA") in an effort to prevent damage and loss of life caused by natural disasters, including flooding, in the area. *See* Exhibit A hereto, News Release, September 13, 2000. The Clearwater County Project Impact Flood Committee ("Flood Committee") was formed as a result, which committee is charged with flood prevention, control, and mitigation, as well as stream restoration. (*See* Exhibit B hereto, Affidavit of Nick Albers.)

The Flood Committee commissioned a stream restoration engineer to conduct a study and formulate a master plan for flood mitigation in the Orofino Creek area. The result was the Watershed Assessment and Master Plan for Flood Mitigation and Stream Restoration on Lower Orofino Creek ("Master Plan"). (*See* Exhibit C hereto, Master Plan.)

The Master Plan explains why Orofino Creek is particularly susceptible to floods. Much of the creek is lacking a natural adjacent floodplain, meaning that in a high-water event, high volumes of water have nowhere to go but downstream. *Id.* at 1-5 to 1-6; 2-20; Fig. 2.16. Encroachment by urban development, poor sediment transport, and backwater effects of flooding from the Clearwater River also contribute to the uniquely high risk of flooding in this drainage. *Id.* at 2-20 to 2-21. Further, both natural processes and humans – including the railroad, in particular – have changed the very character of the creek channel, constricting the flow and creating debris jams. *Id.* at 2-21.

The right-of-way that GNR proposes to abandon is located in the middle watershed of Orofino Creek. The Master Plan, while focusing on the lower watershed (in which the human population is most highly concentrated), does address the specific flood threat that will originate in the middle watershed if abandoned, unmaintained railroad structures are allowed to remain on the branch line.

Specifically, section 2.3.5 of the Master Plan reads:

> 2.3.5 Effects of Bridges and Railroad Trestles
>
> The existing bridges and railroad trestles on Orofino Creek are other causes of flooding problems. These bridges produce horizontal, vertical

> and in-channel obstructions. A vertical obstruction can be caused by a bridge deck that is not constructed above the elevation of the design flood event, or is not able to pass debris jams or ice flows. A horizontal obstruction, or constriction, occurs when a bridge pinches the channel cross-section and forces the flow through a smaller opening than the upstream channel. Lastly, in-channel obstructions consist of bridge foundations such as piers or abutments that are located within the active channel and reduce the available conveyance areas under the bridge and can lead to debris jams and ice jams. All of these obstructions result in backwater effects and decrease the ability of a river to convey flood flows and transport sediment. Moreover, there are alignment and skew issues with these bridges. . . .
>
> Railroad trestles with numerous, closely-spaced piers present an especially dangerous scenario. The middle watershed is said to possess as many as 20 railroad trestle stream crossings. During a site visit to the middle watershed following a flood event, debris jams were observed at all three railroad trestles visited. The debris jams had forced water above and around the bridge and caused extensive scour as noted by the newly-formed downstream depositional bars and freshly-eroded banks. ***Since the railroad is abandoned and not maintained, the effects of debris jams and ice jams are likely to contribute excess sediment to the lower watershed and potentially generate surges of flood water, debris, sediment and ice as they become dislodged.***

Exhibit C, Master Plan, at 2-21 to 2-22 (emphasis added).

The railroad trestles and bridges on the right-of-way do cross Orofino Creek and do have numerous, closely-spaced piers of the type known to cause an "especially dangerous scenario." *Id.*; *see also* Exhibit D hereto, IDL's Orofino-Jaype Railroad Line Structure Location Survey (previously submitted as Exhibit C to State's Comments on Petition for Exemption). As the Master Plan states, damage caused by debris lodged behind these trestles is already apparent. In the event of a high water event such as occurred in 1933, 1948, 1964, 1965, and 1996, the aging railroad structures are quite likely to accumulate debris and/or themselves fail or collapse.

It is clear that debris does, in fact, lodge behind the trestles even in the absence of high-water conditions, a fact that has been acknowledged by the railroad. At the

December 17, 2003 meeting of the Flood Committee, a representative of Camas Prairie Railnet, GNR's predecessor, reported, according to the meeting notes, that "[i]n October, a maintenance crew did go down the line from the Pierce side and cleaned out debris from behind the trestles." Exhibit E hereto, Project Impact Clearwater County Meeting Notes, December 17, 2003, at 2. The accumulation of debris under normal circumstances is a problem that will accelerate and remain largely unmitigated if or when GNR is allowed to abandon the right-of-way without a condition requiring the removal of all railroad structures on the line.

The railroad may argue that removal of the railroad structures would not be cost-effective. But should the STB allow GNR to leave these structures in place, the cost of repairing the natural and riverine environment – to the federal and State government, to reversionary landowners, to communities surrounding Orofino Creek, and to taxpayers – will be astronomical in the inevitable event of a flood. Mitigation of and disaster relief for the 1996 flood, for example, cost in excess of ten million dollars. *See* Exhibit A and Exhibit C at 1-1.

In addition to flood mitigation projects in the lower watershed, the Master Plan identifies and recommends five measures that would mitigate the flood risk, including, significantly, "[a] plan to deal with the hazards caused by the abandoned railroad trestles in the middle watershed." Exhibit C at 5-25.

The City of Orofino, Clearwater County, and the Flood Committee, which agencies would be required to deal with the tremendous financial and environmental consequences of a flood caused or exacerbated by the collapse of one or more of the railroad structures, have repeatedly attempted to mitigate the hazards caused by the railroad structures. *See* Exhibit F, correspondence from Joe Pippenger, Mayor, City of Orofino; Exhibit G, correspondence from Stan Leach, Chair, Clearwater County Commission; and Exhibit H, correspondence from Flood Committee. But any response by GNR or its predecessors to work with these agencies to diminish this likely environmental crisis has been inadequate. Under the circumstances, the only appropriate solution is for the STB to require that GNR remove all railroad structures as a condition of abandonment.

In sum, under normal circumstances, each of the aging railroad structures accumulate debris and contribute to erosion and destruction of the Orofino Creek natural environment. Further, in the likely event that an upstream bridge or trestle will collapse in a high water event, it would wash downstream and cause other bridges to fail, compounding the environmental devastation of a flood event.

For these reasons, a specific flood risk *will* result from abandonment of the railroad line if GNR is not required to remove railroad structures.

## III. LEGAL ANALYSIS

### A. The STB is authorized to impose "*appropriate conditions*" upon a grant of abandonment.

The EA states that "the Board's authority to impose conditions is not limitless," and cites for support of this principle *Iowa Southern Railroad. Co. – Exemption – Abandonment in Pottawattamie, Mills, Fremont and Page Counties, IA*, 5 I.C.C.2d 496 (1989) ("*Iowa Southern*"). Respectfully, it is the State's position that the SEA has misinterpreted *Iowa Southern*. In *Iowa Southern*, the STB examined 1) whether the National Environmental Policy Act applied to the STB's issuance of a Notice of Interim Trail Use or a Certificate of Interim Trail Use; 2) whether the Trails Act is a valid exercise of congressional power under the Commerce Clause; and 3) whether the Trails Act effects an unconstitutional taking of private property without just compensation.

In *Iowa Southern*, the STB did not address its authority to impose conditions on the grant of abandonment. The parameters of this authority that the SEA attempts to impute to the STB have no basis in the law.

The parameters of the STB's authority to impose environmental conditions on abandonment, and the procedure that the STB is to follow in doing so, are set forth in 49 C.F.R. § 1105.10(f):

> Consideration in decisionmaking. The environmental documentation (generally an EA or an EIS) and the comments and responses thereto concerning environmental . . . issues will be part of the record considered by the Board in the proceeding involved. The Board will decide what, if any, environmental or historic preservation conditions to impose upon the authority it issues ***based on the environmental record*** and its substantive responsibilities under the Interstate Commerce Act. The Board will withhold a decision, stay the effective date of an exemption, or ***impose appropriate conditions upon any authority granted***, when an environmental or historic preservation issue has not yet been resolved.

Emphasis added.

Thus, under 49 C.F.R. § 1105.10(f), the STB is to review the environmental record before it and may then impose "appropriate conditions" upon the grant of abandonment. Indeed, the STB has interpreted 49 C.F.R. § 1105.10(f) to mean that salvage may not take place before appropriate environmental conditions have been imposed. *SF & L Railway, Inc. – Abandonment Exemption – in Ellis and Hill Counties, TX*, 1996 WL 422279, slip op. at *6 (I.C.C. July 25, 1996).

"Appropriate" is not defined in the abandonment rules or statutes. The lay definition therefore applies: "suitable for a particular person, condition, occasion, or place; fitting." *American Heritage Dictionary of the English Language* (3d ed. 1992).

Certainly, the "appropriate" standard does not restrict the authority of the STB to impose conditions on abandonment necessary to address adverse environmental impacts resulting from such abandonment.

## IV. COMMENTS OF IDAHO DEPARTMENT OF ENVIRONMENTAL QUALITY

Pursuant to Idaho Code §§ 39-101 *et seq.*, IDEQ is broadly authorized and charged with the protection of human health and the environment within the State of Idaho. IDEQ oversees the development, implementation, and enforcement of environmental programs and regulations to protect air and water quality and to ensure the appropriate handling of solid and hazardous wastes.

### A. The STB should accept the SEA's recommendation that GNR be required to consult with IDEQ prior to the commencement of salvage activities.

IDEQ requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDEQ, and report to the SEA, on environmental quality-related protocol, regulations, and potential permitting requirements prior to the commencement of salvage activities.

### B. The STB should require GNR to remove any and all trestles and bridges from the entire abandoned right-of-way, if and when abandonment is consummated.

The environmental record before the STB compels the conclusion that GNR must be required to remove trestles and bridges from the right-of-way to be abandoned. The health of the environment, and the health and safety of downstream human communities, demand that the aging bridges and trestles be removed.

The following facts, uncontradicted by the environmental record, demonstrate a specific flood risk that will result from this abandonment, absent a condition requiring removal of railroad structures:

1) The railroad structures channeling Orofino Creek do accumulate debris, both in the course of the river's usual flow, and more so during high water events.
2) Debris either blocking the flow of the creek or collected and sent downstream en masse creates and/or exacerbates the existing flood risk and damage caused by an active flood.
3) Orofino Creek is especially prone to flooding and, historically, floods on a regular basis.

It follows that the railroad structures, abandoned and unmaintained, will create a real – and *specific* – flood risk. Nothing in the environmental record contradicts these facts.

The SEA itself notes that "the proposed abandonment involves stream crossings and drainages with potential discharge to Orofino Creek and the Clearwater River." EA at 4. In this area — an area that has been identified by State and federal agencies as particularly susceptible to flooding — abandonment of remote, exposed, unmaintained, aging, weakening structures presents a serious and detrimental environmental impact. Under such circumstances, it is appropriate to order GNR to remove all railroad structures from the right-of-way upon abandonment to avert this impact. A condition requiring the removal of all railroad structures from this right-of-way upon abandonment is certainly appropriate — as well as reasonable.

For these reasons, it is the position of IDEQ that the STB should condition GNR's abandonment exemption upon GNR's removal of any and all trestles, culverts, rails, ties, abutments, and concrete barriers from the entire abandoned right-of-way, whether or not such structures are located on land that will revert to the State following abandonment. Under 49 C.F.R. §§ 1105.10(f) and 1152.50(d)(5), the STB does have the authority to subject the exemption to such conditions.

### C. The STB should *expressly* condition abandonment on GNR's removal of all rails and ties.

The EA states that "GNR plans to remove rails and ties as part of salvage activities[.]" EA at 3. IDEQ requests that the STB codify this intent as an express condition on the grant of abandonment authority.

## V. COMMENTS OF IDAHO DEPARTMENT OF LANDS

IDL's functions include management of state lands and protection of Idaho's natural resources. Pursuant to article IX, section 7 of the Idaho Constitution, IDL, on behalf of the State Board of Land Commissioners, is charged with the "direction, control, and disposition of the public lands of the state." *See also* Idaho Code § 58-101. Upon abandonment of the Jaype branch line, a portion of the right-of-way will revert to, and be managed by, IDL.

### A. The STB should require GNR to remove any and all trestles and bridges from that portion of the abandoned right-of-way traversing State land, if and when abandonment is consummated.

GNR must be required to remove trestles and bridges from that portion of the right-of-way traversing State land. As set forth above, such a requirement is compelled by the environmental record before the STB.

Contrary to SEA's finding that the State did not demonstrate that specific structures do elevate the flood risk, Exhibit C to the State's Comments on Petition for Exemption (Exhibit E hereto) does indeed demonstrate the particular hazard each of these structures presents. For example, Exhibit E demonstrates that:

- Culvert no. 1, which channels a stream tributary to Orofino Creek, is filled with a layer of silt at least 5 inches deep and a willow tree is blocking the outlet.
- Trestle no. 11, which stands in Orofino Creek, has nine (9) wooden piers; water passage between six (6) of these piers, however, is completely blocked by accumulated debris.
- Culvert no. 3, which channels a stream tributary to Orofino Creek, has rusted and is in danger of collapse.
- Approximately eleven (11) concrete "Jersey barriers" formerly positioned by the railroad on the bank of Orofino Creek, approximately 120 feet west of Culvert no. 5, have been displaced by a landslide and now rest in the creek.
- Trestle no. 18, which stands in Orofino Creek, has twelve (12) wooden piers; water passage between several of these piers, however, is completely blocked by accumulated debris.
- Three (3) piers of Trestle no. 18.1 stand on land that will revert to IDL upon abandonment; these three piers are in a visible state of disrepair.
- Culvert no. 7, which channels a stream tributary to Orofino Creek, is partially blocked by brush at its inlet, and the lower half of the culvert is filled with small rocks, blocking approximately one-quarter of its diameter.
- Culvert no. 8 is entirely blocked by brush at its inlet.
- Culvert no. 11 is partially blocked by brush at its inlet and entirely blocked by rocks at its outlet.

- The unnumbered trestle just to the east of Trestle no. 25, which unnumbered trestle stands in Orofino Creek, has nine (9) wooden piers, five (5) of which stand in the water; water passage between four of the piers is impeded by accumulated debris.

As set forth above, debris building up within or behind the structures, particularly the trestles, places pressure on the aging structures, and increases the water's pressure on the structures by narrowing the space available for passage through or around the structures. A specific flood risk will indeed result from abandonment of these remote, exposed, unmaintained, and weakening structures.

Orofino Creek is uniquely subject to regular and severe flooding. Under these circumstances, it is appropriate to order GNR to remove the railroad structures from that portion of the right-of-way traversing State land. IDL lacks adequate resources to maintain or remove these structures, and IDL should not be responsible for cleaning up after the railroad simply because IDL is the reversionary landowner. A condition requiring the removal of all railroad structures from this right-of-way upon abandonment is appropriate under these circumstances.

For these reasons, it is the position of IDL that the STB must condition GNR's abandonment exemption upon GNR's removal of any and all trestles, culverts, rails, ties, abutments, and concrete barriers from that portion of the abandoned right-of-way that will revert to the State following abandonment. Under 49 C.F.R. §§ 1105.10(f) and 1152.50(d)(5), the STB has the authority to subject the exemption to such a condition.

**B. The STB should *expressly* condition abandonment on GNR's removal of all rails and ties.**

IDL also requests that the STB codify GNR's plans to remove rails and ties as part of salvage activities as an express condition on the grant of abandonment authority.

## VI. COMMENTS OF IDAHO DEPARTMENT OF WATER RESOURCES

IDWR's functions include administration of the Idaho Stream Channel Protection Act, Idaho Code §§ 42-3801, *et seq*. This Act seeks to protect "the public health, safety and welfare [by requiring] that the stream channels of the state and their environments be protected against alteration for the protection of fish and wildlife habitat, aquatic life, recreation, aesthetic beauty, and water quality." Idaho Code § 42-3801.

IDWR requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDWR, and report to the SEA, on water quality-related protocol, regulations, and potential permitting requirements prior to the commencement of salvage activities.

## VII. CONCLUSION

IDEQ respectfully requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDEQ and report to SEA. IDEQ further requests that, notwithstanding the SEA's contrary recommendation, the STB require GNR to remove any and all trestles and bridges from the entire abandoned right-of-way, because, under the proper legal standard, this condition is appropriate based on the environmental record. Finally, IDEQ requests that the STB expressly condition abandonment on GNR's removal of all rails and ties.

IDL respectfully requests that the STB require GNR to remove any and all trestles and bridges from that portion of the abandoned right-of-way traversing State land.

Further, IDL requests that, notwithstanding the SEA's contrary recommendation, the STB expressly condition abandonment authority on GNR's removal of all rails and ties from that portion of the right-of-way traversing State land because, under the proper legal standard, this condition is appropriate based on the environmental record.

Finally, IDWR requests that the STB accept the SEA's recommendation that, as a condition of abandonment, GNR be required to consult with IDWR, and report to the SEA, on water quality-related protocol, regulations, and potential permitting requirements prior to the commencement of salvage activities.

DATED this 18th day of October 2004.

Emily Kane

EMILY KANE
Deputy Attorney General
State of Idaho

## CERTIFICATE OF SERVICE

I HEREBY CERTIFY that on this 18th day of October 2004, I caused to be served a true and correct copy of the foregoing **STATE OF IDAHO'S COMMENTS ON ENVIRONMENTAL ANALYSIS**, by placing the same in the United States Mail at Boise, Idaho, postage prepaid, addressed as follows:

Karl Morell, Counsel for Great Northwest Railroad, Inc.
Ball Janik LLP
1455 F Street, N.W., Suite 225
Washington, DC 20005

Emily Kane
EMILY KANE
Deputy Attorney General
State of Idaho

# EXHIBIT A
# to State of Idaho's Comments on Environmental Assessment

News Release
September 13, 2000

DIRK KEMPTHORNE
GOVERNOR

# NEWS RELEASE

FOR IMMEDIATE RELEASE
September 13, 2000
00:081

CONTACT: Mark Snider
(208) 334-2100

## CLEARWATER COUNTY SELECTED FOR "*PROJECT IMPACT*" DISASTER PREVENTION EFFORTS

**(BOISE)** Governor Dirk Kempthorne announced today that Clearwater County has been selected to join a partnership with the Federal Emergency Management Agency (FEMA) in the effort to prevent damage and loss of life caused by natural disasters in the county.

Clearwater County was nominated by Kempthorne and selected by FEMA Director James Lee Witt as one of 62 new communities to join 247 other communities as part of FEMA's nationwide initiative - Project Impact: Building Disaster Resistant Communities. As a result of today's announcement, Clearwater County is eligible for approximately $300,000 to help make their communities more disaster resistant.

"For a number of years, Idaho has worked with FEMA to assist communities across the state to recover from natural disasters," Kempthorne said. "As we've seen with recent wildfires and disaster declarations, the timing for this announcement could not be better. Preventing damage to communities before disasters occur is the only true way to save tax dollars normally spent on response and recovery from disasters. Everybody wins when damages from disasters are prevented or diminished."

The most significant natural hazards that impact Clearwater County are floods, wildfires and landslides. Kempthorne noted that severe flooding as recently as 1996 and 1997 cost in excess of $10 million.

"Clearwater County has been progressive in combating loss, with flood mitigation projects on the lower section of Orofino Creek and the North Central Idaho Strategic Flood Plan. Joining Project Impact will strengthen the county's efforts," Kempthorne added.

Clearwater County joins the city of Boise, the city of Kamiah and Lewis County and Blaine County as Idaho communities partnering with FEMA on Project Impact.

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# EXHIBIT B
# to State of Idaho's Comments on Environmental Assessment

Affidavit of Nick Albers
October 6, 2004

LAWRENCE G. WASDEN
Attorney General

CLIVE J. STRONG
Deputy Attorney General
Chief, Natural Resources Division

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Attorneys for Idaho Department of Lands,
Idaho Department of Water Resources,
and Idaho Department of Environmental Quality

BEFORE THE

SURFACE TRANSPORTATION BOARD

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DOCKET NO. AB-872X

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GREAT NORTHWEST RAILROAD, INC.
– ABANDONMENT EXEMPTION –
IN CLEARWATER COUNTY, IDAHO

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AFFIDAVIT OF NICK ALBERS

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I, NICK ALBERS, being first duly sworn, depose and say:

1. I am over the age of 18 and competent to testify to the matters herein.

2. In 1996 and 1997, in response to a federally declared disaster as a result of severe flooding in Clearwater County, I was appointed Incident Commander by the county commissioners, the mayor of Orofino, Idaho, and the city council of Orofino, Idaho.
3. As Incident Commander, my responsibilities included: public safety issues, identifying necessary flood response projects and measures; ensuring that proper response equipment and other resources were available; evaluation and prioritization of damaged roads to be repaired; managing flood response workers and volunteers; analyzing evacuation needs; educating and notifying the public regarding proper response and evacuation procedures; establishing a bussing system for safe transport of county residents; ensuring that emergency shelters were in place and prepared; coordinating the delivery of water, medical supplies, and other necessities; and subsequent reconstruction following the floods.
4. I am currently a member of the Clearwater County Project Impact Flood Committee ("Flood Committee"), which on September 13, 2000 was selected for partnership with the Federal Emergency Management Agency ("FEMA") in the effort to prevent property damage and loss of life caused by floods and other natural disasters that occur in Clearwater County, Idaho, as well as to restore Orofino Creek to the condition it was in before the 1996 and 1997 floods.
5. The Flood Committee commissioned a restoration engineer to prepare the Orofino Creek Master Plan for Flood Mitigation/Stream Restoration.
6. This plan includes a number of projects that have been prioritized by the Flood Committee and are undertaken as funding is available.
7. For example, in response to an alluvial fan (that is, an accumulation of sediment) developing at the confluence of Orofino Creek and the Clearwater River (downstream from the Jaype branch line), the Flood Committee has worked with federal, state, and local governments, as well as local businesses, to chanellize the stream with a series

of rock vanes, which will help the stream reduce stream bed loading and eliminate the alluvial fan.

8. The Flood Committee considers the railroad trestles on the Jaype branch line to threaten ongoing and future steam restoration and flood prevention projects in Clearwater County.
9. Debris building up behind the trestles both itself places pressure on the aging structures, and increases water pressure by narrowing the space available for passage through the trestles.
10. As Incident Commander, in 1996 I flew in a National Guard helicopter upstream, along Orofino Creek and over the Jaype branch railroad line.
11. From the helicopter, I did observe that extensive debris had built up behind the railroad trestles during the flood.
12. Water pressure on the trestles was great, and likely weakened the structures' integrity.
13. In places, the earthen base underlying the railroad tracks had washed away, leaving the tracks suspended in the air, without support.
14. Some of the trestles were damaged and some pilings were washed out, though none fully collapsed.
15. A number of railroad ties and timbers were found on Michigan Avenue in Orofino, several miles downstream from the railroad line, which indicated the ongoing weakening of the railroad structures.
16. Additional damage occurred in the flood of 1997.
17. During the floods of 1996 and 1997, I was concerned that if one of the trestles on the Jaype line were to collapse under the increased water pressure and volume, it would cause a "domino effect," pushing downstream a large volume of debris and taking out trestles and bridges as it moved downstream.
18. In any future high-water event, the potential "domino effect" will be a major concern unless the railroad structures are removed.

19. Following the 1996 and 1997 floods, Camas Prairie Railnet, the predecessor of Great Northwest Railroad, Inc. did make extensive, necessary repairs to the railroad structures and fortified the embankments along the railroad line with riprap, which project I presume was federally funded.
20. Even after these repairs, the railroad structures appear to be, and likely are, in worse condition than they were before the floods of 1996 and 1997.
21. The problem with debris buildup behind the railroad structures continues yet today.
22. At the December 17, 2003 meeting of the Flood Committee, Kevin Spradlin, representing Camas Prairie Railnet, did report that in October 2003 the railroad maintenance crew had cleared debris that had accumulated behind the center of the trestles, but that the crew had left much debris around the sides of the trestles.
23. If a high-water event were to occur, the remaining debris will increase water pressure on the structures and reduce the volume because of a restricted passage and potentially exacerbate flood conditions.
24. A high-water event occurred in February 2003.
25. A Clearwater County citizen videotaped a trestle on the Jaype branch line during the February 2003 high-water event.
26. I watched the video on December 17, 2003.
27. The video demonstrated that during the high-water event, there was extensive buildup of debris behind the trestles and further damage to the trestles' structural components. The accumulated debris exerts significant pressure on the trestles.
28. In any future high-water event, it is likely that additional debris will lodge against bridges and exacerbate existing flood conditions, as it did in 1996 and 1997.
29. This situation will contribute to erosion, harm fish and wildlife that depend on the water resource, and create a serious hazard to downstream people and property including the city of Orofino, which is Clearwater County's largest community.

30. The selection of Clearwater County to partner with FEMA demonstrates that flood prevention, control, and mitigation in Clearwater County are high priorities to the federal government.

31. The commitment of funds and support by state, local, and private sources demonstrates that flood prevention, control, and mitigation in Clearwater County are high priorities to the community.

32. The aging railroad trestles on the Jaype branch line are seen by the Flood Committee as the greatest threat to the work on steam restoration and flood prevention undertaken by the Flood Committee, as well as that undertaken by state agencies, federal agencies, local agencies, private individuals, businesses, and communities in Clearwater County.

33. The risk of damage to persons, property, and the natural environment should be averted by the Surface Transportation Board in the course of the abandonment process by ordering Great Northwest Railroad, Inc. to remove all railroad structures on the Jaype branch right-of-way.

Further your affiant sayeth naught.

DATED this 6th_day of October 2004.

Nick Albers
NICK ALBERS

SUBSCRIBED and sworn to before me this 6th day of October 2004.

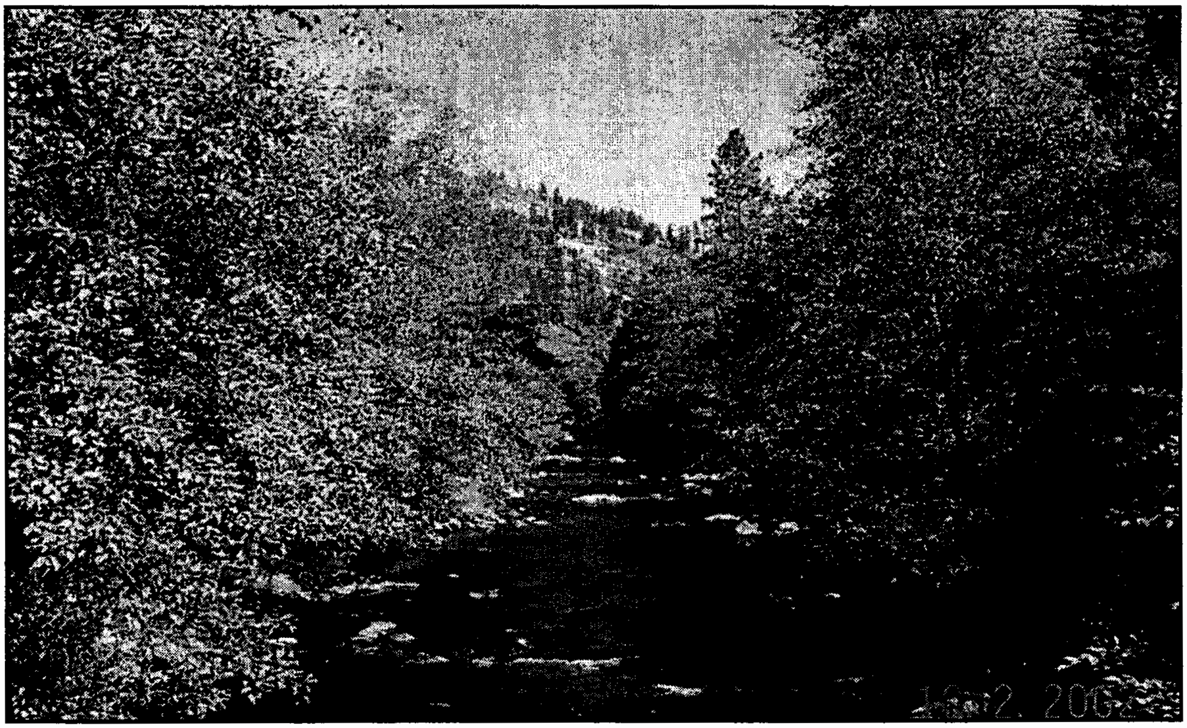
Robin Christensen
Notary Public for Idaho
Residing at Orofino
My Commission Expires: 1-6-06

ROBIN CHRISTENSEN NOTARY PUBLIC STATE OF IDAHO
(SEAL)

# EXHIBIT C
# to State of Idaho's Comments on Environmental Assessment

Watershed Assessment and Master Plan
for Flood Mitigation and Stream Restoration on
Lower Orofino Creek
May 7, 2003

# WATERSHED ASSESSMENT AND MASTER PLAN FOR FLOOD MITIGATION AND STREAM RESTORATION ON LOWER OROFINO CREEK



**PREPARED FOR:**


**Clearwater County**
P.O. Box 586
Orofino, Idaho 83544

Clearwater Economic Development Association


May 7, 2003

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APPENDIX D: STRUCTURE DETAILS

## ACKNOWLEDGEMENTS

Water Consulting, Inc. would like to thank the following individuals for their technical expertise, local knowledge and continued participation in support of developing this document:

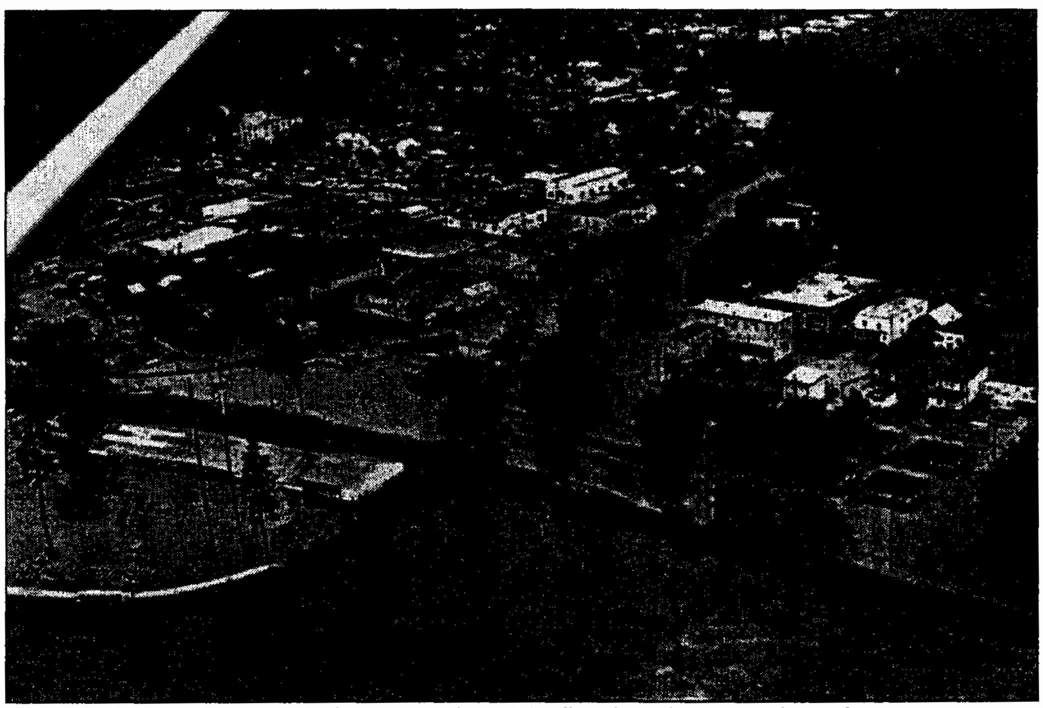
Christine Frei, Clearwater County Project Impact Coordinator, CEDA
Nick Albers, Clearwater County Road Department
Cindy Barnett, County Clerk, Clearwater County
Dustan Bott, Nez Perce Tribe Water Resources Division
Dean Brandt, Brandt Cedar Mill
Dave Braun, Landowner
Roy Brooks, Landowner
Anne Connor, Civil Engineer, Clearwater National Forest
Robin Christiansen, Auditor, Clearwater County
Randy Curtis, Civil Engineer, Clearwater County
Pete Curfman, Commissioner, Clearwater County
Linda Davis, Landowner
Don Ebert, Commissioner, Clearwater County
John Elliot, Building Official, City of Orofino
Dale Fletcher, Clearwater County Planning and Zoning
Jim Franklin, Landowner
Bruce Hanson, Soils Specialist, Natural Resource Conservation Service
Mike Hoffman, Water Quality Resource Conservationist, Idaho Soil Conservation Commission
Alex Irby, Konkolville Lumber Mill
Rick Laam, City Administrator, City of Orofino
Stan Leach, Chair, Clearwater County Commission
Pat Manfull, Clearwater County Road Department
Bob McKnight, Idaho Department of Lands
Sandy Medley, Clearwater Unlimited Chamber of Commerce
Jim Mallory, Potlatch Corporation
David Morgan, National Marine Fisheries Services
Joe Pippenger, Mayor, City of Orofino
Paul Pippenger, Landowner/Developer
Mark Reaney, Cuddy & Associates
Tim Rubio, Clearwater County Economic Development
Debi Ruppe, Bureau of Disaster Services
Lonnie Simpson, Landowner
Lauri Stifanick, County Clerk, Clearwater County
Dennis Thompson, Business Owner
Jason Vangen, Nez Perce Tribe Water Resources Division
Angela Vanderpas, Clearwater County
Floyd Williams, Public Works Administrator, City of Orofino

# 1.0 EXECUTIVE SUMMARY

## 1.1 History of Flooding in Orofino

Located in the floodplain near the confluence of Orofino Creek and the Clearwater River, the City of Orofino has experienced extensive damage from the impact of frequent floods in the Clearwater River Basin. Floods of record affecting the City of Orofino occurred in the Clearwater River in 1948 and 1964. In addition, significant floods in Orofino Creek occurred in 1933/1934, 1948, 1957, 1964, and most recently in 1996 when approximately 10 million dollars of disaster relief funds were appropriated to Clearwater County to repair damaged infrastructure, aid in the cleanup efforts and provide economic assistance to individuals affected by flood damage.

In addition to sustaining flood damage in 1996, Orofino Creek experienced extraordinary sediment loading that caused severe bank erosion, loss of riparian vegetation and filling of important pool habitat features, resulting in extensive changes in the meander pattern, channel cross section, bed profile and available habitat of the Creek. Most notable of these changes is the large, unstable delta that continues to form at the mouth of the Creek. Many residents of Orofino remember when Orofino Creek supported a productive fishery that was significantly different from the impaired fishery that currently exists. Recently, efforts to obtain permits to perform maintenance on Orofino Creek have been affected by habitat concerns for threatened and endangered species such as steelhead trout and bull trout. For these reasons, a master plan that accomplishes both flood control and habitat restoration objectives is sought.



*A photograph depicting the 1964 flood in the City of Orofino.*

## 1.2 Goals and Objectives

Clearwater County and the Clearwater County Project Impact Flood Committee (Committee) procured the services of Water Consulting, Inc. (WCI) to prepare a watershed assessment and master plan for habitat restoration and flood mitigation for lower Orofino Creek in the City of Orofino, Idaho. In December 2001, WCI conducted a preliminary assessment of the existing conditions and developed a restoration plan that outlined a phased approach to analyzing and addressing the flooding problems and habitat limitations that exist in the watershed. This watershed assessment and master plan is Phase One of a multi-phase effort that seeks to use natural channel design techniques to provide flood mitigation and habitat restoration for the Orofino Creek watershed.

In August 2002, a kick-off meeting was held to define roles, discuss project issues and identify project goals and objectives. In attendance were members of the Committee, several residents of the City of Orofino and representatives from WCI. The following goals and objectives were identified at the kick-off meeting:

- Identify and address the causes of flooding; i.e., the causes of excessive sedimentation, bank erosion and bank instability;
- Evaluate the effects of bridges on Orofino Creek;
- Determine habitat limitations and evaluate habitat potential for aquatic and riparian species;
- Assess conditions in the upper watershed and tributaries;
- Determine Orofino Creek's potential condition;
- Recommend "Natural Channel Design" alternatives that provide long-term success and minimize maintenance;
- Prioritize treatment areas and project locations;
- Use local expertise, equipment and volunteers;
- Coordinate with Clearwater Subbasin planning efforts; and
- Create opportunities for stream access and recreation.

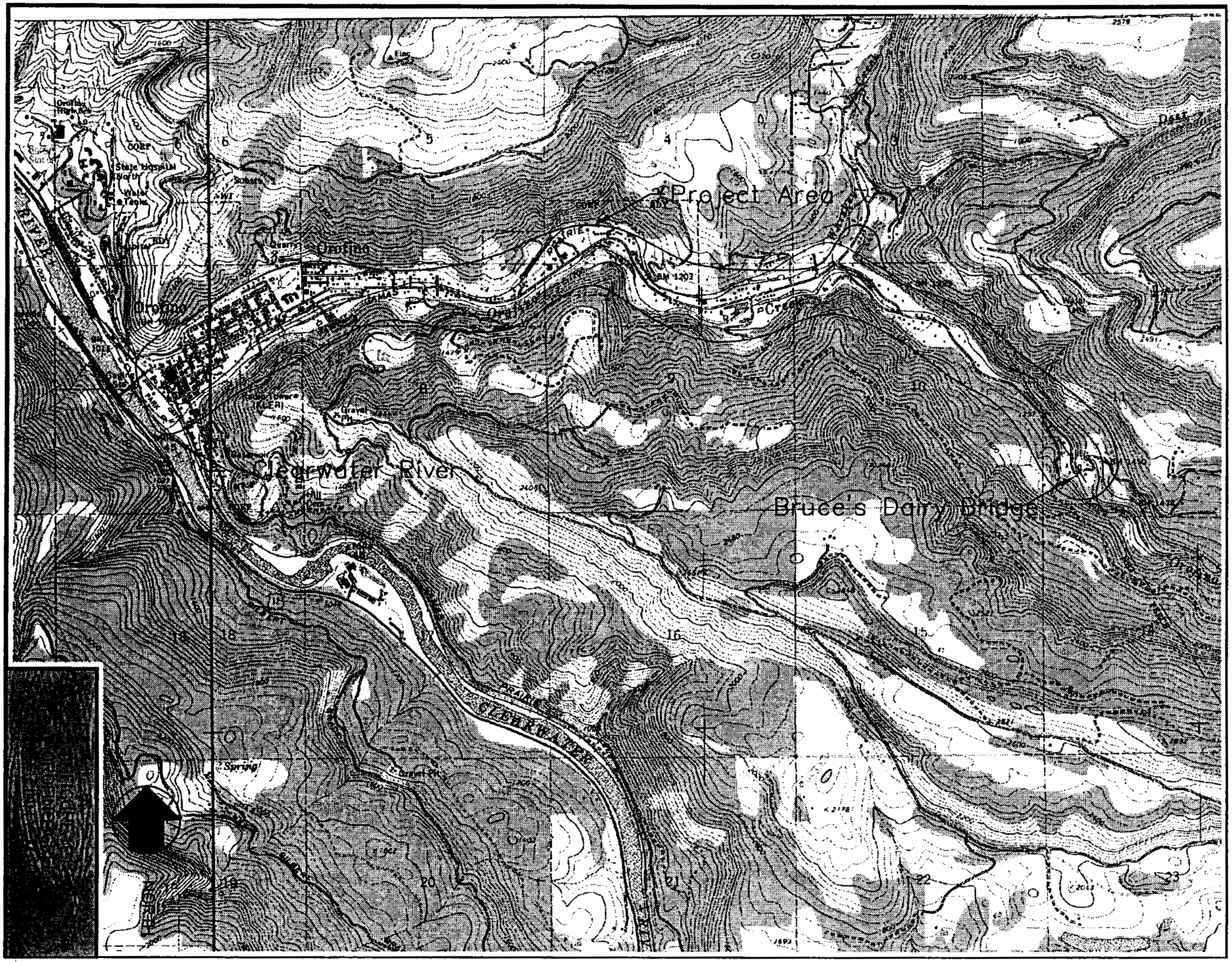
In April 2003 interviews were held with local residents and Committee members to discuss flood history, local expectations and project objectives. The information and perspective acquired from these interviews were vital to the development of this document, its recommendations and its potential for implementation.

## 1.3 Clearwater Subbasin Plan

Efforts were made to use existing information developed in the Clearwater Subbasin Plan. The Clearwater Subbasin Plan has identified several limiting factors within the Orofino Creek watershed that inhibit aquatic and riparian habitat. Unfortunately, due to Orofino Creek's degraded existing condition, the stream is not classified as a restoration priority in the Clearwater Subbasin Assessment (2002). However, the data collected and restoration alternatives recommended could provide additional insight into the restoration needs for the Orofino Creek Watershed.

## 1.4 Project Location

Although this plan attempts to address the condition of the entire Orofino Creek watershed, its recommendations focus on the lower 4.5 miles of Orofino Creek from Bruce's Dairy Bridge to the confluence with the Clearwater River. A project vicinity map is presented in Figure 1.1.


Project Area
Bruce's Dairy Bridge
Clearwater River
Orofino
State Hospital
Spring
CLEARWATER
NORTH

## 1.5 Existing Condition

For Orofino Creek and other nearby tributaries to the Clearwater River, the predominant stream types in this setting are B3c (Rosgen, 1996). Step-pool morphology and moderate width, sloping flood prone areas adjacent to the river characterize B3c stream types. A well-vegetated flood prone area allows for flood flows to spread out somewhat, dissipating energy over a wider surface. These stream types have a low gradient, low sinuosity and tend to be relatively stable. The existing F3 stream type has a riffle-pool morphology and is completely incised into the valley, which means that these streams do not have an adjacent floodplain. During a flood event, all the flow is contained within a narrow corridor rather than spreading out onto a floodplain.

As Orofino Creek approaches the Clearwater River, the valley setting changes to a broad, flat, alluvial valley with a wide floodplain and adjacent terraces. Stream types in this setting tend to be C stream types characterized by riffle-pool morphology and wide, flat, densely vegetated floodplains adjacent to the channels. These streams are highly sinuous, with bank stability related to dense rooting of shrubs and trees along the stream banks. These channels are highly prone to increased bank erosion and sediment supply when the vegetation is disturbed or the channel modified as with Orofino Creek. Due to encroachment, the potential to restore lower Orofino Creek to a C stream type is limited.

A departure from historical conditions exists in Orofino Creek as a result of several anthropogenic and natural impacts. Most of these impacts have caused impaired channel types that are not indicative of the geologic valley setting, hydrologic regime and sediment load of Orofino Creek. Moreover, the impaired channel types are less efficient at transporting flood flows and sediment than the historical stream type. Likely sources of impairment include:

- Loss of floodplain due to urban encroachment;
- Loss of floodplain due to the placement of fill;
- Channel straightening, deepening and widening (channelization);
- Constrictions and debris jams caused by undersized bridges and railroad trestles;
- Loss of riparian vegetation/invasion of non-riparian vegetation;
- Excessive sediment loading from eroding banks; and
- Extensive use of riprap bank stabilization.

Due to these impairments, flood impacts have been exacerbated, and are most widespread in the urbanized lower watershed. Flood events in Orofino usually lead to extensive bank erosion, excessive sediment loading and property damage. The Orofino Business District is in the 100-year flood plain of the Clearwater River and Orofino Creek. During flood events, a backwater effect from the Clearwater River extends approximately 1,000 feet up Orofino Creek. In an average year, peak discharges from the two watersheds are desynchronized, with Orofino Creek peaking in April and the Clearwater River peaking in June. If the two peaks are synchronized, excessive sediment deposition occurs in Orofino Creek and floodwaters threaten the Business District.

## 1.6 Geomorphic Assessment

Anthropogenic modifications to Orofino Creek, potentially compounded by extrinsic controls such as climate and base level changes, have dramatically affected perennial flow, floodplain function, sediment transport, and aquatic and riparian habitat conditions. Specific stream reaches have responded in various ways to these alterations. Understanding these varied channel responses and the successional tendencies of Orofino Creek is critical for developing sound restoration projects. Channel successional processes are apparent in the project area and provide some guidance in predicting future channel conditions if current channel degradation is not addressed. Section 2.2 describes the probable geomorphic trends as determined from field investigations, review of available aerial photography, and preliminary hydraulic modeling based on collected field data.

Several channel types exist within the project area, most of which are not consistent with the historical B3c stream type. The instability in the lower watershed is a direct result of Orofino Creek attempting to regain its historic channel characteristics. A summary of the geomorphic assessment and survey results is presented in Table 1.1.

**Table 1.1**
**Summary of Existing Channel Characteristics**

| Reach | Stream Length(ft) | Sinuosity | Dominant Bed Material | Entrenchment Ratio | Width:Depth Ratio | Slope | Stream Type |
|---|---|---|---|---|---|---|---|
| 1 | 5500 | 1.02 | Cobble | 1.2 | 31 | 1.2% | F3 |
| 2 | 5200 | 1.06 | Cobble | > 2.2 | 10 | 1.4% | F3 |
| 3 | 3300 | 1.32 | Cobble | > 2.2 | > 40 | 1.7% | D3 |
| 4 | 3000 | 1.20 | Cobble | 1.3 | 13 | 1.1% | F3 |
| 5 | 3500 | 1.03 | Cobble | 1.3 | 25 | 1.2% | F3 |
| 6 | 4000 | 1.05 | Cobble | 1.4 | 10 | 1.7% | B3c |

The channel succession process, if allowed to occur without intervening restoration, would result in continued habitat impairment, lowered water tables, and excessive sediment loading to the downstream reaches of Orofino Creek and the Clearwater River. If left untreated, Orofino Creek would require decades, if not centuries, to naturally stabilize. The environmental and economic consequences associated with the successional sequence described in Section 2.0 include:

- Accelerated stream bank erosion and property loss;
- Aquatic habitat impairment;
- Reduced stream length and available in-stream habitat; and
- Downstream sedimentation.

## 1.7 Fish Habitat Assessment

Fish habitat in Orofino Creek is functioning below its potential. Orofino Creek is recognized in several publications as an impaired stream due to high water temperatures, considerable channel modifications, dewatering, and poor water quality caused by watershed urbanization, mining, and sedimentation. The completed survey largely substantiated these conclusions. The stream has been widely manipulated in an effort to increase the flood flow channel conveyance and stabilize eroding banks. Extensive bank armoring and channel straightening have degraded fish habitat in the lower watershed. Flood damage that resulted from the 1996 event also caused considerable fish habitat impairment. Channel over widening, riparian vegetation loss, and pool filling were evident over most of the surveyed reaches. The existing aquatic and riparian habitat conditions will likely not improve in the near future without considerable human intervention. Table 1.2 summarizes the fish species inhabiting Orofino Creek.

Table 1.2
Fish Species Inhabiting Orofino Creek

| Native Salmonid Species | Other Native Species | Non-native Game Fish Species |
|---|---|---|
| Bull trout | Northern pikeminnow | Brook trout |
| Westslope cutthroat trout | Redside shiner | Smallmouth bass |
| Steelhead trout | Paiute sculpin | Kokanee salmon |
| | Bridgelip sucker | |
| | Longnose dace | |
| | Speckled dace | |

The existing condition of Orofino Creek is unlikely to support a native salmonid community due to extensive habitat and water quality/quantity impairment. In addition, Orofino Creek is unlikely to support a large steelhead population due to the short length of accessible channel. The natural falls at river mile 5.2 preclude upstream fish migration and the likelihood that Orofino Creek could maintain a migratory fishery. Whiskey Creek, a tributary in the lower watershed is also degraded, but offers potential for additional habitat within the lower watershed.

By creating a floodplain and building a self-maintaining channel with alternating riffles and pools, improved fish habitat could attract adult steelhead and provide habitat for other fish species inhabiting the drainage. Channel reconstruction that improves channel and floodplain dimensions, incorporates large woody debris, and diversifies the aquatic environment would be expected to improve the existing fish habitat condition and could result in a more diverse and populous fish community. Unfortunately, due to Orofino Creek's degraded existing condition, the stream is not classified as a restoration priority in the Clearwater Subbasin Assessment (2002) and so is unlikely to be awarded restoration funding through Bonneville Power Administration programs.

## 1.8 Hydrologic Analysis

Since no stream discharge gage data exist for Orofino Creek, bankfull and flood flow discharges were estimated using three methods, including:

- Field calibrating bankfull discharge at the Lolo Creek USGS stream gaging station;
- Conducting field surveys on Orofino Creek and performing steady-state hydraulic modeling; and
- Conducting flood frequency and unit discharge analyses for the USGS stream flow gaging stations.

The bankfull discharge for Orofino Creek below Whiskey Creek was estimated to be 1,500 cfs. The bankfull discharge for Orofino Creek above Whiskey Creek was estimated to be 1,000 cfs. According to the Flood Study for Orofino Creek published by the Federal Emergency Management Agency, the 100-year flood is estimated to be 7,600 cfs. Results of the hydrologic analysis are presented in Table 1.3.

**Table 1.3**
**Selected Discharges for the Orofino Creek Watershed**

| | Recurrence Interval | Selected Discharge |
|---|---|---|
| **Orofino Creek below Whiskey Creek** | Bankfull Discharge ($Q_{1.5}$) | 1,500 cfs |
| | 100-Year Discharge ($Q_{100}$) | 7,600 cfs |
| **Orofino Creek above Whiskey Creek** | Bankfull Discharge ($Q_{1.5}$) | 1,000 cfs |
| | 100-Year Discharge ($Q_{100}$) | 6,500 cfs |

To better understand the hydrology of Orofino Creek and its relationship to other watersheds, it is recommended that a discharge gage be installed on Orofino Creek. Moreover, gage data would help to validate the results of this analysis and provide useful data for future projects.

## 1.9 Hydraulic and Engineering Analysis

Section 4.0 provides a description of the methodologies used to develop the hydraulic and engineering design elements of the proposed restoration activities for Orofino Creek. The hydraulic discussion focuses upon development of typical channel cross-section templates, channel plan form dimensions and longitudinal profile parameters. In addition, sediment transport analyses were completed for existing and potential conditions. Lastly, a discussion of the bridge analysis is included along with recommendations.

The results indicate that the existing channel dimensions and bridge configurations are highly varied and cause a variety of hydraulic and sediment transport problems. According to the results, some reaches are aggrading (deposition), while others are degrading (scour). These localized fluctuations in slope have increased the risk for lateral migration and bank erosion. As a result, there has been widespread riprap bank stabilization in the lower watershed. Within the project area, at least 7,200 linear feet of riprapped banks were documented. This correlates to approximately 15% of the banks along Orofino Creek in the lower watershed. Although riprap may provide a means to permanently stabilize a bank or deal with an emergency situation, it does not treat the larger problem of sediment transport and inappropriate bankfull channel dimensions. Ranges of design parameters for typical cross sections, planform alignment, and longitudinal profile are provided in Tables 4.1 through 4.3 (Section 4.0). A summary of bridge modeling results is presented in Table 4.11

## 1.10 Restoration Plan

Restoration treatments vary based on channel conditions, valley morphology, bankfull hydrology, the predicted flood series, and restoration potential. Restoration options range from aggressive, channel-floodplain reconstruction to passive techniques using revegetation methods and recommendations for improved riparian management. Section 5.0 presents a range of restoration design concepts that can be applied to meet the master plan goals and objectives. These concepts include:

- Revegetation;
- Channel shaping;
- Bank stabilization;
- Flood proofing;
- Channel and floodplain reconstruction; and
- Diversion construction.

## 1.11 Project Prioritization

During October 2002, WCI staff members walked the lower 4.5 miles of Orofino Creek and noted areas of significant impairment. Overall, 26 areas of impairment were documented. For each impairment noted, a potential restoration alternative is proposed. The 26 potential projects were evaluated and ranked by the Committee according to the project's ability to meet the project goals and objectives. Primary selection criteria included:

- Whether the project location is a historical problem area;
- Ability to protect infrastructure or private property;
- Ability to provide flood relief;
- Existing level of impairment; and
- Potential to reduce sedimentation and erosion.

Table 1.4 presents a summary of the seven (7) top ranking projects for which conceptual designs were developed. Conceptual designs are presented in Section 5.4.

**Table 1.4**
**Lower Orofino Creek Project Ranking**

| Rank | Project Description | Reach | Station |
|---|---|---|---|
| 1 | Channel reconstruction at the confluence | 1 | 0+00 to 5+00 |
| 2 | Newman's Corner - Reach 3 reconstruction | 3 | 105+00 to 142+00 |
| 3 | Upstream of the Forest Street Bridge | 2 | 62+00 to 69+00 |
| 4 | Brandt Mill bank stabilization | 4 | 164+00 to 167+00 |
| 5 | Channel shaping at Noah's Bridge | 5 | 187+00 to 190+00 |
| 6 | Pump diversion at Konkolville Lumber Mill | 4 | 150+00 to 152+00 |
| 7 | Reach 6 channel reconstruction | 6 | 198+00 to 216+00 |

In addition to construction projects in the lower watershed, additional mitigation measures throughout the entire Orofino Creek watershed are necessary to achieve the project goals and ensure long-term success of the recommendations in this document. Additional issues have been identified but not addressed in detail because they are beyond the scope of this project. These issues include:

- The need for a gaging station on Orofino Creek;
- The need for additional data collection such as sediment loading rates, channel scour potential, bank erosion rates and fish population surveys;
- A plan to deal with the hazards caused by the abandoned railroad trestles in the middle watershed;
- Public education related to floodplain management and natural hazard mitigation; and
- A workshop on the principles of natural channel design geared toward equipment operators.

## 1.12 Implementation Costs and Time

Table 1.5 summarizes the estimated project construction costs and construction time periods for the seven (7) top ranking projects. In addition to construction costs, the costs below include provisions for final design, permitting, construction management, project monitoring, project maintenance and a 15% contingency. Implementation costs could be significantly reduced by the use of donated construction equipment, volunteer equipment operators and donated materials. Table 1.5 also includes an estimated cost to treat the remaining 19 impaired areas.

**Table 1.5**
**Summary of Estimated Project Construction Costs and Construction Time Periods**

| Project | Station | Cost | Construction Time |
|---|---|---|---|
| Confluence | 0+00 to 5+00 | $81,263 | 2-3 weeks |
| Reach 3 | 105+00 to 142+00 | $742,218* | 6-9 weeks |
| Forest St. Bridge | 62+00 to 69+00 | $344,265* | 2-4 weeks |
| Brandt Mill | 164+00 to 167+00 | $57,929 | 1-2 weeks |
| Noah's Bridge | 187+00 to 190+00 | $47,032 | 1-2 weeks |
| Konkolville Diversion | 150+00 to 152+00 | $40,575 | 1 week |
| Reach 6 | 198+00 to 216+00 | $177,848 | 4-6 weeks |
| Other impaired areas | | $2,512,000 | N/A |
| **Total** | | **$4,003,132** | **17 - 26 weeks** |

*Includes cost of bridge replacement

Table 1.5 identifies detailed costs for seven (7) of the 26 potential projects on Orofino Creek. To implement all 26 projects would cost approximately two (2) to four (4) million dollars and take several years. Refer to Appendix C for cost estimate details.

## 1.13 Conclusion

The proposed projects are expected to create a more stable stream capable of conveying the discharges and transporting the sediment made available by the watershed. The improved channel and floodplain conditions are expected to decrease flood damage and increase habitat potential in Orofino Creek. Constructed grade control and bank stabilization structures, along with a reconstructed channel profile and revegetation efforts, will increase the fish habitat diversity in the project reach. Other long-term benefits of the project include improvements to water quality and recreational tourism.

The recommendations contained in this document attempt to address the concerns of the residents of the City of Orofino and the problems in the lower watershed. Successful implementation of all 26 projects described in this report will not prevent flooding or entirely restore habitat in Orofino Creek. Recognizing the need to improve land use management practices and address the entire watershed is mandatory for reversing the impaired state of Orofino Creek. Until significant efforts are made to treat the root of the problem, the problems will continue to be passed downstream into the lower watershed and the City of Orofino.

As discussed in Section 1.1, approximately 10 million dollars of disaster relief funds were appropriated to Clearwater County after the 1996 flood to repair damaged infrastructure, aid in the cleanup efforts and provide economic assistance to individuals affected by flood damage. Although this project seeks to provide flood mitigation for lower Orofino Creek only, the two (2) to four (4) million-dollar implementation cost is significantly less expensive than the disaster relief costs. Moreover, the recommendations presented could provide additional economic benefits associated with habitat restoration and recreation potential.

## 2.0 EXISTING CONDITION

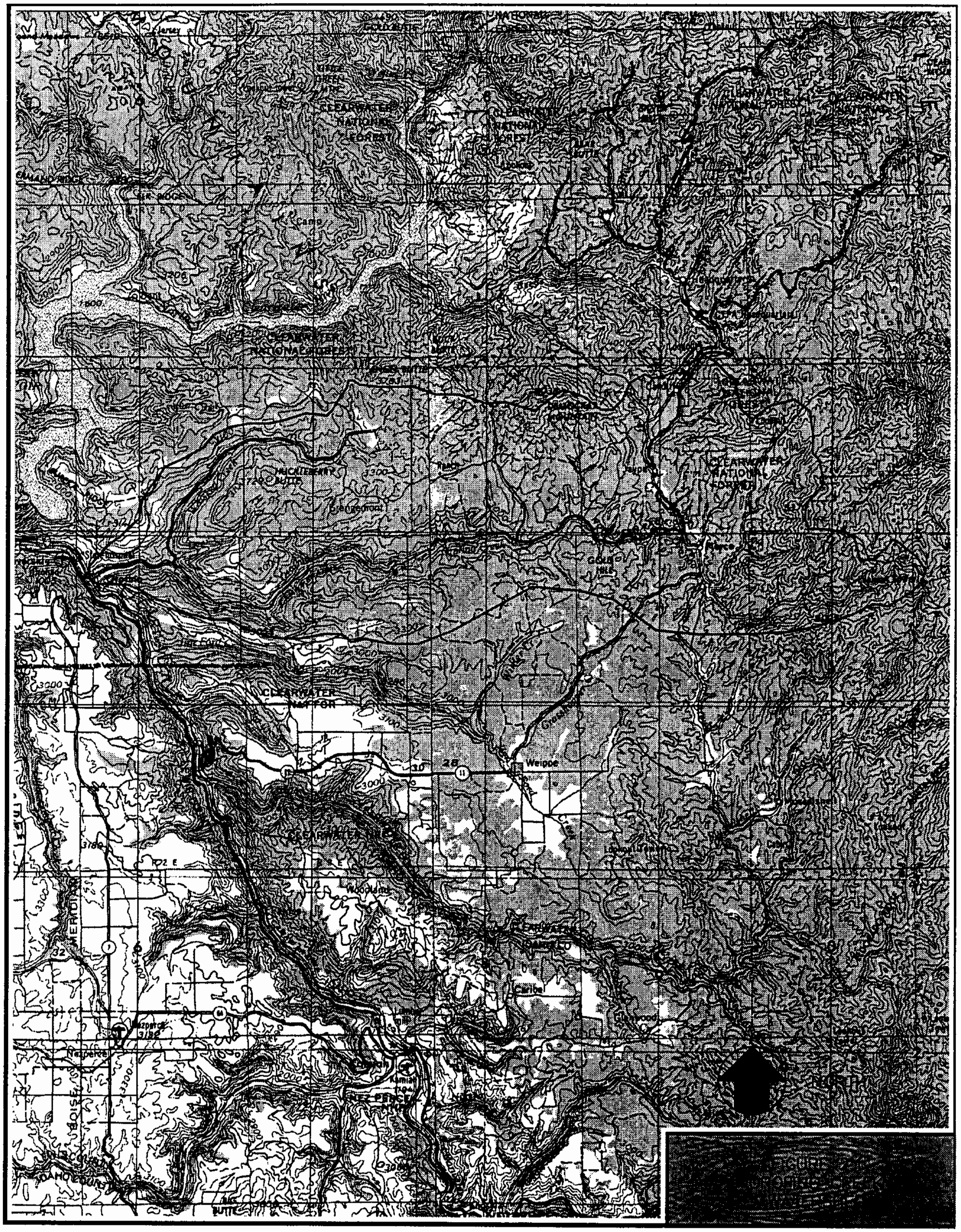
This section includes a characterization of the Orofino Creek watershed, an assessment of river geomorphology, and an evaluation of riparian vegetation, riparian habitat and fish habitat.

Level I surveys were completed for the entire study area. Level I surveys included the review of 1934 and 1996 aerial photographs and an initial site survey. Pre-mapping of channel types, sediment sources, and riparian habitat types was completed were included in the Level I survey. Six reaches of similar character were delineated within the lower watershed and surveyed to document the existing channel characteristics.

Level II surveys included methods outlined in David Rosgen's Applied River Morphology (1996). Channel measurements including channel entrenchment, width to depth ratio, slope, bed materials composition, and sinuosity were collected at the reach level throughout the study area. Additional data included surveys of representative channel cross-section, longitudinal profiles and Wolman (1954) pebble counts. The data were processed and then used to classify the stream channel type in each reach.

### 2.1 Watershed Characterization

The Orofino Creek watershed area encompasses approximately 200 square miles in central Idaho, with elevations ranging from 1,020 feet at the confluence with the Clearwater River to over 6,000 feet at the watershed divide. Whiskey Creek is a major tributary in the lower Orofino Creek watershed. A map of the watershed is presented in Figure 2.1.



CLEARWATER NATIONAL FOREST
Weippe
Woodland
Nezperce

### 2.1.1 Land Use and History

The information provided in Table 2.1 was derived from the Clearwater Subbasin Plan.

**Table 2.1**
**Land Use in the Orofino Creek Watershed**

| | Lower Watershed | Middle Watershed | Upper Watershed | Headwaters |
|---|---|---|---|---|
| **Land Ownership** | Private | Potlatch/State | Potlatch/State | Potlatch/State |
| **Road Density** | High | Moderate | High | Extreme |
| **Grazing** | Low | Low | Moderate | High |
| **Mining** | Low | Low | Moderate | Moderate |
| **Surface Erosion Hazard** | High | Low | Low | High |

Historically, land use in the Orofino Creek Watershed has been characterized by agriculture, timber harvest, and urban development. The headwaters lie in the Clearwater National Forest.

### 2.1.2 Riparian Vegetation

The riparian community typical of tributaries to the lower Clearwater River is classified as *P. trichocarpa / Rosa woodsii* (Asherin and Orme 1978). Historically, tributaries maintained broad, flat floodplains consisting of sand and gravel substrates ideal for cottonwood growth. Channel modifications on lower Orofino Creek have disrupted floodplain maintaining processes and the colonization of cottonwoods that depended on sand/gravel floodplains. Black cottonwood is the dominant overstory tree with white alder present as a seral species in some areas. White alder dominates the lower Orofino Creek riparian community. Asherin and Orme (1978) determined that the usually-disturbed understory riparian communities consisted of Woods rose (*Rosa woodsii*), poison ivy (*Toxicodendron radicans*), and black hawthorn (*Crataegus douglasii*) as a shrubby layer. Introduced species such as canary grass, cheatgrass and Kentucky bluegrass (*Poa pratensis*) have colonized portions of Orofino Creek. Yellow starthistle and spotted knapweed were present especially on disturbed sites adjacent to the creek. In general, non-riparian vegetation throughout the watershed is characterized by evergreen, coniferous and mixed forest.

### 2.1.3 Hydrology

The Orofino Creek Watershed has a mean annual precipitation ranging from 25 inches at the City of Orofino to more than 50 inches at the highest elevations (Western Regional Climate Center). Most of the precipitation in the watershed occurs as snow, which melts between May and July in most years.

The hydrology of the basin tends to be "flashy" with high peak flows resulting from snowmelt runoff and periodic rain-on-snow events. The combination of flashy runoff with high sediment producing headwaters creates a very dynamic river system. These dynamic river systems commonly have relatively unstable stream banks and are prone to braiding (multiple channels) in lower gradient valley bottoms where large sediments deposit (alluvial fans).

### 2.1.4 Geology

The Columbia Plateau, a huge mass of basalt, covers portions of Washington, Oregon, and central Idaho. Historically, the plateau was formed by lava flows that spread over the area. West of Orofino, the major deep rocks are diorite. In the lower watershed Basalt is the major deep rock type. On the other hand, granites and granitic gneisses are the major deep rock types in the upper watershed. The huge solid granite formation is a major rock type of the Bitterroot Batholith, which was formed at the edge of the Pacific Ocean and Continental North America and moved east to the present location during the Mesozoic Era (about 65 million years ago)(Alt, D.D. and D.W. Hyndman 1989).

### 2.1.5 Wetlands

There are few functional wetlands in the lower watershed. Channel and floodplain modifications, primarily the construction of floodplain levees have filled and disconnected wetland areas from the main channel. In addition, wetlands have been adversely impacted by past land management and severe flooding. Channel modifications that have straightened and simplified the channel have disconnected the stream from historical wetlands that since have been filled and developed.

## 2.2 Geomorphic Assessment

Six reaches of similar character were delineated within the lower watershed and surveyed to document the existing channel characteristics. Plan views of the reach delineations are provided in Appendix B.

### 2.2.1 Reach 1: Station 0+00 to 55+00

Reach 1 begins at the confluence of Orofino Creek and the Clearwater River and extends approximately one mile upstream. The following characteristics typify Reach 1.

- Urban encroachment (residential, commercial and industrial)
- Stable riprap and vegetated banks
- Over wide bankfull channel
- Narrow riparian buffer
- Numerous bridge constrictions
- Evidence of past channelization and berms

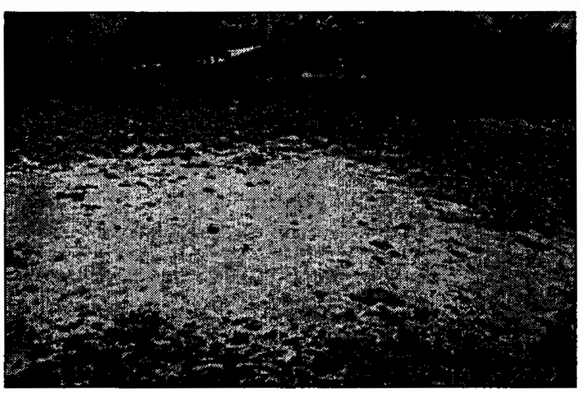
Lateral floodplain constraints are apparent in this reach. The left floodplain is largely limited by the steep hillslope that constrains the creek in this reach. Several portions of the left bank that are not bordered by the hillslope have been developed as residential properties. These properties encroach on the Orofino Creek floodplain and create flood hazards for their occupants and downstream property owners.

The floodplain adjacent to the right bank is constrained by a cobble levee, railroad grade, and residential and industrial development. Floodplain modifications have filled historical wetlands that once absorbed water during high discharge events. Floodplain filling has also increased the floodplain elevation and furthered the confinement of Orofino Creek. The cobble levee set back from the right bank limits floodwater access to the downtown corridor. The narrow floodplain located between the top of the channel banks and the levee along portions of the reach does provide some floodplain relief and sediment deposition.

***Photograph 2.1***

*Typical conditions in Reach 1. Evidence of past channelization can be observed by the unnatural straightness of the creek.*

According to the FEMA Flood Study for Orofino, a backwater effect from the Clearwater River extends approximately 1,000 feet up Orofino Creek during large magnitude flood events. In an average year, peak discharges from the two watersheds are desynchronized, with Orofino Creek peaking in April and the Clearwater River peaking in June. If the two peaks are synchronized and a large flood occurs, excessive sediment deposition occurs in Orofino Creek and flood waters from both the Clearwater River and Orofino Creek threaten the Business District.

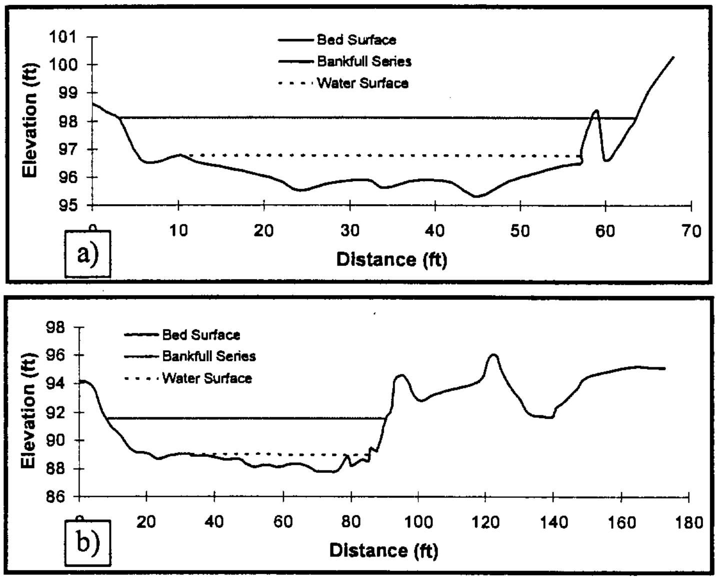


***Photograph 2.2***

*The large depositional area at the confluence.*

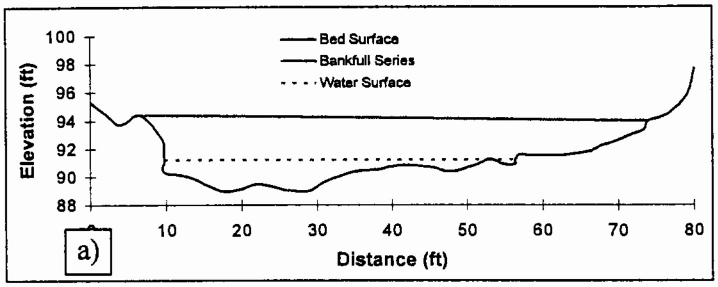
**Survey Results**

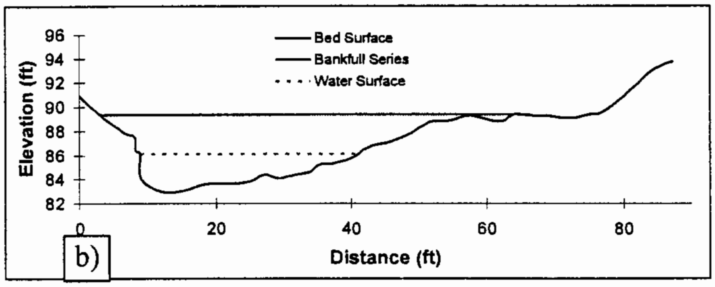
Despite the extensive channel manipulation and encroachment, the middle portion of Reach 1 included a stable reference section. Although it is controlled by a bedrock outcrop, the reference section was surveyed and evaluated for channel geometry. Four cross-sections and two longitudinal profiles were completed in the project reach. A representative pool and riffle, and longitudinal profile were surveyed downstream from the tepee burner. A second representative pool and riffle, longitudinal profile, and pebble count were completed in the reference section.




| Reach Description | Width (ft) | Channel Area ($ft^2$) | Mean Depth ($ft^2$) | Max Depth ($ft^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 60.5 | 115.8 | 1.9 | 2.8 | 1.8 | 31.6 |
| Reference | 82.5 | 224.0 | 2.7 | 3.7 | 2.6 | 30.4 |

**Figure 2.2: Riffle cross-sections completed for the typical (a) and reference (b) reaches.**




| Reach Description | Width (ft) | Channel Area ($ft^2$) | Mean Depth ($ft^2$) | Max Depth ($ft^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 67.5 | 233.4 | 3.5 | 5.3 | 3.3 | 19.5 |
| Reference | 61.0 | 202.5 | 3.3 | 6.4 | 3.1 | 18.4 |

**Figure 2.3: Pool cross-sections completed for the typical (a) and reference (b) reaches.**

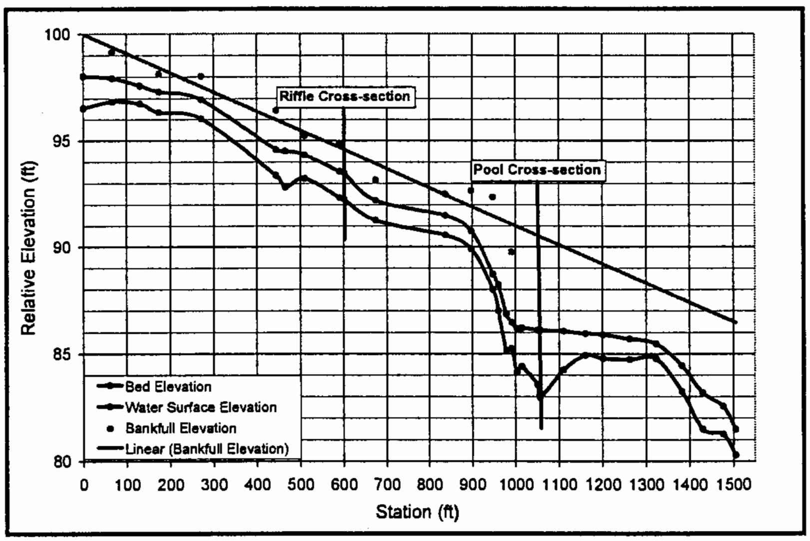



**Figure 2.4: Reference reach longitudinal profile.**

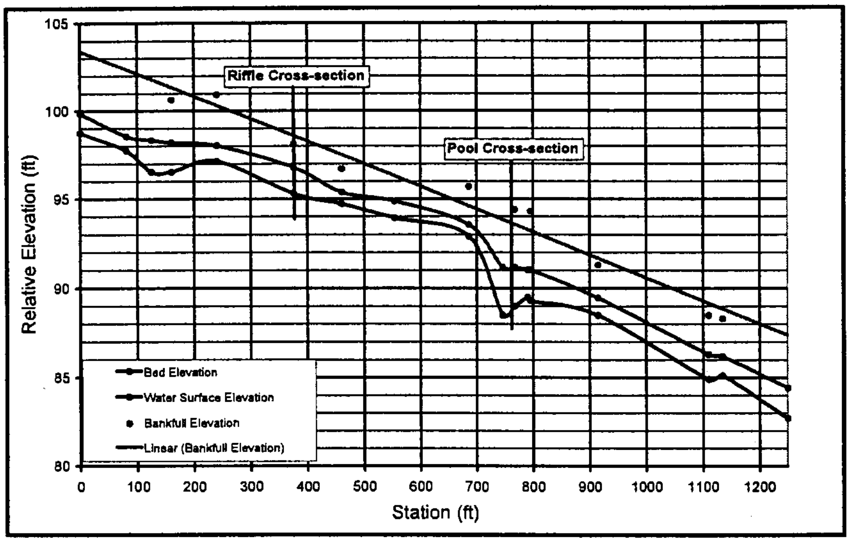
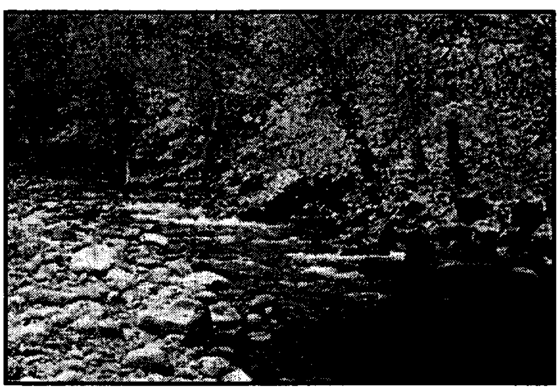
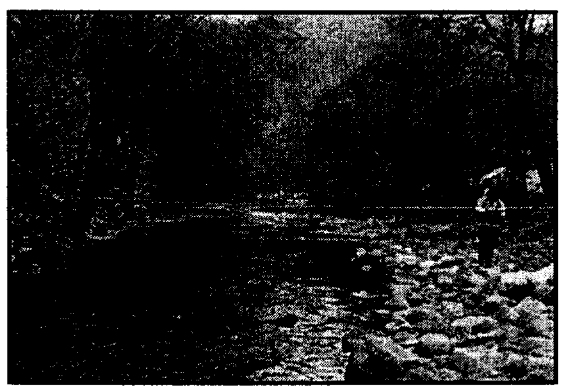



**Figure 2.5: Typical Reach 1 longitudinal profile.**

<u>**Survey Discussion**</u>

Significant differences exist between the typical reach geometry and that of the reference reach. Differences in cross-sectional area, width and depth likely result in different sediment transport capabilities and subsequent differences in channel stability. Typically, the stream type throughout Reach 1 is F with B and C inclusions, as demonstrated by the over-widened channel and the formation of point bars within the constrained channel. It is likely that the channel is in a slow state of transition as it attempts to regain its historical B/C stream type.





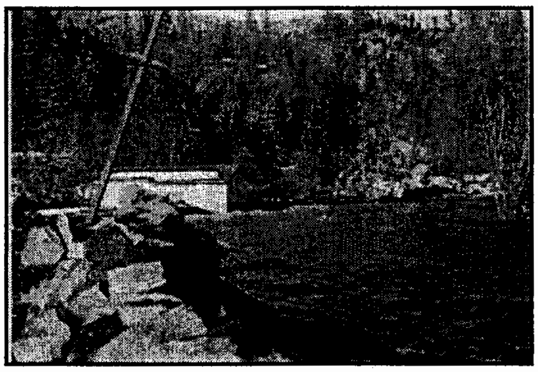
***Photograph 2.3:*** *The reference reach riffle/pool interface (a). The reference reach pool located downstream of the riffle (b). Note the sizeable bed material, straight channel, and residential development on the right floodplain in (b).*

### 2.2.2 Reach 2: Station 55+00 to 107+00

Reach 2 is approximately one mile in length and is characterized by the following conditions.

- Urban encroachment (mostly residential)
- Extensive riprap and channelization
- Limited floodplain
- Over-wide bankfull channel
- Loss of riparian vegetation
- Channel instability

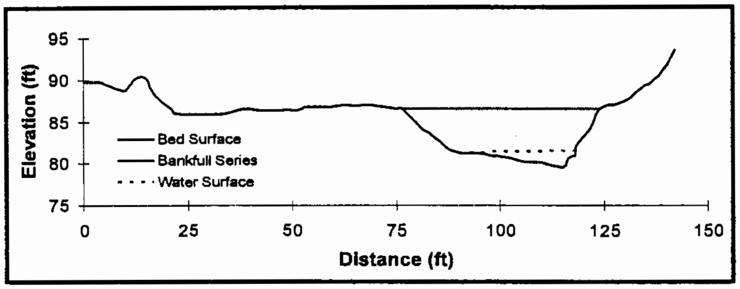
Lateral floodplain constraints are apparent throughout Reach 2. In addition, the creek has been significantly altered since the high magnitude 1996 flood. In 1996, Orofino Creek eroded through the bank and Michigan Avenue at Newman's Corner (90 degree bend). The avulsion resulted in extensive damage including the loss of one house and the temporary loss of power and drinking water. Several other structures were threatened and emergency services were disrupted as upstream residents were cut off from town. Ironically, the house that was lost was not in the floodplain, and another nearby house burned down because fire hydrants were rendered inoperable. Following the flood, large diameter rock were placed and grouted to protect the Michigan Avenue roadbed.



***Photograph 2.4:*** *Newman's Corner during the 1996 flood (a). The property was re-filled, the road rebuilt and the channel was riprapped in its original location (b).*

<u>**Survey Results**</u>

A riffle cross-section and a longitudinal profile were completed in the project reach. In general, the channel was over-widened and characterized by shallow riffle and run habitat. Channel straightening and past dredging has increased the channel gradient through Reach 2.




| Reach Description | Width (ft) | Channel Area (ft²) | Mean Depth (ft²) | Max Depth (ft²) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 47.5 | 222.7 | 4.7 | 6.8 | 51.6 | 10.1 |

**Figure 2.6: A typical riffle cross-section completed in the riprap section of Reach 2.**

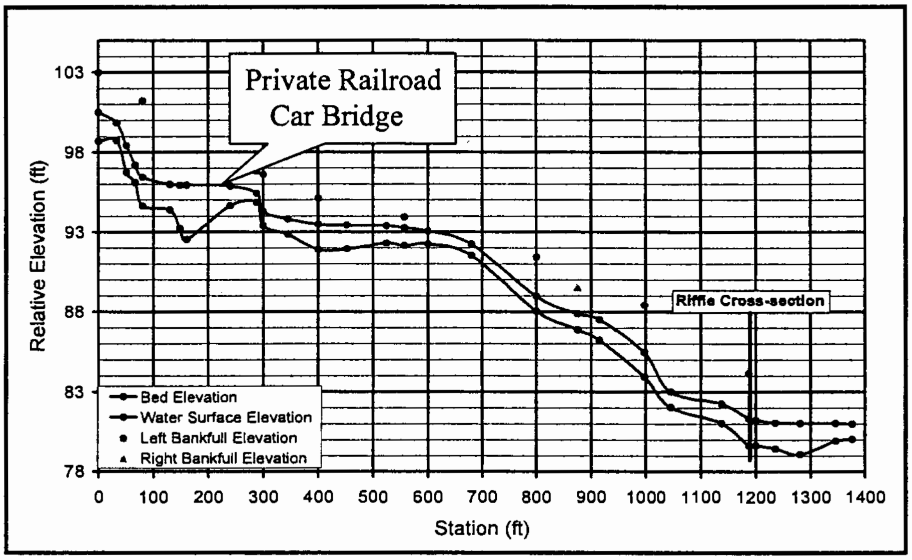



**Figure 2.7: Reach 2 typical longitudinal profile.**

**Survey Discussion**

The representative reach survey captured a typical riffle in Reach 1. The channel cross-section suggests that the riffle is confined between the armored bank and the cobble floodplain on the left bank. Existing channel conditions appeared to be a result of the channel excavation that took place following the 1996 flood. Observed stream types in Reach 2 were D, and F, both of which denote a deviation from the historic channel type. D channel types were observed in the over-widened, braided sections adjacent to the old church location. F stream types were the dominant channel type observed throughout the reach. Due to extensive riprap and armoring, the possibility for the channel to heal without human intervention is unlikely.

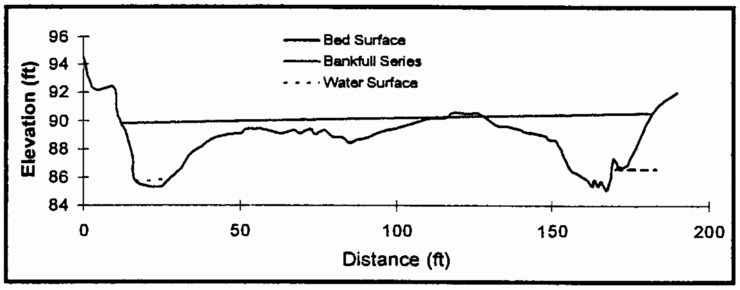
### 2.2.3 Reach 3: Station 107+00 to 140+00

Reach 3 begins at Newman's Corner (90 degree bend) at the storage/rental center and continues upstream to the Konkolville Mill. Reach 3 is characterized by the following conditions.

- Widespread instability and channel braiding (multiple channels)
- Channel modifications using rock barbs/vanes
- Moderate floodplain width
- Over-wide bankfull channel

**<u>Survey Results</u>**

A riffle cross-section and a longitudinal profile were completed in the project reach. In general, the channel was over-widened and characterized by shallow riffle and run habitat. Rather than a single deep channel, the creek maintains two separate undersized channels.




| Reach Description | Width (ft) | Channel Area (ft$^2$) | Mean Depth (ft$^2$) | Max Depth (ft$^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 170.2 | 279.3 | 1.6 | 5.4 | 175.65 | 103.7 |

**Figure 2.8: A typical riffle cross-section completed in the over-widened channel section of Reach 3. Note the excessive channel width and high width/depth ratio.**

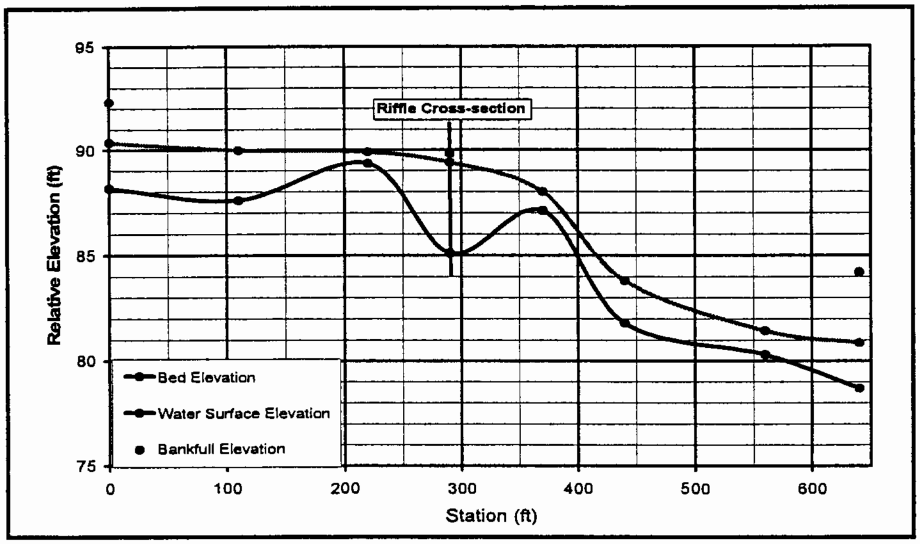
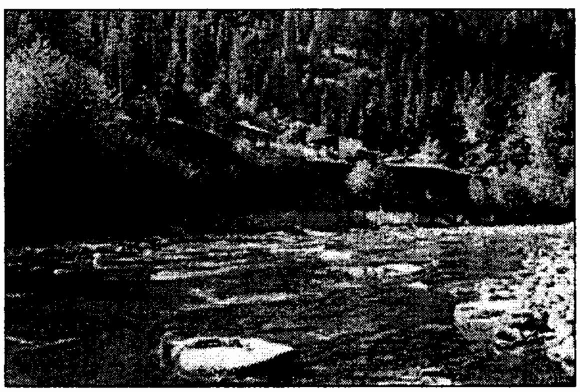
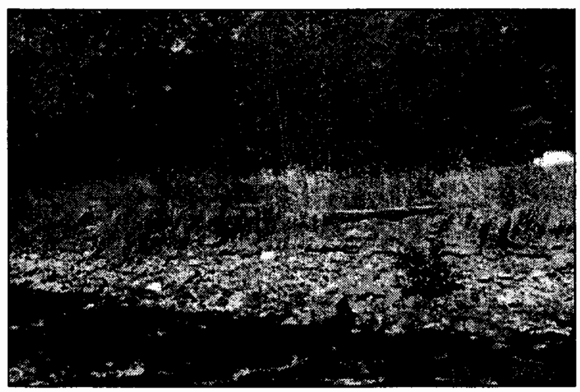



**Figure 2.9: Reach 3 typical longitudinal profile.**

**Survey Discussion**

The representative reach survey captured a typical riffle in Reach 3. The dominant stream type observed in Reach 3 is stream type D. D type streams imply multiple channels due to sediment deposition. Large mid channel deposition bars were observed throughout Reach 3. The excessive deposition has led to lateral channel migration and increased bank erosion. Large eroding banks were noted along the left bank. It is likely that the channel is in a rapid state of transition as it attempts to regain its historical B/C stream type.





***Photograph 2.5:*** *The eroding banks and over-wide channel that typify Reach 3*

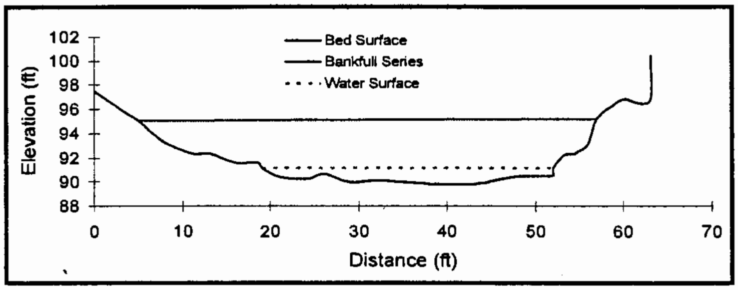
### 2.2.4 Reach 4: Station 140+00 to 170+00

Reach 4 encompasses both the Konkolville and Brandt Lumber Mills. The upstream terminus of the reach is the confluence with Whiskey Creek. Reach 4 is characterized by the following conditions.

- Industrial encroachment
- Extensive riprap and channelization
- Over-wide bankfull channel
- Loss of riparian vegetation
- Limited floodplain
- Channel manipulation for water diversions

**Survey Results**

A riffle cross-section and a longitudinal profile were completed in the project reach. In general, the channel was confined by the riprap banks and characterized by over-wide riffle morphology.




| Reach Description | Width (ft) | Channel Area ($ft^2$) | Mean Depth ($ft^2$) | Max Depth ($ft^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 52.0 | 210.8 | 4.1 | 5.4 | 55.7 | 12.8 |

**Figure 2.10: A typical riffle cross-section completed in the channelized section of Reach 4.**

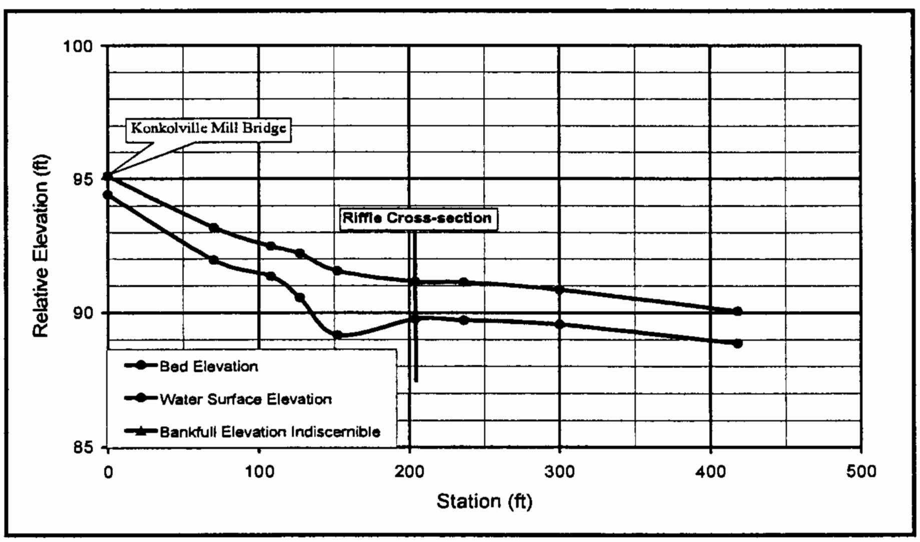



**Figure 2.11: Reach 4 typical longitudinal profile.**

**Survey Discussion**

The representative reach survey captured a typical riffle in Reach 4. The channel cross-section suggests that the stream corridor is confined by the encroaching mill facility. The longitudinal profile illustrates the simplified channel condition. One shallow pool was located mid-way down the profile. Bulldozer tracks and constructed pools for a water diversion suggest frequent channel disturbance by heavy equipment.

Similar to Reach 1, the observed stream type throughout this reach was F with B/C inclusions. Point bar formation was observed downstream of Whiskey Creek as the channel attempts to deposit bedload and regain sinuosity.

***Photograph 2.6**: (a) Channel manipulation for a water diversion. (b) A typical section in Reach 4. Note the formation of point bars and increased sinuosity.*

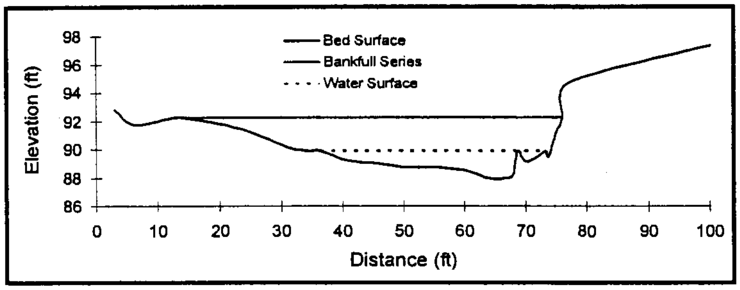
### 2.2.5 Reach 5: Station 170+00 to 205+00

Reach 5 begins at the confluence with Whiskey Creek and continues upstream past the Orofino Creek Road Bridge (Noah's Bridge). Reach 5 is characterized by the following conditions.

- Extensive riprap and channelization
- Over-wide bankfull channel
- Limited floodplain
- Residential floodplain encroachment

**Survey Results**

A riffle cross-section and a longitudinal profile were completed in the project reach. In general, Orofino Creek in Reach 5 is a C stream type inside of a larger F stream type channel. Channel features were differentiable between riffle, runs, and pools. Cobble point bars were consistent along the longitudinal profile.




| Reach Description | Width (ft) | Channel Area (ft²) | Mean Depth (ft²) | Max Depth (ft²) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 62.0 | 154.2 | 2.5 | 4.2 | 65.1 | 24.9 |

**Figure 2.12: A typical riffle cross-section completed in the lower section of Reach 5 upstream of the Whiskey Creek confluence.**

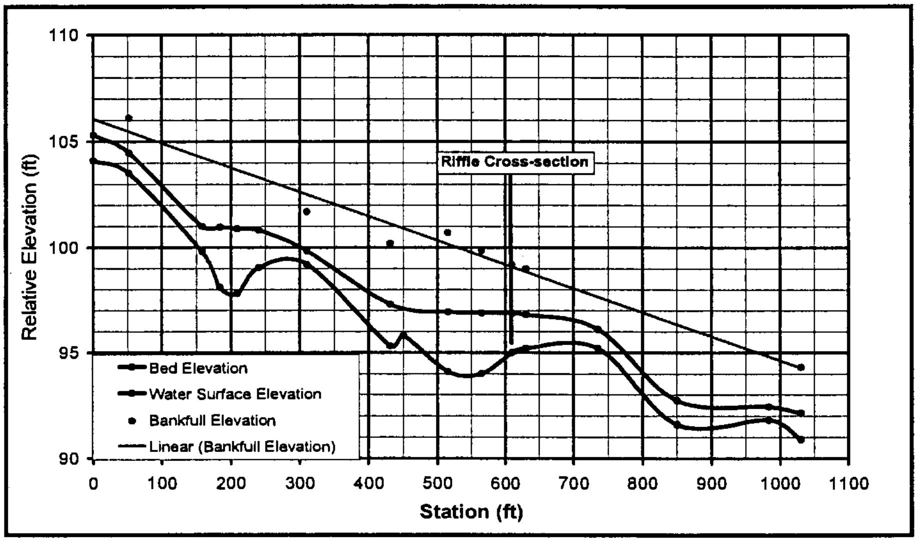



**Figure 2.13: Reach 5 typical longitudinal profile.**

## Survey Discussion

Although much of Reach 5 is armored with riprap, it is relatively stable. As mentioned, a C stream type has slowly formed within the existing F channel and a sequence of pools and riffles has been established. The riffle-pool sequence is important for energy dissipation during high flow events. Point bars were frequent in the reach suggesting that the channel is efficiently sorting its bed load during runoff events.

Available floodplain in Reach 5 is limited due to roadway encroachment, residential encroachment and the steep hillside along the left bank. Minor areas of bank erosion and riprap failure were observed in several locations. Most likely, this is due to increased bank shear stresses caused by channel incision and the limited floodplain area.

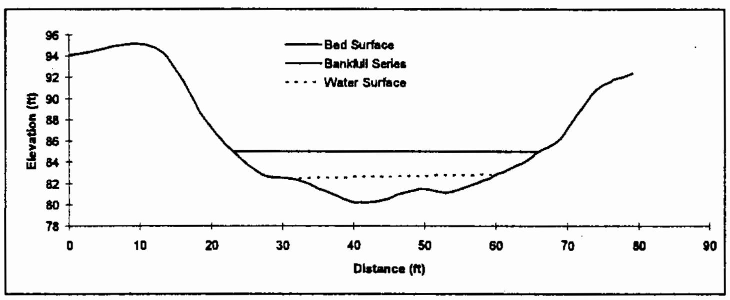
***Photograph 2.7** (a) Floodplain encroachment in Reach 5. Note the sandbags piled along the bank that indicate frequent flooding. (b) A typical section in Reach 5. Note the point bar formation on the left. Also note the stable riprap and vegetation growing in the riprap.*

### 2.2.6 Reach 6: Station 205+00 to 245+00

Reach 6 extends from upstream of the Orofino Creek Road Bridge (Noah's Bridge) to the Bridge at Bruce's Dairy. Reach 6 is characterized by the following conditions.

- Extensive riprap bank stabilization
- Residential floodplain encroachment

**Survey Results**
A riffle cross-section and a longitudinal profile were completed in the project reach.




| Reach Description | Width (ft) | Channel Area ($ft^2$) | Mean Depth ($ft^2$) | Max Depth ($ft^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 43 | 131 | 3.1 | 4.8 | 55.2 | 13.9 |

**Figure 2.14: A typical riffle cross-section completed near Bruce's Dairy Bridge in Reach 6**

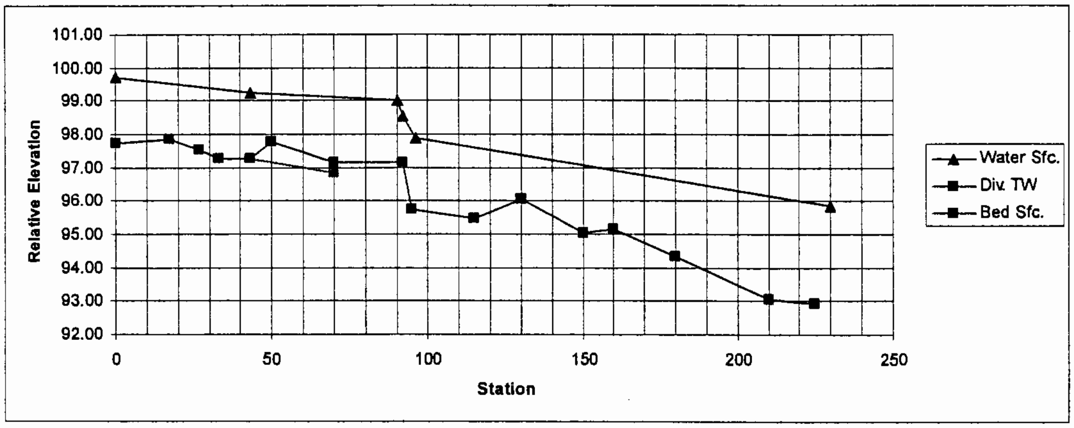
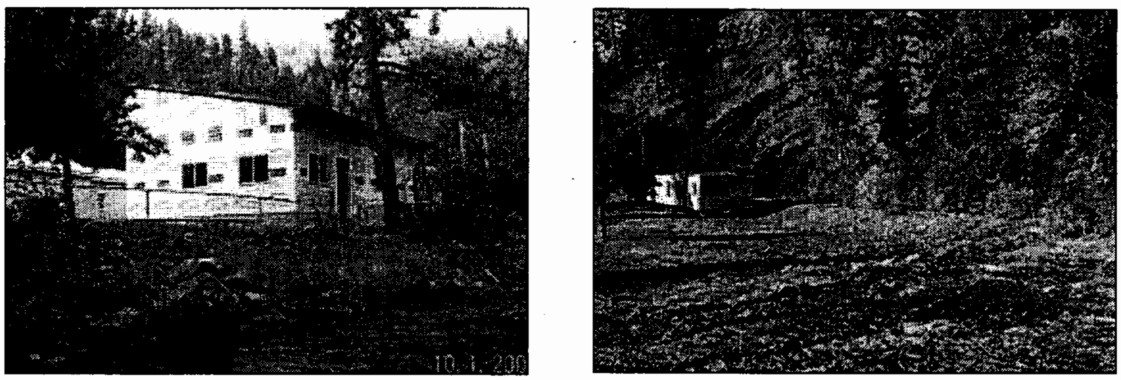



**Figure 2.15 Reach 6 typical longitudinal profile.**

**Survey Discussion**

Reach 6, the most upstream reach in the lower watershed, contained the least human-induced disturbance. Riprap and channel manipulation was observed, but was not as widespread as the other reaches. Residential floodplain encroachment has resulted in less available floodplain and significant risk for residents.



***Photograph 2.8:*** *(a) New floodplain encroachment and removal of riparian vegetation along Orofino Creek. (b) A new berm along Orofino Creek. Similar modifications have led to instability and extensive damage in the lower reaches.*

### 2.2.7 Reach Summary

A summary of the geomorphic assessment and survey results is presented in Table 2.2.

**Table 2.2**
**Summary of Existing Channel Characteristics**

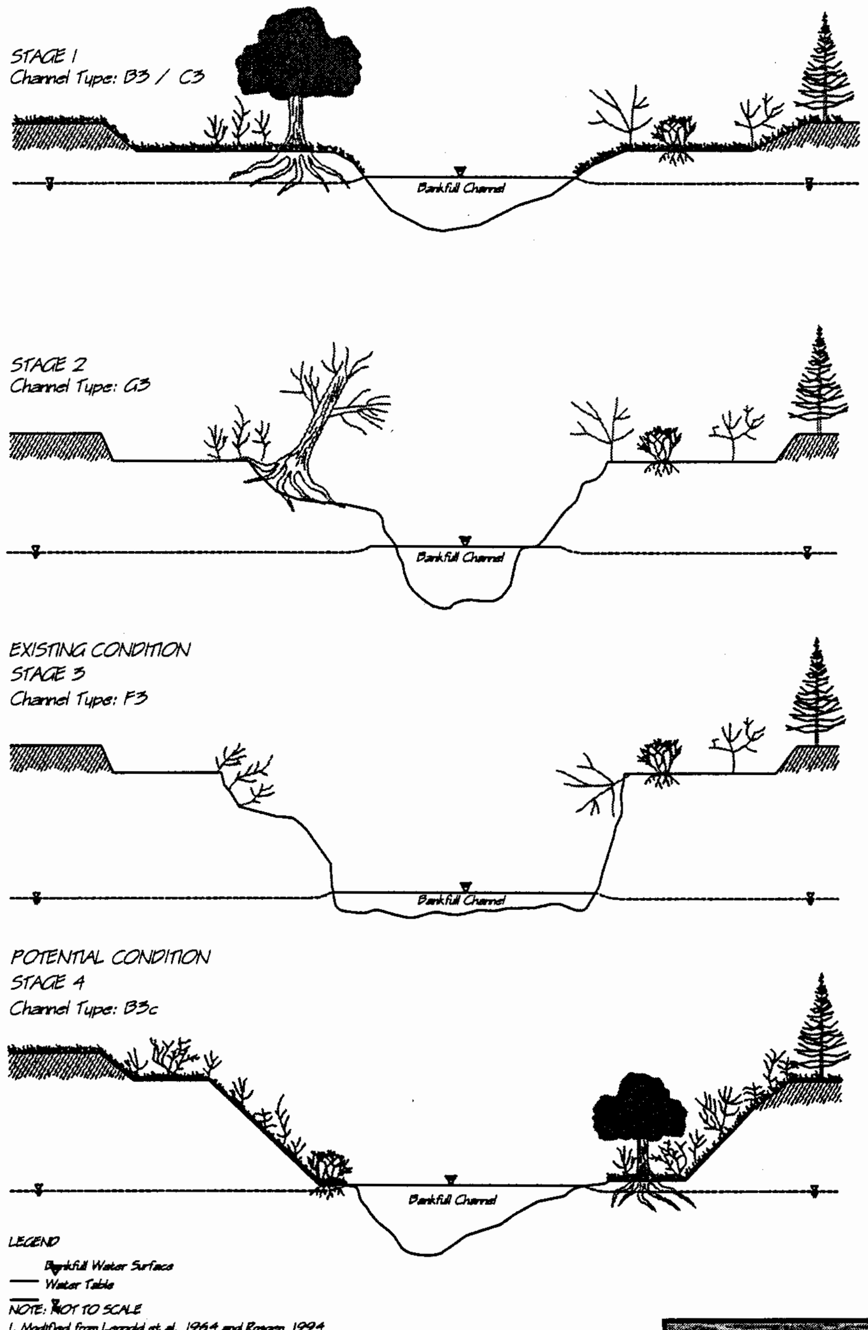
| Reach | Stream Length(ft) | Sinuosity | Dominant Bed Material | Entrenchment Ratio | Width:Depth Ratio | Slope | Stream Type |
|---|---|---|---|---|---|---|---|
| 1 | 5500 | 1.02 | Cobble | 1.2 | 31 | 1.2% | F3 |
| 2 | 5200 | 1.06 | Cobble | > 2.2 | 10 | 1.4% | F3 |
| 3 | 3300 | 1.32 | Cobble | > 2.2 | > 40 | 1.7% | D3 |
| 4 | 3000 | 1.20 | Cobble | 1.3 | 13 | 1.1% | F3 |
| 5 | 3500 | 1.03 | Cobble | 1.3 | 25 | 1.2% | F3 |
| 6 | 4000 | 1.05 | Cobble | 1.4 | 14 | 1.7% | B3c |

Due to the disastrous flood history and instability of Orofino Creek in the lower watershed, it can be concluded that the F3 and D3 stream types are not optimal stream types for the lower watershed. Most likely, the historical channel type for the lower watershed was a B3c or C3 stream type. The instability in the lower watershed is a direct result of Orofino Creek attempting to regain its historical channel characteristics. Figure 2.16 depicts a likely succession scenario for Orofino Creek as it attempts to regain its optimal channel geometry.

Anthropogenic modifications to Lame Deer Creek, potentially compounded by extrinsic controls such as climate and base level changes, have dramatically affected perennial flow, floodplain function, sediment transport, and aquatic and riparian habitat conditions. Specific stream reaches have responded in various ways to these alterations. Understanding these varied channel responses and the successional tendencies of Orofino Creek is critical for developing sound restoration projects. Channel succession processes are apparent in the project area and provide some guidance in predicting future channel conditions if current channel degradation is not addressed. Figure 2.16 illustrates the probable geomorphic trends as determined from field investigations, review of available aerial photography, and preliminary hydraulic modeling based on collected field data.

Orofino Creek has degraded in a process similar to the successional sequence illustrated in Figure 2.16 and described in the preceding paragraphs. Presently, the channel is incised up to ten feet into the historical floodplain, and is in a relatively early stage of rebuilding a new channel within the entrenched channel (Figure 2.16, stage 3). A majority of the reach is classified as a highly entrenched, high width/depth ratio F3 stream type displaying moderate bank erodibility and impaired sediment transport capacity.

# Cross-Section Diagrams Illustrating the Geomorphic Succession of Orofino Creek



## 2.3 Causes of Flooding

As discussed in Section 2.2, widespread instability exists in Orofino Creek as a result of several types of channel manipulation. Most of these "spot" treatments have resulted in stream types that do not accommodate the geologic valley setting, hydrologic regime and sediment load of Orofino Creek. Although many of the banks have been armored, the potential still exists for widespread flood damage associated with large magnitude flood events. Several sources of flooding are discussed in the following sections.

### 2.3.1 Channelization

Channelization is the straightening, widening and deepening of a river for flood control purposes. Most often, channelization includes extensive bank armoring. Channelization results in a channel that is too wide to effectively convey bankfull discharge events and too narrow to effectively convey flood events. In many cases, bankfull discharges do not generate enough shear stress to mobilize sediment and deposition occurs. Large flood events generate excessive shear stress that scours the entire bed, cause vertical instability and may cause bank failure. Bank failure is exacerbated by the loss of stable riparian vegetation that typically provides bank stability. Floodplains and point bars that serve as depositional areas are essentially eliminated by channelization.

When a channel is disconnected from its floodplain, such as with many portions of Orofino Creek, the sediment load accumulates in the channel, continues to be entrained in the flow, and compounds the volume of material and water in the channel. This excess volume of material consumes channel conveyance area and can lead to flooding. In addition, deposition can lead to lateral migration and bank erosion.

### 2.3.2 Encroachment

Encroachment by urban development is a major source of floodplain loss in the lower Orofino Creek watershed. Encroachment combined with the placement of fill material in the floodplain, reduces the area available for the disbursement of floodwaters and storage of fine sediments. If left unprotected, structures that encroach on the floodplain are subject to flood damage and sediment deposition.

### 2.3.3 Sediment Transport

A stable stream is able to transport flow and sediment generated by a watershed in such a manner so that it maintains its pattern, profile and dimension without aggradation or degradation. A stable stream is able to accommodate changes in sediment and flow regimes over time by maintaining the plan view morphology, longitudinal profile dimensions, and cross-sectional geometry associated with the bankfull channel. This balance, or dynamic equilibrium, establishes the sediment transport competency of the channel by maintaining the hydraulic parameters necessary to mobilize and transport sediment during bankfull and higher discharges.

As discussed, several anthropogenic impacts have resulted in changes to the cross sectional area, bed profile and sinuosity of Orofino Creek. Moreover, these changes have disrupted the dynamic equilibrium of Orofino Creek. The result is a system that is unable to transport the sediment load delivered by the watershed. During bankfull discharge events, the existing over-widened channel does not generate sufficient shear stress to transport sediment and experiences deposition. During large magnitude flood events, the floodplain is not accessible, and abnormally high shear stresses are generated in the channel, resulting in bank erosion, channel scour and flooding. As a result, the channel is in a constant state of change and is unstable.

The sediment transport problem is exacerbated by the depositional nature of the lower watershed, which could be classified as an active alluvial fan. Localized scour and deposition have created lateral instability and subsequent bank erosion. Bank treatments that do not restore the dynamic equilibrium either pass the problem downstream or fail. As shown in Table 2.1, the dominant material in the lower watershed can be characterized as large cobble. Due to the fact that this material is not the dominant material in the upper watershed, it can be surmised that the excessive sediment loading in the lower watershed is derived from the banks within the lower and middle watershed.

### 2.3.4 Clearwater River Backwater Effect

In addition to anthropogenic impacts, natural impacts also affect the sediment transport capability of Orofino Creek. The greatest natural impact is the backwater effect generated by flooding from the Clearwater River. According to the FEMA water surface profiles the backwater effect extends upstream approximately 1000 feet. In such circumstances, Orofino Creek functions as a floodplain for the Clearwater River. As a result, the dynamic equilibrium of Orofino Creek is disrupted and deposition occurs.

In an average year, peak discharges from the two watersheds are desynchronized, with Orofino Creek peaking in April and the Clearwater River peaking in June. If the two peaks are synchronized and a large flood occurs, excessive sediment deposition occurs in Orofino Creek and flood waters from both the Clearwater River and Orofino Creek threaten the Orofino Business District.

### 2.3.5 Effects of Bridges and Railroad Trestles

The existing bridges and railroad trestles on Orofino Creek are other causes of flooding problems. These bridges present horizontal, vertical and in-channel obstructions. A vertical obstruction can be caused by a bridge deck that is not constructed above the elevation of the design flood event, or is not able to pass debris jams or ice flows. A horizontal obstruction, or constriction, occurs when a bridge pinches the channel cross-section and forces the flow through a smaller opening than the upstream channel. Lastly, in-channel obstructions consist of bridge foundations such as piers or abutments that are located within the active channel and reduce the available conveyance area under the bridge and can lead to debris jams and ice jams. All of these obstructions result in backwater effects and decrease the ability of a river to convey flood flows and transport sediment. Moreover, there are alignment and skew issues with these bridges. The performance of the bridges in lower Orofino Creek is discussed in more detail in Section 4.0.

Railroad trestles with numerous, closely-spaced piers present an especially dangerous scenario. The middle watershed is said to possess as many as 20 railroad trestle stream crossings. During a site visit to the middle watershed following a flood event, debris jams were observed at all three railroad trestles visited. The debris jams had forced water above and around the bridge and caused extensive scour as noted by the newly-formed downstream depositional bars and freshly-eroded banks. Since the railroad is abandoned and not maintained, the effects of debris jams and ice jams are likely to contribute excess sediment to the lower watershed and potentially generate surges of flood water, debris, sediment and ice as they become dislodged.

## 2.4 Fish Habitat Assessment

A fish habitat evaluation was completed in October 2002 from upstream of the Whiskey Creek confluence, downstream to the mouth of Orofino Creek. The fish habitat evaluation consisted of measuring channel morphology characteristics, visually assessing fish habitat in the proposed project area, and reviewing the 1996 aerial photograph series. The Orofino Creek fish community is comprised of native and introduced salmonids, non-native game fish species, and other native species (Table 2.3). Orofino Creek is recognized as a cold water bull trout spawning and rearing stream by the U.S. Environmental Protection Agency (CFR 40 Chapter I Part 131.33).

**Table 2.3**
**Fish Species Inhabiting Orofino Creek**

| Native Salmonid Species | Other Native Species | Non-native Game Fish Species |
|---|---|---|
| Bull trout | Northern pikeminnow | Brook trout |
| Westslope cutthroat trout | Redside shiner | Smallmouth bass |
| Steelhead trout | Paiute sculpin | Kokanee salmon |
| | Bridgelip sucker | |
| | Longnose dace | |
| | Speckled dace | |

The Orofino Creek project area has been heavily impacted by channel and floodplain modifications. Modifications have included channel straightening and armoring, floodplain encroachment, channel dredging, and woody debris removal. Channel and floodplain modification have generally simplified, armored, and widened the channel. Invasive grasses and sporadic native woody shrubs characterize the poor riparian condition of the project. The riparian condition impairs the formation of complex channel habitats augmented by overhead cover, in-stream woody debris, and bank stabilizing root masses.

Channel modifications have resulted in adverse changes to native fish habitat, affecting multiple species and life-stages within the project area. The existing channel condition in the project area is likely incapable of supporting viable steelhead and other native fish populations due to elevated water temperatures, the absence of deep resting pools, the dominance of shallow riffle habitat in the reach, summer channel dewatering, and overall channel instability. The restoration treatments proposed in this document will improve aquatic and riparian habitat conditions in the lower 5 miles of Orofino Creek by modifying the channel dimensions and alignment, adding large woody debris, and planting riparian vegetation.

### 2.4.1 Available Fisheries Assessments

The following documents were reviewed to gather existing information on Orofino Creek.

Review Draft Clearwater Subbasin Assessment (Ecovista et al. 2002)

The Clearwater Subbasin Assessment (Assessment) provided a detailed assessment of primary assessment units (AU) comprising the Clearwater River subbasin. Orofino Creek was included in the Lolo/Middle Clearwater AU. At the AU scale, focal native salmonid populations are currently depressed. The lowest steelhead smolt carrying capacity estimates at the AU scale are associated with the Lolo/Middle Fork and Lower Clearwater AUs. Major factors limiting fish populations within the Lolo/Middle Fork AU include temperature, sediment, and upland and in-stream habitat disturbance or degradation.

Although infrequently mentioned, Orofino Creek was often included as a stream characterized by suboptimal aquatic and riparian resources. Resident and migratory fish populations in the watershed are depressed by high water temperatures, dewatering, habitat alterations including channelization, and fish passage barriers. Steelhead habitat quality is rated poor for Orofino Creek. Whiskey Creek, the largest tributary in the Orofino Creek watershed, is classified as impaired by the State of Idaho and is included on the state's 303d list. Orofino Creek is considered a key tributary in the Middle Clearwater River, providing important supplemental flows to the river.

Road densities in the watershed are classified as high on account of the municipal road system in the developed portion of the stream corridor. Historical mining in the watershed continues to have repercussions on water quality and bank stability primarily in the upper watershed.

Orofino Creek Passage Project Biological and Engineering Feasibility Report (Huntington et al. 1988)

The comprehensive report investigated the feasibility of providing fish passage over the natural falls beginning 5.2 miles upstream of the Orofino Creek mouth. Approximately 112 km of Orofino Creek were surveyed by the authors. The majority of the survey was completed upstream of the natural falls. However, fish habitat and fish community conditions were also evaluated from falls downstream to the mouth of Orofino Creek. This distance correlates to the proposed project area.

The authors made several observations concerning lower Orofino Creek's potential to sustain summer steelhead and spring chinook. Factors limiting potential steelhead and spring chinook populations in the lower watershed included:

1) Potential spawning areas were limited in lower Orofino Creek due to the predominance of coarse substrates exceeding the range of spawning gravel sizes preferred by the target species. Infrequent spawning gravels were distributed along channel margins.

2) Infrequency of large pools capable of supporting adult fish during low flow periods.

3) Predominance of shallow riffles likely to isolate fish during low flow periods.

4) Stream shading was highly variable (20% of area) and influenced by bank stabilization activities. Poor riparian cover influenced high water temperatures.

5) Summertime water temperatures as high as 83.3 °F exceeded the lethal threshold for steelhead and chinook (Reiser and Bjornn 1979).

6) Channel margin ground water springs provided thermal refugia to limited numbers of juvenile steelhead.

7) The presence of temperature-tolerant species in the lower watershed, combined with the infrequency of salmonids, suggested that the high water temperature regime in the lower watershed was not a transient condition.

<u>A Biological and Physical Inventory of Clear Creek, Orofino Creek, and the Potlatch River, Tributary Streams of the Clearwater river, Idaho (Johnson 1986)</u>

The author described the stream conditions and the results from a fish population sampling completed in 1983 downstream of the natural falls. Sampled fish species included rainbow-steelhead, bull trout, kokanee salmon, bridgelip sucker, longnose dace, and paiute sculpin. Low electrofishing efficiencies precluded developing density and population estimates. Water depth and water surface turbulence comprised the primary in-stream cover components. Complex pool habitats that would provide juvenile steelhead cover were infrequent. Overall channel stability was characterized as good with eleven percent of the banks eroding. Riparian vegetation was underdeveloped and shaded thirty percent of the sampled area. The coarse and moderately embedded substrate was determined to be slightly suboptimal for juvenile steelhead.

<u>A Biological and Physical Inventory of the Streams Within the Nez Perce Reservation (Kucera et al. 1983)</u>

Fish sampling results were summarized in (Johnson 1986). Habitat characteristics including stream flow variation, summer water temperatures, riparian cover, and substrate attributes were likely areas of concern for migratory and resident fish species. Deficient in-stream cover and low nitrate levels were additional areas of concern for improving the Orofino Creek fish community.

### 2.4.2 Fish Habitat Assessment Methods

The fish habitat assessment was completed at the time of the reconnaissance channel survey. Due to the generally homogeneous degraded aquatic habitat, one or two cross-sections, a longitudinal profile, and pebble count were completed in the six reaches of the project area. A survey laser and measuring tapes were used to measure the channel dimensions and profile. Pebble counts were completed by randomly picking 100 particles in the area of the cross-section. A digital camera was used to photograph the cross-sections and stream channel.

The collected data were processed to yield the following information.

- Channel width (mean, standard deviation)
- Channel depth (mean, standard deviation)
- Channel area (mean, standard deviation)
- Bankfull discharge slope

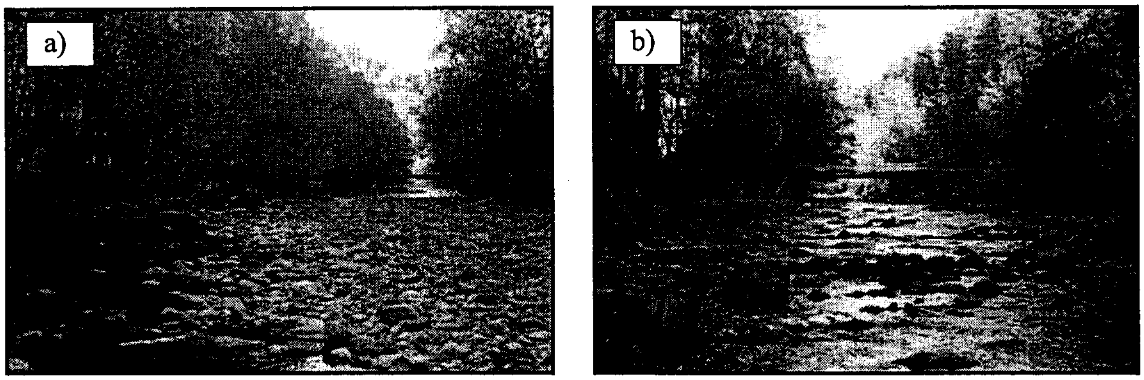
### 2.4.3 Fish Habitat Assessment Results

**Reach 1: 0+00 to 55+00**

<u>Overview</u>
Orofino Creek in Reach 1 was characterized by an over-widened channel dominated by riffle and run channel features. Fish habitat in the reach is limited by:

- Lack of deep, complex pools,
- Aquatic and riparian habitat simplification created by floodplain constraints, channelization, and urbanization,
- Narrow riparian buffer, and
- Deficient woody debris recruitment.

Channel morphology in the focus reach is dominated by riffle and run habitats (Photograph 2.9). The over-widened channel condition has resulted in a wide shallow channel with minimal fish habitat. The coarse bedload and lack of large woody debris in the reach likely precludes the formation of deep, complex pools that are required by the target coldwater native salmonids. Deep pools provide thermal refugia during late summer base flows when water temperatures typically exceed the thermal maximum threshold of westslope cutthroat, bull trout, and steelhead that likely historically inhabited the lower portion of Orofino Creek. Similarly, deep pools provide over-wintering habitats for juvenile and adult fish that would otherwise be stranded in shallow riffles prone to ice formation and resulting bed scour.




***Photograph 2.9:*** *Typical channel conditions in Reach 1 of Orofino Creek. A coarse cobble bed (a) and a shallow, over-widened channel (b) typify the channel condition in Reach 1. The channel is confined by a floodplain levee and bordering residential and industrial development.*

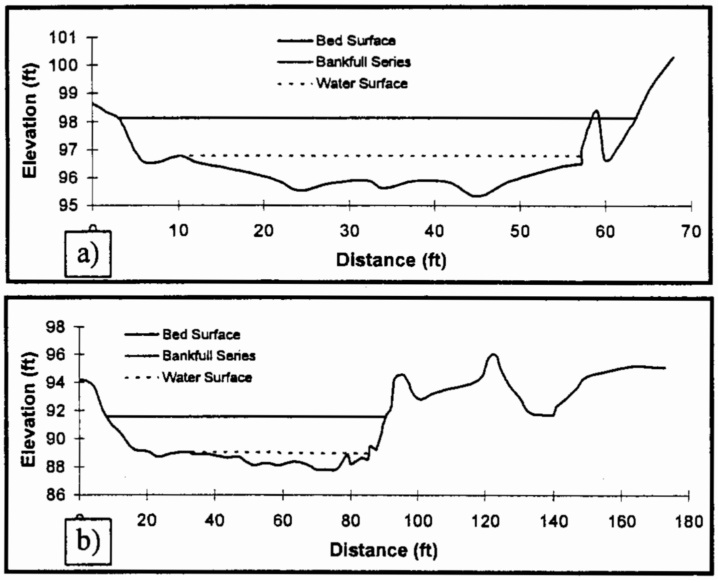
A narrow riparian strip shades Orofino Creek in Reach 1. Riparian vegetation is critical for shading the stream and lowering water temperatures, critical for maintain coldwater native fish species. Although the riparian zone is locally dense, the width of the riparian zone is typically narrow and susceptible to damaging flood events. Development adjacent to the channel has removed much of the riparian corridor that likely existed historically. The confined floodplain will also limit future riparian vegetation recruitment as the fine mineralized soils required by species such as cottonwood *Populus trichocarpa*, are now infrequently found in the lower watershed.

Woody debris is a critical component for aquatic habitat formation in Clearwater River tributaries. Large woody debris was found infrequently during the channel survey. Poor woody debris recruitment from upstream reaches and woody debris removal from the stream may account for low woody debris counts in the reach. Woody debris retention in the reach may also be hampered by the degree of channel straightening, high water velocities during runoff, and narrow floodplain.

While the aforementioned conditions are largely responsible for the impaired fish habitat condition, the middle portion of Reach 1 included a stable reference section. Although the controlled by a bedrock outcrop, the reference section was surveyed and evaluated for fish habitat quality.

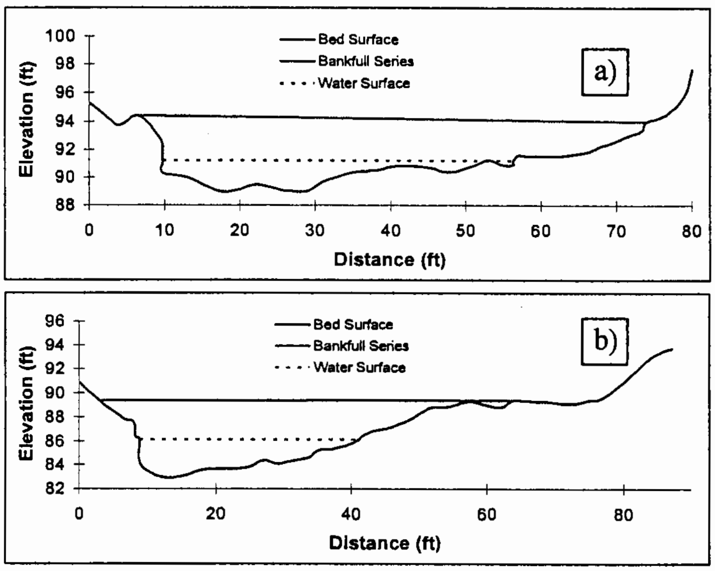
**Survey Results**

Four cross-sections and two longitudinal profiles were completed in the project reach. A representative pool and riffle, and longitudinal profile were surveyed downstream from the tepee burner. A second representative pool and riffle, longitudinal profile, and pebble count were completed in the reference section.




| Reach Description | Width (ft) | Channel Area (ft$^2$) | Mean Depth (ft$^2$) | Max Depth (ft$^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 60.5 | 115.8 | 1.9 | 2.8 | 1.8 | 31.6 |
| Reference | 82.5 | 224.0 | 2.7 | 3.7 | 2.6 | 30.4 |

**Figure 2.17: Riffle cross-sections completed for the typical (a) and reference (b) reaches.**




| Reach Description | Width (ft) | Channel Area (ft$^2$) | Mean Depth (ft$^2$) | Max Depth (ft$^2$) | Hydraulic Radius | W/D |
|---|---|---|---|---|---|---|
| Typical Condition | 67.5 | 233.4 | 3.5 | 5.3 | 3.3 | 19.5 |
| Reference | 61.0 | 202.5 | 3.3 | 6.4 | 3.1 | 18.4 |

**Figure 2.18: Pool cross-sections completed for the typical (a) and reference (b) reaches.**

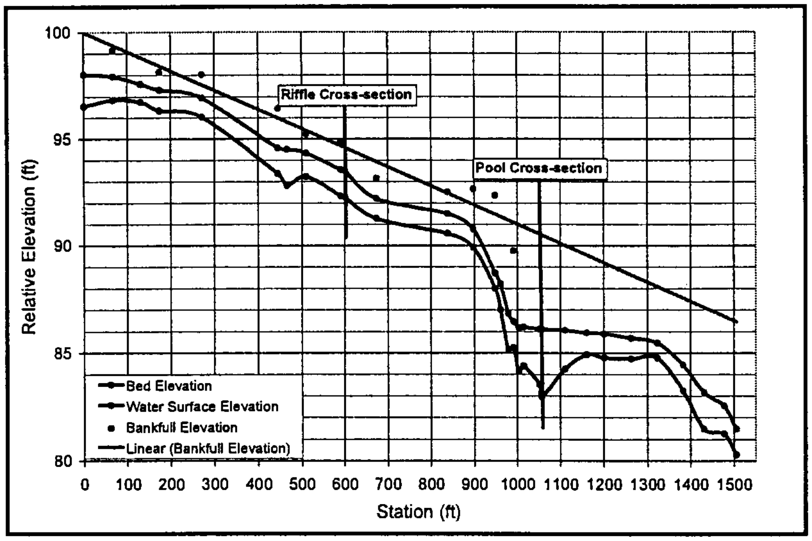



**Figure 2.19: Reference reach longitudinal profile.**
**The reference reach is controlled by a bedrock outcrop.**

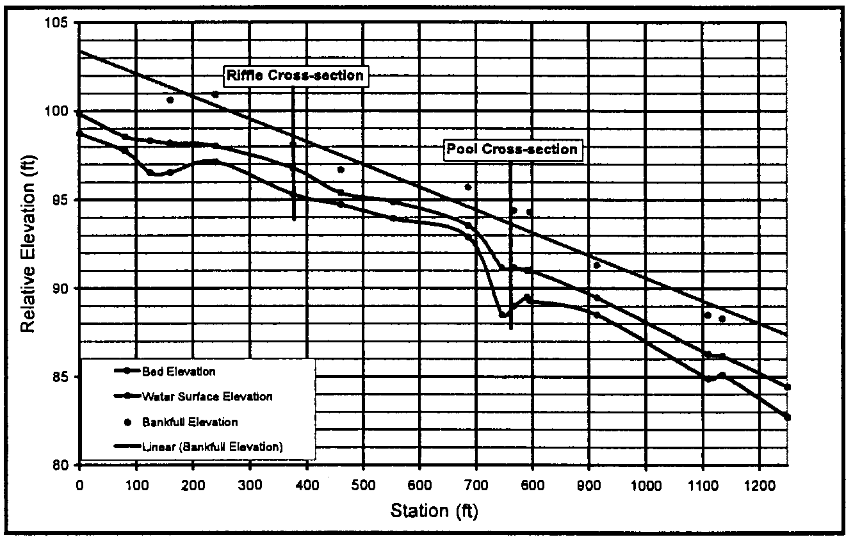
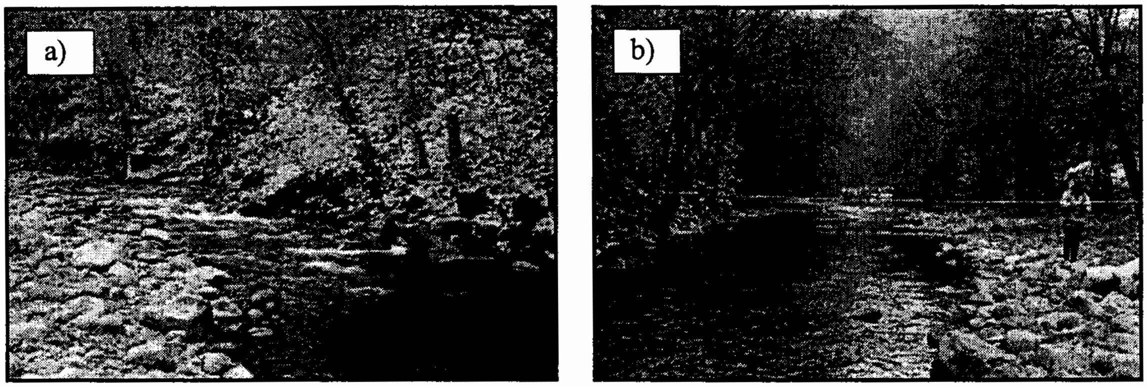



**Figure 2.20: Typical reach longitudinal profile.**
**The reach was typified by shallow riffle habitat with infrequent pools.**

## Survey Discussion

The representative reach survey captured typical riffle and pool channel features found in Reach 1. Pool habitats were generally pocket pools associated with lateral channel scour at the bank edge or large boulders. Large woody debris was absent from the reach. The reference section offered the best fish habitat in the reach (Photograph 2.10). Created by a bedrock outcrop, a large scour pool provided deep water habitat for fish, although no fish were observed. Being the only high quality pool habitat in Reach 1, it is likely that fish aggregate in this pool.




***Photograph 2.10:*** *The reference reach riffle/pool interface (a). The reference reach pool located downstream of the riffle (b). Note the sizeable bed material, straight channel, and residential development on the right floodplain in (b).*

**Reach 2: 55+00 to 107+00**

Overview

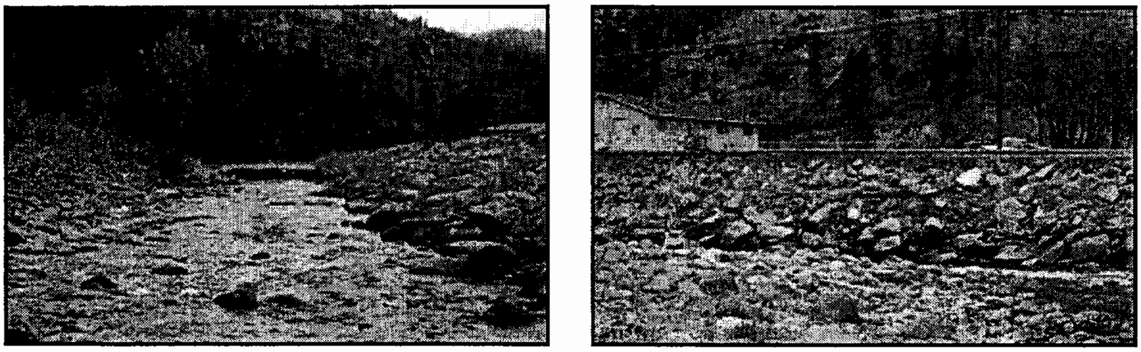
Orofino Creek in Reach 2 was characterized by an over-widened channel, significant bank armoring and channel straightening, and impaired riparian zone. Fish habitat in the reach is limited by:

- Lack of deep, complex pools,
- Aquatic and riparian habitat simplification created by floodplain constraints, significant bank armoring, and in-channel disturbance,
- Narrow to non-existent riparian buffer, and
- Deficient woody debris recruitment.

Orofino Creek in Reach 2 has been significantly altered since the high magnitude 1996 flood. These and subsequent channel alterations have caused extensive instability and related fish habitat degradation.

The stream channel is over-widened in much of Reach 2. Similar to Reach 1, the over-widened channel condition has resulted in a wide shallow channel with minimal fish habitat. The coarse bedload and lack of large woody debris in the reach likely precludes the formation of deep, complex pools that are required by the target coldwater native salmonids. The armored right bank does not allow undercut bank formation and the associated fish habitat that is created by lateral bank scour. Continued floodplain filling has narrowed the stream corridor and reduced the amount of area available to absorb floodwaters. Confining the stream will negatively affect fish habitat by increasing in-stream water velocities and the transport of woody debris through the reach.

Riparian vegetation on the armored bank is nearly non-existent due to the grouting of the placed riprap. The poor riparian condition has likely led to increased water temperatures in the focus reach. The extensively armored right bank has reduced the bank roughness. Smoother banks increase the transport of woody debris through the reach and reduce the residence time of woody material in the system. The lack of woody debris in the reach will continue to hamper fish habitat development.



***Photograph 2.11:*** *Typical channel conditions in Reach 2 adjacent to the grouted riprap bank.*

One extensive pool found in the surveyed area was associated with Newman's Corner (the 90° bend) as Orofino Creek enters the armored bank reach. Although over 3.5 feet deep, the pool lacked complexity and overhead covered that is typically provided by riparian vegetation and woody debris.

**Reach 3: 107+00 to 140+00**

Overview

Orofino Creek in Reach 3 was characterized by an over-widened channel and expansive stream corridor. A large eroding hillslope and assorted bank stabilization structures were key features in the reach. Fish habitat in the reach is limited by:

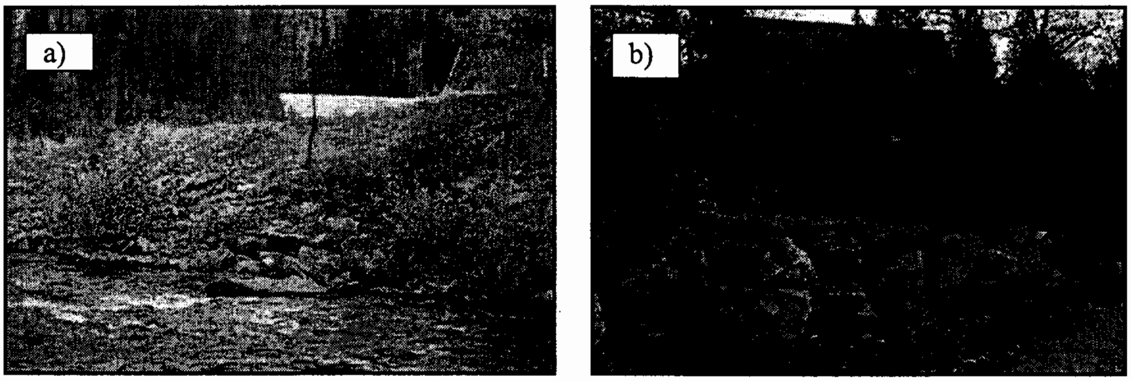
- Lack of deep, complex pools,
- Excess bedload and poor channel definition,
- Bank stabilization structures, and
- Deficient woody debris recruitment.

The stream corridor in Reach 3 is substantially broader than upstream and downstream reaches of Orofino Creek. Floodplain filling was evident along the right bank and bank stabilization structures have been placed on both banks to limit bank erosion (Photograph 2.12). Moderately-deep pools associated with riprap spurs provided quality fish habitat in the reach. Split channels flow through the reach, creating two separate low flow channels with minimal fish habitat (Photograph 2.13). Lateral bank erosion in places along the left bank also created deeper water capable of supporting adult fish. The smaller of the braided channels also contained moderate fish habitat with overhanging riparian vegetation.

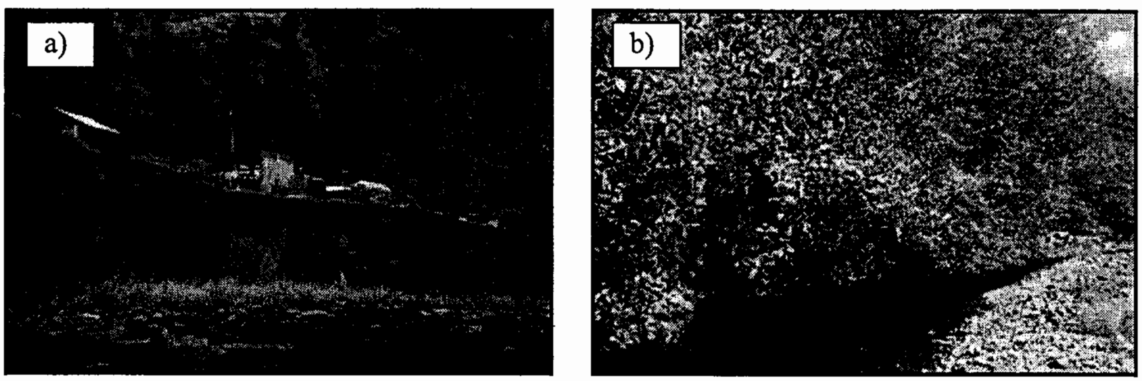
The over-widened channel condition and large substrate particles sizes have led to pool filling and habitat homogenization. The large channel width disperses water over a large channel area. However, the dispersion of high flows across the width of the stream corridor is inefficient for deep pool creation necessary for supporting native fish species.

The existing condition is likely to continue until the stream forms a single channel through the reach. Woody debris retention in the reach is non-existent due to the relatively smooth channel/floodplain surface and coarse bed material.

Riparian vegetation is sporadic in Reach 3. Vegetation coverage is locally dense on the right bank and portions of the left bank. Vegetation has also colonized the center bar separating the two low flow channels. Center bar willows were typically young and likely influenced by high flow events when the entire valley bottom is inundated.




***Photograph 2.12:*** *A riprap bar provides bank protection and creates fish habitat in the lower section of Reach 3 (a). Stacked large rock halts bank erosion and protects residential development (b).*




***Photograph 2.13:*** *The large eroding terrace in the middle portion of Reach 3 (a). During high water events, Orofino Creek interacts with the sediments source. The smaller of the two braided low flow channels is shaded by riparian vegetation.(b).*

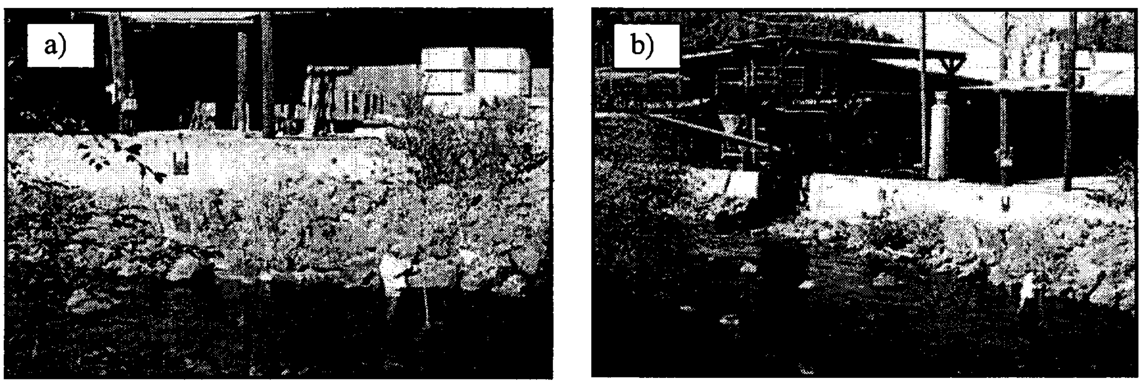
**Reach 4: 140+00 to 170+00**

Overview

Orofino Creek in Reach 4 was characterized by the Konkolville Lumber Mill property. The creek is channelized with heavily armored banks through this reach. Mill refuse was commonly encountered in the reach. Limiting fish habitat factors include:

- Lack of deep, complex pools,
- Channel confinement and straightening,
- Unstable, high gradient bed,
- Deficient riparian zone, and
- Deficient woody debris recruitment.

The stream corridor in Reach 4 is significantly confined by the armored banks and concrete flood wall on the right bank. Channel features are limited to riffles and runs with occasional pocket pools that have formed adjacent to large boulders placed on the banks or that have fallen into the creek. Refuse from the mill including large chains, discarded wood, and plastic culverts, was scattered in the creek. Floodplain was non-existent in the reach and riparian vegetation was significantly depressed by the bank manipulations (Photograph 2.14). Riparian vegetation was primarily limited to exotic species and invasive canary grass. In general, the channel was confined by the riprap banks and characterized by shallow riffle and run habitats. Fish habitat in the reach was generally poor due to the absence of secure large woody debris, poor riparian condition, and channel instability.




***Photograph 2.14:*** *Bank armoring includes large riprap and a concrete floodwall (a). Channel features were limited to shallow riffle and run habitats (b).*

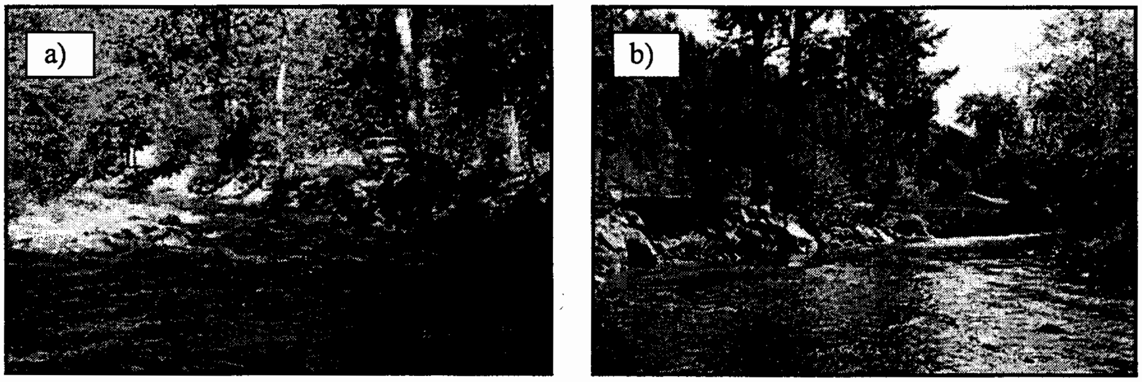
**Reach 5: 170+00 to 205+00**

Overview

Orofino Creek in Reach 5 is encroached on by residential development and the adjacent Orofino Creek Road. Fish habitat in the reach was higher quality and more heterogeneous than in the downstream reaches. Limiting fish habitat factors include:

- Lack of complex pools,
- Channel confinement and straightening,
- Residential development and road encroachment,
- Narrow riparian zone, and
- Deficient woody debris recruitment.

Orofino Creek in above the confluence of Whiskey Creek is less manipulated than in the Konkolville corridor. However, substantial riprap has been placed on the right bank to protect the Orofino Creek Road (Photograph 2.15). Although not optimal fish habitat, the armored bank has created vertical bed scour and provides several deep pools for fish. Riparian vegetation is locally dense and shades a greater portion of the creek than in downstream reaches. Woody debris was infrequent in the reach, but the channel condition and riparian community increase the potential for large woody debris retention in the reach.




***Photograph 2.15:*** *Bank armoring along the right bank to protect Orofino Creek Road (a). Though not optimal fish habitat, the riprap has induced vertical bed scour creating deeper pools for fish (b).*

Reach 5 was less manipulated than downstream surveyed reaches. The undulating bed provided fish habitat in deeper pools. The riffle-pool sequence is also important for energy dissipation during high flow events. Point bars were frequent in the reach suggesting that the channel is efficiently sorting its bed load during runoff events. Fish habitat could be improved with the addition of large woody debris and augmenting the existing riparian vegetation.

### 2.4.4 Existing Fish Habitat Assessment Discussion

Fish habitat in Orofino Creek is functioning below its potential. Orofino Creek is recognized in several publications as an impaired stream due to high water temperatures, considerable channel modifications, dewatering, and poor water quality caused by watershed urbanization, mining, and sedimentation. The completed survey largely substantiated these conclusions. The stream has been widely manipulated in an effort to increase the flood flow channel conveyance. Extensive bank armoring and channel straightening have degraded fish habitat while furthering channel instability in the lower watershed. Flood damage that resulted from the 1996 event also caused considerable fish habitat impairment. Channel over-widening, riparian vegetation loss, and pool filling were evident over most of the surveyed reaches. The existing aquatic and riparian habitat conditions will likely not improve in the near future without considerable human intervention.

### 2.4.5 Habitat Formation and Channel Morphology

Orofino Creek in the project area has been modified by floodplain levee construction, channel dredging, bridge placement, and the widespread placement of bank stabilization structures. The channel in the assessment reach was relatively uniform, often lacking a defined thalweg (low flow channel) and riffle-pool pattern that would be expected for Rosgen B and C stream types. The moderately steep channel, confined channel, and lack of pools have impaired the formation of complex fish habitat that would be expected in forested tributaries of the Clearwater River drainage.

In Clearwater River tributaries, large woody debris and bedrock outcrops are important elements in the formation and maintenance of complex pool habitats. Large woody debris capable of forming pools, sorting gravel, and providing fish habitat was generally absent in the project reach. The riparian zone bordering Orofino Creek is currently functioning below its potential. Large cottonwoods that would be capable of modifying the channel morphology upon their recruitment to the stream are infrequent in the lower watershed. Alders, which are prevalent in the lower watershed, could provide some channel structure though their smaller diameter makes this species an inferior surrogate for cottonwoods. The narrow width of the riparian is also cause for concern. As the alders age and decay, they may not be replaced at a sufficient rate to maintain the existing riparian canopy. This would reduce stream shading and further increase water temperatures in the lower watershed. Augmenting the existing riparian community with cottonwoods would improve the future riparian condition and replace the existing alders as they are recruited to the stream.

The coarse alluvium in the project area exceeds the spawning particle range preferred by salmonids. The transport of finer gravels through the project reach will likely continue given the existing channel and floodplain conditions.

### 2.4.6 Secondary Habitat Features

Overhead turbulence, woody material, and vegetation typically provide fish habitat in streams. A complex channel that with these attributes would be expected to support more fish than would a simplified channel without these features. Each of these secondary habitat features provides cover or diversifies the flow patterns in the channel. Overhead turbulence creates visual obscurations for avian and terrestrial predators. Woody material provides visual isolation in the stream and also creates differential flow paths that may be preferentially selected by fish for feeding and resting stations. Vegetation functions similar to woody debris in the channel for visually isolating individual fish and diversifying flow paths. Wood and vegetation also provide substrates for aquatic macroinvertebrates, an important food source for fish.

Overhead turbulence and riparian vegetation provided secondary habitat in the reference reach and in Reach 5. Overhead turbulence was more common in the reference reach due to the prevalence of bedrock and boulders in the channel. Most of the reaches had locally dense riparian vegetation that provided shade and small woody debris to the channel.

Sections lacking riparian vegetation (Konkolville Mill site) likely increase water temperatures and have more simplified fish habitat.

### 2.4.7 Limiting Habitat Factors

Because steelhead is the focus species for the stream restoration project, the following sections will address the habitat conditions that may be limiting steelhead populations in the Orofino Creek project reach. Orofino Creek once hosted a diverse fish community comprised of steelhead-redband trout, westslope cutthroat trout, bull trout, and potentially juvenile chinook salmon. Channel modifications, habitat impairment, and water quality degradation are thought to be largely responsible for reducing the salmonid community diversity in Orofino Creek (out-of-basin conditions have also affected migratory steelhead and chinook salmon that historically may have used Orofino Creek).

The existing impaired condition of the project area is believed to affect all life-stages of salmonids using Orofino Creek. The following sections highlight the probable impacts of the existing channel condition on the affected life-stages.

### 2.4.8 Primary Limiting Habitat Factors

**Rearing Habitat**

Rearing habitat in the surveyed project area was nearly non-existent. The lack of structure (undercut banks, in-stream wood, and overhanging vegetation), combined with continuous riffle habitat and an over-widened channel offer extremely limited rearing habitat for juvenile salmonids. Backwaters and shallow off-channel habitats that would provide diverse juvenile rearing habitats are infrequent in the reach due to the constricted floodplain width. Channel and floodplain modifications that have effectively straightened the channel and limited lateral channel migration have negated side channel formation. Side channels provide shallow, slow water microhabitats beneficial for juvenile fish development. The infrequency of woody debris found in the project reach further constricts the amount of rearing space in the project reach.

**Adult Holding Habitat**

Lower Orofino Creek lacks important holding habitats required by adult salmonids. Holding habitats include deep, complex pools with large woody debris. Especially in smaller streams, woody debris is important for protecting migrating fish from avian and terrestrial predators. The current simplified, over-widened channel condition does not provide the deep pools that are necessary for attracting adult steelhead.

### 2.4.9 Secondary Limiting Habitat Factors

**Spawning Areas**

Spawning areas are largely non-existent in the project reach due to channel manipulations, the existing channel pattern, and large sediment particle sizes. Orofino Creek is unlikely to support a large steelhead population due to the short length of accessible channel. The natural falls at RM 5.2 preclude upstream fish migration and the likelihood that Orofino Creek could maintain a migratory fishery. However, by creating a floodplain and building a self-maintaining channel with alternating riffles and pools, improved fish habitat could attract adult steelhead and provide habitat for other fish species inhabiting the drainage. Restoration projects on other similar streams have increased the distribution and quality of fish habitat.

**Additional Limiting Factors**

Several other possible limiting factors that likely affect the quality of salmonid habitat in the project reach include elevated summer water temperatures, the abundant sediment load, and summer low flow conditions. Although these problems exist on a watershed scale, the proposed stream restoration project will address each of them in the lower watershed. Bank stabilization, grade control, and fish habitat structures will improve channel stability and reduce the inputs of fine sediment to the channel. Improving the channel-floodplain connectivity and channel condition will increase the deposition of fine sediment on the floodplain rather than in the channel. Revegetating the floodplain will similarly improve channel and floodplain stability, improve the long-term riparian condition, and reduce the negative effects of future floods. Enhancing the riparian corridor will increase stream shading and reduce summer time water temperatures. Narrowing the channel as proposed in the restoration project will also lower summer time water temperatures and increase the wetted channel area during low flow periods.

### 2.4.10 Fish Habitat Summary

In summary, the existing condition of Orofino Creek is unlikely to support a native salmonid community due to extensive habitat and water quality/quantity impairment. Channel reconstruction that improves channel and floodplain dimensions, incorporates large woody debris, and diversifies the aquatic environment would be expected to improve the existing fish habitat condition and could result in a more diverse and populous fish community. Unfortunately, due to Orofino Creek's degraded existing condition, the stream is not classified as a restoration priority in the Clearwater Subbasin Assessment (2002) and so is unlikely to be awarded restoration funding through Bonneville Power Administration programs.

## 3.0 HYDROLOGIC ANALYSIS

This section will evaluate all available data and analysis procedures used to estimate the Orofino Creek flood series. The flood series analysis included estimating flows ranging from the 1.5-year to the 100-year recurrence interval discharges. The 1.5-year return interval flood event is referred to as the bankfull discharge. Due to its more frequent recurrence interval relative to discharges of greater magnitude, the bankfull discharge is responsible for forming and maintaining the channel and transporting the greatest amount of sediment over time (Andrews 1980). Bankfull discharge estimates were used to evaluate existing geomorphic stability of Orofino Creek and to assess sediment transport properties and function of the existing channel. Additional flood flow discharges were estimated for the 10, 25, 50 and 100-year recurrence interval events. Flood flow analysis results were used to conduct preliminary hydraulic modeling of primary bridges, to evaluate existing floodway characteristics, and to develop appropriate restoration options for reducing flood risk in the study area.

Historical stream flow gaging station data for Orofino Creek is extremely limited. Gaging data, including daily means, were collected from October 1, 1982 to September 30, 1983 on Orofino Creek at Bruce's Dairy Bridge (USGS Gaging Station No. 13339800). The station was located approximately 4.5 miles upstream from the mouth of the Clearwater River and represented 90% of the total watershed area of Orofino Creek. Due to the short period of record, several alternative flood prediction procedures were employed, including:

- Field calibrating bankfull discharge at the Lolo Creek USGS stream gaging station,
- Conducting field surveys on Orofino Creek and performing steady-state hydraulic modeling, and
- Conducting flood frequency and unit discharge analyses for the USGS stream flow gaging stations summarized in Table 3.1 below.

**Table 3.1**
**Selected Gaging Stations for the Orofino Creek Flood Frequency Analysis**

| # | Station Number | Location | Drainage Area ($mile^2$) | Period of Record (years) |
|---|---|---|---|---|
| 1 | 13339500 | Lolo Creek near Greer | 243 | 1980-2001 (22) |
| 2 | 13339700 | Canal Gulch Creek at Pierce Ranger Station | 5.9 | 1962-1981(20) |
| 3 | 13339900 | Deer Creek near Orofino | 6.8 | 1962-1981 (18) |
| 4 | 13340000 | Clearwater River at Orofino | 5580 | 1931-1938, 1965-2001 (44) |
| 5 | 13342450 | Lapwai Creek near Lapwai | 235 | 1975-2001 (26) |
| 6 | 13337500 | SF Clearwater River near Elk City | 261 | 1945-1974 (30) |
| 7 | 13338000 | SF Clearwater River near Grangeville | 865 | 1911-1920, 1923-1963 (51) |
| 8 | 13337000 | Lochsa River near Lowell | 1180 | 1911,1912, 1930-2001 (74) |
| 9 | 13339000 | Clearwater River at Kamiah | 4850 | 1911-1965 (55) |

## 3.1 Methods

### 3.1.1 Method A – USGS Stream Gauge Calibration

A standard log-Pearson Type III flood frequency analysis was completed for the Lolo Creek USGS stream gaging station near Greer, Idaho (#13339500). Bankfull discharge was calibrated to the stream gage using field survey techniques. The primary assumption with this method was that the estimated bankfull discharge of Orofino Creek and Lolo Creek should be similar as both watersheds display similar hydrophysiographic characteristics, including catchment area, parent geology, soils, precipitation patterns, and runoff regimes. The drainage areas for Lolo Creek and Orofino Creek are approximately 243 square miles and 210 square miles, respectively.

Bankfull channel indicators, including the tops of recent point bars, channel shape, and vegetative growth patterns (Rosgen and Silvey, 1996 and Leopold et al., 1964), were identified. A continuous longitudinal profile of bed features, water surface, and bankfull indicators was surveyed upstream and downstream through the USGS staff gage. The gage height associated with the bankfull stage was recorded and cross-referenced to the discharge-rating curve developed for the period of record. The exceedance probability associated with the bankfull discharge was determined and converted to an annual return period. Because the return period of the field-calculated bankfull discharge was within 1.3 to 1.8 years of the associated gage station bankfull stage elevation, the bankfull indicators were assumed to be within an acceptable range for use.

### 3.1.2 Method B - Field Survey and Hydraulic Modeling

Field surveys were completed on Lolo Creek at the monumented USGS stream gaging cross-section, and on Orofino Creek approximately 1,800 feet upstream from the confluence with the Clearwater River. Survey sites were located on stable riffle sections displaying well-defined bankfull indicators. Channel geometry and hydraulics were processed using WinXSPRO (USDA Forest Service, 1998) and HEC-RAS (USACE, 1995). Relative roughness was computed by comparing the average depth of the bankfull channel to the measured $D_{84}$ of the riffle pavement material. Derived values were compared to resistance factors developed by Limerinos (1970) and Leopold, et al. (1964).

A primary assumption with this method was that the geomorphic features associated with the bankfull channel represented the optimum channel geometry and were formed by flows with return intervals between 1.3 and 1.8 years. A second assumption was that the hydrophysiographic characteristics of the study streams were similar in terms of catchment area, parent geology, soils, precipitation patterns, and runoff regimes. Consequently, the bankfull discharge results are expected to be similar and acceptable for comparative analysis.

### 3.1.3 Method C - Flood Frequency and Unit Discharge Analysis

Frequency analysis is a method for assigning probabilities to flood events of a given magnitude. USGS gaging stations located in Clearwater and Idaho Counties with sufficient periods of record were selected to conduct log-Pearson Type III distribution analysis. WCI assumed a 1.5-year recurrence interval to be representative of the bankfull discharge for all watersheds. The selected gauging stations are noted in Table 3.1.

A unit discharge analysis was applied to the results of the flood frequency analyses. This type of analysis is commonly used to examine flood-producing properties of a watershed and is an applicable method for estimating the flood series of ungaged streams. Results of the flood frequency analyses (cfs) were referenced to the corresponding catchment area (miles$^2$) and converted to cubic feet per second per square mile (CSM). A prediction model was developed to define the strength of the relationship for both the bankfull and 100-year CSM values. This method was not considered satisfactory for accurately predicting the flood series of Orofino Creek but was used for preliminary estimation as well as for validating flood estimates obtained from Methods A and B.

## 3.2 Results

### 3.2.1 Method A – USGS Stream Gage Calibration

**Bankfull Discharge**

Based on the adjusted profile of observed bankfull indicators and the most current rating table for the Lolo Creek USGS gaging station, the estimated bankfull discharge corresponded to a staff gage height of 12.5 feet, resulting in a discharge of 1,450 cfs (CSM = 6.0). Based on 22 years of record, the return period associated with the bankfull discharge was approximately 1.4 years. Since the average return interval of the bankfull discharge is approximately 1.5 for streams in the United States (Dunne and Leopold 1978), the results were considered to be reasonably accurate for estimating bankfull discharge.

**Table 3.2**
**Lolo Creek USGS stream flow gaging station calibration results**

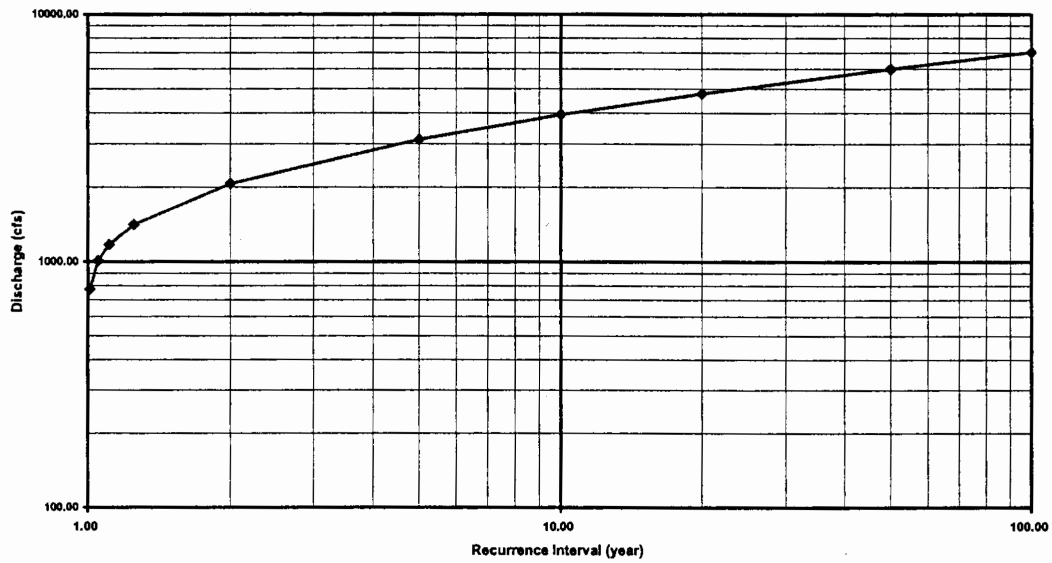
| Bankfull Gage Height (ft) | Bankfull Discharge (cfs) | Recurrence Interval (years) |
|---|---|---|
| 1.25 | 1,400-1,500 | 1.4 |

Applying the derived bankfull CSM for Lolo Creek to the Orofino Creek watershed resulted in an estimated bankfull discharge of 1,346 cfs. Castro and Jackson (2001) developed regional hydraulic geometry for Pacific Northwest streams based on analysis of USGS flood frequency analyses. They reported a bankfull discharge value of 1,311 cfs for the Lolo Creek gaging station. Their result supports the bankfull discharge prediction applying the stream gauge calibration method employed in this study.

**100-Year Discharge**

The flood frequency analysis completed for the Lolo Creek stream gaging station is displayed in Figure 3.1. The analysis was based on 22 years of record (1980-2002) and included the 1996 flood event of record that was equivalent to the 50-year recurrence interval discharge. The estimated 100-year discharge was 7,020 cfs based on a log-Pearson Type III distribution (CSM = 28.9). Applying the derived 100-year flood CSM for Lolo Creek to the Orofino Creek watershed resulted in an estimated 100-year discharge of 6,069 cfs.

**Figure 3.1 Flood Frequency Analysis for Lolo Creek near Greer, Idaho. (log-Pearson Type III Distribution)**




### 3.2.2 Method B - Field Survey and Hydraulic Modeling

A majority of the stream banks on Orofino Creek have been manipulated through placement of riprap and other types of armoring. Consequently, the availability of stable, reference reaches with defined bankfull indicators was limited in the project area. A 1,500-ft relatively undisturbed stream segment located upstream of the Johnson Avenue Bridge was selected and surveyed. Hydraulic modeling results predicted bankfull discharge values ranging from 1,400 cfs to 1,500 cfs. Predicted CSM values ranged from 6.7 to 7.1 (Table 3.3).

**Table 3.3**
**Estimated Bankfull Discharge and Corresponding CSM Values**

| Site | Estimated Discharge (cfs) | Estimated CSM |
|---|---|---|
| Lolo Creek | 1,500 | 6.4 |
| Orofino Creek | 1,400-1,500 | 6.7-7.1 |

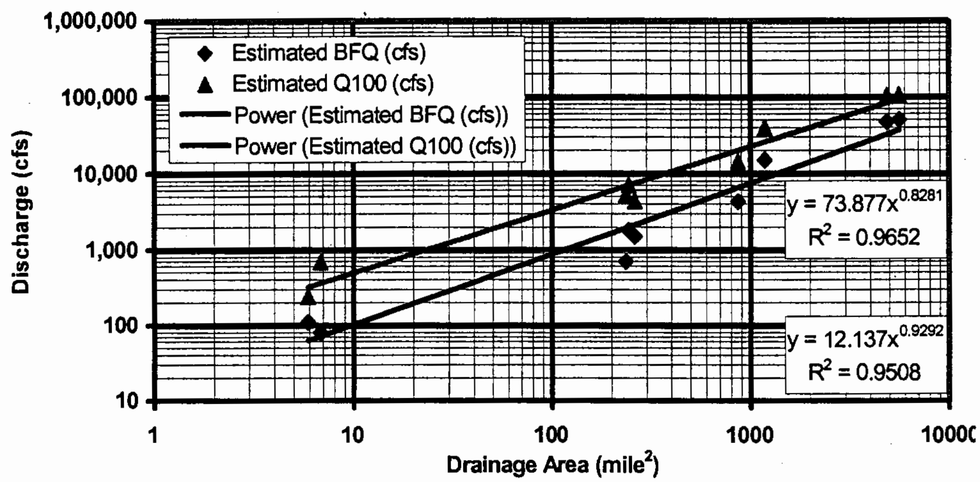
### 3.2.3 Method C - Flood Frequency and Unit Discharge Analysis

The estimated bankfull and $Q_{100}$ discharges were computed for the USGS stream flow gaging stations located on tributaries and the main-stem Clearwater River in the vicinity of Orofino Creek (Table 3.4). Regression models with reported correlation coefficients were also completed (Figure 3.2). The results indicated that the bankfull discharge and $Q_{100}$ for Orofino Creek are approximately 1,750 cfs (CSM = 8.3) and 6,200 cfs (CSM = 29.5), respectively. The coefficients of determination, or r-squared ($r^2$) values were 0.95 and 0.97 for the bankfull and 100-year estimated discharges, respectively.

Table 3.4
Summary of estimated bankfull and $Q_{100}$ discharges (cfs)

| # | Station Number | Location | Estimated Bankfull Discharge | $Q_{100}$ | Drainage Area (mile$^2$) |
|---|---|---|---|---|---|
| 1 | 13339500 | Lolo Creek near Greer | 1,800 | 7,020 | 243 |
| 2 | 13339700 | Canal Gulch Creek at Pierce Ranger Station | 110 | 240 | 5.9 |
| 3 | 13339900 | Deer Creek near Orofino | 80 | 692 | 6.8 |
| 4 | 13340000 | Clearwater River at Orofino | 50,000 | 105,200 | 5,580 |
| 5 | 13342450 | Lapwai Creek near Lapwai | 700 | 5,200 | 235 |
| 6 | 13337500 | SF Clearwater River near Elk City | 1,500 | 4,400 | 261 |
| 7 | 13338000 | SF Clearwater River near Grangeville | 4,300 | 14,200 | 865 |
| 8 | 13337000 | Lochsa River near Lowell | 15,000 | 39,800 | 1,180 |
| 9 | 13339000 | Clearwater River at Kamiah | 47,000 | 103,600 | 4,850 |

**Figure 3.2: CSM Model for Select USGS Stream Discharge Gaging Stations in Idaho and Clearwater Counties.**




Data obtained from the following USGS Streamflow Gauging Stations: Lolo creek, Deer Creek near Orofino, Clearwater River at Orofino, Clearwa River near Elk City, SF Clearwater River nearr Grangeville, Lochsa River near Lowell, Clearwater River at Kamiah, Canal Gulch Creek, and Lapwai Creek near Lapwai

## 3.3 Discussion and Selected Discharges

Bankfull discharge estimates ranged from 1,346 – 1,750 cfs (CSM range = 6.0 – 8.3), resulting in an average value of 1,515 cfs (CSM = 7.2) (Table 3.5). Predicted discharge and CSM values for the 100-year recurrence interval flood ranged from 5,904 to 6,069 cfs (CSM range = 28.9 – 29.5), resulting in an average discharge of 5,987 cfs (CSM = 28.5).

**Table 3.5**
**Summary of the $Q_{1.5}$ and $Q_{100}$ Discharge Results**

| Recurrence Interval (yrs) | Method A | | Method B | | Method C | | Average | |
|---|---|---|---|---|---|---|---|---|
| | Discharge (cfs) | CSM | Discharge (cfs) | CSM | Discharge (cfs) | CSM | Discharge (cfs) | CSM |
| **Bankfull ($Q_{1.5}$)** | 1,346 | 6.0 | 1,450 | 6.9 | 1,750 | 8.3 | 1,515 | 7.2 |
| **100-Year ($Q_{100}$)** | 6,069 | 28.9 | n/a | n/a | 6,200 | 29.5 | 6,135 | 29.2 |

### 3.3.1 Bankfull Discharge

Results from Method A suggested a $Q_{1.5}$ discharge value of 1,346 cfs for Orofino Creek based on an applied CSM value derived for Lolo Creek. The field survey and hydraulic modeling (Method B) yielded a predicted bankfull discharge of 1,450 cfs. Regional relationships (Method C) indicated a $Q_{1.5}$ value of 1,750 cfs. Based on the results of this analysis, the selected bankfull discharge for Orofino Creek is 1,500 cfs.

### 3.3.2 100-Year Discharge

Results from Method A suggested a $Q_{100}$ discharge value of 6,069 cfs for Orofino Creek based on an applied CSM value derived for Lolo Creek. Regional relationships (Method C) indicated a $Q_{100}$ value of 6,200 cfs. The flood insurance study for Orofino Creek referenced a 100-year discharge of 7,600 cfs. Based on the results of this and previous studies, the selected $Q_{100}$ value for Orofino Creek is 6,620 cfs. However, to maintain consistency with previous flood studies, the published FEMA value of 7,600 was used for all hydraulic and floodway modeling conducted for this study.

Table 3.6 summarizes the selected bankfull and 100-year discharge values for Orofino Creek. The results of the flood frequency analysis should be regarded as an approximation of the bankfull and $Q_{100}$ discharges. Due to the lack of long-term stream flow gaging data on Orofino Creek, analytical and analog based procedures were employed to further refine the annual flood series.

Table 3.6
Selected Discharges for the Orofino Creek Watershed

| | Recurrence Interval | Selected Discharge |
|---|---|---|
| **Orofino Creek below Whiskey Creek** | Bankfull Discharge ($Q_{1.5}$) | 1,500 cfs |
| | 100-Year Discharge ($Q_{100}$) | 7600 cfs |
| **Orofino Creek above Whiskey Creek** | Bankfull Discharge ($Q_{1.5}$) | 1,000 cfs |
| | 100-Year Discharge ($Q_{100}$) | 6500 cfs |

# 4.0 HYDRAULIC AND ENGINEERING ANALYSIS

This section provides a description of the methodologies used to develop the hydraulic and engineering design elements of the proposed restoration activities for Orofino Creek. The hydraulic discussion focuses upon development of typical channel cross-section templates, a channel planform alignment and a longitudinal bed profile. In addition, sediment transport analyses were completed for existing and potential conditions. Lastly, a discussion of the HEC-RAS flood and bridge modeling is included.

## 4.1 Design Dimensions

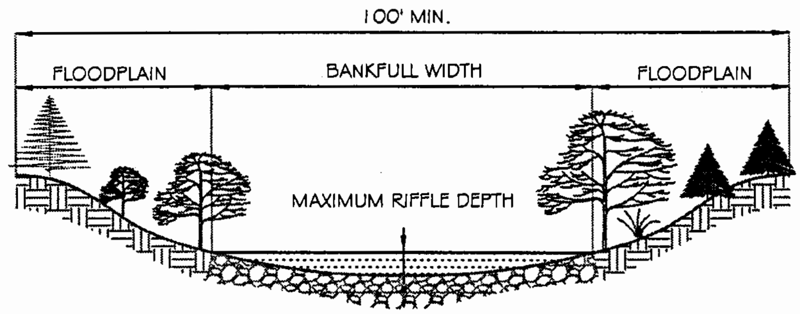
### 4.1.1 Cross Section Geometry

The proposed three-stage channel design incorporates the principles of natural channel design philosophy, which is based on sizing the active channel to the bankfull flow conditions, accommodating base flow conditions and providing an adequate floodplain to accommodate flood events, including the 100 year flood (Rosgen and Silvey, 1996 and Leopold et al., 1964). Due to the lack of discharge data on Orofino Creek, field surveys were completed for watersheds displaying similar hydrophysiographic characteristics to Orofino Creek. Similarities included drainage area, geology, soils, precipitation patterns, and runoff regimes. In addition, site-specific conditions including the bankfull width to depth ratio, particle size distribution, and slope were similar between the surveyed stream reaches. As such, extrapolation of the hydraulic geometry from these reference reaches surveys was deemed appropriate for design purposes. For additional information on hydrology and flood flow analysis, please refer to Section 3.0.

The typical pool, riffle, and run cross sections were designed to the bankfull flow hydraulic conditions. Table 4.1 summarizes design dimensions for typical riffle, run and pool cross-sections. Figure 4.1 includes typical diagrams for these sections.

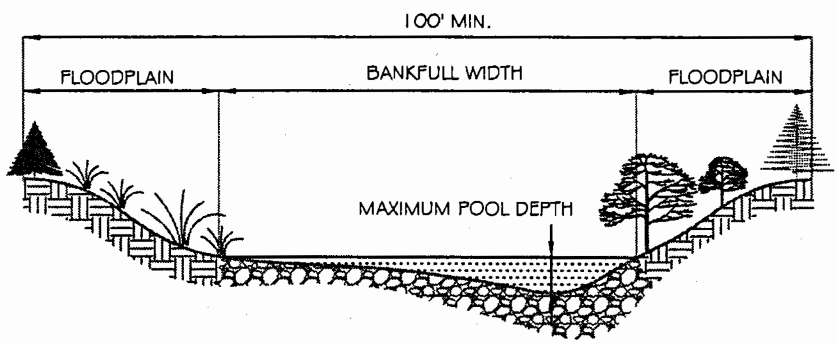
**Table 4.1**
**Summary of Bankfull Cross-Section Characteristics – Potential Condition**

| | Geomorphic Channel Unit | Cross-Section Area ($ft^2$) | Width (ft) | Mean Depth (ft) | Max. Depth (ft) | Scour Depth (ft) |
|---|---|---|---|---|---|---|
| Above Whiskey Creek | Riffle | 175 +/-25 | 56 +/-7 | 3.1 +/-.4 | 3.9 +/-.5 | 5.0 +/-.6 |
| | Pool | 220 +/-30 | 64 +/-8 | 2.7 +/-.5 | 7.8 +/-1 | 9.5+/-1.2 |
| Below Whiskey Cr | Riffle | 250 +/-25 | 67 +/-7 | 3.7 +/-.4 | 4.7 +/-.5 | 6.0 +/-.6 |
| | Pool | 310 +/-30 | 77 +/-8 | 3.2 +/-.5 | 9.3 +/-1 | 11.4+/-1 |




TYPICAL RIFFLE CROSS-SECTION

NOT TO SCALE




TYPICAL POOL CROSS-SECTION

NOT TO SCALE

BANKFULL CHANNEL DESIGN DIMENSIONS
ABOVE WHISKEY CR. - B3c CHANNEL TYPE

| PARAMETER / FEATURE | POOL | RIFFLE | RUN |
|---|---|---|---|
| DISCHARGE | 1000 cfs | 1000 cfs | 1000 cfs |
| WIDTH | 64 +/-8 ft | 56 +/-7 ft | N/A |
| MEAN DEPTH | 2.7 +/- 0.5 ft | 3.1 +/- 0.4 ft | N/A |
| MAX. DEPTH | 7.8 +/-1.0 ft | 3.9 ft +/- 0.5 ft | N/A |
| SCOUR DEPTH | 9.5 +/- 1.2 ft | 5.0 +/- 0.6 ft | N/A |
| XS AREA | 220 +/- 30 sq ft | 175 +/- 25 sq ft | N/A |
| WIDTH:DEPTH | N/A | 18 +/- 2 | N/A |

BANKFULL CHANNEL DESIGN DIMENSIONS
BELOW WHISKEY CR. - B3c CHANNEL TYPE

| PARAMETER / FEATURE | POOL | RIFFLE | RUN |
|---|---|---|---|
| DISCHARGE | 1500 cfs | 1500 cfs | 1500 cfs |
| WIDTH | 77 +/-8 ft | 67 +/-7 ft | N/A |
| MEAN DEPTH | 3.2 +/- 0.5 ft | 3.7 +/- 0.4 ft | N/A |
| MAX. DEPTH | 9.3 +/-1.0 ft | 4.7 ft +/- 0.5 ft | N/A |
| SCOUR DEPTH | 11.4 +/- 1.2 ft | 6.0 +/- 0.6 ft | N/A |
| XS AREA | 310 +/- 30 sq ft | 250 +/- 25 sq ft | N/A |
| WIDTH:DEPTH | N/A | 18 +/- 2 | N/A |

[redacted]

### 4.1.2 Plan Form and Pattern

The proposed values for planform characteristics for Orofino Creek are based on empirical models developed by Leopold, et. al (1964), Williams (1986), and analytically based field investigations conducted by WCI on reference reaches located within the project area. In addition, aerial photographs were used to study the historical alignment and pattern of Orofino Creek. The potential ranges of channel pattern characteristics including sinuosity, meander length, radius of curvature, belt width, and meander width ratio for a B3c channel type are summarized in Table 4.2.

**Table 4.2**
**Summary of Channel Pattern Characteristics**
**Potential Condition**

| Location | Plan Form Characteristic | Range | Mean |
|---|---|---|---|
| Above Whiskey Cr. | Sinuosity | 1.1 – 1.5 | 1.3 |
| | Meander Length | 620 – 940 ft | 780 ft |
| | Radius of Curvature | 150 – 300 ft | 225 ft |
| | Belt Width | 110 – 390 ft | 250 ft |
| | Meander Width Ratio | 2.0 – 7.0 | 4.5 |
| Below Whiskey Cr. | Sinuosity | 1.2 – 1.4 | 1.3 |
| | Meander Length | 840 – 1,120 ft | 950 ft |
| | Radius of Curvature | 180 – 320 ft | 250 ft |
| | Belt Width | 130 – 450 ft | 300 ft |
| | Meander Width Ratio | 2.0 – 7.0 ft | 4.5 ft |

### 4.1.3 Longitudinal Profile

Natural stream gradient varies in the longitudinal profile from pools to riffles. Typically, stream gradient decreases in meanders associated with pools, and steepens in the straighter riffles. This undulation in the bed profile dissipates stream energy and maintains the vertical stability of the riffle, as well as providing a variety of in-stream habitat. Natural rivers are able to maintain grade control through scour along a stable stream bank and deposition of larger material at the tailout of the meander. In reconstructed channels, however, excavation of the channel bed disturbs the pavement and sub-pavement materials that form the natural grade control. Therefore, until geomorphic processes re-establish the bed armor of the new channel, interim grade control is necessary to maintain the vertical stability of the designed pool, riffle, and run facet slopes.

The proposed facet design slopes were developed based on field investigations conducted by WCI on reference reaches. Surveyed stream reaches displayed similar bankfull width to depth ratios, channel slopes, and bed materials. Extrapolation of these relations was deemed appropriate for design purposes (Rosgen, 1998. Presented at the American

Society of Civil Engineers, Denver, CO). Table 4.3 summarizes the design facet slopes for pool, riffle, and geomorphic channel units.

**Table 4.3**
**Summary of Channel Profile Characteristics**
**Potential Condition**

| Geomorphic Channel Unit | Range | Mean |
|---|---|---|
| Riffle Slopes | 0.011 – 0.017 (ft/ft) | 0.014 (ft/ft) |
| Pool Slopes | n/a | n/a |
| Step Frequency | 230 – 350 ft | 290 ft |
| Estimated Velocity | 5.0 – 6.5 fps | 5.8 fps |

## 4.2 Sediment Transport

### 4.2.1 Entrainment Analysis – Existing Condition

A stable stream is able to accommodate changes in sediment and flow regimes over time by maintaining the plan view morphology, longitudinal profile dimensions, and cross-sectional geometry associated with the bankfull channel. This balance, or dynamic equilibrium, establishes the sediment transport competency of the channel by maintaining the hydraulic parameters necessary to mobilize and transport sediment during bankfull and higher discharges.

Existing sediment transport competency was evaluated to determine the ability of Orofino Creek to mobilize and transport bed material delivered by the watershed. Figures 4.2 and 4.3 display the existing particle size distribution curves for three surveyed locations in the project area. Results are tabulated in Table 4.4.

**Figure 4.2: Particle Size Distribution for Reach 1**

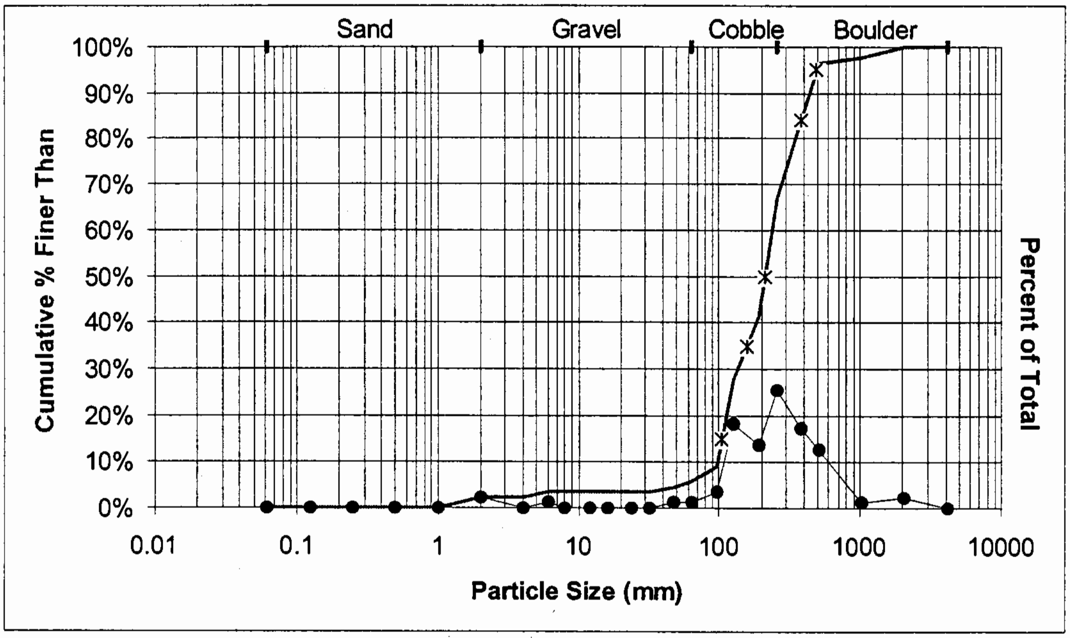
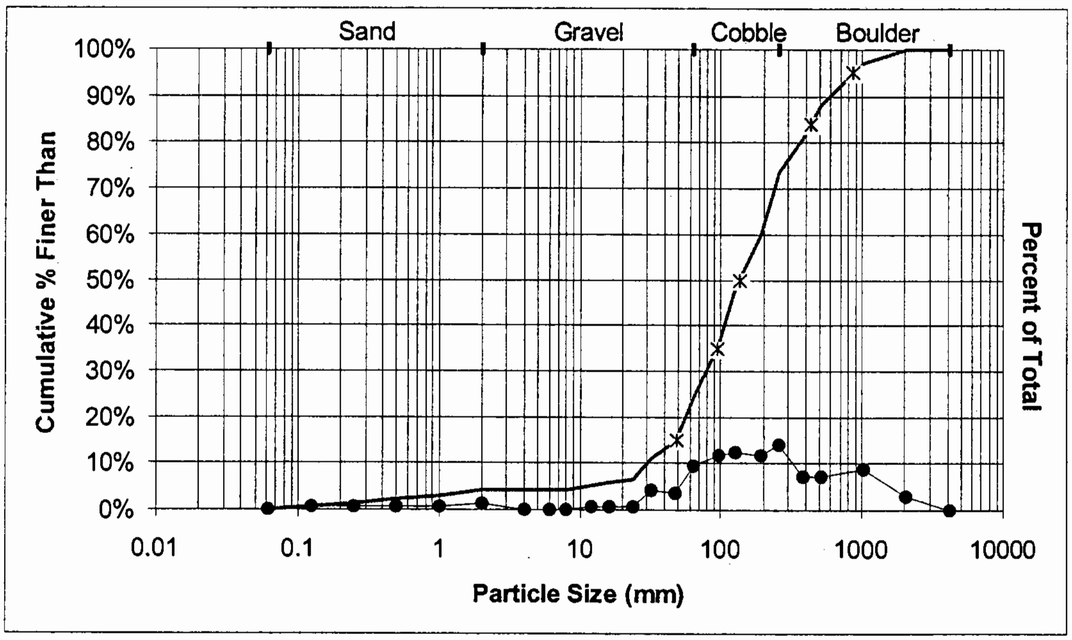



**Figure 4.3: Particle Size Distribution for Reach 4**



| Table 4.4<br>Summary of Existing Particle Size Distributions (mm) | | | | | |
|---|---|---|---|---|---|
| | $D_{15}$ | $D_{35}$ | $D_{50}$ | $D_{84}$ | $D_{95}$ |
| **Reach 1** | 105 | 159 | 212 | 385 | 494 |
| **Reach 4** | 49 | 94 | 136 | 432 | 869 |
| **Whiskey Creek** | 19 | 79 | 115 | 238 | 407 |

Critical shear stress is the force required to set a grain in motion along the streambed. A combination of streambed bar samples, Wolman pebble counts, and pavement and sub-pavement core samples were collected from two locations on Orofino Creek and one location on Whiskey Creek, and used to evaluate the shear stress levels and the incipient motion of streambed particles in the existing channel. The $D_{84}$ size fraction was determined to be the critical particle size for evaluating the mobilization of streambed particles. This concept is consistent with several studies including (Pickup, 1976; Jackson and Beschta, 1982; Grant, 1987; Carling, 1988; Sidle, 1998; Booth, 1990; Leopold, 1992).

***Photograph 4.1:***

*Typical sediment deposits in Orofino Creek*

For this analysis, the two methods used were the mean shear stress approach and the probable mean depth approach. The mean shear stress approach was used to characterize the stream's ability at the bankfull stage to move sediment based on the local cross section geometry, slope and particle size distribution. The probable mean depth approach was used to calculate the mean depth based on the particle size distribution and draw a comparison to the existing mean depth. If the existing mean depth is greater than the calculated mean depth, the channel is capable of transporting larger particles. If the existing mean depth is less than the calculated mean depth, the channel may not transport larger particles and could experience aggradation. The latter approach is based on the assumption that in order to maintain channel dimensions, the maximum depth must be within an appropriate range to entrain the $D_{84}$ particle size. Also, the maximum depth can be calculated using dimensionless shear stress and an equation developed by Shields (1936).

**Mean Shear Stress Approach**

Table 4.5 presents a comparison of the calculated shear stress and associated particle size that is mobilized at the bankfull stage with and the $D_{50}$ and $D_{84}$ size classes at five locations.

**Table 4.5**
**Sediment Transport Competency of Orofino Creek – Existing Conditions**
**Mean Shear Stress Approach**

| Location | Calculated Mean Shear Stress ($lb/ft^2$) | Particle Size Mobilized (mm) | Existing $D_{50}$ (mm) | Existing $D_{84}$ mm) |
|---|---|---|---|---|
| Reach 1 | 1.81 | 150-300 | 212 | 494 |
| Reach 2 | 1.36 | 130-210 | 212*[1] | 494*[1] |
| Reach 3 | 3.77 | 300-500 | 136*[2] | 432*[2] |
| Reach 4 | 2.60 | 250-400 | 136 | 432 |
| Whiskey Creek | 2.57 | 250-400 | 115 | 238 |

*[1] Particle sizes assumed to be similar to Reach 1
*[2] Particle sizes assumed to be similar to Reach 4

Results indicate that the sediment transport capacity is widely varied throughout the project area. According to the Shields curve, the existing channel conditions generate shear stress values capable of initiating motion of particles up to 150 mm or as much as 500 mm. This represents a wide range of size classes for the existing channel. These results demonstrate the dynamic instability of the project area.

**Probable Mean Depth Approach**

Table 4.6 presents a comparison of the calculated mean depths necessary to mobilize the $D_{50}$ and $D_{84}$ size classes with the actual mean depth at a surveyed riffle cross section.

| Table 4.6<br>Sediment Transport Competency of Orofino Creek – Existing Conditions<br>Probable Mean Depth Approach | | | | | |
|---|---|---|---|---|---|
| **Location** | **D50 (mm)** | **D84 (mm)** | **Calculated Mean Depth to move $D_{50}$ (ft)** | **Calculated Mean Depth to move $D_{84}$ (ft)** | **Mean Depth at Riffle Cross Section (ft)** |
| Reach 1 | 212 | 494 | 3.07 | 5.59 | 2.71 |
| Reach 2 | 212*[1] | 494*[1] | 2.82 | 5.13 | 1.91 |
| Reach 3 | 136*[2] | 432*[2] | 1.06 | 3.34 | 4.69 |
| Reach 4 | 136 | 432 | 1.34 | 4.26 | 4.05 |
| Whiskey Creek | 115 | 238 | 0.84 | 1.75 | 2.16 |

*[1] Particle sizes assumed to be similar to Reach 1
*[2] Particle sizes assumed to be similar to Reach 4

Again, the results indicate that the sediment transport capacity is widely varied throughout the project area. Survey results from Reach 1 represent the most stable results. The calculated mean depth to move the $D_{50}$ particle size on Reach 1 is greater than the actual mean depth, but the calculated mean depth is very close to the actual mean depth. Thus, it seems that the cross sectional geometry of Reach 1 is sufficient to move the $D_{50}$ particle size, but not sufficient to move the $D_{84}$ particle size. Therefore, the reach seems to have proper channel geometry to move sediment.

**Discussion**

Table 4.7 presents a summary of the results from the two approaches.

| Table 4.7<br>Sediment Transport Summary for Orofino Creek<br>Existing Conditions | | |
|---|---|---|
| **Location** | **Mean Shear Stress Approach** | **Mean Depth Approach** |
| Reach 1 | Stable | Stable |
| Reach 2 | Aggradation | Aggradation |
| Reach 3 | Degradation | Degradation |
| Reach 4 | Degradation | Degradation |
| Whiskey Creek | Degradation | Degradation |

The two approaches show similar results for sediment transport competency. As discussed in Section 2.0, a majority of Orofino Creek has been channelized and stabilized using riprap. Most likely, these modifications have caused localized changes in slope and width-to-depth ratios, resulting in variable sediment transport capabilities and channel instability. Although some reaches may be stable, most of the project area is not functioning at its potential. The results of the two methods support these observations.

### 4.2.2 Entrainment Analysis – Potential Condition

This analysis is divided into two sections consisting of mean shear stress analysis and riffle depth analysis for the potential condition. For the particle entrainment analysis, mean shear stress was used to characterize the stream's ability to move sediment based on the proposed design dimensions and the particle size distribution. For the riffle depth analysis, the particle size distribution and critical dimensionless shear stress.

**Mean Shear Stress Approach**

Mean shear stress was calculated for the design bankfull dimensions. Table 4.8 presents a comparison of the design mean shear stress and range of particle sizes associated with the design mean shear stress with the existing $D_{50}$, $D_{84}$, and $D_{95}$ size classes.

**Table 4.8**
**Sediment Transport Competency of Orofino Creek – Potential Condition**
**Mean Shear Stress Approach**

| Feature | Design Mean Shear Stress (lb/ft$^2$) | Particle size associated with design mean shear stress (mm) | Existing $D_{50}$ (mm) | Existing $D_{84}$ (mm) | Existing $D_{95}$ (mm) |
|---|---|---|---|---|---|
| Riffle | 2.35 | 210-400 | 211 | 384 | 949 |

As shown in Table 4.8, the design riffle cross section can generate enough shear stress to move particles up to the $D_{84}$ size class. However, the $D_{90}$ particle size (approximately 430 mm) would not be moved by this shear force. Thus, the designed riffle cross section should maintain its geometry and transport the sediment that is delivered from the watershed.

**Riffle Depth Analysis**

As discussed previously, the mean riffle depth at the bankfull stage establishes the mean shear stress and sediment transport competency of the channel. Moreover, it is responsible for maintaining the channel geometry that establishes a stable system.

In addition to conducting pebble counts, WCI surveyed point bar deposits in Reach 1 to determine a geometric mean particle size. The geometric mean particle size was determined to be approximately 240 mm. Based on the assumption that this particle size is mobilized at the bankfull stage, minimum and maximum mean bankfull depths were calculated using various design slopes. The results of this analysis are presented in Table 4.9. The results identify possible combinations of design slope, minimum mean depth, and maximum mean depth at the riffle cross-section.

**Table 4.9**
**Sediment Transport Competency of Orofino Creek – Potential Condition**
**Riffle Depth Analysis**

| Existing $D_{84}$ (mm) | Existing $D_{50}$ (mm) | Geometric Mean Particle Size (mm) | Avg. Design Slope (ft/ft) | Minimum riffle depth to move the largest particle (ft) | Maximum riffle depth (ft) |
|---|---|---|---|---|---|
| 384 | 211 | 240 | 0.010 | 3.84 | 6.15 |
| 384 | 211 | 240 | 0.011 | 3.50 | 5.59 |
| 384 | 211 | 240 | 0.012 | 3.20 | 5.13 |
| 384 | 211 | 240 | 0.013 | 2.96 | 4.73 |
| 384 | 211 | 240 | 0.014 | 2.75 | 4.39 |

## 4.3 Bridge Assessment

### 4.3.1 Preliminary survey

A preliminary survey of the ten bridges in the lower watershed was conducted to determine the need for modeling. General bridge and channel morphology characteristics were measured for each bridge. The data collected included:

- Bridge construction plans;
- Bridge geometry (span, deck width, pier and abutment locations, approaches);
- Condition of structure;
- Potential for channel constriction and skew;
- Upstream and downstream effects;
- Risk assessment (potential for overtopping, mass failure, and consequences);
- Scour potential; and
- Fish passage concerns.

This data were used to assess the impact of the bridges on the creek, potential for scour and risk of failure. Based on the initial survey, seven bridges were selected for additional hydraulic modeling and analysis.

### 4.3.2 Hydraulic Modeling

In order to determine the hydrodynamic characteristics of Orofino Creek in the vicinity of the selected bridges, the Army Corps of Engineers Hydraulic Engineering Center's River Analysis System (HEC-RAS) was employed. This software computes water surface profiles and hydraulic variables in a one dimensional steady flow system. A separate model was developed for each bridge, except for the three bridges near the confluence which were combined into one model to assess the effects of the backwater from the Clearwater River.

Channel and floodplain metrics were surveyed for each of the seven bridges selected for modeling. A longitudinal profile and representative channel cross-sections were surveyed for each bridge using a laser level. In addition, floodplain features, water surfaces, and recent high water indicators were recorded for model calibration. The survey was used to build the geometry of the HEC-RAS model.

The HEC-RAS model calculates a step-backwater profile by balancing the energy equation based on the channel geometry, surface roughness and flood discharge. Roughness coefficients of 0.048 (active channel) and 0.06 (floodplain) were used for modeling. Relative roughness was computed by comparing the mean depth of the modeled flood stage (d) to the measured $D_{84}$ of the bed material ($d/D_{84}$). This value was compared to resistance factors developed by Limerinos and Leopold, and Wolman and Miller to determine a friction factor (u/u*) and corresponding Manning's roughness coefficient. The computed value corresponds well with published values by David Rosgen for B3c type channels.

Flood frequency data was derived from the Hydrologic Analysis in Section 3.0. Flood frequency data used for this study is listed in Table 4.10.

**Table 4.10**
**Selected $Q_{BANKFULL}$, $Q_{10}$ and $Q_{100}$ Discharges ($ft^3/s$)**
**Orofino Creek, ID**

| Recurrence Interval (yrs) | Upstrm. of Whiskey Cr. | Dwnstrm. of Whiskey Cr. |
|---|---|---|
| Bankfull (1.3-1.8) | 1,000 | 1,500 |
| 10 | 3,850 | 4,500 |
| 500 | 6,500 | 7,600 |

### 4.3.3 Observations and Results

**Railroad Bridge: Station 4+00**

The first bridge crossing on Orofino Creek upstream of its confluence with the Clearwater River is the Railroad Bridge. It is located approximately 400 feet upstream of the confluence. The low chord of the bridge is set at approximately the same elevation as the top of the Main St. Bridge. Field observations indicate that ample freeboard is available for all flows. The only problem evident was the potential for scour immediately downstream of the left bridge abutment.

**Main St. Bridge: Station 5+00**

The Main St. Bridge is a reinforced concrete structure built in the early 1980's. The bridge was designed by the Idaho Department of Transportation (IDT) in accordance with 1977 AASHTO Specifications and 1978 through 1981 Interim Specifications. According to the as built drawing dated 25 May 1983 (IDT File No. 2997 / Dwg. No. 15189), the bridge was designed to convey a 50-yr flow of 6,600 cfs (9.1 fps) and a 100-yr flow of 7,600 cfs (3.7 fps). The bridge profile shows the 50-yr flow intersecting the bridge near the top of the stringer. The 100-yr flow is shown as overtopping the roadway by approximately 1.5 feet.

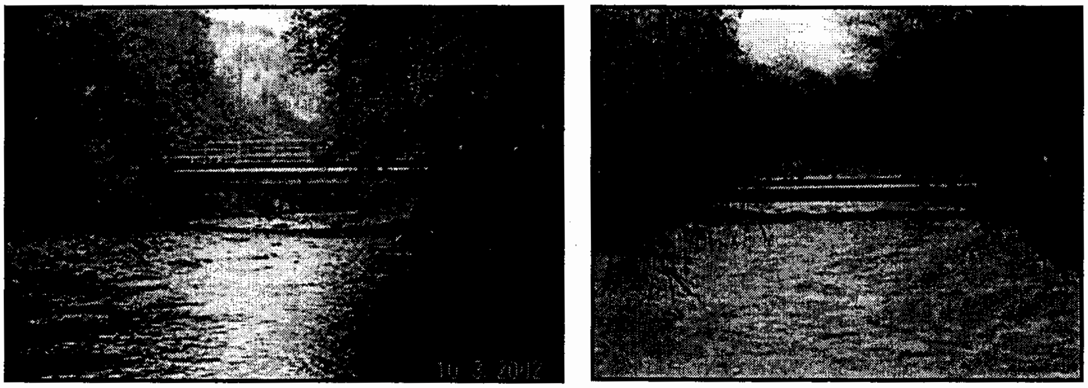
The bridge was modeled in conjunction with the Johnson Avenue Bridge and the railroad bridge. Two situations were modeled for the three bridges. In the first scenario, the Clearwater River was assumed to be experiencing a 100-yr flood and the downstream control for the model was assumed to be the water surface elevation associated with that flow. Under these conditions, both of the highway bridges are inundated by between two and six feet of water. Only the deck of the railroad bridge remains above water. In the second scenario, the Clearwater River was assumed to be at an average low flow and the average water surface slope for Orofino Creek was used for the upstream and downstream conditions. The results for the second scenario are presented below.

The HEC-RAS model for the Main St. Bridge shows similar results to those reported by IDT. The 100-yr flow of 7,600 cfs overtops the bridge deck by approximately 0.5 feet. The 10-yr flow of 4,500 cfs intersects the bridge near the top of the stringer and causes a pressure flow condition through the bridge. Approximately 3.5 feet of freeboard is shown for the bankfull flow of 1,500 cfs. The backwater effect caused by all three of these flows appears to extend upstream to the Main St. Bridge.

**Johnson Avenue Bridge: Station 8+00**

The Johnson Avenue Bridge is located approximately 800 feet upstream of the confluence with the Clearwater River. It is another reinforced concrete structure that was built in the early 1980's. The bed profile is relatively flat at the upstream approach and then transitions to a higher gradient immediately downstream of the bridge. The bridge opening has an unusually low amount of freeboard, which may contribute to the deposition of bedload immediately upstream. Backwater due to flooding on the Clearwater River may also induce sediment deposition upstream of the bridge.

The HEC-RAS model for the Johnson Avenue Bridge showed the 100-yr flow (7,600 cfs) overtopping the bridge by approximately four feet. The 10-yr flow (4,500 cfs) intersected the bridge stringer and caused a pressure flow condition through the bridge. The bankfull flow (1,500 cfs) passed through the bridge with approximately 2.5 feet of freeboard.



***Photograph 4.2:*** *(a) The Johnson Avenue Bridge at low flow. (b) The Johnson Avenue Bridge during the January 2003 flood (approximately a 5- year event). The HEC-RAS model showed the 100-yr flow (7600 cfs) overtopping the bridge by approximately 4 feet.*

**Private Railcar Bridge: Station 27+00**

The bridge located approximately 2700 feet above the confluence with the Clearwater River is constructed from two railcars placed side-by-side and set into concrete abutments in the adjacent banks. It appears to be in good condition and the abutments are protected by large diameter riprap. The bridge does not appear to constrict the entrenched channel and was therefore not surveyed or modeled.

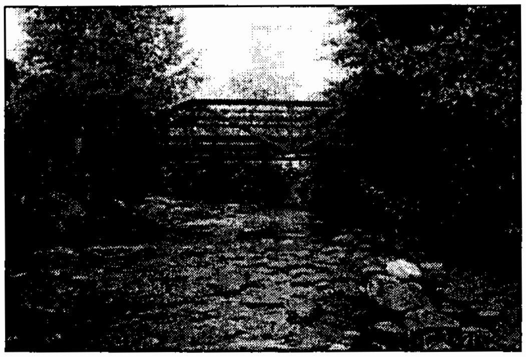
**Private Railcar Bridge: Station 44+00**

The private bridge located approximately 4,400 feet upstream of the confluence provides access to several private residences on the south side of the creek. The bridge is constructed from a single railcar with concrete abutments. The abutments are located in the active channel, but do not appear to constrict it significantly. The bridge was not modeled as it does not appear to cause significant impacts to the channel.

**Forest St. Bridge: Station 65+00**

The Forest Street Bridge is an aging steel girder bridge with concrete abutments. The left abutment appears to have been replaced recently. The left bank upstream of the bridge is nearly vertical and appears to be actively eroding. Potential causes may include channel down cutting and lateral migration. Large blocks of broken concrete have been placed immediately upstream of the left abutment to protect it. The concrete riprap may actually exacerbate the erosion by inducing scour around the abutment. If left untreated, the creek could eventually undermine the bridge abutment again leading to failure of the bridge.

The HEC-RAS model showed the bridge being overtopped by the 100-yr flow (7,600 cfs). A hydraulic jump appeared to be induced downstream of the bridge at this flow. The scour resulting from the erosive forces associated with a hydraulic jump could contribute to the failure of the bridge. The model indicated a significant backwater effect extending at least 100 feet upstream of the bridge. The aggradation associated with the backwater effect will likely lead to lateral migration and additional bank erosion.



***Photograph 4.3:*** *(a) The Forest Street Bridge – note how the left abutment encroaches on the active channel. (b) Scour and erosion at the left abutment.*

**Private Railcar Bridge: Station 106+00**

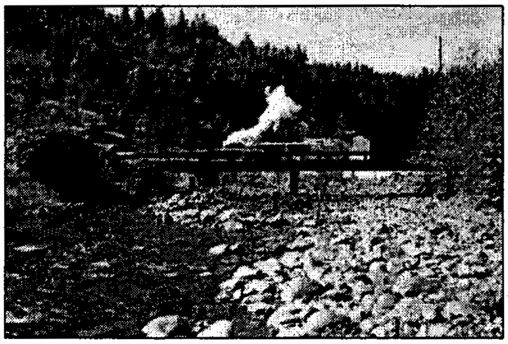
This private bridge is located in the vicinity of Newman's Corner approximately 10,600 feet upstream from the confluence. The bridge consists of a single railcar with concrete abutments set into the armored banks. The right abutment is anchored into the grouted riprap lining the bank adjacent to the highway. The bridge spans the width of the entrenched channel and is set at an elevation such that it does not present any additional constriction (beyond the road, riprap & training dyke already constricting the channel). As such, the bridge was not surveyed or modeled. Amazingly, this bridge survived the 1996 flood event when Orofino Creek cut behind the right abutment and into Michigan Avenue (see photograph 2.4).

**Konkolville Mill Bridge: Station 150+00**

The bridge providing access to the Konkolville Mill spans Orofino Creek with the aid of two piers located in the active channel. Access to the flood plain is limited in this reach due to lateral and vertical entrenchment. The bed profile is nearly flat to a point approximately 50 feet upstream of the bridge where the gradient increases significantly (~2%).

According to the HEC-RAS model, the channel has ample capacity to convey flood flows through the bridge. Approximately two feet of freeboard was evident in the model for the 100-yr flow (7,600 cfs). The excessive width of the channel through the bridge may contribute to the aggradation and braiding observed in this reach. Potential treatments include reshaping the channel to provide some floodplain and installing a "W-weir" to control the channel grade and focus the flows between the piers thereby reducing the potential for scour.

Ideally, bridge piers should be located outside of the bankfull channel. Since modifications to the bridge structures are not part of the scope of this project, other alternatives were explored. To mitigate the possible effects of pier scour, hydraulic structures such as W-weirs are recommended. W-weirs are designed to split the flow around a pier thus creating an area of lower shear stress and reduced scour at the pier. Moreover, W-weirs provide grade control and habitat complexity.



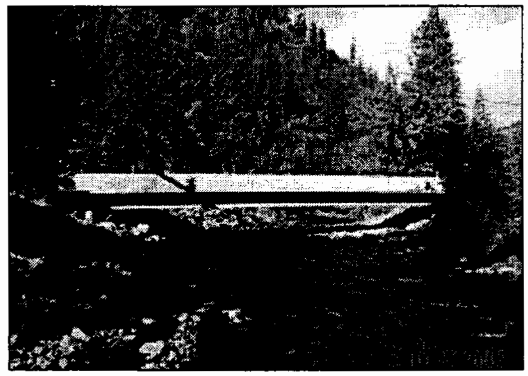
***Photograph 4.4:*** *(a) The Konkolville Mill Bridge – note the two in-channel piers. (b) An example of a W-weir that could be constructed to mitigate scour.*

**Orofino Creek Road Bridge (Noah's Bridge): Station 188+00**

The new reinforced concrete bridge near the turnoff to the Brandt Cedar Mill appears to be in good condition despite a variety of issues that plague the creek in its vicinity. Channel aggradation is evident upstream of the bridge in the longitudinal bed profile. Significant amounts of large cobble have been deposited in the vicinity of the bridge entrance.

The HEC-RAS model indicated no freeboard present during the 10-yr flow (3,850 cfs) and showed the bridge as being overtopped by the 100-yr flow.

Evidence of erosion downstream of the bridge was present in the form of extensive large-diameter riprap lining the left bank. The 10 – 15 degree skew angle of the bridge opening appears to focus flows directly into the downstream left bank. The three bank barbs constructed just upstream of the bridge on the left bank may exacerbate the problem by forcing the flow to the right bank where it rebounds and ricochets into the downstream left bank. The barbs have induced sediment deposition and begun to form a point bar. A second point bar has begun to form downstream of the bridge on the right bank. To correct the sediment transport problems at this bridge, channel shaping is recommended to restore the appropriate bankfull dimension.

***Photograph 4.5:*** *The Orofino Creek Road Bridge (Noah's Bridge) during (a) the January 2003flood (approximately a 5-year event) and (b) low flow. The over-wide channel has resulted in aggradation and the loss of bridge freeboard*

**Bruce's Dairy Bridge: Station 240+00**

The bridge near Bruce's Dairy is located near the upstream terminus of the project. Despite its age, the bridge appears to be in good condition and has limited impact on Orofino Creek. The bridge is located in a transitional zone. The channel upstream of the bridge is relatively steep and deeply incised with little or no access to floodplain. The bedload carried by the channel upstream of the bridge is composed primarily of large diameter cobble and small boulders. Beginning at the bridge, the gradient decreases and the creek eventually gains access to a limited amount of floodplain. Downstream of the bridge, the creek transports more medium to large diameter cobble. According to one local resident, the floodwaters were contained in the channel through the bridge, but managed to escape the banks approximately 300 feet downstream.

The HEC-RAS model for the bridge was calibrated using an approximate water surface elevation from the 1997 flood (3,850 cfs). The model indicated approximately two feet of freeboard during the 100-yr event flow of 6,500 cfs. The model did not indicate any backwater effect upstream of the bridge.

**Summary**

Table 4.11 presents a summary of the bridge modeling results and observations. Figure 4.1 illustrates a conceptual bridge cross-section for Orofino Creek below Whiskey Creek.

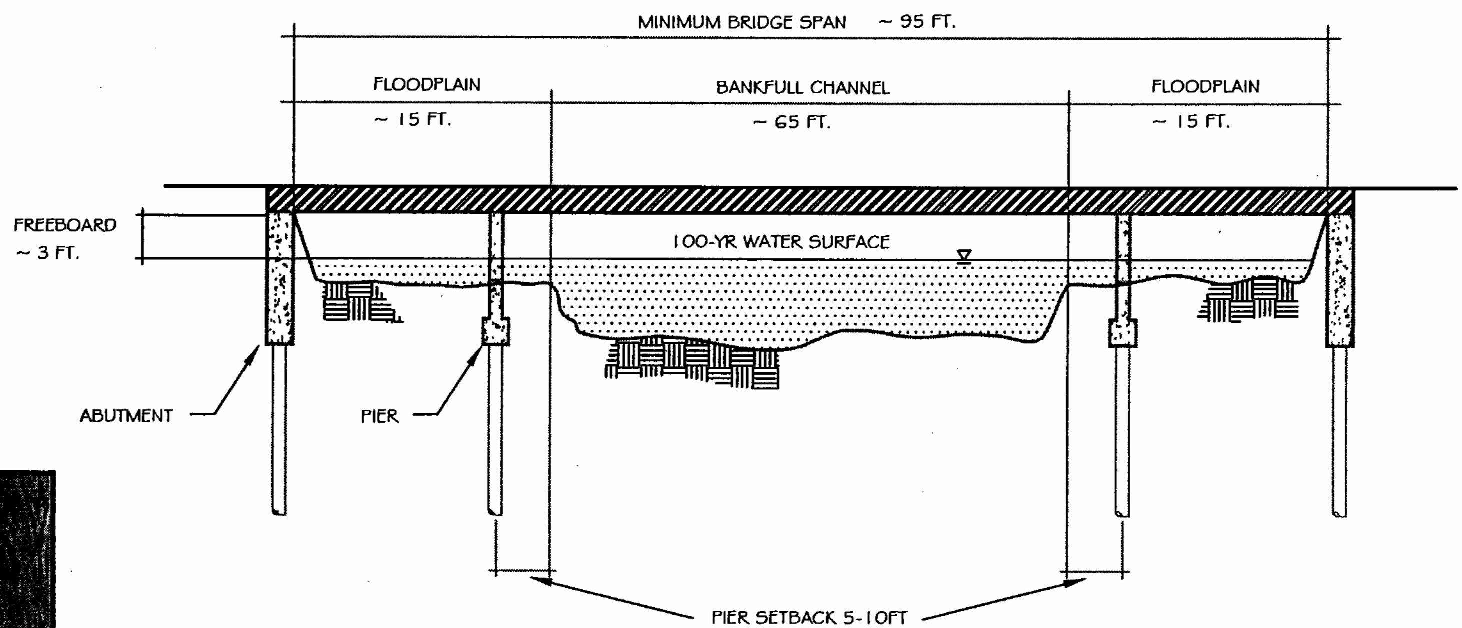
## Table 4.11
## Bridge Assessment Summary Table

| Bridge name | Skew Angle | Span (ft) | Deck Width (ft) | Freeboard (ft) | | | Piers in BF Channel | Abutments in BF Channel | Aggradation/ Degradation | Bridge Scour | Bank Erosion | Impact |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Q100 (cfs) | Q10 (cfs) | Qbf (cfs) | | | | | | |
| **Flows modeled above Whiskey Creek:** | | | | **6500** | **3850** | **1000** | | | | | | |
| Bruce's Dairy | 0° | 45 | 20 | 2 | 5 | 10 | No | Yes | No | No | No | Minor |
| Orofino Cr. Road | 10-15° | 84 | 32 | OT | PR | 4 | No | Yes | Yes | No | Yes | Major |
| **Flows modeled below Whiskey Creek :** | | | | **7600** | **4500** | **1500** | | | | | | |
| Konkolville Mill | 0° | 90 | 10 | 2 | 4 | 5 | Yes | No | Yes | No | Yes | Major |
| Private (railcar) | 0° | 50 | 20 | n/a | n/a | n/a | No | Yes | n/a | No | Yes | Minor |
| Forest St. | 0° | 58 | 20 | OT | 2 | 7 | No | Yes | Yes | Yes | Yes | Major |
| Private (railcar) | 0° | 50 | 10 | n/a | n/a | n/a | Yes | Yes | n/a | Yes | Yes | Minor |
| Private (railcar) | 0° | 50 | 20 | n/a | n/a | n/a | No | Yes | n/a | Yes | Yes | Minor |
| Johnson Ave. | 0° | 84 | 40 | OT | PR | 3 | No | No | Yes | No | No | Major |
| Main St. | 0° | 102 | 36 | OT | PR | 3 | No | No | Yes | No | No | Major |
| Railroad | 0° | 100 | 20 | PR | 2 | 10 | Yes | No | Yes | Yes | Yes | Minor |

OT = Overtopping PR = Pressure Flow BF = Bankfull

# OROFINO CREEK
# CONCEPTUAL BRIDGE CROSS–SECTION

NOT TO SCALE



# 5.0 RESTORATION PLAN

Natural Channel Design Philosophy (NCDP) aims to restore natural channel stability, dynamic equilibrium, and habitat to impaired streams (Brown, et al. 2001). Streams in dynamic equilibrium are generally more biologically productive, providing higher quality and more complex habitat than altered or unstable streams. NCDP is the foundation for developing a naturally stable channel design and meeting habitat restoration objectives. The Rosgen Stream Classification System (RSCS) and reach characterization techniques are core to this methodology and in its rudimentary form, categorize streams into one of eight primary stream types (Rosgen, 1996; Bain and Stevenson, 1999). However, the RSCS is only an initial step to a complex protocol for temporally evaluating geomorphic stability, sediment availability, sediment transport competency, and riparian condition. NCDP focuses on restoring geomorphic characteristics while incorporating fish habitat structures composed of native materials in natural arrays that replicate native salmonid habitat as necessary for restoring inland native fish populations.

Level III surveys were completed for areas of impairment within the lower Orofino Creek Watershed. The primary objectives of the Level III survey were to: 1) identify limiting factors and degree of impairment; and 2) to develop conceptual restoration design plans for future design and implementation. The methods incorporated in Level III surveys varied based on site characteristics and degree of impact(s).

## 5.1 Potential Stream Condition

The potential stream type used for restoration is the most probable stream type given the geomorphic valley setting and the limitations imposed by human-caused influences that are not subject to change. For example, the most probable historic stream type for a segment of river may be a C stream type, but because of encroachment by a highway fill, the potential stream type may be changed to a B stream type in a narrower valley. If more than one potential stream type is possible, usually the most stable and productive stream type is selected that will meet the objectives of the project.

For Orofino Creek and other nearby tributaries to the Clearwater River, the predominant stream types in this setting are B3c (Rosgen, 1996). Step-pool morphology and moderate width, sloping flood prone areas adjacent to the river characterize B3c stream types. A well-vegetated flood prone area allows for flood flows to spread out somewhat, dissipating energy over a wider surface. These stream types have a low gradient, low sinuosity and tend to be relatively stable. The existing F3 stream type has riffle-pool morphology and is completely incised into the valley, which means that these streams do not have an adjacent floodplain. During a flood event, all the flow is contained within a narrow corridor rather than spreading out onto a floodplain.

As Orofino Creek approaches the Clearwater River, the valley setting changes to a broad, flat, alluvial valley with a wide floodplain and adjacent terraces. Stream types in this setting tend to be C streams characterized by riffle-pool morphology and wide, flat, densely vegetated floodplains adjacent to the channels. These streams are highly sinuous, with bank stability related to dense rooting of shrubs and trees along the stream banks. These channels are highly prone to increased bank erosion and sediment supply when the vegetation is disturbed or the channel modified. Due to encroachment, the potential to restore lower Orofino Creek to a C stream type is extremely limited.

## 5.2 Restoration Alternatives

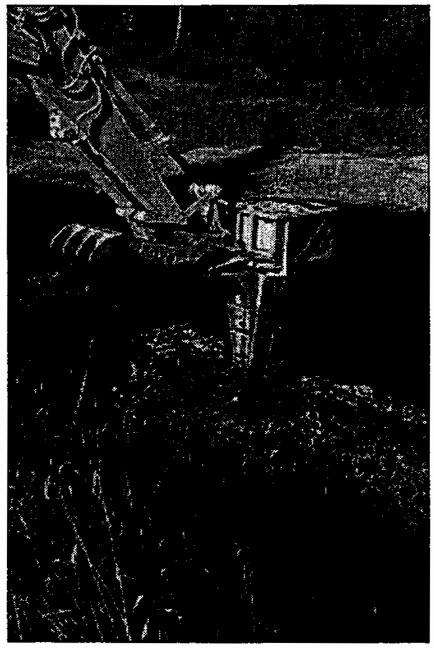
Six potential treatments that can be applied to the range of habitat, flood and channel stability issues associated with Orofino Creek have been identified. To varying degrees, these treatments can be applied to meet the master plan goals and objectives.

### 5.2.1 Revegetation

Revegetation treatments offer the most passive methods to establish long-term channel stability and habitat diversity. Stream banks composed of mature, native vegetation are among the most stable reaches of Orofino Creek. The primary advantage of riparian plantings is that installation can be accomplished with minimum impact to the stream channel, existing vegetation and private property. In addition to providing shade and cover for aquatic species, riparian plantings can develop root masses that penetrate deep into the soil and hold stream banks together. Other advantages include cost effectiveness and the range of applications offered by new revegetation technologies.

The new technology now makes it possible to plant sites that were previously considered to be "unplantable" by conventional methods. The innovative Stinger and Rotary Stinger technology of Northwest Revegetation and Ecological Restoration (NWRER) can successfully revegetate difficult sites such as riprap and cobble dominated banks and bars. The Stinger is capable of planting a full size range of containerized plants, cuttings and poles through riprap and cobble. The Stinger can plant cuttings and poles to a depth of up to approximately seven (7) feet. This deep planting assures the cutting remain in contact with moist soil even during the driest months which significantly increases their survivability. The Rotary Stinger is best suited for planting rooted plants in cobble and gravel. The rooted plants are propagated in containers having a volume of approximately one gallon. The unique shape of the containers produces a long root system that extends below the roots of most competing vegetation. In addition, the long root system allows the plant to access water and nutrients from deep within the soil. When the containerized plants are inoculated with a diversity of beneficial soil microbes the growth, vigor and sustainability of the plant is significantly improved.

The most significant disadvantage to vegetative treatments is that results are not immediate and time is required establish a mature forest that provides the benefits described previously. As such, revegetation is not an appropriate treatment for areas that are subjected to high shear stress, perched too high above the water table or vulnerable to grazing impacts. The most appropriate application for revegetation technology on Orofino Creek is stable banks that lack vegetation such as riprap banks and privately owned banks that have been cleared.



***Photograph 5.1*** *(a) The Stinger revegetation technology. (b) The Rotary Stinger revegetation technology.*

Costs for revegetation will vary depending on site conditions. It is estimated that the design and implementation of revegetation projects on Orofino Creek will cost between $5 and $20 per linear foot of bank treated. Sites that have easy access and loose soils are among the less expensive, while sites such as riprap banks, high scarps and those with limited access represent the higher end of the cost spectrum.

### 5.2.2 Channel Shaping

As discussed in Section 2.0, manipulation of Orofino Creek has resulted in changes to channel geometry that have significantly affected sediment transport competency. Channel shaping offers an opportunity to reshape portions of the Orofino Creek channel to appropriate bankfull dimensions without relocating the channel and without significant disturbance to the banks, existing vegetation or private property. In addition to modifying the cross-sectional area, the bed profile can be reshaped to include pool and riffle sequences that provide habitat diversity, channel complexity and sediment transport capability. The installation of grade control structures made of natural materials will be necessary to maintain the bed profile over the range of discharges delivered by the watershed.

The major function of grade control is to maintain channel shape, pattern, and gradient. To help maintain vertical stability and riffle/pool gradients, it is important to provide some form of grade control in the restoration design. As mentioned previously, natural rivers are able to maintain this grade control through scour along a stable streambank and deposition of larger material at the end of the meander at the pool tailout. In reconstructed channels, however, excavation of the channel bed disturbs the pavement and sub-pavement materials that form the natural grade control. Therefore, until geomorphic processes re-establish the bed armor of the new channel, interim grade control is necessary to maintain the vertical stability of the designed pool, riffle, and run facet slopes until the channel is able to maintain itself.

Considering the potential B3c stream type of Orofino Creek, rock cross-vanes are proposed for grade control. A typical rock cross-vane is presented in Photograph 5.2 and Appendix D. Cross-vanes direct shear stress away from the stream banks and concentrate it toward the center of the channel thus creating optimal fish habitat in the scour pool below the structure. Cross-vanes include a rock sill at the floodplain elevation that extends laterally across the floodplain perpendicular to the flow to prevent downcutting until adequate vegetation is established. Cross-vanes are specifically designed and constructed to pass bedload and prevent bed aggradation. These structures have no significant effect on base flood elevations or velocities, but provide stabilization of the channel profile at key locations, primarily at the downstream terminus of meanders (at the pool tailout) and also in extended riffle sections.

***Photograph 5.2***

*Example of a rock cross vane grade control structure. Refer to Appendix D for structure details.*

Other examples of grade control structures include W weirs, which are similar to cross vanes in function, but different in shape. W weirs are particularly effective upstream of bridges, and can provide protection for bridge piers and abutments.

With the installation of grade control structures, channel shaping can provide both habitat and channel stability benefits. The construction of deep pools can provide refuge and cooler temperatures that benefit native fish species. Resizing the channel to bankfull dimensions will provide more efficient sediment transport capabilities, thus decreasing the possibility of excess deposition or erosion.

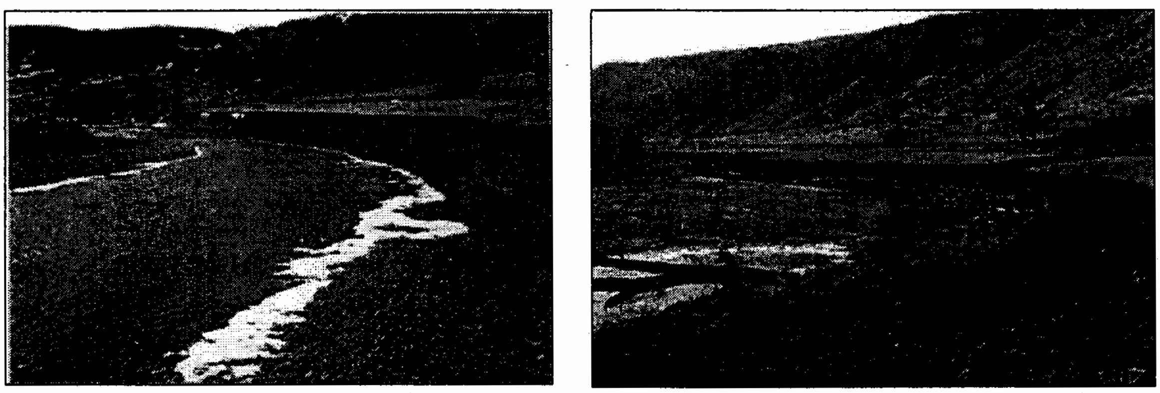
Channel shaping is most effective when the project is tied into stable upstream and downstream reaches. Channel shaping is best suited to reaches where the stream banks are stable, the channel is incised, and encroachment limits the potential to increase sinuosity. Moreover, channel shaping is most appropriate for those reaches where the potential stream type is B. Typically, B channels are characterized by moderately incised floodplains. Reaches one and two are good candidates for channel shaping. For those sections of Orofino Creek where a C3 channel type is the potential condition, channel shaping within an incised channel may not be desirable.

Costs for channel shaping will vary depending on site conditions. It is estimated that the design and implementation of channel shaping projects on Orofino Creek will cost between $120 and $160 per linear foot of bank treated. Sites that have easy access, less earthwork, and less grade control structures are among the least expensive, while sites that have difficult access, more earthwork, and more grade control structures are more expensive. Also, projects of greater length may be constructed for less per foot.

### 5.2.3 Bank Stabilization

As discussed in Sections 2.0 and 4.0, bank instability along Orofino Creek is one of the major in-stream sediment sources and causes of property damage in the lower watershed. To treat this problem, rock riprap bank stabilization has been constructed along much the creek's banks. In many places, riprap has arrested localized bank erosion, but provided limited ability for the creek to reestablish its bankfull dimensions and support riparian vegetation and habitat.

Bank stabilization using natural channel design techniques can provide both bank stability and habitat potential. One such structure that accomplishes these objectives is the combination of vanes and woody debris composites. The purpose of the vane is to provide grade control and flow redirection, while the woody debris composites provide bank stability, create fish habitat and allow vegetation to become established. A typical installation is illustrated in photograph 5.3 and Appendix D.



***Photograph 5.3:*** *An example of bank stabilization using woody debris composites and sod transplants (a) before and (b) after construction. Refer to Appendix D for structure details.*

Woody debris composites and vanes benefit the stream and fishery by improving bank stability, reducing bank erosion rates, adding protection to fill slopes and/or embankments, reducing near-bank shear stress, and enhancing aquatic habitat and lateral channel margin complexity.

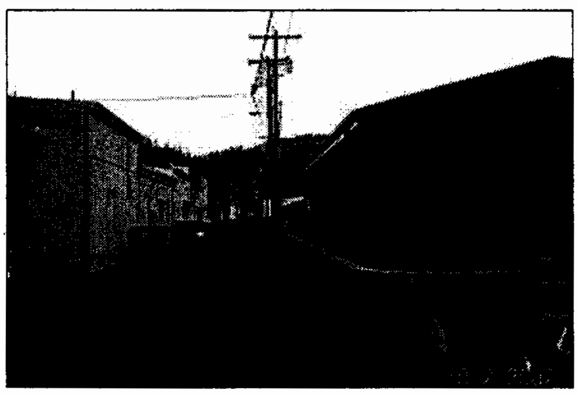
Other bank stabilization techniques such as riprap, gabions and concrete retaining walls were considered, but eliminated from further consideration because they do not accommodate natural stream structure and function, tend to be more expensive, and do not meet the habitat objectives of this project. In areas of high concern or increased shear stress against the stream banks, such as near bridge crossings or other constrictions, rock riprap could be used along with woody debris composites to provide protection for infrastructure. In these areas, aesthetics and habitat will be sacrificed for increased durability during flood events.

Costs for bank stabilization will vary depending on site conditions. It is estimated that the design and implementation of bank stabilization projects on Orofino Creek will cost between $100 and $140 per linear foot of bank treated. Sites that have easy access and limited earthwork are among the least expensive, while sites that contain high scarps, extensive earthwork and limited access are more expensive.

### 5.2.4 Flood Proofing

Due to floodplain encroachment, the flood elevations of the Clearwater River and its backwater effect on Orofino Creek, natural channel design techniques cannot prevent the inundation of the Orofino Business District from large magnitude flood events. Various degrees of flood proofing may provide the best protection for this area. Flood proofing can be applied on a site-specific or a city-wide approach.

Site specific measures could be applied to new construction or existing structures. Since 100-year flood elevations in the City are known, new construction can be placed above this elevation. Typically, flood proofing requirements can be administered and enforced through the City Planning, Building or Zoning Department. Photograph 5.4 illustrates an example of new construction with flood proofing within the Orofino Business District.



***Photograph 5.4***
*Example of flood proofing in the Orofino Business District.*

*Note the elevation of the new structure on the right in comparison to the older structures on the left.*

The most appropriate application of this recommendation may be through public education and workshops sponsored by the City. At a minimum, flood proofing alternatives should be shared with owners of high risk property and new building permit applicants. One way to accomplish this may be through the distribution of information pamphlets at the time of building permits.

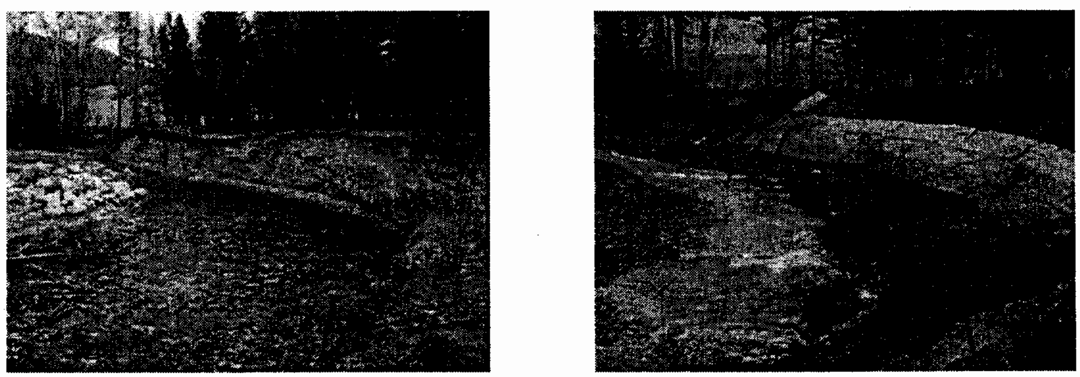
At a great expense, an added measure of flood protection for infrequent, large magnitude flooding events could be provided on a large scale through the construction of setback levees along the Clearwater River and the extent of the backwater effect on Orofino Creek. Implementation of this alternative would likely cost millions of dollars. Further examination of this alternative was discontinued since it is cost prohibitive and beyond the scope of this study. However, since it provides a measure of flood protection for the City of Orofino, it was deemed appropriate for discussion in this section.

### 5.2.5 Stream Channel Reconstruction

Channel reconstruction involves the realignment of the channel bed along with channel shaping, bank stabilization and revegetation. Channel reconstruction is the best means to restore the river to its historic condition. With channel reconstruction, it is possible to restore the historic meander pattern of a river and adjust the bed elevation so that floodplain connection is regained. Other advantages include improved sediment transport competency, complex and diverse aquatic habitat creation, flood relief and long-term bank stability. Disadvantages to channel reconstruction include extensive disturbance, possible impacts to private property, more extensive permit reviews, and higher design and construction costs than other alternatives.

Channel reconstruction is most appropriate for unstable, braided reaches, such as Reach 3 and parts of Reaches 2, 5 and 6. Although the costs are higher, the results achieved provide long-term habitat and flood control benefits.

Costs for channel reconstruction will vary depending on site conditions. It is estimated that the design and implementation of channel reconstruction projects on Orofino Creek will cost between $150 and $200 per linear foot of river. Earthwork and frequency of structures are the major factors that influence cost. Projects of greater length may be constructed for less per foot.



***Photograph 5.5:*** *An example of channel reconstruction using natural channel design techniques (a) before and (b) after construction*

### 5.2.6 Diversions

Opportunities exist to improve existing agricultural, industrial and residential water diversions on Orofino Creek. At several locations along the creek, inefficient diversions were observed. Many of these locations appear to require routine channel manipulation, and caused detrimental effects to the adjacent stream channel and banks.

In an effort to reduce channel manipulation and diversion maintenance, it is recommended that several sites be considered for the installation of a cross vane diversion structure. As discussed previously, these structures provide grade control, bank stability and sediment transport in addition to offering a stable point for an in-stream diversion. Two possible locations for diversions are the Brandt Mill and Konkolville Mill sites. It is estimated that the design and implementation of diversion projects on Orofino Creek will cost between $25,000 and $30,000 each depending on site conditions.

***Photograph 5.6***

*Example of a cross-vane used as a diversion structure.*

## 5.3 Recommended Projects

During October 2002, WCI staff members walked the lower 4.5 miles of Orofino Creek and noted areas of significant impairment. Overall, 26 areas of impairment were documented. For each impairment noted, a potential restoration alternative is proposed. Table 5.1 presents a summary of impaired stream locations on Orofino Creek and potential restoration treatments. Refer to Appendix B for the plan view alignment and station location.

**Table 5.1: Summary of Impaired Stream Locations on Orofino Creek and Potential Restoration Treatments**

| Reach | Station | Impairment | Level of Impairment | Bank | Treatment |
|---|---|---|---|---|---|
| 1 | 1+00 to 5+00 | 1 | 3 | Left | E |
| 1 | 5+00 to 8+00 | 8 | 2 | | B,G |
| 1 | 27+00 to 35+00 | 2 | 1 | Right | A |
| 1 | 35+00 to 36+00 | 1 | 1 | Right | C |
| 1 | 40+00 to 42+00 | 2,3 | 2 | Left | C,F |
| 2 | 56+00 to 59+00 | 4 | 2 | Right | A |
| 2 | 62+00 to 69+00 | 2,3,8 | 3 | Left | C,G |
| 2 | 69+00 to 74+00 | 2,5 | 1 | Right | A,B |
| 2 | 85+00 to 90+00 | 2,3 | 2 | Left | C |
| 2 | 90+00 to 100+00 | 5 | 2 | | E |
| 2 | 100+00 to 105+00 | 2 | 1 | Left | A |
| 3 | 105+00 to 138+00 | 5 | 3 | | E,G |
| 3 | 138+00 to 140+00 | 1 | 2 | Left | C |
| 4 | 140+00 to 142+00 | 1 | 2 | Left | C |
| 4 | 145+00 to 160+00 | 2 | 1 | Both | A |
| 4 | 150+00 to 152+00 | 1,6,8 | 3 | Left | D,G |
| 4 | 164+00 to 167+00 | 1,6 | 3 | Left | B,C,D |
| 5 | 175+00 to 180+00 | 7 | 1 | | A,B |
| 5 | 180+00 to 185+00 | 1,2 | 1 | Left | A,B |
| 5 | 187+00 to 190+00 | 8 | 2 | | B |
| 5 | 191+00 to 196+00 | 4 | 2 | Left | A,F |
| 6 | 198+00 to 216+00 | 5 | 2 | | E |
| 6 | 215+00 to 218+00 | 2 | 1 | Left | A |
| 6 | 219+00 to 221+00 | 4 | 1 | Left | A,F |
| 6 | 230+00 to 233+00 | 2 | 1 | Left | A |
| 6 | 237+00 to 239+00 | 1 | 2 | Right | C |
| | Impairment | Level of | Impairment | Potential | Treatment |
| 1 | Eroding Bank | 1 | Low | A | Revegetation |
| 2 | Riprap Bank | 2 | Medium | B | Channel Shaping |
| 3 | Dumped Riprap | 3 | High | C | Bank Stabilization |
| 4 | Encroachment | | | D | Diversion |
| 5 | Braiding | | | E | Reconstruction |
| 6 | Diversion problem | | | F | Flood Proofing |
| 7 | Over wide Channel | | | G | Bridge Replacement |
| 8 | Bridge at Risk | | | | |

The 26 potential projects were evaluated and ranked by the Committee according to the project's ability to meet the project goals and objectives. Primary selection criteria included:

- Whether the project location is a historical problem area;
- Ability to protect infrastructure or private property;
- Ability to provide flood relief;
- Existing level of impairment; and
- Potential to reduce sedimentation and erosion.

Each of the potential projects was given a poor, fair, good or excellent rating for each of the selection criteria. Numerical values were assigned for each of the ratings and an overall ranking of potential projects was developed. Table 5.2 presents a summary of the seven (7) top ranking projects for which conceptual designs were developed.

Table 5.2
Lower Orofino Creek Project Ranking

| Rank | Project Description | Reach | Station |
|---|---|---|---|
| 1 | Channel reconstruction at the confluence | 1 | 0+00 to 5+00 |
| 2 | Newman's Corner - Reach 3 reconstruction | 3 | 105+00 to 142+00 |
| 3 | Upstream of the Forest Street Bridge | 2 | 62+00 to 69+00 |
| 4 | Brandt Mill bank stabilization | 4 | 164+00 to 167+00 |
| 5 | Channel shaping at Noah's Bridge | 5 | 187+00 to 190+00 |
| 6 | Pump diversion and Bridge at Konkolville Mill | 4 | 150+00 to 152+00 |
| 7 | Reach 6 channel reconstruction | 6 | 198+00 to 216+00 |

## 5.4 Conceptual Designs

Conceptual designs and costs were developed for the seven projects listed in Table 5.2. Descriptions, illustrations and cost estimates are provided for each project. Refer to Appendix C for additional cost information. Refer to Appendix D for structure details.

### 5.4.1 Channel Reconstruction at the Confluence

The project at the confluence offers a long-term solution to prevent additional bank erosion and excessive alluvial deposition at the mouth of Orofino Creek. The proposed project involves the construction of a single-thread, bankfull channel and floodplain that are capable of transporting alluvial sediments over the variety of flow conditions presented at the confluence, while maintaining the channel form and eliminating the need for routine maintenance. To accomplish this, a new channel must be excavated from the railroad bridge to the Clearwater River (500 feet). The new channel will pass through the center of the delta and curve downstream to join the Clearwater River. The remainder of the delta must be backfilled to a bankfull elevation. The channel will be designed and constructed to best maintain sediment transport capability through the delta and into the

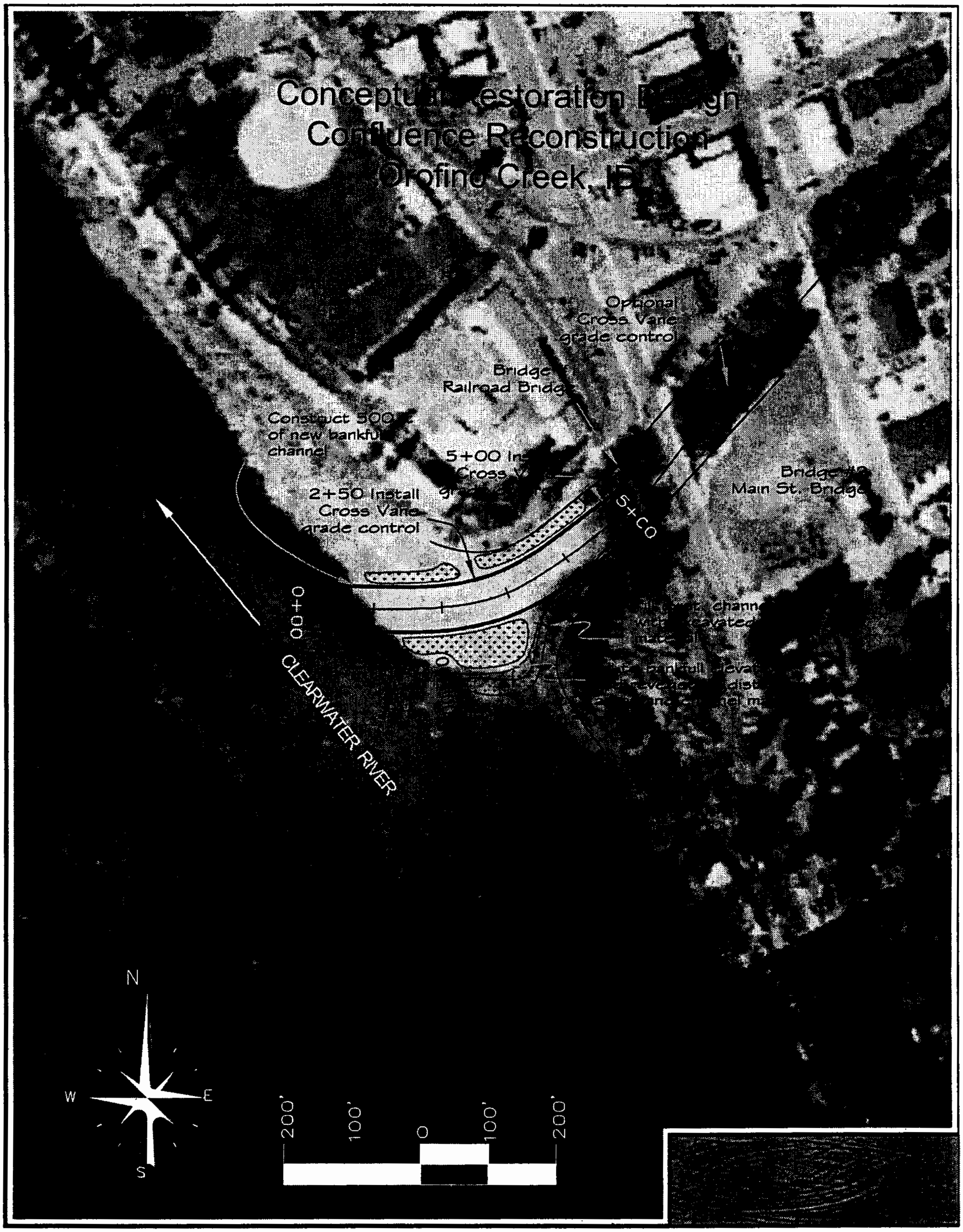
Clearwater River. Grade control structures are proposed to maintain the channel bed profile, establish the channel thalweg and dissipate energy. It is anticipated that the project can be accomplished without significantly raising flood elevations on either river. A conceptual plan is presented in Figure 5.1. The estimated cost for this project is $81,263.

This project ranked the highest because it will reduce bank erosion and property loss at the confluence. In addition, the single thread B-stream type will generate the shear stress and velocity necessary to prevent the accumulation of alluvial sediments in the bankfull channel. From a fishery perspective, it is anticipated that the constructed pools in the new channel will provide refuge to fish in the Clearwater River during higher flows. Moreover, the new channel will facilitate fish passage in Orofino Creek and increase available habitat. If a more stable delta is created, the opportunity for riparian vegetation to colonize on the floodplain will increase. Habitat improvements are likely to benefit threatened and endangered species such as steelhead trout and bull trout that inhabit the Clearwater River and Orofino Creek. Other non-threatened salmonid species will benefit as well.

A delta is a naturally unstable river feature is formed and changed by floods and the deposition of alluvial sediments. If the constructed channel becomes filled with sediment, the possibility exists for the channel to migrate within the delta. During spring runoff or flood events, the delta may be inundated by the Clearwater River. Fortunately, the runoff regimes of the Clearwater River and Orofino Creek are desynchronized. Typically, Orofino Creek reaches peak stage during rain-on-snow events in the winter or snowmelt runoff in April. The Clearwater River usually reaches peak stage as the result of snowmelt runoff in late May or early June. It is likely that both rivers will be transporting bed load during their respective events. In the rare circumstance that both rivers peak simultaneously, the backwater effect created by the Clearwater River will cause Orofino Creek to deposit bed load before it reaches the Clearwater River. Under this rare circumstance, it may be necessary to re-excavate the Orofino Creek channel. Although the Clearwater River may deposit fine sediment in the Orofino Creek channel during a normal year, Orofino Creek will be capable of moving those sediments as the Clearwater River recedes. If left untreated, additional bank erosion, property loss and potential damage to infrastructure is possible.

### 5.4.2 Newman's Corner - Reach 3 Reconstruction and Restoration

This project offers the opportunity to restore and stabilize approximately 3400 feet of Orofino Creek and address the alignment of the Creek at Newman's Corner. This project ranked very high because of the historical problems associated with Newman's Corner and the degree of channel impairment upstream. The project will involve converting the existing D3 stream type into a more stable B3c stream type. The B3c stream will be significantly narrower and deeper than the D3 stream type, and provide more efficient sediment transport. The excess channel width will be converted into floodplain at a bankfull elevation and tied into the existing higher banks.


Confluence Reconstruction
Optional
Cross Vane
grade control
Bridge
Construct 500
of new bankfull
channel
5+00 Install
2+50 Install
Cross Vane
5+00
0+00
CLEARWATER RIVER
N
W
E
S
200'
100'
0
100'
200'

The major challenge associated with this project is the reconstruction of the 90-degree bend at Newman's corner. To provide the appropriate radius of curvature will require the excavation of the large outcropping on the south bank. To accomplish this, the existing railcar bridge and private access road will have to be replaced and/or reconstructed. In addition, several large eroding banks are present in this reach. Stabilization and revegetation of these banks is also recommended as part of this project.

If a more stable stream is created, the opportunity for riparian vegetation to colonize on the floodplain will increase. In-stream and floodplain habitat improvements are likely to benefit native salmonid fish species. By reducing bank erosion and channel instability, impacts to downstream reaches and property owners within the reach will be decreased. Refer to Section 5.2.5 for more information about stream reconstruction techniques and the associated benefits. A conceptual restoration plan for Reach 3 is presented in Figure 5.2. The estimated cost for this project is $742,218, including $250,000 for bridge replacement and road construction.

### 5.4.3 Forest Street Bridge Replacement and Bank Stabilization

Observed impairments in the vicinity of the Forest Street Bridge include a lack of floodplain area, bridge abutment scour and bank erosion. Although it would be preferable to increase the available floodplain area and increase the bridge span, several restraints preclude exploration of these alternatives. Project constraints include residential encroachment on both banks, a sewer line along the left bank, a concrete retaining wall on the right bank, channel incision, and steep, eroding banks that have been treated with dumped riprap and concrete. In addition, the existing 56-foot span is significantly less than the desired span for any bridge on Orofino Creek, and has resulted in significant contraction scour at the left abutment. If left untreated, the creek could eventually undermine the bridge abutment again leading to failure of the bridge.

A conceptual project design is illustrated in Figure 5.3a. The recommendations include upstream bank stabilization, channel shaping and bridge replacement. Three structures are proposed in the immediate vicinity of the new bridge. Two cross-vanes would be constructed, one just upstream of the bridge (Sta. 66+00) and another downstream (Sta. 63+50) to control the elevation of the channel bed and to maintain the cross-sectional shape of the channel. They would be constructed of large diameter rocks and tied into the bank with a cutoff trench at bankfull elevation. A J-hook vane would be constructed at the apex of the meander about two hundred feet upstream of the bridge (Sta. 68+00) to draw the thalweg away from the eroding left bank and direct the flow toward the center of the bridge section. In addition to providing grade control, these structures would promote formation of a riffle-pool bed structure and provide additional low-velocity pool habitat. Although limited floodplain area is available, the channel could be shaped to the proper bankfull dimensions. It would taper to match the existing channel dimensions at the upstream and downstream ends of the project. The additional width would accommodate the construction of a modest amount of floodplain along the channel margins. The vertical left bank upstream of the bridge would be graded at a 2:1 slope and revegetated for stability.

# Conceptual Restoration Design
## Reach 3 - Orofino Creek

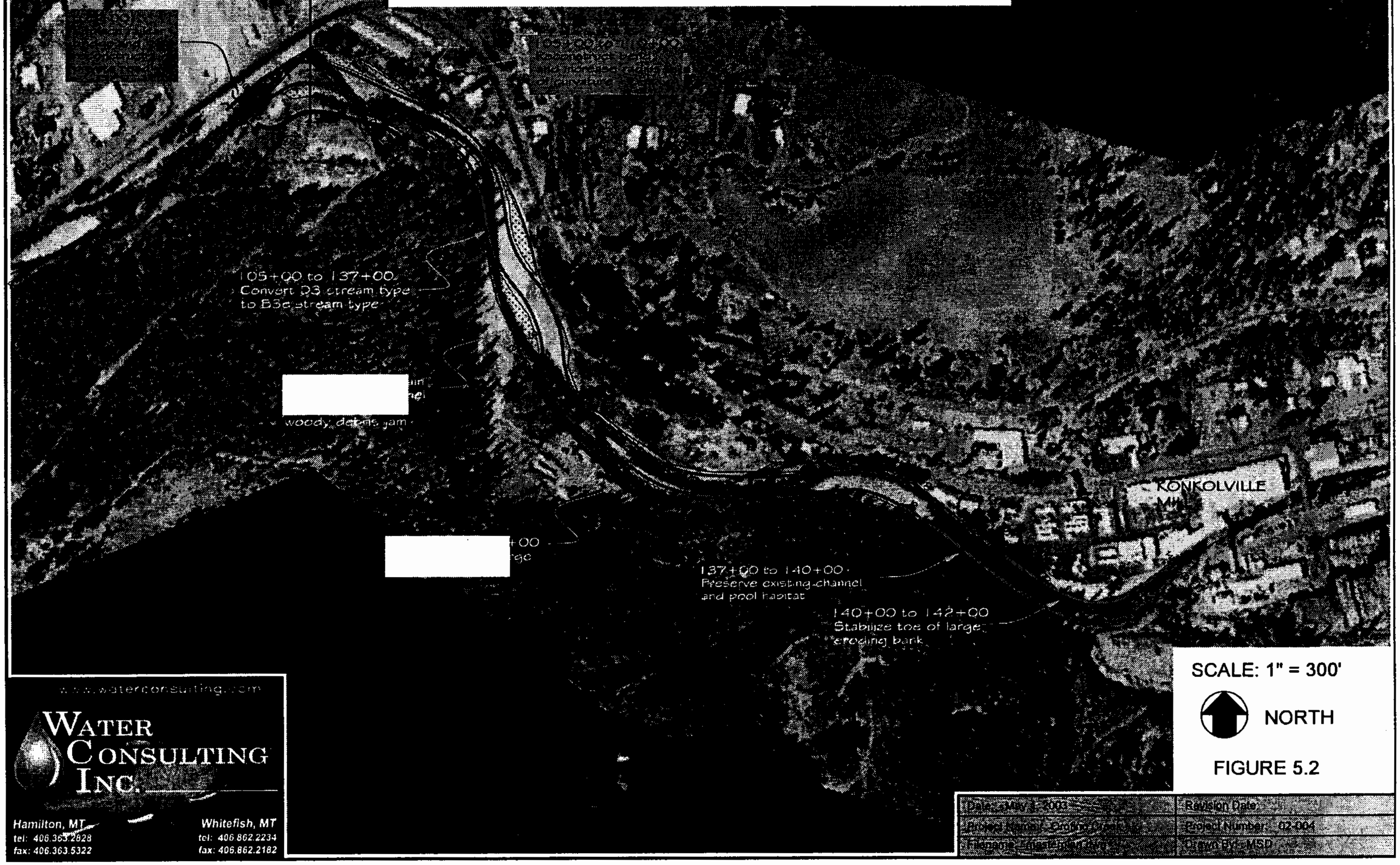
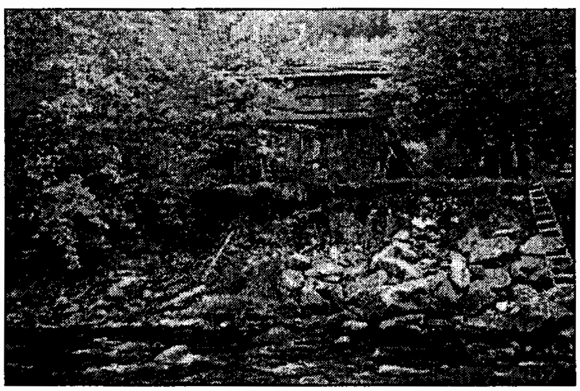



FIGURE 5.2


Conceptual Restoration Design
Forest Street Bridge
Orofino Creek, ID
Install Cross-Vane
Sta. 66+00
Existing Span = 58'
Existing Width = 20'
EXISTING BERM
Forest St.
100'
50
0
50'
100'
N
S
W
E

It is recommended that the existing 56' bridge span be replaced with a 70' span as illustrated in Figure 5.3b. This would increase the conveyance through the bridge enough to allow most floodwaters to pass without creating a significant backwater effect. By eliminating the backwater upstream of the bridge, there would be less potential for deposition of sediment. The channel aggradation and ensuing lateral erosion associated with backwater deposition would thus be eliminated. Replacing the bridge would also allow the concrete riprap to be replaced or reused around the bridge abutments. The estimated cost for the recommended improvements is $344,265. Of this amount, $250,000 is allocated for bridge replacement.

Shaping the channel to bankfull dimensions would promote the overall goals of the project by decreasing erosion in the reach. In addition, the base flow water depth in the channel would increase and provide a more hospitable environment for salmonid and other fish species residing and spawning in Orofino Creek. The constructed floodplain could be covered with transplanted riparian shrub/soil complex if available. Otherwise, it could be seeded, planted with riparian species and covered with a biodegradable erosion control fabric. Riparian plants develop dense root masses which bind the soil and, once established, provide shade and holding cover for fish.



***Photograph 5.7***

*The eroding left bank upstream of the Forest Street Bridge.*

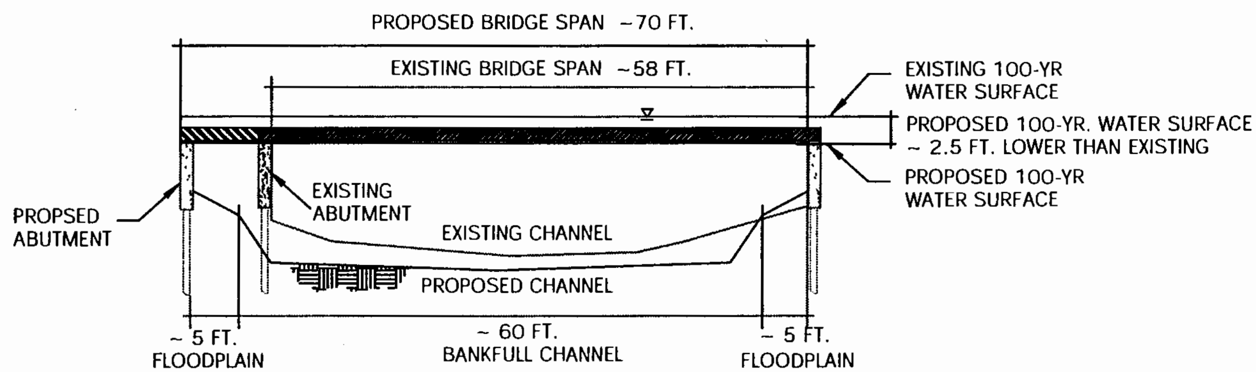
### 5.4.4 Brandt Cedar Mill Bank Stabilization

This project involves the stabilization of approximately 300 feet of eroding bank adjacent to the Brandt Cedar Mill. Prior efforts between the landowner, CEDA and the Idaho DEQ have produced a fully permitted design that is awaiting funding. The proposed design is consistent with the goals and objectives of this document. According to the description submitted in the grant application, the project will use a combination of large root wads, cedar logs, rock and vegetative plantings to reduce bank erosion and promote the development of fish habitat. Project benefits include sediment/erosion reduction and habitat creation for fish.

For this document, a conceptual design has been prepared and is presented in Figure 5.4. In addition to the treatments described above, flood relief measures and a cross vane diversion intake structure are proposed. To reduce flood elevations and bank shear stress, it is recommended that 10 to 20 feet of the opposite bank be lowered to a floodplain elevation and revegetated. Preliminary discussions with the landowner indicated that

# OROFINO CREEK
# FOREST ST. BRIDGE (#5)
# CROSS-SECTION

## NOT TO SCALE




Conceptual Restoration Design
Brandt Mill Reach
Orofino Creek, ID
100'
50'
0
50'
100'
N
W
E
S
EXISTING RIPRAP W/ COBBLE TOE
STABLE & WELL VEGETATED
EXISTING POINT BAR
Michigan Ave.
Construct Bankfull Bench by
Lowering 10' of Right Bank
to Bankfull Elevation
EXISTING TERRACE CONSTRUCTED
HIGHER THAN ROAD ELEVATION
Construct Bankfull Bench by Lowering
10' - 20' of Right Bank
to Bankfull Elevation
166+50
EXISTING PUMP HOUSE
Proposed Bank Stabilization Project
CONSTRUCT J-HOOK VANE
STA. 165+00

this option could be negotiated. During a field review of the site, evidence of routine maintenance and channel manipulation was observed in the vicinity of the pump intake. A cross vane grade control structure is proposed upstream of the bridge to provide a more stable pump intake location and reduce the need for in-stream maintenance. The estimated cost for this project is $57,929. As demonstrated by the cooperation between the parties involved, in-kind contributions of labor, equipment and materials can greatly reduce project costs.

### 5.4.5 Channel Shaping at Noah's Bridge (Orofino Creek Road)

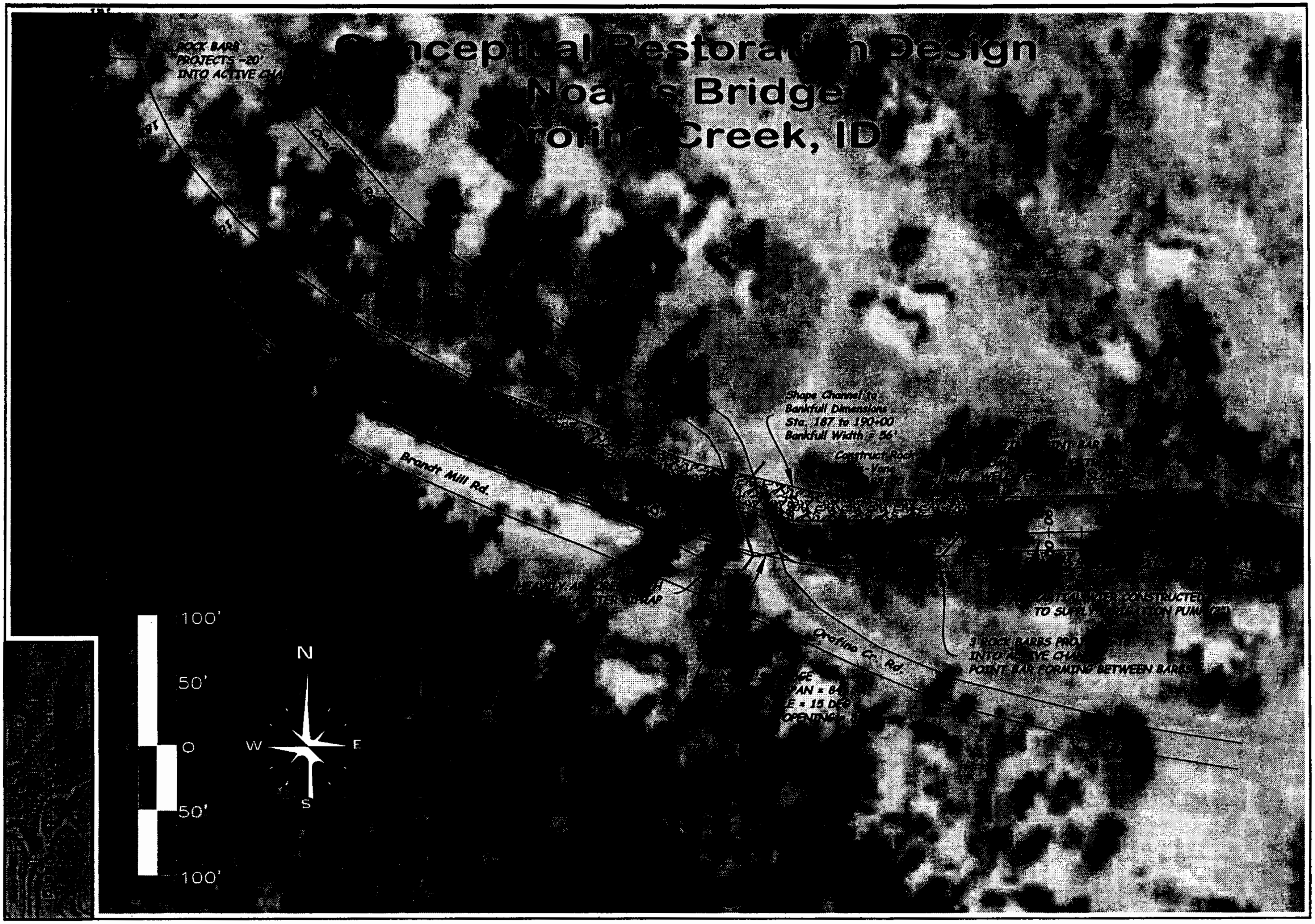
Noah's Bridge adequately spans the bankfull channel and floodplain, but is not functioning at its potential due to the vertical bed instability of Orofino Creek in the vicinity of the bridge. Channel aggradation is evident in the longitudinal bed profile upstream of the bridge. Significant amounts of large cobble have been deposited in the vicinity of the bridge entrance and decreased conveyance. Hydraulic modeling results indicated that no freeboard is available during the 10-yr discharge (3,850 cfs) and showed the bridge as being overtopped by the 100-yr discharge.

To correct the sediment transport problems at this bridge, channel shaping is recommended to restore the appropriate bankfull channel dimensions and bed slope. Restoring an average bed slope in the vicinity of the bridge could lower the bed elevation as much as two feet at the bridge. It is feasible to accomplish this without compromising the structural integrity of the abutments. By decreasing the bankfull channel width to 56 feet, lowering of the bed can be accomplished without impacting the existing stream banks. Additional area within the existing channel would be converted to floodplain. Additional hydraulic modeling results indicate that lowering the bed elevation by two feet could increase the bridge conveyance by 20% to 4,150 cfs.

A cross vane grade control structure is proposed upstream of the bridge. This structure will stabilize the bed and center the thalweg under the bridge. In addition, a deep pool will be constructed downstream of the cross vane and upstream of the bridge. The pool will provide energy dissipation and fish habitat. The pool feature will tail-out into a riffle feature at the bridge. Figures 5.5a and 5.5b illustrate conceptual designs for Noah's Bridge. The estimated cost for this project is $47,032.

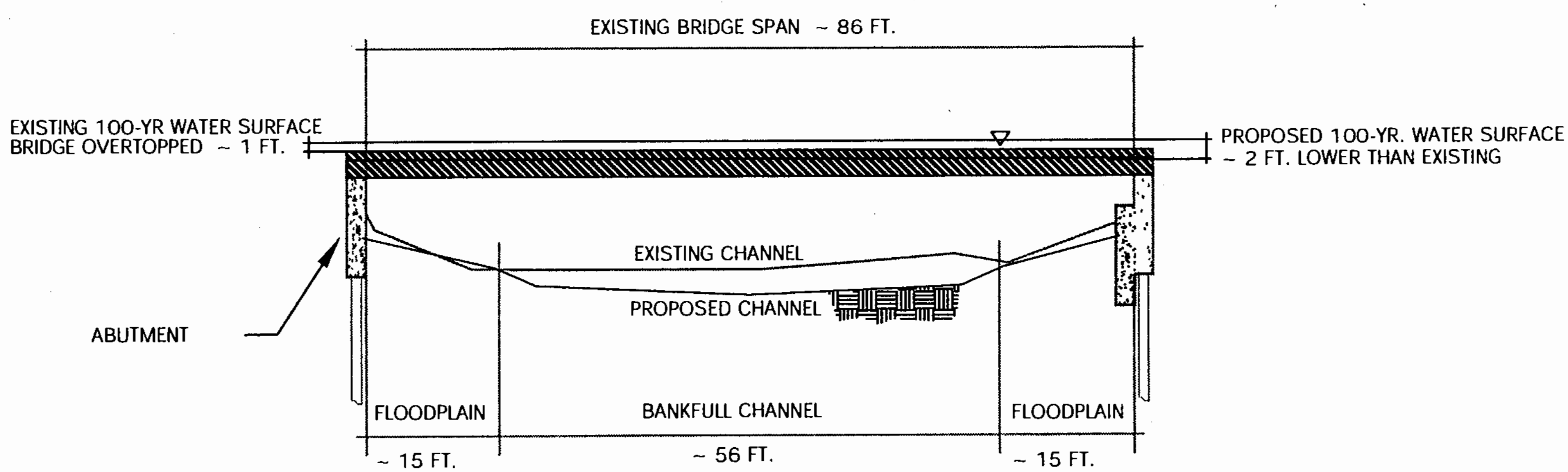
### 5.4.6 Industrial Water Diversion at the Konkolville Lumber Mill

Upstream of the Konkolville Lumber Mill Bridge is a pumping station for an industrial water intake used by the Mill. During a field review of the site, evidence of routine maintenance and channel manipulation was observed in the vicinity of the pump intake. These observations were discussed and confirmed with the owner of the Mill. Bank erosion and impaired riparian habitat were also observed at the site and throughout Reach 4. The Konkolville Bridge is an older structure with two piers in the active channel. Channel aggradation is evident in the longitudinal bed profile upstream of the bridge. Significant amounts of large cobble have been deposited in the vicinity of the bridge entrance and decreased conveyance. However, according to hydraulic modeling results,


Conceptual Restoration Design
Noah's Bridge
Orofino Creek, ID
ROCK BARB
PROJECTS ~20'
INTO ACTIVE CH
Shape Channel to
Bankfull Dimensions
Sta. 187 to 190+00
Bankfull Width = 56'
Construct Rock
Vane
Branch Mill Rd.
Orofino Cr. Rd.
TO SUPPLY
3 ROCK BARBS PRO
POINT BAR FORMING BETWEEN BARS
100'
50'
0
50'
100'
N
E
S
W

# OROFINO CREEK
# NOAH'S BRIDGE (#2)
# EXISTING CROSS-SECTION

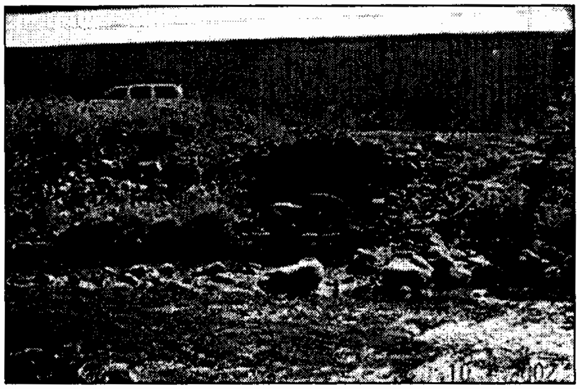
## NOT TO SCALE




FIGURE

OROFINO CREEK
NOAH'S BRIDGE
EXISTING CROSS SECTION

the channel has ample capacity to convey flood flows through the bridge. Approximately two feet of freeboard was evident in the hydraulic model for the 100-yr discharge (7,600 cfs).



***Photograph 5.8***

*The existing diversion at the Konkolville Lumber Mill.*

A cross vane grade control structure is proposed upstream of the bridge to provide a more stable pump intake location and reduce the need for in-stream maintenance. In addition, this structure will stabilize the bed and center the thalweg under the bridge. A deep pool will be constructed downstream of the cross vane and upstream of the bridge. The pool will provide energy dissipation and fish habitat. The pool feature will tail-out into a riffle feature at the bridge.

The in-stream piers represent a significant obstruction for passing debris and ice. In addition, the piers could induce bed scour during higher discharge events. A W weir could be employed to reduce scour potential at the piers. However, this alternative may be cost prohibitive when compared to the cost of retrofitting the bridge and removing the piers from the channel. As such, a solution that addresses the bridge and removal of its piers from the channel is sought in conjunction with the diversion structure. Figures 5.6a and 5.6b illustrate conceptual designs for this project. The estimated cost for this project is $40,575, not including bridge replacement.

### 5.4.7 Reach 6 Reconstruction and Restoration

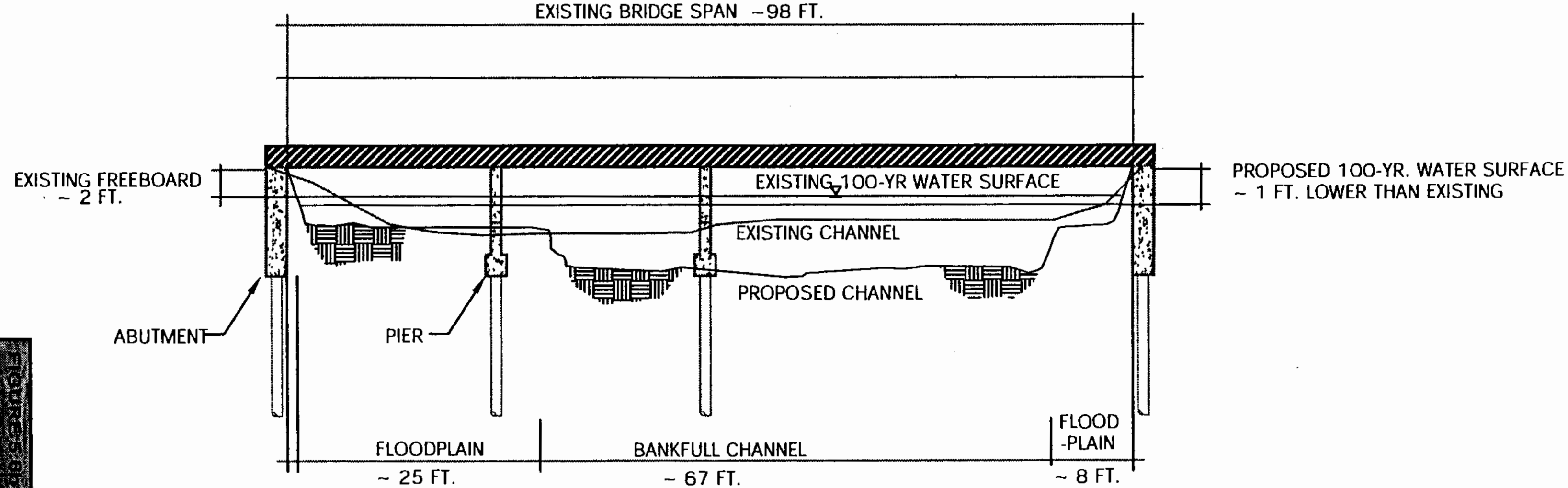
This project offers the opportunity to restore and stabilize approximately 1,800 feet of Orofino Creek. The project will involve converting the existing D3 stream type into a B3c stream type. The B3c stream will be significantly narrower and deeper than the D3 stream type, and provide more efficient sediment transport. The excess channel width will be converted into floodplain at a bankfull elevation and tied into the existing higher banks.

Two cutoff channels exist in the project area. To prevent Orofino Creek from recapturing these channels, constructed debris jams are proposed to stabilize the channel inlets. Debris jams provide bank stabilization and woody debris habitat but do not prevent the cutoff channels from providing flood relief during over bank flows. The riprap bank at the upper end of the project area could be revegetated using the expandable stinger technology discussed in Section 5.2.1.


100'
50'
0
50'
100'
N
W
E
S
EXISTING CHANNEL TYPE
EXISTING WIDTH
Construct Bankfu
KONKOLVILLE MILL
EXISTING BRIDGE PIERS
EXISTING RETAINING WALL W/
CONSTRUCTED FROM LARGE COBBLE
Bankfull Bench
Diversion
EXISTING DIVERSION WIER

# OROFINO CREEK
# KONKOLVILLE MILL BRIDGE (#3)
# CROSS-SECTION

NOT TO SCALE

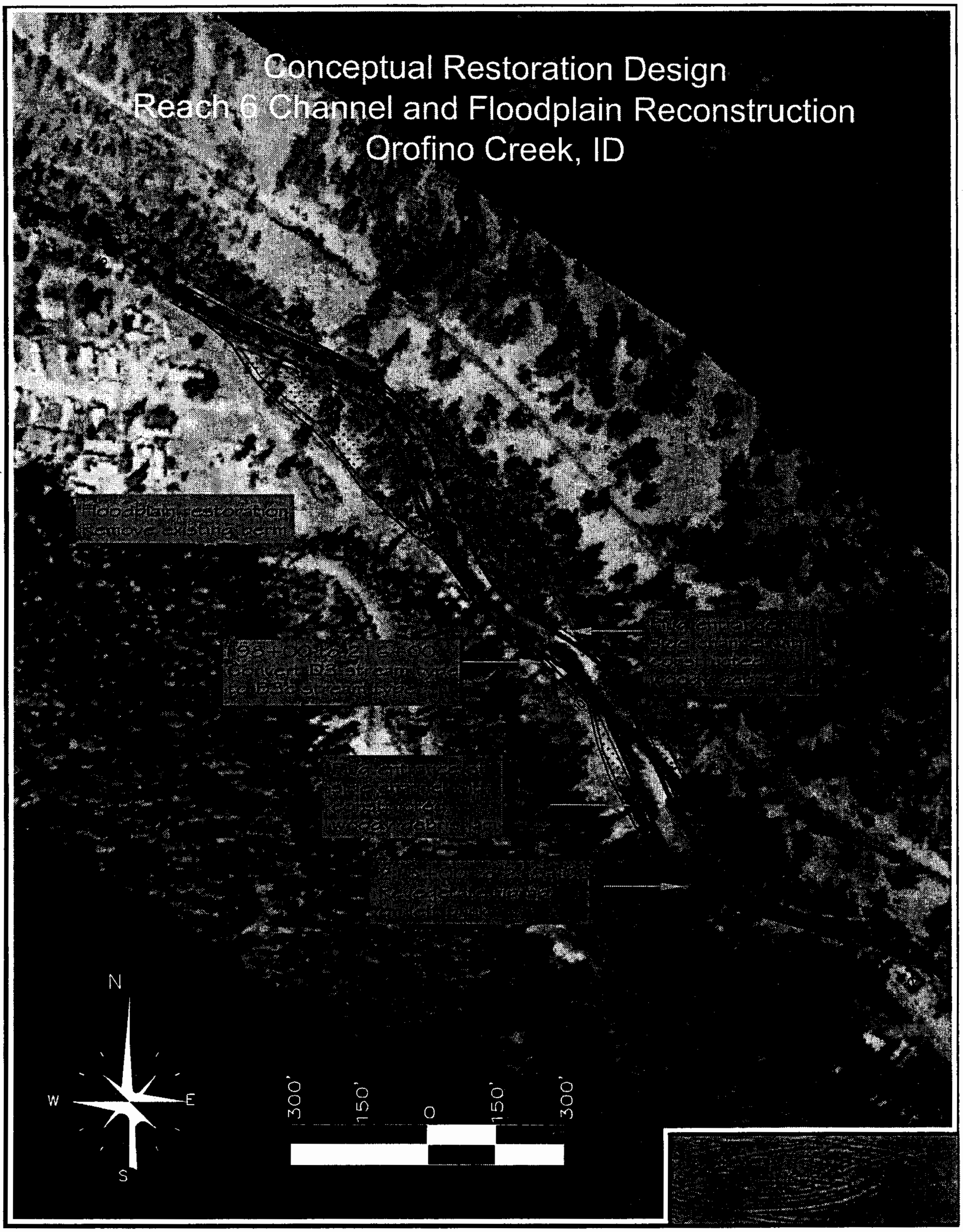


If a more stable stream is created, the opportunity for riparian vegetation to colonize on the floodplain will increase. In-stream and floodplain habitat improvements are likely to benefit native salmonid fish species. By reducing bank erosion and channel instability, impacts to downstream reaches and property owners within the reach will be decreased. Refer to Section 5.2.5 for more information about stream reconstruction techniques and the associated benefits. A conceptual restoration plan for Reach 6 is presented in Figure 5.7. The estimated cost for this project is $177,848.

## 5.5 Additional Needs

In addition to construction projects in the lower watershed, additional mitigation measures throughout the entire Orofino Creek watershed are necessary to achieve the project goals and ensure long-term success of the recommendations in this document. Additional issues have been identified but not addressed in detail because they are beyond the scope of this project. These issues include:

- The need for a gaging station on Orofino Creek;
- The need for additional data collection such as sediment loading rates, channel scour potential, bank erosion rates and fish population surveys;
- A plan to deal with the hazards caused by the abandoned railroad trestles in the middle watershed;
- Public education related to floodplain management and natural hazard mitigation; and
- A workshop on the principles of natural channel design geared toward equipment operators.


Conceptual Restoration Design
Reach 6 Channel and Floodplain Reconstruction
Orofino Creek, ID
N
W
E
S
300'
150'
0
150'
300'

# 6.0 CONSTRUCTION IMPLEMENTATION

## 6.1 Estimated Construction Costs and Construction Time

Table 6.1 summarizes the estimated project construction costs and construction time periods for the seven (7) top ranking projects. In addition to construction costs, the costs below include provisions for final design, permitting, construction management, project monitoring, project maintenance and a 15% contingency. Implementation costs could be significantly reduced by the use of donated construction equipment, volunteer equipment operators and donated materials. Refer to Appendix C for additional information regarding the cost estimates.

**Table 6.1**
**Summary of Estimated Project Construction Costs and Construction Time Periods**

| Project | Station | Cost | Construction Time |
|---|---|---|---|
| Confluence | 0+00 to 5+00 | $81,263 | 2-3 weeks |
| Reach 3 | 105+00 to 142+00 | $742,218* | 6-9 weeks |
| Forest St. Bridge | 62+00 to 69+00 | $344,265* | 2-4 weeks |
| Brandt Mill | 164+00 to 167+00 | $57,929 | 1-2 weeks |
| Noah's Bridge | 187+00 to 190+00 | $47,032 | 1-2 weeks |
| Konkolville Diversion | 150+00 to 152+00 | $40,575 | 1 week |
| Reach 6 | 198+00 to 216+00 | $177,848 | 4-6 weeks |
| Other impaired areas | | $2,512,000 | N/A |
| **Total** | | **$4,003,132*** | **17 - 26 weeks** |

*Includes estimated cost of bridge replacement

Costs for bridge replacement have been included in the cost estimates. Although it is unlikely that bridges will be replaced in the near future, it was determined that the effects of bridges were worthy of attention and a necessary part of treating the overall problems on Orofino Creek. The level of impairment caused by each bridge must be weighed against the cost of replacement and the potential impacts of no action.

## 6.2 Landowner Coordination

Property ownership in the project area has not been researched in detail. Along Orofino Creek, development is dense and lot sizes are small, therefore several property owners could be involved with each project. Prior to any project construction, adequate time should be allowed for coordination with adjacent residents and individuals who are affected by the project. Landowner coordination can be facilitated through continuation of the monthly Flood Committee meetings that provided support and direction for the master planning efforts.

## 6.3 Permitting

Any projects constructed below the Ordinary High Water Mark (bankfull) on Orofino Creek will require a Department of the Army Nationwide Permit (NWP) issued by the U.S. Army Corps of Engineers. A Joint Application between the U.S. Army Corps of Engineers, Idaho Department of Water Resources and Idaho Department of Lands is available for stream related projects in Idaho. At a minimum, the permit application must include a description of work, delineation of wetlands, quantities of materials to be discharged below bankfull and contact information for landowners adjacent to the project.

Under the jurisdiction of the National Marine Fisheries Service, threatened and endangered species in this section of the Clearwater River that may be affected by projects in Orofino Creek include steelhead trout and chinook salmon. In addition, Orofino Creek is recognized as a cold-water bull trout spawning and rearing stream by the U.S. Environmental Protection Agency, and construction projects will likely require prior consultation with the U.S. Fish and Wildlife Service. As such, a biological assessment must be prepared for any projects that potentially impact the habitat of these species. At a minimum, the biological assessment must include a description of the project, a description of existing conditions, a species list with descriptions, and most importantly, an analysis of the project's effects on the species.

Depending on the funding sources that are used for project construction, other permits or procedures may be required, such as compliance with the National Environmental Policy Act (NEPA). A timeframe of six to nine months should be allowed to obtain the necessary stream permits.

## 6.4 Revegetation Plan

A comprehensive revegetation program is essential for the long-term success of Orofino Creek restoration projects. Revegetation increases stream stability, improves biological function, and enhances project area aesthetics through the development of a diverse riparian forest. The species list developed for Orofino Creek focuses on native species that are adapted to the regional conditions. Non-native plants should be avoided as introduced species may out-complete native species, are often less desirable for wildlife, and may not be adapted to the range of environmental conditions in the watershed. Specific species should be planted according to their moisture tolerance. More specifically, plant success is often dependent on the distance and elevation relative to shallow groundwater. Upland vegetation is most successful on drier, well-draining sites. Riparian and wetland vegetation requires moist sites to be successful.

The following list includes many of the common species found in the Orofino Creek watershed. The native species list can be used to create diverse riparian and upland plant communities. Other plant species will be added incorporated after conferring with local experts.

| Table 6.2<br>Plant Species List for Revegetation Efforts on Orofino Creek | |
|---|---|
| **Common Riparian Species** | **Upland Tree, Shrub and Grass Species** |
| Black Cottonwood: *Populus trichocarpa* | Mountain Mahogany: *Cercocarpus ledifolius* |
| Alder: *Alnus* spp. | Bitterbrush: *Purshia tridentate* |
| Willow: *Salix* spp. | Idaho fescue: *Festuca idahoensis var. roemeri* |
| Serviceberry: *Amelanchier* spp. | BluebunchWheatgrass: *Pseudoroegneria spicata* |
| Common chokecherry: *Prunus virginiana* | Ponderosa Pine: *Pinus ponderosa* |
| Bitter cherry: *Prunus emarginata* | Western Redcedar: *Thuja plicata* |
| Syringa: *Philadelphus lewisii* | |
| Snowberry: Symphorocarpus spp. | |
| Dogwood: *Cornus stolonifera* | |
| Sedges: *Carex* spp. | |

## 6.5 Recommended Best Management Practices (BMP's)

All heavy equipment should be washed prior to mobilization to the site to minimize the introduction of foreign materials and fluids to the project site. It is the equipment contractor's responsibility to insure that adequate measures have been taken. Equipment should be new or in a well-maintained condition to minimize the likelihood of a fluid leak. If a fluid leak does occur, the construction supervisor will be notified immediately, and all work ceased until the leak has been rectified. At all times during the construction phase, fluid spill containment equipment will be present on-site and ready for deployment should an accidental spill occur.

It is understood that there will be short-term pulses of sediment produced during the diversion of water into the temporary channels and during re-introduction to the newly constructed channels. There may also be periodic pulses during channel shaping and structure placement from sub-surface waters and or seepage through the cofferdams. If necessary, any subsurface water that may collect in the excavation areas will be pumped away from live water. There will be short periods of time that minor pulses of turbid water may be discharged into the stream or waters that feed the stream. Past experience and monitoring indicate that these pulses last for less than one half hour before water returns to background levels. If numerous live water crossings are anticipated for hauling/transporting material, temporary crossings will be constructed using culverts. These crossings will be located during the staking period.

Trash pumps and associated equipment (hoses, clamps, etc.) will be on-site and available for deployment as necessary to help reduce turbidity in the stream and/or nearby state waters. Pump deployment may be necessary to help dewater construction locations to aid in construction. It is understood that the water pumped will be turbid and all efforts will be made to discharge to upland sites and not into water bodies of the State of Idaho. However, at various times throughout the project, the discharge or mixing of turbid water into/within either jurisdictional wetlands, Lame Deer Creek, or other water bodies considered State waters may be unavoidable. Dirt bags will be available on-site at the onset of construction and may be deployed if necessary.

If necessary and the contractor elects, impervious sheeting may be applied to the upstream side of the temporary gravel cofferdams to reduce seepage into the project area. A reduction in seepage may be necessary to ease construction for the operator or to reduce the volume of turbid water that is exiting the project either through the pump or mixing at the downstream end.

Finally, it may be necessary to have alternative measures available to deal with stormwater runoff from the project site. Although construction will proceed in a timely and sequential manner, an intense rainstorm may create some stormwater runoff issues within the project area. To minimize potential stormwater delivery to live water, either straw/hay bales and/or silt fencing will be available to temporarily isolate construction sites during rain events.

Other measures may be developed and implemented throughout construction. The intent will be to minimize adverse impacts with the understanding and realization that short-term impacts will occur as a result of this project. However, these minor, short-term effects will be offset by the long-term project benefits associated with this project.

## 6.6 Monitoring

The master plan provides an ideal opportunity for monitoring ecosystem responses to river and floodplain restoration. River restoration and the implementation of bioengineering techniques are growing sciences. An effective monitoring program that quantitatively measures physical and biological responses to applied restoration techniques is highly recommended. Monitoring data will provide a better understanding of the biological and physical responses of the subject rivers to the proposed restoration treatments described in this document. Monitoring will permit modification to structure designs, as needed, to ensure only the most effective types of structures are incorporated with future projects.

A comprehensive monitoring program would evaluate channel, vegetation, and fisheries responses in both project areas and untreated reaches. Data would be collected at the culmination of the project construction to establish the as-built condition. Additional monitoring would be completed after the first, second, fifth,.and tenth years following construction.

To monitor the channel condition, permanent cross-sections and longitudinal profile (LP) stations would be established. Cross-sections would be located in multiple pool, riffle, and run habitats. A channel survey, pebble count, and photo points would be completed at each cross-section. The LP stations would be established at specific channel features to quantify changes and degree of departure from design specifications. Bank pins would also be installed at selected locations in project and untreated reaches to compare bank erodibility condition and actual erosion and sediment input rates.

Vegetation monitoring would include evaluating treated and untreated reaches for relevant attributes such as vegetation composition and cover, utilization, shrub and tree regeneration, and coarse woody debris (transect and grid methods). Noting the presence and abundance of noxious vegetation, particularly where weeds have been treated in association with projects, would be an essential component to the vegetation-monitoring program.

One of the restoration goals is to improve habitat for native salmonid species. The fish population-monitoring program should focus on spawning migrations and larval emigration. The monitoring program should be compatible with existing efforts to maximize limited resources. Monitoring techniques may include using radio telemetry to track migrating fish, deploying emergent nets to monitor larval emergence, employing screw traps to estimate emigration rates, and setting fyke traps along channel margins to similarly estimate larval emigration in project areas.

The preceding recommendations are based on standard monitoring techniques. Quantifying the physical, vegetative, and biological responses to the restoration projects will be critical for implementing future projects. Positive responses to the projects would validate the restoration techniques while neutral or negative results would necessitate modifying existing and future restoration designs. Although costly to implement, a comprehensive monitoring program will be important for evaluating restoration success.

## 7.0 REPORT REFERENCES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# EXHIBIT D
# to State of Idaho's Comments on Environmental Assessment

IDL's Orofino-Jaype Railroad Line
Structure Location Survey
April 2004

# "END OF THE LINE"

## OROFINO-JAYPE RAILROAD LINE

## STRUCTURE LOCATION SURVEY

## APRIL 2004

## OROFINO-JAYPE RAILROAD SURVEY

## LIME PIT SECTION

| | |
|---|---|
| START | OWNERSHIP LINE BETWEEN SECTION 4 & SECTION 9, TOWNSHIP 36 NORTH, RANGE 3 EAST.<br>Latitude N 46º 29' 07.9", Longitude W 116º 05' 08.9" (Accuracy ± 22.2') |
| CULVERT 1 | Culvert 36" x 40', fill depth approximately 5' ( 4' @ inlet, 6' @ outlet).<br>Live Class II Stream tributary to Orofino Creek, 5" wide X 1" deep.<br>Culvert bottom silted in 5" deep due to willow at outlet.<br>Water falling thru rock prior to inlet, rock wall supports culvert outlet.<br>Water drainage through sharp, narrow canyon.<br>Location SESE Section 4, Township 36 north, Range 3 East.<br>Latitude N 46º 29' 09.7", Longitude W 116º 05' 04.5" (Accuracy ± 65.1') |
| CULVERT 2 | Culvert 24" x 20', fill depth approximately 2-3'.<br>Live Class II stream tributary to Orofino Creek, 10" wide X 3" deep.<br>Water drainage through typical draw.<br>Location NESW Section 3, Township 36 North, Range 3 East.<br>Latitude N 46º 29' 20.9", Longitude W 116º 04' 17.7" (Accuracy ± 28.2'). |
| R/R CROSSING | Railroad crosses road to Lime Pit.<br>Location NWSE Section 3, Township 36 North, Range 3 East.<br>Latitude N 46º 29' 25.5", Longitude W 116º 03' 56.5" (Accuracy ± 30.0') |
| TRESTLE # 11 | Trestle 12.3' wide X 160.9' long, maximum depth to water 16.4'.<br>Crosses Orofino Creek, a Class I Stream.<br>Abutment 4' tall on west end, Abutment on east end consist of a 5.4' vertical wall and a 8.3' stepped wall (total height 13.7').<br>Trestle has 9 piers comprised of two single round post pilings, one double stringer gabion piers, two double cement supported stringer piers (over water), one double stringer gabion pier, one double round post piling, and two single round post pilings - listed from west to east.<br>Location NWSE Section 3, Township 36 North, Range 3 East.<br>Latitude N 46º 29' 28.6", Longitude W 116º 03' 48.7" (Accuracy ± 27.0') |
| END | OWNERSHIP LINE BETWEEN SECTION 3 & SECTION 2, TOWNSHIP 36 NORTH, RANGE 3 EAST.<br>Latitude N 46º 29' 28.2", Longitude W 116º 03' 33.4" (Accuracy ± 22.7') |

## RUDO SECTION

| | |
|---|---|
| START | OWNERSHIP LINE BETWEEN THE NESW AND THE NWSE OF SECTION 6, TOWNSHIP 36 NORTH, RANGE 3 EAST.<br>Latitude N 46° 29' 26.7" , Longitude W 116° 00' 19.2" (Accuracy ± 21.2') |
| LINE CROSSING | Orange "X" on dead Douglas-fir 150-200' north of tracks. Potlatch Location Tag dated 1/25/63. Approximately 7 chains north to 1/16 corner (corner common to the two state parcels). Tree located at Latitude N 46° 29' 40.4", W 115° 59' 57.5" (Accuracy ± 21.7')<br><br>Line crossing at tracks south of this tree and tag are at Latitude N 46° 29' 38.2", W 115° 59' 57.5" (Accuracy ± 21.2') |
| LINE CROSSING | Orange "X" on dead Douglas-fir south of tracks. GPS of tracks is Latitude N 46° 29' 45.3", W 115° 59' 49.9" (Accuracy ± 26.2') |
| CULVERT 3 | Culvert 36" x 40', fill depth approximately 4-5'. Culvert has rusted.<br>Live Class II Stream tributary to Orofino Creek, 4" wide X 1" deep.<br>Water falling down rock face 50-60' prior to inlet.<br>Maximum water flow evidence indicates only 1/4 of culvert diameter used.<br>Stream may be intermittent.<br>Clean inlet area with minimal silt chance.<br>Location NENE Section 6, Township 36 North, Range 4 East.<br>Latitude N 46° 29' 48.1", Longitude W 115° 59' 45.4" (Accuracy ± 168') |
| END STATE ??? | Latitude N 46° 29' 52.0", Longitude W 115° 59' 41.2" (Accuracy ± 26.1')<br>Approximately 60' west of the west abutment.<br><br>THIS IS OWNERSHIP LINE IF ENTIRE EAST LINE RUNS DUE NORTH |
| TRESTLE # 15 WEST SIDE | Latitude N 46° 29' 52.0", Longitude W 115° 59' 40.4" (Accuracy ± 24.0') |
| TRESTLE # 15 | Trestle 12.3' wide X 226' long, maximum depth to water 24'.<br>Crosses Orofino Creek, a Class I stream.<br>Abutments 2-3' tall on east end and 3' tall on west end.<br>Trestle has 12 piers comprised of six single round post pilings, five double round post pilings, and one single piling - listed from west to east.<br>Pilings 1-4 are above dry ground, pilings 5-11 are above water, and piling 12 is above dry ground.<br>Piling # 7 has a gabion foundation.<br><br>THIS TRESTLE MAY OR MAY NOT BE ON STATE LAND DEPENDENT TO SECTION LINE ORIENTATION. |
| TRESTLE # 15 EAST SIDE | Latitude N 46° 29' 52.0", Longitude W 115° 59' 37.2" (Accuracy ± 25.5') |

## LOWER COW CREEK SECTION

| | |
|---|---|
| START | OWNERSHIP LINE BETWEEN THE SWSW OF SECTION 33, TOWNSHIP 37 NORTH, RANGE 4 EAST AND THE NWNW SECTION 3, TOWNSHIP 36 NORTH, RANGE 4 EAST.<br>The approximate ownership line is painted with three orange stripes on trees on each side of the tracks and located at Latitude N 46° 29' 57.1", Longitude W 115° 57' 51.1". (Accuracy ± 19.5') |
| Trestle # 17 | Curved trestle 12.3' wide X 222' long with maximum height of 30'. The west abutment is 3' high and the east abutment is 3' high and based on a rock cliff that drops straight to the water level.<br>Trestle has 7 single stringers, 4 double stringers (last three over water), and a single stringer (over water) - listed from west to east.<br>Location SESW Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 01.8", Longitude W 115° 57' 42.9" (Accuracy ± 21.0') |
| Trestle # 17.1 | Curved trestle 12.3' wide X 297' long with maximum height of 25'. The abutments are both 3' high.<br>Trestle has 8 single stringers, 6 double stringers (all over water), and 1 double stringer (over ground) - listed from west to east.<br>Location SESW Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 00.5", Longitude W 115° 57' 35.6" (Accuracy ± 23.3') |
| Leave State | Leave state ownership approximately 3 chains east of Trestle # 17.1. Approximate line is marked with a orange "S" and arrow on a rock face.<br>Location section line between the SESW Section 33, Township 37 North, Range 5 East and the NENW Section 3, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 57.1", Longitude W 115° 57' 32.6" (Accuracy ± 27.8') |
| Enter State | Enter state ownership approximately 50' west of Trestle # 17.3 (Trestle 17.2 is on Railroad land). Approximate line is marked with an orange "S" and arrow on a rock.<br>Location section line between the SWSE Section 33, Township 37 North, Range 5 East and the NWNE Section 3, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 57.1", Longitude W 115° 57' 22.9" (Accuracy ± 27.5') |
| Trestle # 17.3 | Straight trestle 12.3' wide X 314' long with maximum height of 30.5'. The west abutment is 3' high and the west abutment has a 3' abutment with a 4' step abutment below the first abutment.<br>Trestle has 5 single stringers (last one over water), 3 double stringers (all over water), 6 single pilings, 2 piling/stringer combination, and a single stringer.<br>Location SWSE Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 29' 59.0", Longitude W 115° 57' 20.8" (Accuracy ± 28.0') |
| Pond / Culverts<br>(Culvert 4) | Culvert inlet not visible (believed to be below water level). Approximate depth of fill over inlet is 30'. Two 48" culvert outlets are visible at creek level with fill depth of 40-50'. These culverts service a major drainage.<br>Location SESE Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 04.3", Longitude W 115° 57' 06.1" (Accuracy ± 25.5') |

| | |
|---|---|
| Culvert 5 | Culvert 36" X 40' with no water present. Distortion noticed in band area but no soil displacement visible. Fill depth 3-4'. A slide is evident into Orofino Creek for 120' west of culvert. Approximately 11 concrete "Jersey Barriers" placed by railroad to prevent bank washout have displaced into the middle of Orofino Creek.<br>Location SESE Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 29' 59.5", Longitude W 115° 56' 54.2" (Accuracy ± 20.6') |
| Trestle # 18 | Curved trestle 12.3' wide X 219' long with maximum height of 26.5'. The west Trestle has 3 single pilings, a double piling, 4 double stringers, and 5 single stringers - listed from west to east. The double stringers are over water but no concrete visible. Angle iron braces are present.<br>Location SESW Section 34, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 02.4", Longitude W 115° 56' 36.1" (Accuracy ± 25.4') |
| Materials | A pile of abutment materials is located approximately 100' west of the Trestle # 18.1 at Latitude 46° 29' 58.7" , Longitude W 115° 56' 30.4" (Accuracy ± 26.7'). |
| Trestle #18.1 | Approximately 46.5' of the west end of the trestle is on state. Trestle height is16' at the ownership line. Three stringers are on state, all over ground.<br>An orange painted "S" and an arrow on a bridge tie on the north side of the trestle indicates the ownership line.<br>Location SESW Section 34, Township 37 North, Range 5 East.<br>Latitude N 46° 29' 57.1", Longitude W 115° 56' 28.3" (Accuracy ± 22.4') |
| END STATE | OWNERSHIP LINE BETWEEN THE SESW OF SECTION 34, TOWNSHIP 37 NORTH, RANGE 4 EAST AND THE NENW SECTION 3, TOWNSHIP 36 NORTH, RANGE 4 EAST.<br>The line lies across the west end of Trestle # 18.1 located at Latitude N 46° 29' 57.1", Longitude W 115° 56' 28.3" (Accuracy ± 22.4') |

# RUDE-COW SECTION

| | |
|---|---|
| START | APPROXIMATE OWNERSHIP LINE BETWEEN THE W2 AND E2 OF SECTION 36, TOWNSHIP 37 NORTH, RANGE 4 EAST. NO VISIBLE LINE CROSSING.<br>Latitude N 46° 30' 03.0", Longitude W 115° 54' 21.4" (Accuracy ±18.3')<br>PROCEED EAST. |
| CULVERT 6 | Culvert 24" x 24', fill depth approximately 3'. Culvert has some rust.<br>No water flowing at time of inspection. Probably only carries spring runoff.<br>Clean inlet area. Outlet filled with silt about 1/3 of diameter for a distance of 5'.<br>Location SWNE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 01.6", Longitude W 115° 54' 13.2" (Accuracy ± 25.8') |
| CULVERT 7 | Culvert 36" x 40', fill depth approximately 4-5'.<br>Live Class II Stream tributary to Orofino Creek, Flow 5" wide X 2" deep.<br>Some brush in inlet area. Lower 1/2 of culvert filled about 1/4 diameter with small rocks.<br>Location SWNE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 16.8", Longitude W 115° 53' 54.2" (Accuracy ± 26.3') |
| CULVERT 8 | Culvert 24" x 40', fill depth approximately 10'. No water present.<br>Brush in inlet area but culvert usable. No picture due to brush.<br>Location SENE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 30.4", Longitude W 115° 53' 37.9" (Accuracy ± 19.9') |
| CULVERT 9 | Diagonal culvert 36" x 74', fill depth approximately 6-8'.<br>Live Class II Stream tributary to Orofino Creek, Flow 12" wide X 3" deep.<br>Maximum use appears to be 1/4 culvert diameter.<br>Location SENE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 31.6", Longitude W 115° 53' 30.4" (Accuracy ± 30.3') |
| CULVERT 10 | Culvert 24" x 36', fill depth approximately 6'. Culvert in good shape.<br>Spring, flow of 3" X 1" at time of inspection.<br>Location SENE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 31.4", Longitude W 115° 53' 27.3" (Accuracy ± 30.2') |
| TRESTLE # 21 | Trestle 12.3' wide X 75' long, maximum depth to water 21'.<br>Live Class I Stream tributary to Orofino Creek, Flow 5' wide X 2-3' deep.<br>Abutments 3' tall on each end. Trestle has 4 piers comprised of five single round post pilings. Two pilings in water, two are on dry ground.<br>Trestle is 65' west of the ownership line.<br>Location SENE Section 36, Township 37 North, Range 4 East.<br>Latitude N 46° 30' 28.2", Longitude W 115° 53' 07.0" (Accuracy ± 25.3') |
| END STATE | Latitude N 46° 30' 28.2", Longitude W 115° 53' 06.0" (Accuracy ± 22.5') |

## PIERCE SECTION

| | |
|---|---|
| START | OWNERSHIP LINE BETWEEN THE NENE OF SECTION 5 AND THE NWNW OF SECTION 4, TOWNSHIP 36 NORTH, RANGE 5 EAST.<br>The line lies across the west abutment of the trestle at Latitude N 46° 29' 55.1", Longitude W 115° 50' 50.5" (Accuracy ± 29.9') |
| TRESTLE # 24 | Straight Trestle 12.3' wide X 155' long, maximum depth to water 34'.<br>Crosses Orofino Creek.<br>Abutments 4' tall on each end. Trestle has 3 single stringers, a double piling round post piling, a single piling, a double piling, and 2 single pilings - listed from west to east.<br>Extensive crib abutment on west end of trestle.<br>Location NWNW Section 4, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 55.1", Longitude W 115° 50' 49.1" (Accuracy ± 22.9') |
| TRESTLE | Curved Trestle 12.3' wide X 157' long, maximum depth to water 34'.<br>Crosses Orofino Creek. Tin-covered ties.<br>Abutments 4' tall on each end. Trestle has all round pilings listed as follows from west to east - single, 4 double, and 3 single pilings. Old pilings visible.<br>Extensive crib abutment on west end of trestle.<br>Location NWNW Section 4, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 54.5", Longitude W 115° 50' 43.5" (Accuracy ± 22.9') |
| TRESTLE | Curved Trestle 12.3' wide X 244' long, maximum depth to water 34'.<br>Crosses Orofino Creek.<br>Abutments 3' tall on each end. Trestle has stringers or pilings listed as follows from west to east - 3 single stringers, 3 single pilings, a double piling, 2 single pilings, a double piling, and 4 single pilings.<br>Location NWNW Section 4, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 48.1", Longitude W 115° 50' 34.8" (Accuracy ±33.7') |
| END STATE | East side of the NWNW Section 4, Township 36 North, Range 5 East.<br>Latitude N 46° 29' 46.7", Longitude W 115° 50' 31.7" (Accuracy ± 21.0') |
| ENTER STATE | West side of SESE Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 07.5", Longitude W 115° 49' 39.7" (Accuracy ± 18.1') |
| CULVERT 11 | Culvert 24" X 80' (approximately). Runs diagonally upstream. Flow 4' deep X 6" wide.<br>Fill 4' at inlet and 12' at outlet. Outlet not visible (buried in rocks).<br>Location SESE Section 33, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 07.3", Longitude W 115° 49' 25.0" (Accuracy ± 19.1') |
| TRESTLE 25 | Straight Trestle 12.3' wide X 168' long, maximum depth to water 20.5'.<br>Crosses Orofino Creek.<br>Abutments 3' tall on each end. Trestle has all pilings listed as follows from west to east - 2 single pilings, 5 double pilings, and 1 single piling.<br>Location SESW Section 34, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 06.1", Longitude W 115° 49' 11.3" (Accuracy ± 24.2') |

## PIERCE SECTION - CONTINUED

| | |
|---|---|
| TRESTLE | Curved Trestle 12.3' wide X 174' long, maximum depth to water 23.5'.<br>Crosses Orofino Creek.<br>Abutments 3' tall on each end. Trestle has 2 single stringers, a double stringer, 3 double pilings, a double stringer, and 2 single stringers - listed from west to east.<br>Location SESW Section 34, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 06.5", Longitude W 115° 48' 52.5" (Accuracy ± 18.8') |
| END STATE | East side of the SESW Section 34, Township 37 North, Range 5 East.<br>Latitude N 46° 30' 00.1", Longitude W 115° 48' 43.1" (Accuracy ± 22.7') |

SUMMARY OF CULVERTS AND TRESTLES
OROFINO-JAYPE RAILROAD LINE

## LIME PIT SECTION

| OBJECT | SIZE | LATITUDE | LONGITUDE |
|---|---|---|---|
| CULVERT 1 | 36" x 40' | N 46° 29' 09.7" | W 116° 05' 04.5" |
| CULVERT 2 | 24" x 20' | N 46° 29' 20.9" | W 116° 04' 17.7" |
| TRESTLE # 11 | 160.9' | N 46° 29' 28.6" | W 116° 03' 48.7" |

## RUDO SECTION

| | | | |
|---|---|---|---|
| CULVERT 3 | 36" x 40' | N 46° 29' 48.1" | W 115° 59' 45.4" |
| TRESTLE # 15 | 226' | N 46° 29' 52.0" | W 115° 59' 40.4" |

THIS TRESTLE MAY OR MAY NOT BE ON STATE LAND DEPENDENT TO SECTION LINE ORIENTATION.

## LOWER COW CREEK SECTION

| | | | |
|---|---|---|---|
| Trestle # 17 | 222' | N 46° 30' 01.8" | W 115° 57' 42.9" |
| Trestle # 17.1 | 297' | N 46° 30' 00.5" | W 115° 57' 35.6" |
| Trestle # 17.3 | 314' | N 46° 29' 59.0" | W 115° 57' 20.8" |
| Pond / Culverts (Culvert 4) | 2 - 48" | N 46° 30' 04.3" | W 115° 57' 06.1" |
| Culvert 5 | 36" X 40' | N 46° 29' 59.5" | W 115° 56' 54.2" |
| Trestle # 18 | 219' | N 46° 30' 02.4" | W 115° 56' 36.1" |
| Trestle #18.1 | 46.5' * | N 46° 29' 57.1" | W 115° 56' 28.3" |

* Rest of trestle is on Potlatch Corporation land.

## RUDE-COW SECTION

| | | | |
|---|---|---|---|
| CULVERT 6 | 24" X24' | N 46° 30' 01.6" | W 115° 54' 13.2" |
| CULVERT 7 | 36" x 40' | N 46° 30' 16.8" | W 115° 53' 54.2" |
| CULVERT 8 | 24" X 40' | N 46° 30' 30.4" | W 115° 53' 37.9" |
| CULVERT 9 | 36" x 74' | N 46° 30' 31.6" | W 115° 53' 30.4" |
| CULVERT 10 | 24" x 36' | N 46° 30' 31.4" | W 115° 53' 27.3" |
| TRESTLE # 21 | 75' | N 46° 30' 28.2" | W 115° 53' 07.0" |

## PIERCE SECTION

| | | | |
|---|---|---|---|
| TRESTLE # 24 | 155' | N 46° 29' 55.1" | W 115° 50' 49.1" |
| TRESTLE | 157' | N 46° 29' 54.5" | W 115° 50' 43.5" |
| TRESTLE | 244' | N 46° 29' 48.1" | W 115° 50' 34.8" |
| CULVERT 11 | 24" X 80' | N 46° 30' 07.3" | W 115° 49' 25.0" |
| TRESTLE 25 | 168' | N 46° 30' 06.1" | W 115° 49' 11.3" |
| TRESTLE | 174' | N 46° 30' 06.5" | W 115° 48' 52.5" |

**TOTAL TRESTLE LENGTH = 2,458'**

## OROFINO-JAYPE RAILROAD SURVEY

### LIME PIT SECTION

| | |
|---|---|
| START | OWNERSHIP LINE BETWEEN SECTION 4 & SECTION 9, TOWNSHIP 36 NORTH, RANGE 3 EAST.<br>Latitude N 46° 29' 07.9", Longitude W 116° 05' 08.9" (Accuracy ± 22.2') |
| CULVERT 1 | Culvert 36" x 40', fill depth approximately 5' ( 4' @ inlet, 6' @ outlet).<br>Live Class II Stream tributary to Orofino Creek, 5" wide X 1" deep.<br>Culvert bottom silted in 5" deep due to willow at outlet.<br>Water falling thru rock prior to inlet, rock wall supports culvert outlet.<br>Water drainage through sharp, narrow canyon.<br>Location SESE Section 4, Township 36 north, Range 3 East.<br>Latitude N 46° 29' 09.7", Longitude W 116° 05' 04.5" (Accuracy ± 65.1') |
| CULVERT 2 | Culvert 24" x 20', fill depth approximately 2-3'.<br>Live Class II stream tributary to Orofino Creek, 10" wide X 3" deep.<br>Water drainage through typical draw.<br>Location NESW Section 3, Township 36 North, Range 3 East.<br>Latitude N 46° 29' 20.9", Longitude W 116° 04' 17.7" (Accuracy ± 28.2'). |
| R/R CROSSING | Railroad crosses road to Lime Pit.<br>Location NWSE Section 3, Township 36 North, Range 3 East.<br>Latitude N 46° 29' 25.5", Longitude W 116° 03' 56.5" (Accuracy ± 30.0') |
| TRESTLE # 11 | Trestle 12.3' wide X 160.9' long, maximum depth to water 16.4'.<br>Crosses Orofino Creek, a Class I Stream.<br>Abutment 4' tall on west end, Abutment on east end consist of a 5.4' vertical wall and a 8.3' stepped wall (total height 13.7').<br>Trestle has 9 piers comprised of two single round post pilings, one double stringer gabion piers, two double cement supported stringer piers (over water), one double stringer gabion pier, one double round post piling, and two single round post pilings - listed from west to east.<br>Location NWSE Section 3, Township 36 North, Range 3 East.<br>Latitude N 46° 29' 28.6", Longitude W 116° 03' 48.7" (Accuracy ± 27.0') |
| END | OWNERSHIP LINE BETWEEN SECTION 3 & SECTION 2, TOWNSHIP 36 NORTH, RANGE 3 EAST.<br>Latitude N 46° 29' 28.2", Longitude W 116° 03' 33.4" (Accuracy ± 22.7') |

CULVERT # 1 INLET

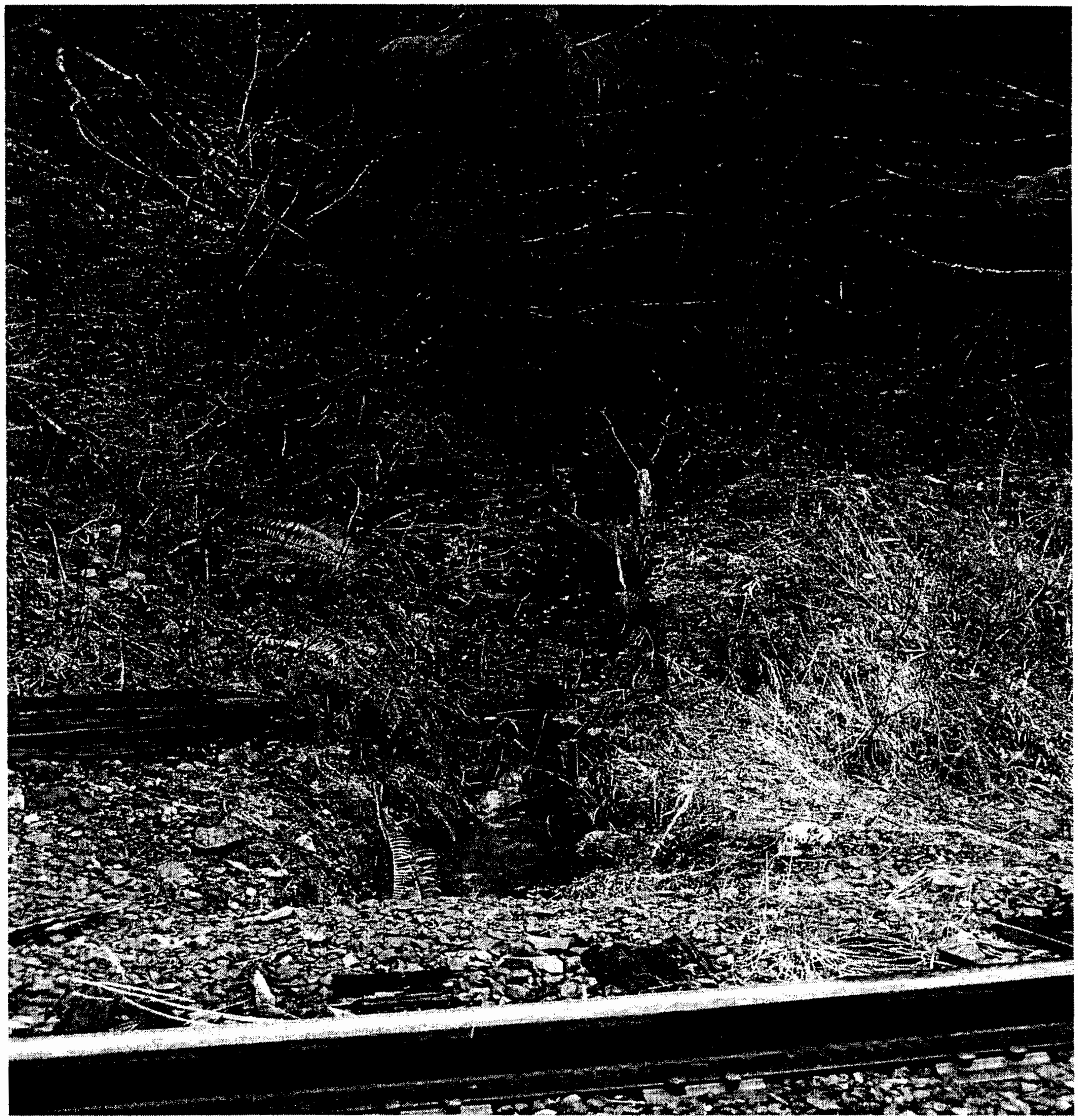
Culvert 36" x 40', Fill Depth approximately 5' ( 4' @ inlet, 6' @ outlet).
Live Class II Stream tributary to Orofino Creek, 5" wide X 1" deep.
Culvert bottom silted in 5" deep due to willow at outlet.
Water falling thru rock prior to inlet, rock wall supports culvert outlet.

Location SESE Section 4, Township 36 north, Range 3 East.

Latitude N 46° 29' 09.7", Longitude W 116° 05' 04.5" (Accuracy ± 65.1')

**CULVERT # 1**
**(OUTLET)**

**OROFINO CREEK ON LEFT SIDE OF PICTURE**



CULVERT # 2
WATER SOURCE INTO INLET

Culvert 24" x 20', Fill Depth approximately 2-3'.
Live Class II stream tributary to Orofino Creek, 10" wide X 3" deep.

Location NESW Section 3, Township 36 North, Range 3 East.

Latitude N 46° 29' 20.9", Longitude W 116° 04' 17.7" (Accuracy ± 28.2').

CULVERT # 2

TOP PICTURE-
CLOSE-UP VIEW OF
INLET

PICTURE TO RIGHT-
VIEW OF OUTLET

## Trestle # 11

Trestle 12.3' wide X 160.9' long, maximum depth to water 16.4'.
Crosses Orofino Creek, a Class I Stream.

Abutment 4' tall on West end, Abutment on East end consist of a 5.4' vertical wall and a 8.3' stepped wall (total height 13.7').
Trestle has 9 piers comprised of two single round post pilings, one double stringer gabion piers, two double cement supported stringer piers (over water), one double stringer gabion pier, one double round post piling, and two single round post pilings - listed from west to east.

Location NWSE Section 3, Township 36 North, Range 3 East.

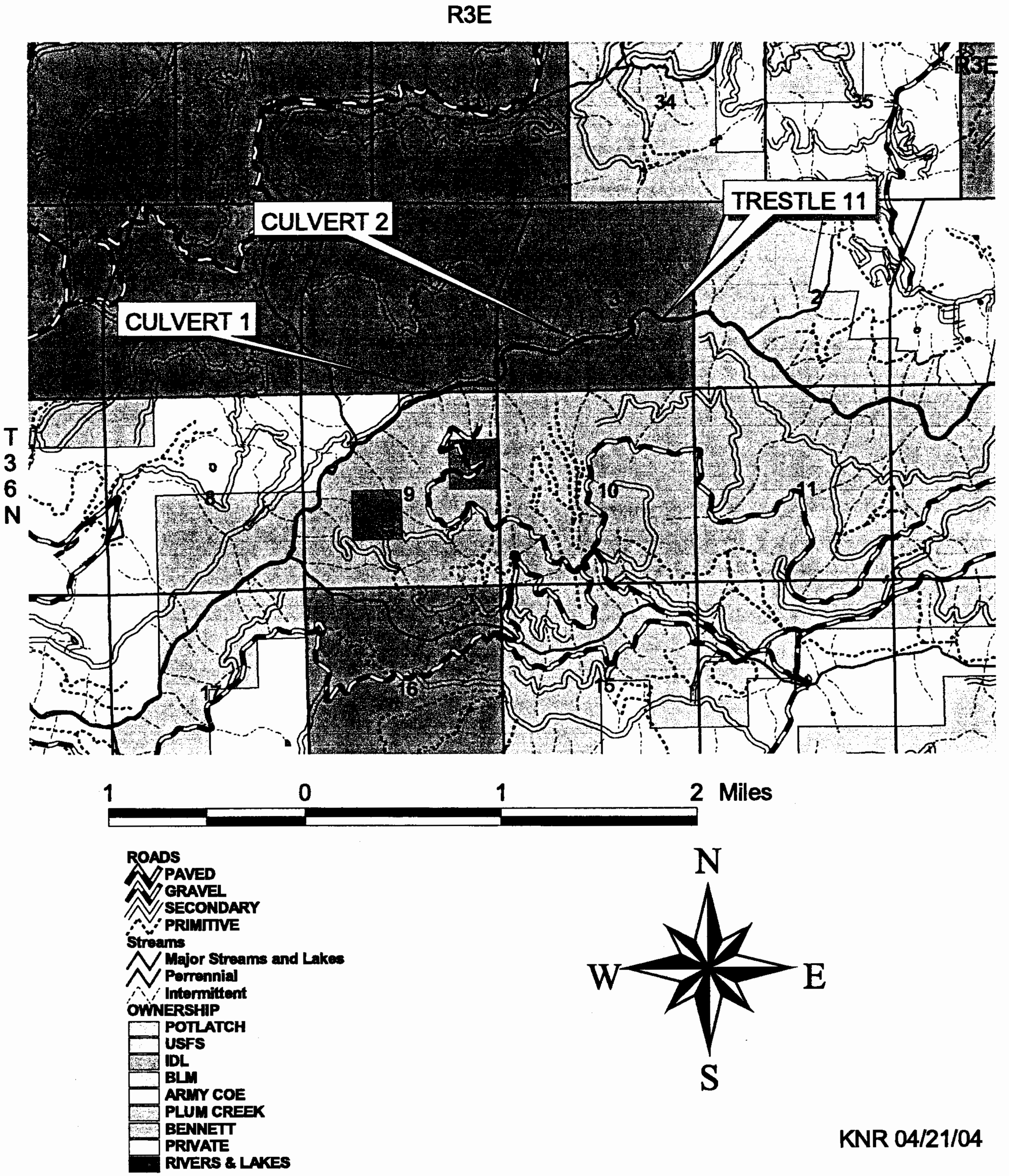
Latitude N 46° 29' 28.6", Longitude W 116° 03' 48.7" (Accuracy ± 27.0')

**Trestle # 11**
**Side View**

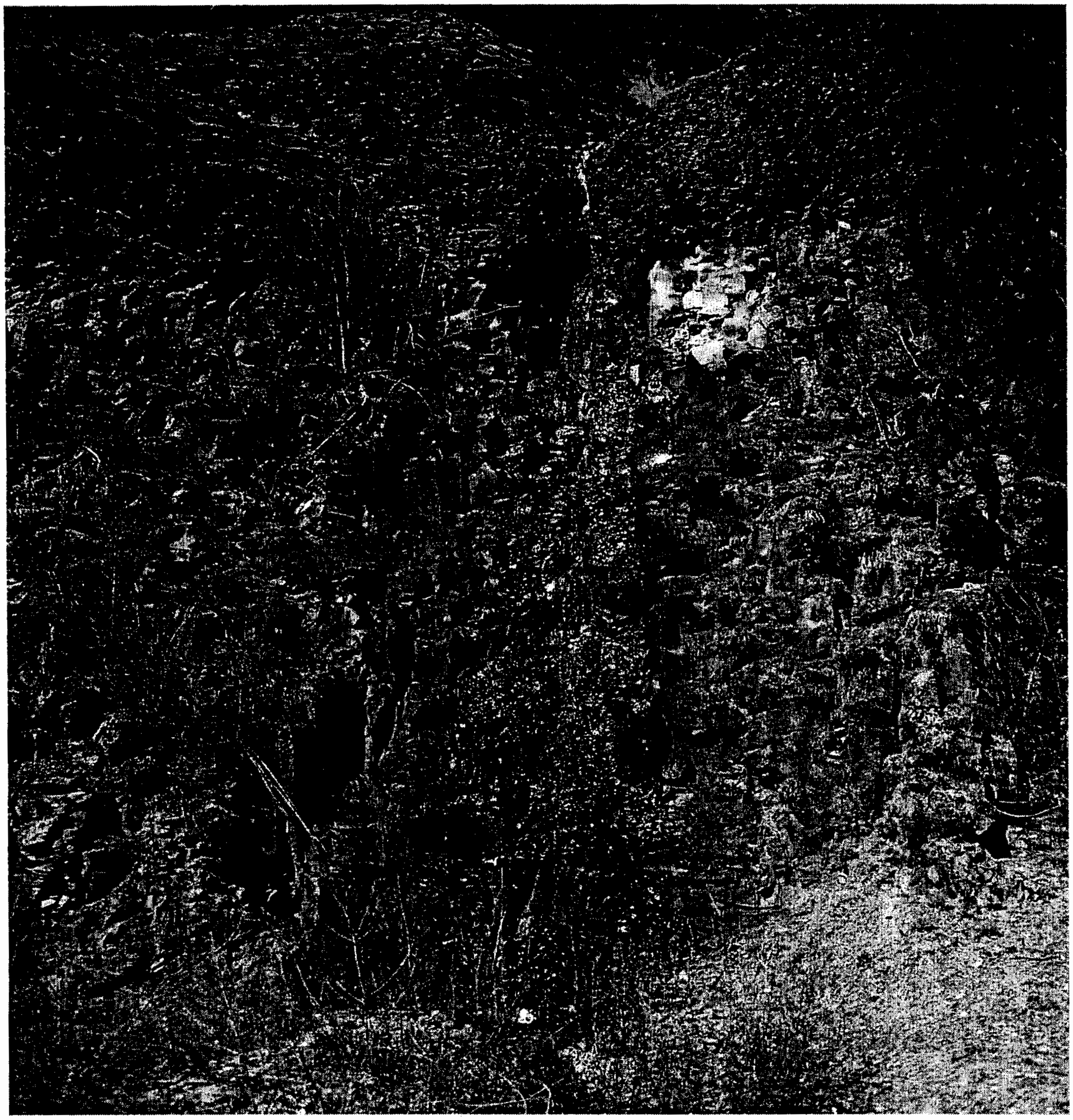
**TYPICAL ROUND PILING CONSTRUCTION**

**TYPICAL CEMENT PIER SUPPORT**

# RAILROAD ABANDONMENT
# LIME PIT SECTION




KNR 04/21/04



CULVERT # 3 WATER SOURCE

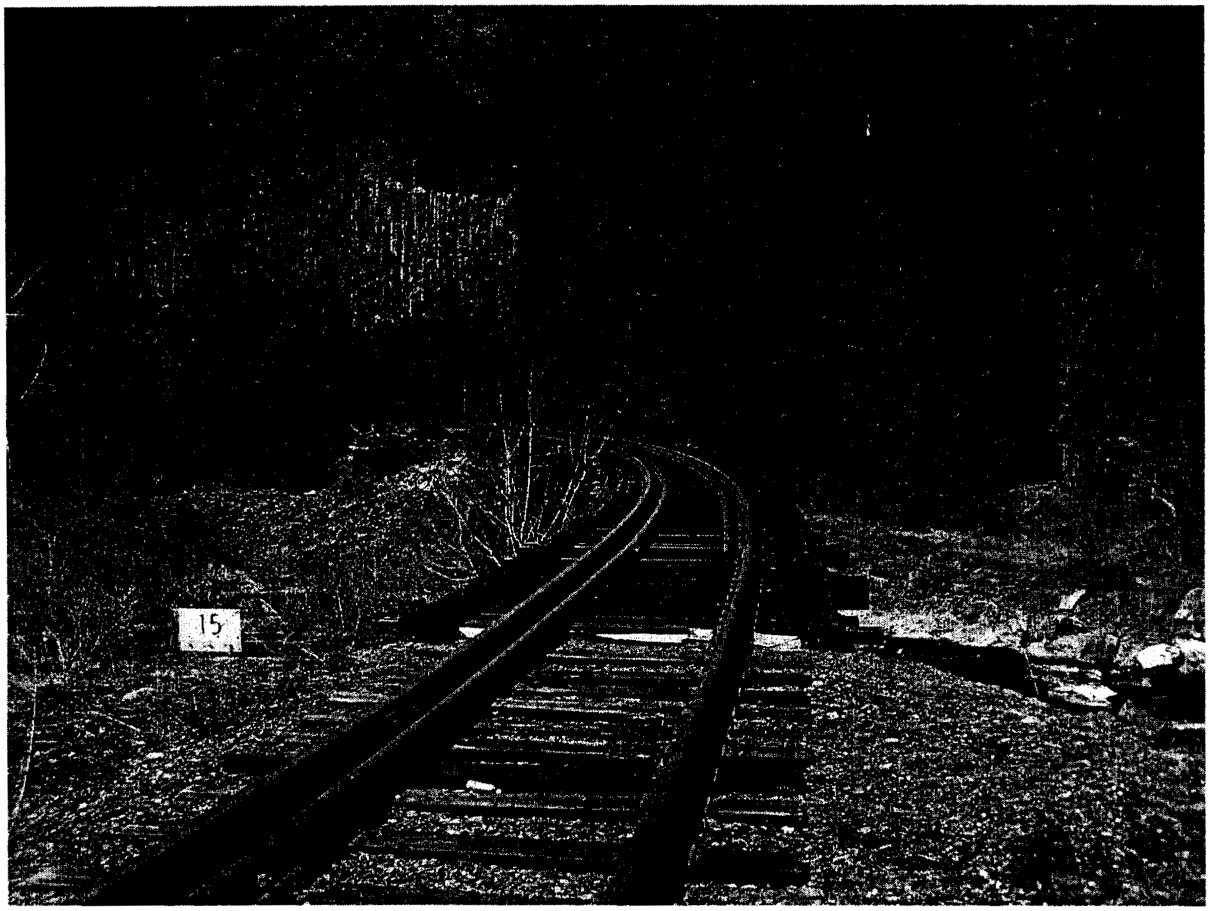
Culvert 36" x 40', Fill Depth approximately 4-5'. Culvert has rusted.
Live Class II Stream tributary to Orofino Creek, 4" wide X 1" deep.
Water falling down rock face 50-60' prior to inlet.
Maximum water flow evidence indicates only 1/4 of culvert diameter used.
Stream may be intermittent.
Clean inlet area with minimal silt chance.

Location NENE Section 6, Township 36 North, Range 4 East.

Latitude N 46° 29' 48.1", Longitude W 115° 59' 45.4" (Accuracy ± 168')

CULVERT # 3
INLET AREA

CULVERT # 3
OUTLET




TRESTLE # 15

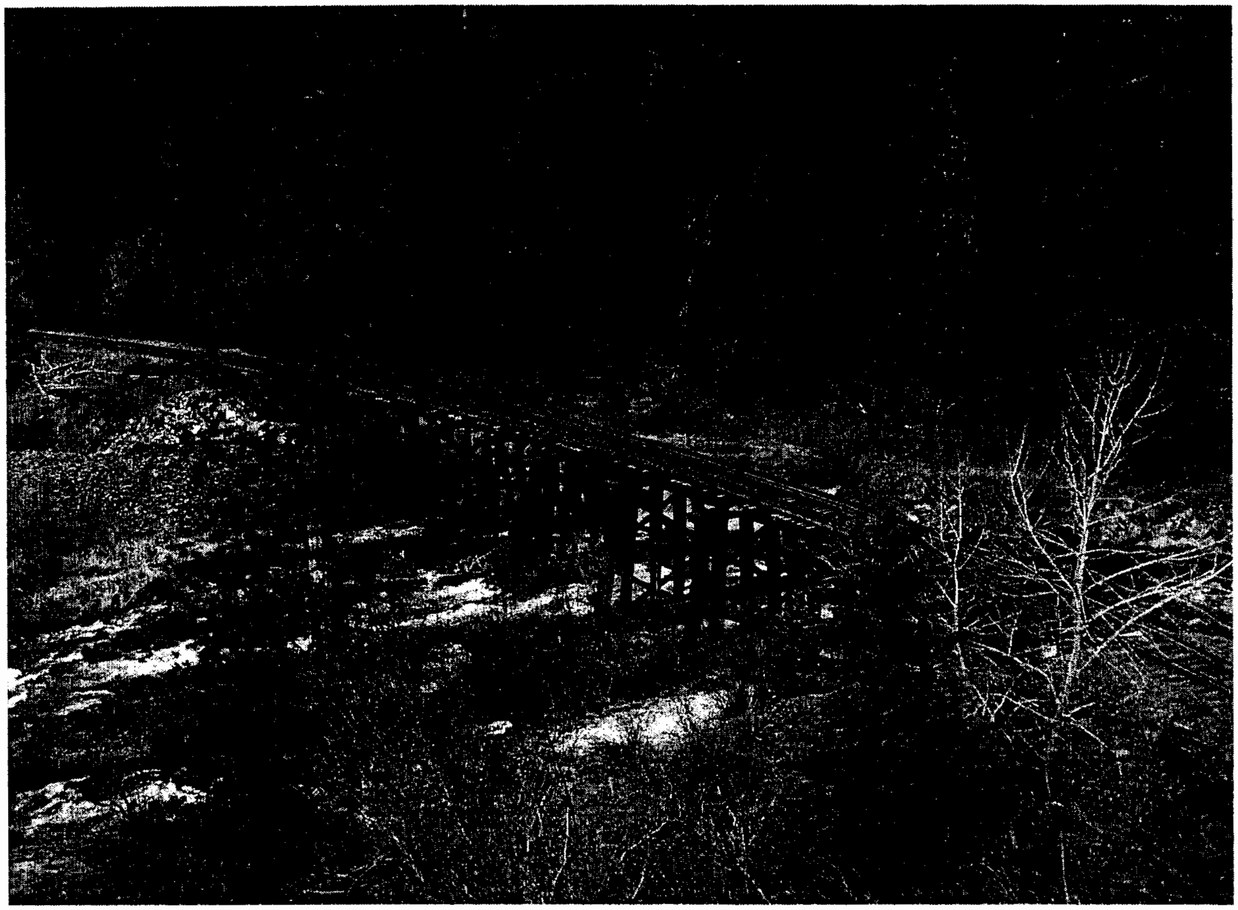
PICTURE TAKEN FROM EAST SIDE OF TRESTLE

Trestle 12.3' wide X 226' long, maximum depth to water 24'.
Crosses Orofino Creek, a Class I stream.
Abutment 2-3' tall on east end, Abutment 3' tall on west end.
Trestle has 12 piers comprised of six single round post pilings, five double round post pilings, and one single piling - listed from west to east.
Pilings 1-4 are above dry ground, pilings 5-11 are above water, and piling 12 is above dry ground.
Piling # 7 has a gabion foundation.

Location NENE Section 6, Township 36 North, Range 4 East.

Latitude N 46° 29' 52.0", Longitude W 115° 59' 37.2" (Accuracy ± 25.5')

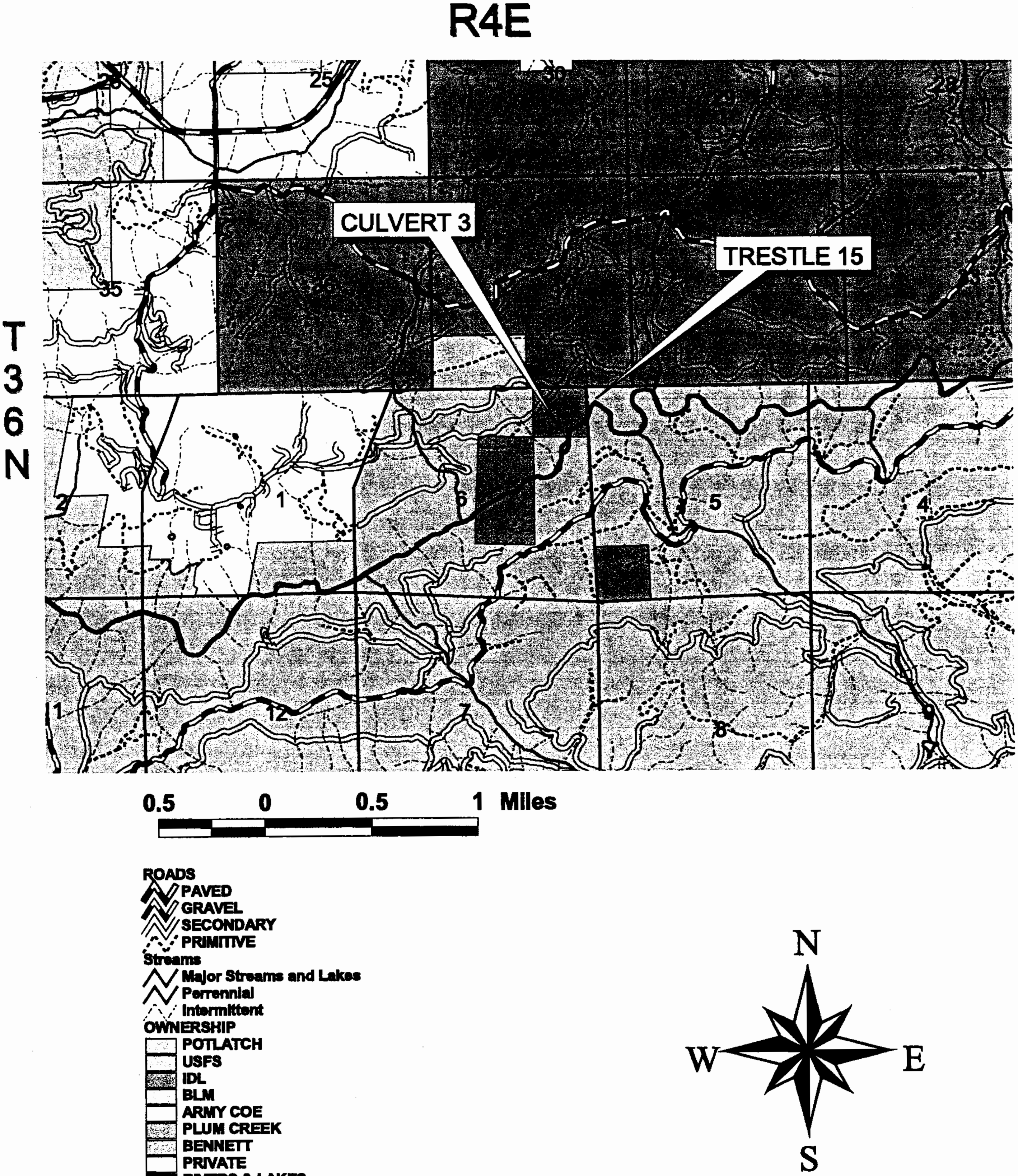
THIS TRESTLE MAY OR MAY NOT BE ON STATE LAND DEPENDENT TO SECTION LINE ORIENTATION.



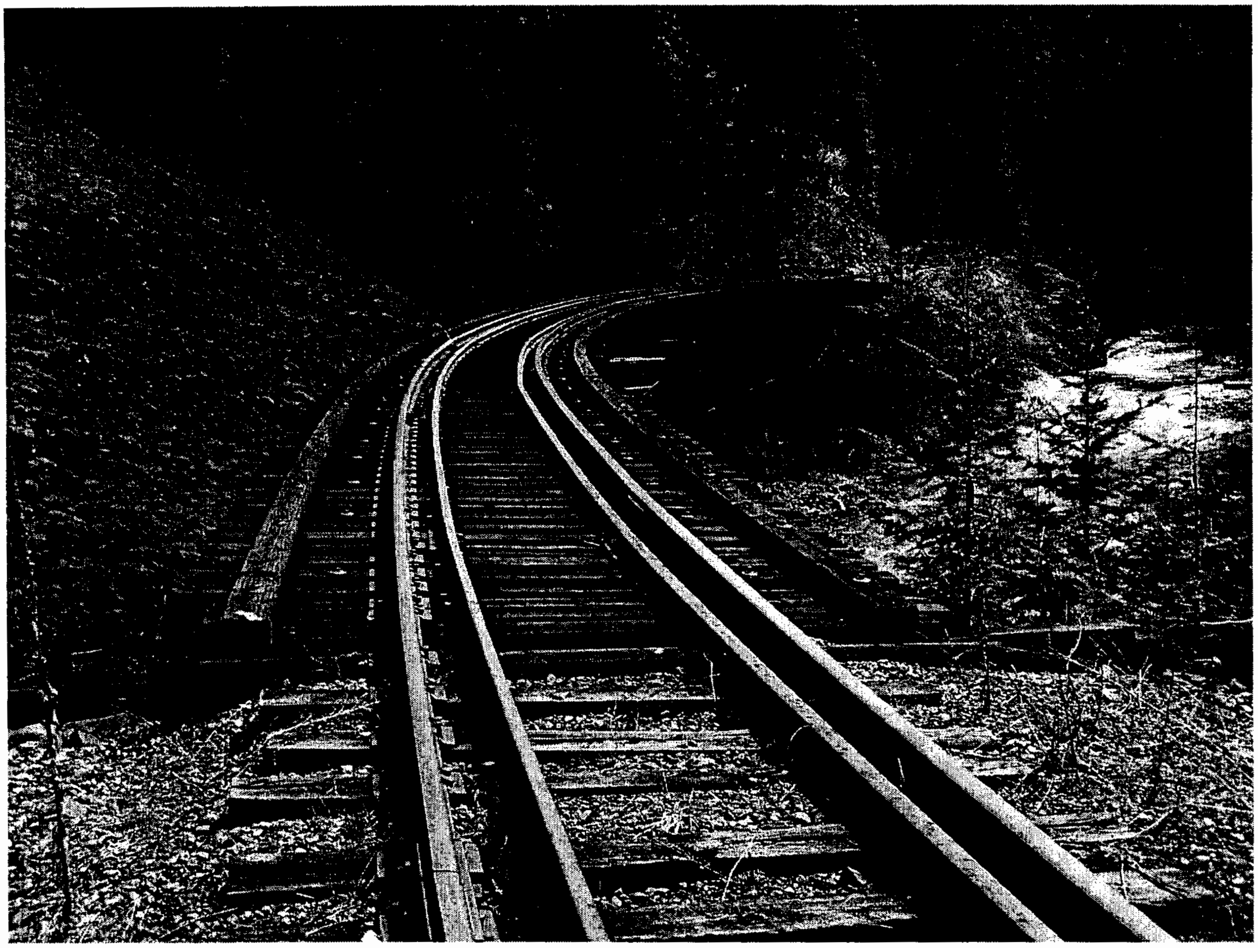
TRESTLE # 15

SIDE VIEW FROM EAST END OF TRESTLE

# RAILROAD ABANDONMENT
# RUDO SECTION




KNR 04/21/04



TRESTLE # 17

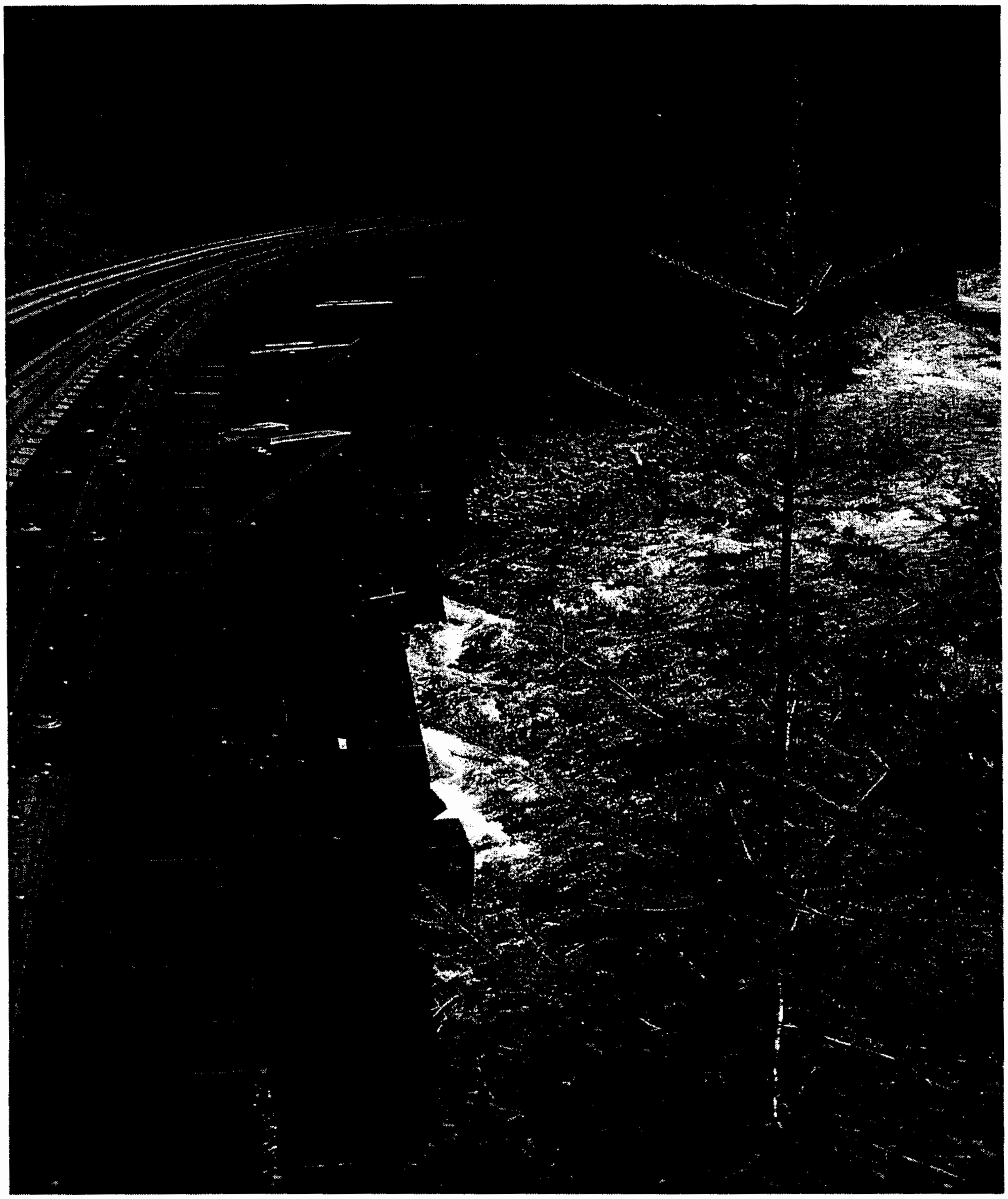
VIEW FROM WEST END OF TRESTLE

Curved trestle 12.3' wide X 222' long with maximum height of 30'.

Both abutments are 3' high with the east abutment based on a rock cliff that drops straight to the water level.
Trestle has 7 single stringers, 4 double stringers (last three over water), and a single stringer (over water) - listed from west to east.

Location SESW Section 33, Township 37 North, Range 5 East.

Latitude N 46° 30' 01.8", Longitude W 115° 57' 42.9" (Accuracy ± 21.0')



TRESTLE # 17

SIDE VIEW FROM WEST END OF TRESTLE


TRESTLE # 17.1

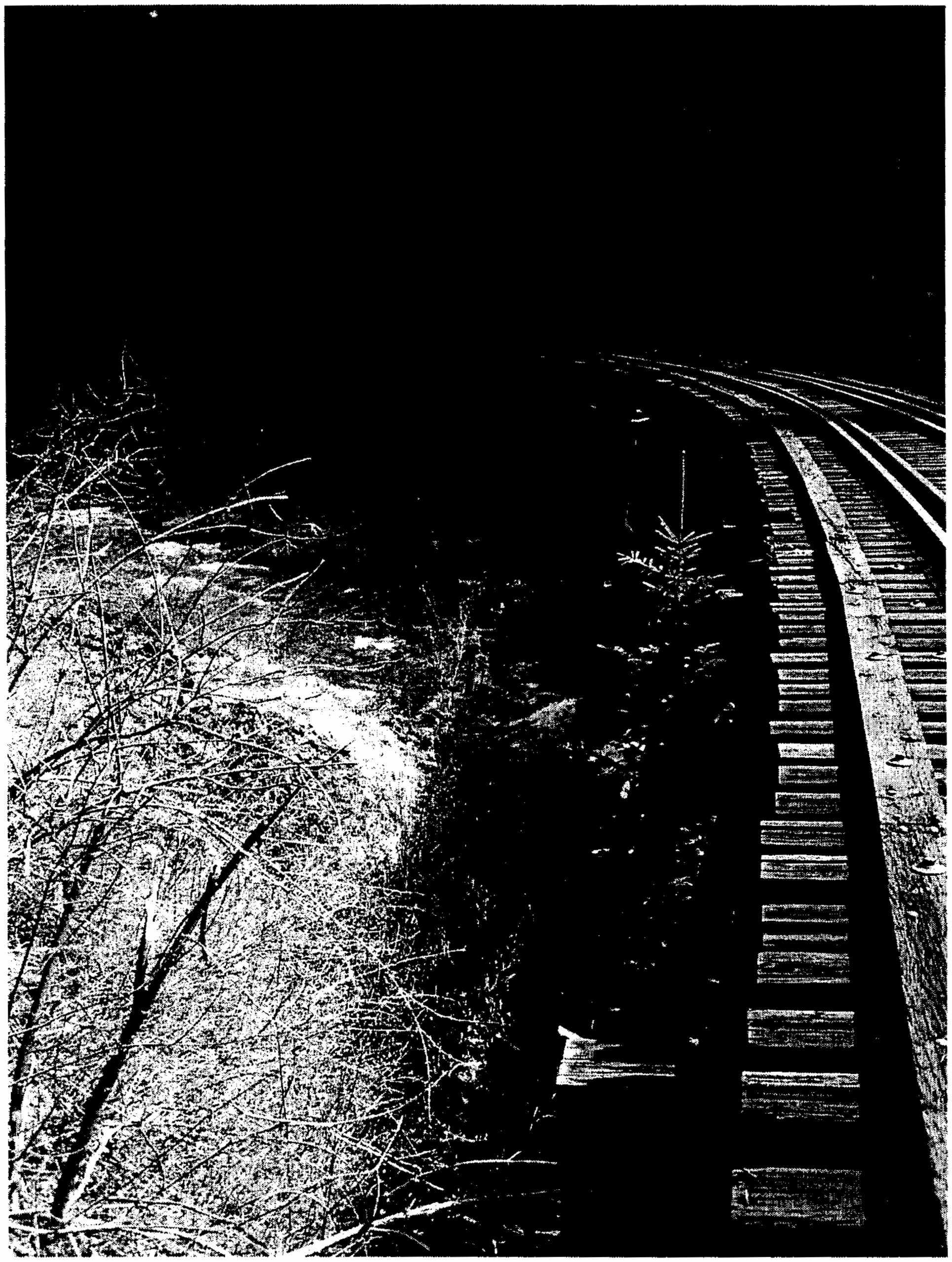
VIEW FROM WEST END OF TRESTLE

Curved trestle 12.3' wide X 297' long with maximum height of 25'.

The abutments are both 3' high.
Trestle has 8 single stringers, 6 double stringers (all over water), and 1 double stringer (over ground) - listed from west to east.

Location SESW Section 33, Township 37 North, Range 5 East.

Latitude N 46° 30' 00.5", Longitude W 115° 57' 35.6" (Accuracy ± 23.3')



CULVERT # 17.1

SIDE VIEW FROM WEST END OF TRESTLE

TRESTLE # 17.3

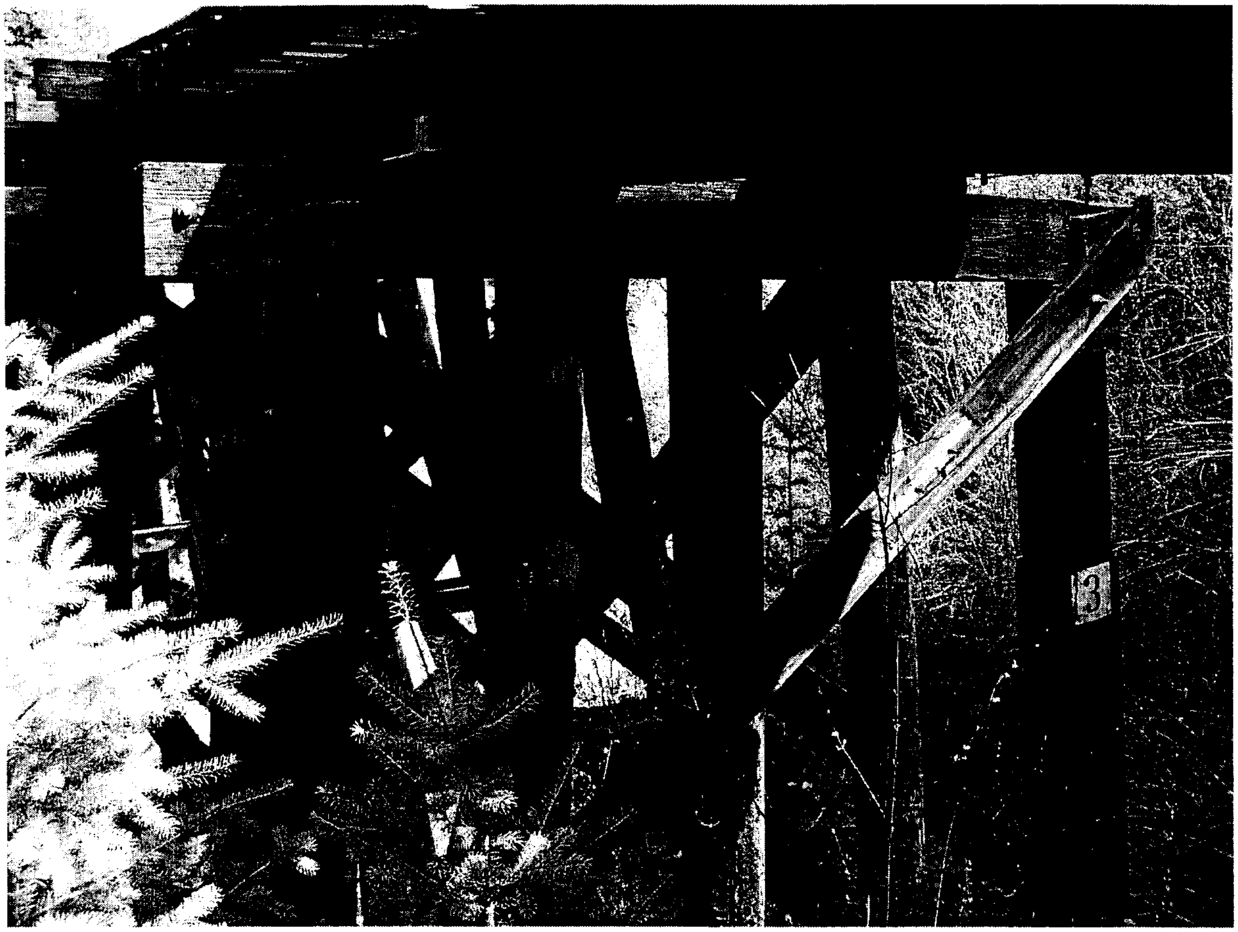
VIEW FROM WEST END OF TRESTLE

Straight trestle 12.3' wide X 314' long with maximum height of 30.5'.

The west abutment is 3' high and the west abutment has a 3' abutment with a 4' step abutment below the first abutment.
Trestle has 5 single stringers (last one over water), 3 double stringers (all over water), 6 single pilings, 2 piling/stringer combination, and a single stringer.

Location SWSE Section 33, Township 37 North, Range 5 East.

Latitude N 46° 29' 59.0", Longitude W 115° 57' 20.8" (Accuracy ± 28.0')



TRESTLE # 17.3

SIDE VIEW

Some trestles have combination stringer / round piling supports.
This side view shows that combination.

POND AND ASSOCIATED CULVERTS

Culvert inlet not visible (believed to be below water level). Approximate depth of fill over inlet is 30'. Two 48" culvert outlets are visible at creek level with fill depth of 40-50'. These culverts service a major drainage.

Location SESE Section 33, Township 37 North, Range 5 East.

Latitude N 46° 30' 04.3", Longitude W 115° 57' 06.1" (Accuracy ± 25.5')

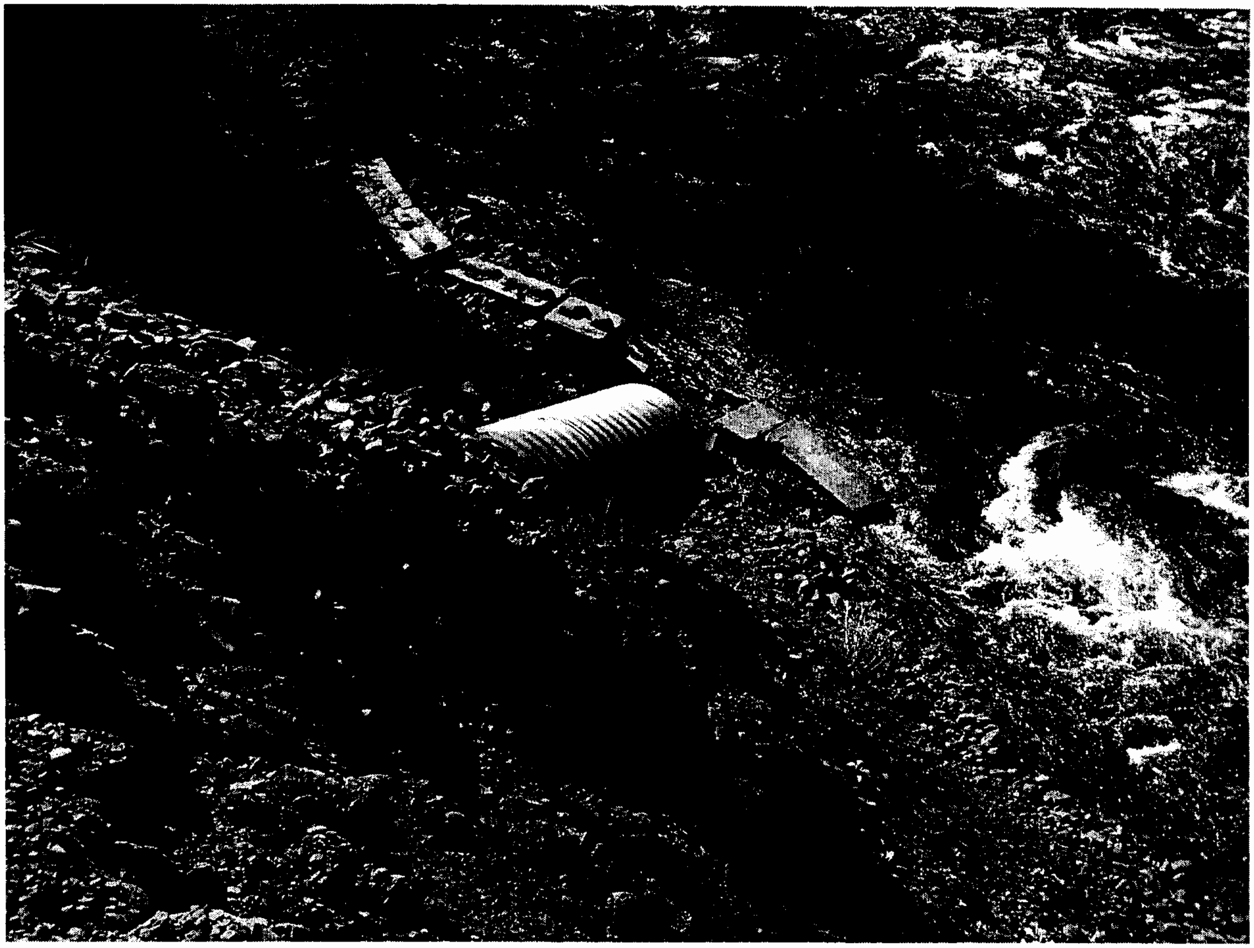
CULVERT # 5

INLET

Culvert 36" X 40' with no water present. Distortion noticed in band area but no soil displacement visible. Fill depth 3-4'. A slide evident into Orofino Creek for 120' west of culvert. Approximately 11 concrete "Jersey Barriers" placed by railroad to prevent bank washout have displaced into the middle of Orofino Creek.

Location SESE Section 33, Township 37 North, Range 5 East.

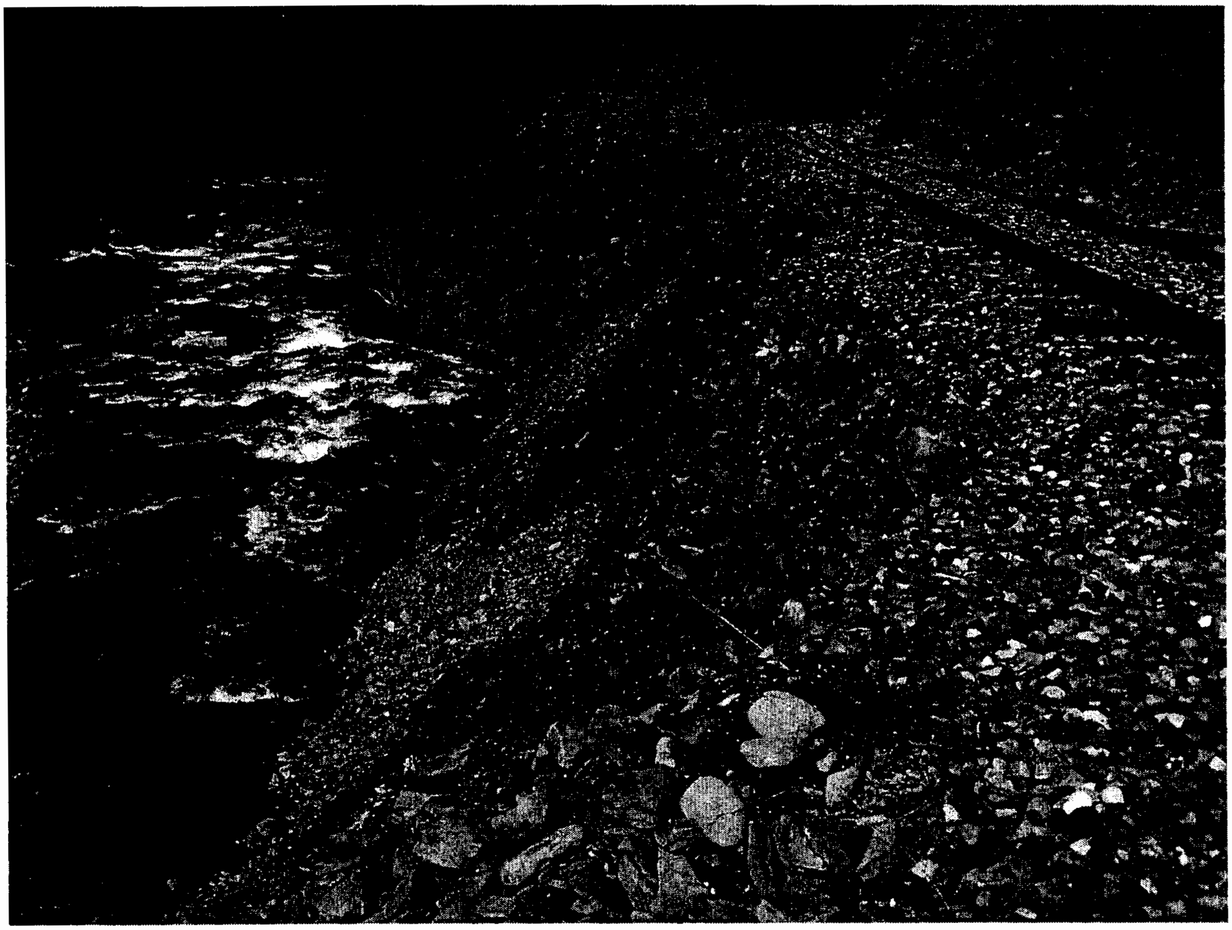
Latitude N 46° 29' 59.5", Longitude W 115° 56' 54.2" (Accuracy ± 20.6')



CULVERT # 5

OUTLET

NOTE CEMENT "JERSEY BARRIERS" AT EDGE OF OROFINO CREEK.

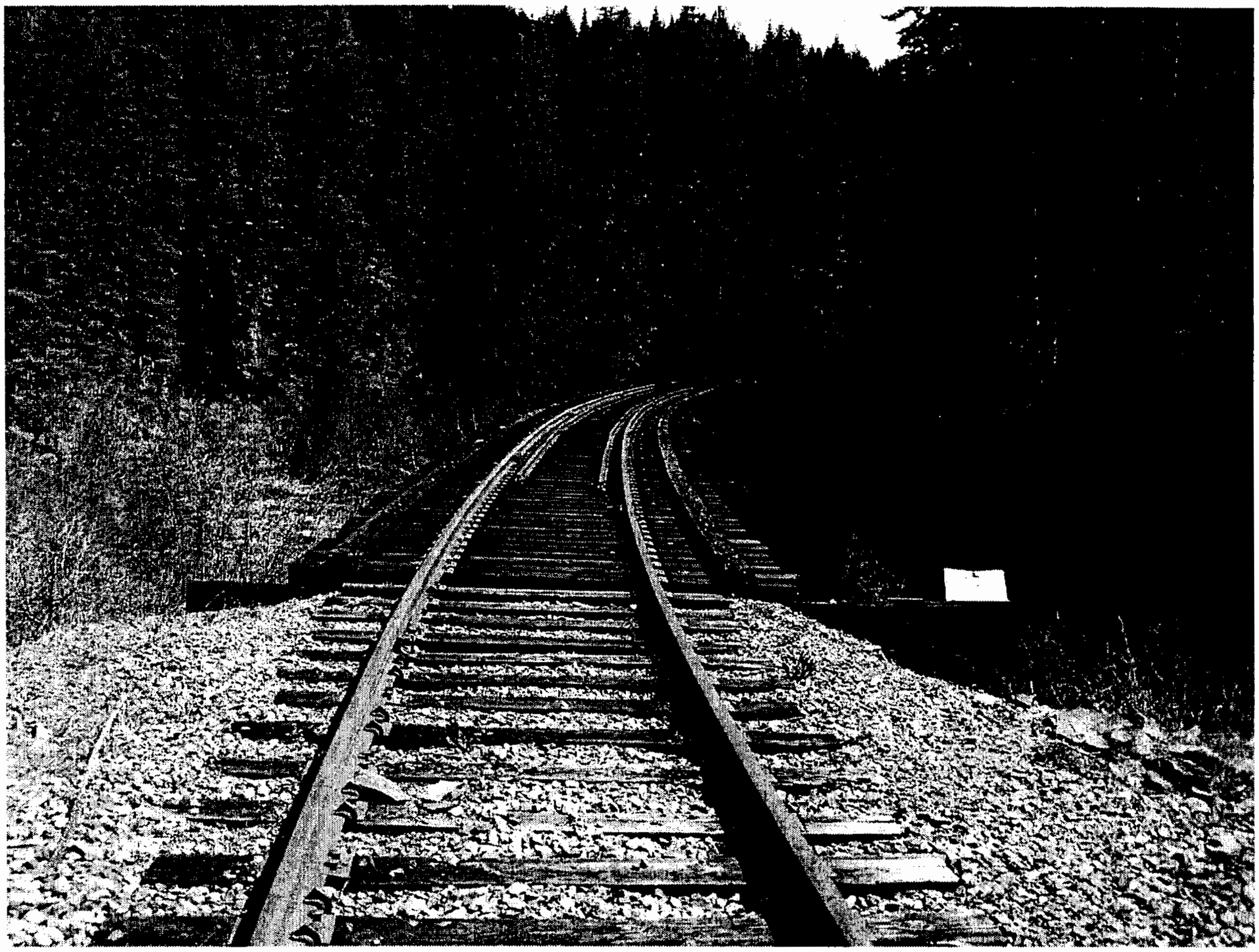


SLIDE AREA AND "JERSEY BARRIERS"

A slide evident into Orofino Creek for 120' west of culvert. Approximately 11 concrete "Jersey Barriers" placed by railroad to prevent bank washout have displaced into the middle of Orofino Creek.

Location SESE Section 33, Township 37 North, Range 5 East.

Latitude N 46° 29' 59.5", Longitude W 115° 56' 54.2" (Accuracy ± 20.6')



TRESTLE # 18

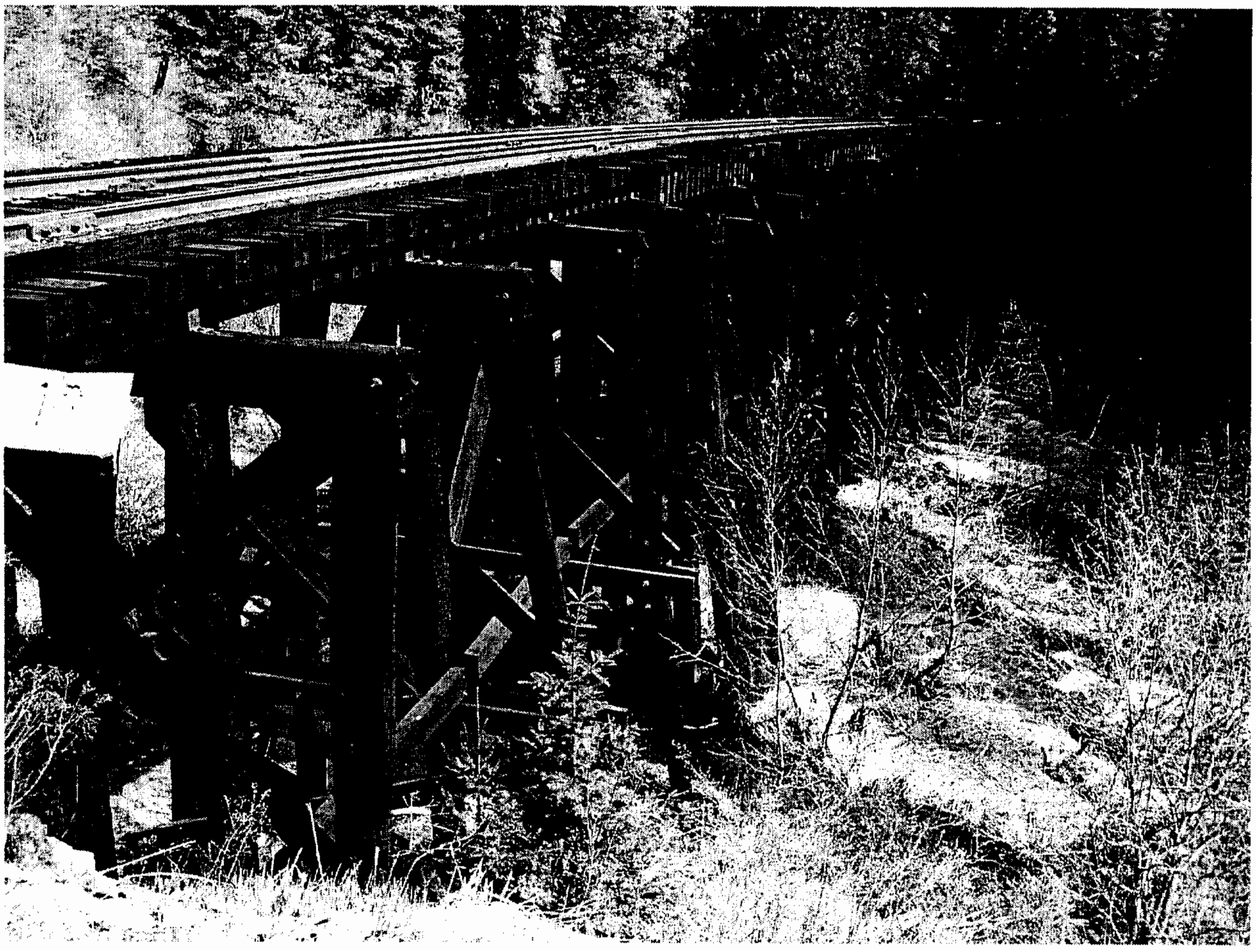
VIEW FROM WEST END OF TRESTLE

Curved trestle 12.3' wide X 219' long with maximum height of 26.5'.

Trestle has 3 single pilings, a double piling, 4 double stringers, and 5 single stringers - listed from west to east. The double stringers are over water but no concrete visible. Angle iron braces are present.

Location SESW Section 34, Township 37 North, Range 5 East.

Latitude N 46° 30' 02.4", Longitude W 115° 56' 36.1" (Accuracy ± 25.4')



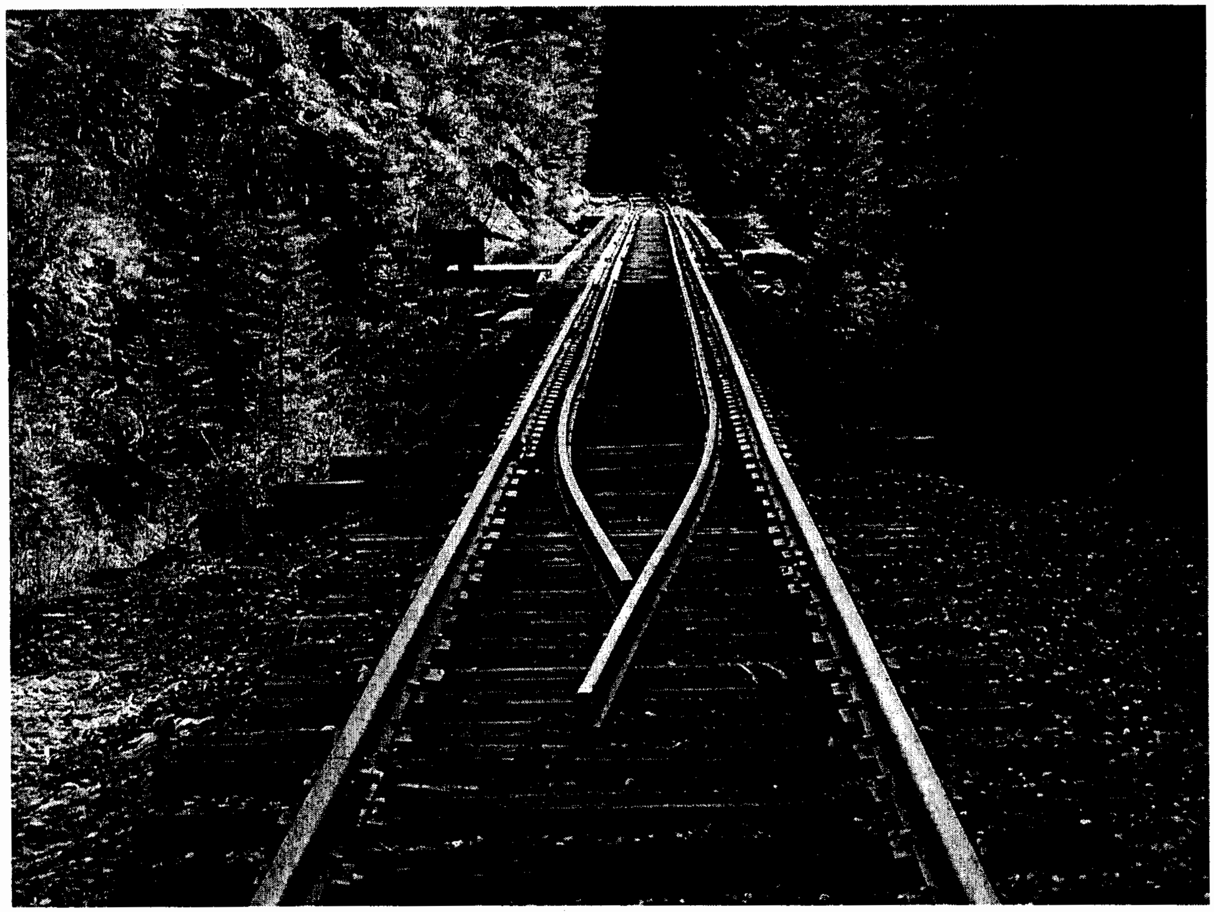
TRESTLE # 18

SIDE VIEW

ABUTMENT MATERIAL STOCKPILE

A pile of abutment materials is located approximately 100' west of the Trestle # 18.1

Latitude 46° 29' 58.7" , Longitude W 115° 56' 30.4" (Accuracy ± 26.7').



TRESTLE # 18.1

VIEW FROM WEST END OF TRESTLE

Approximately 46.5' of the west end of the trestle is on state. Trestle height is16' at the ownership line. Three stringers are on state, all over ground.
An orange painted "S" and an arrow on a bridge tie on the north side of the trestle indicates the ownership line.

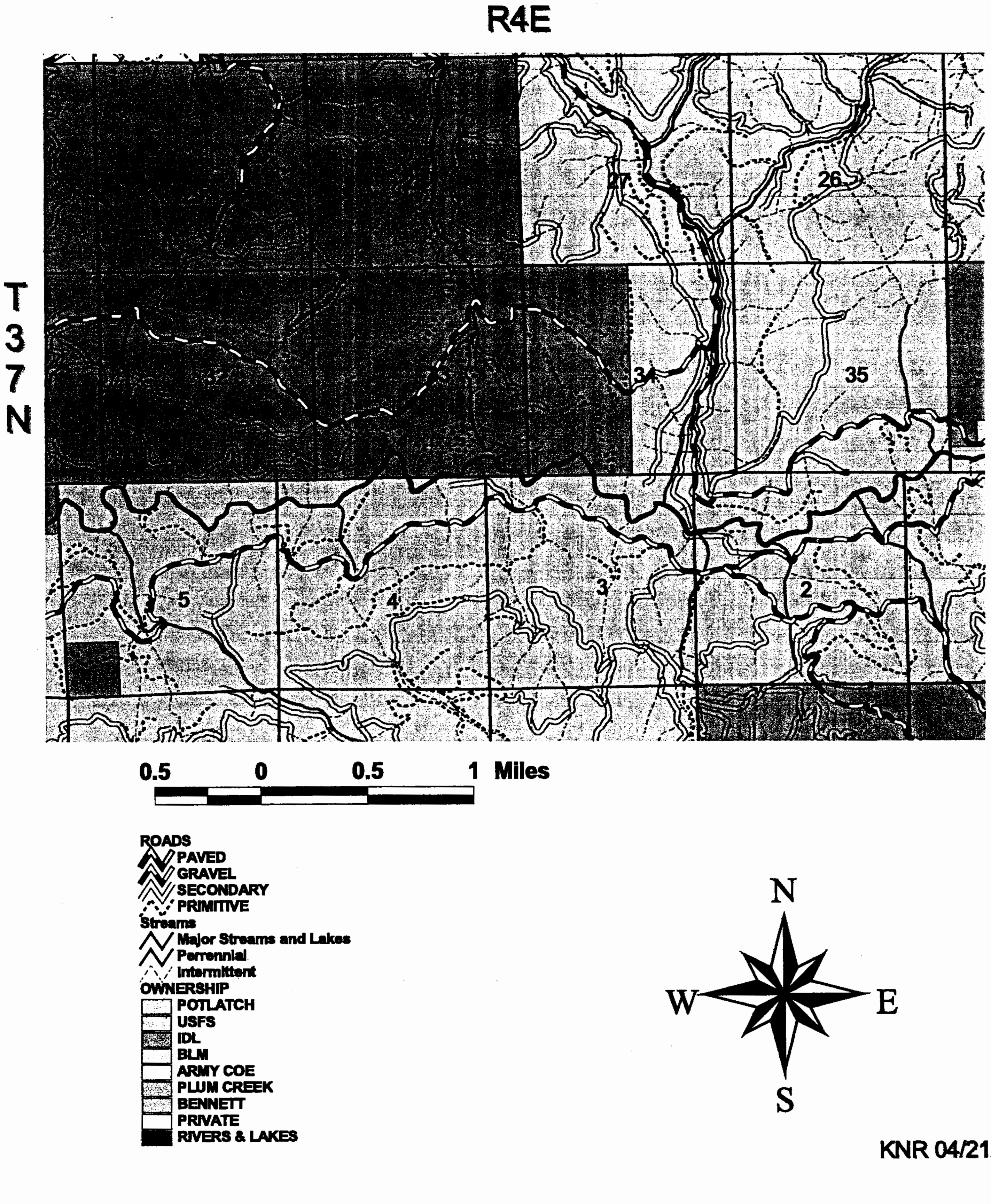
Location SESW Section 34, Township 37 North, Range 5 East.

Latitude N 46° 29' 57.1", Longitude W 115° 56' 28.3" (Accuracy ± 22.4')

TRESTLE # 18.1

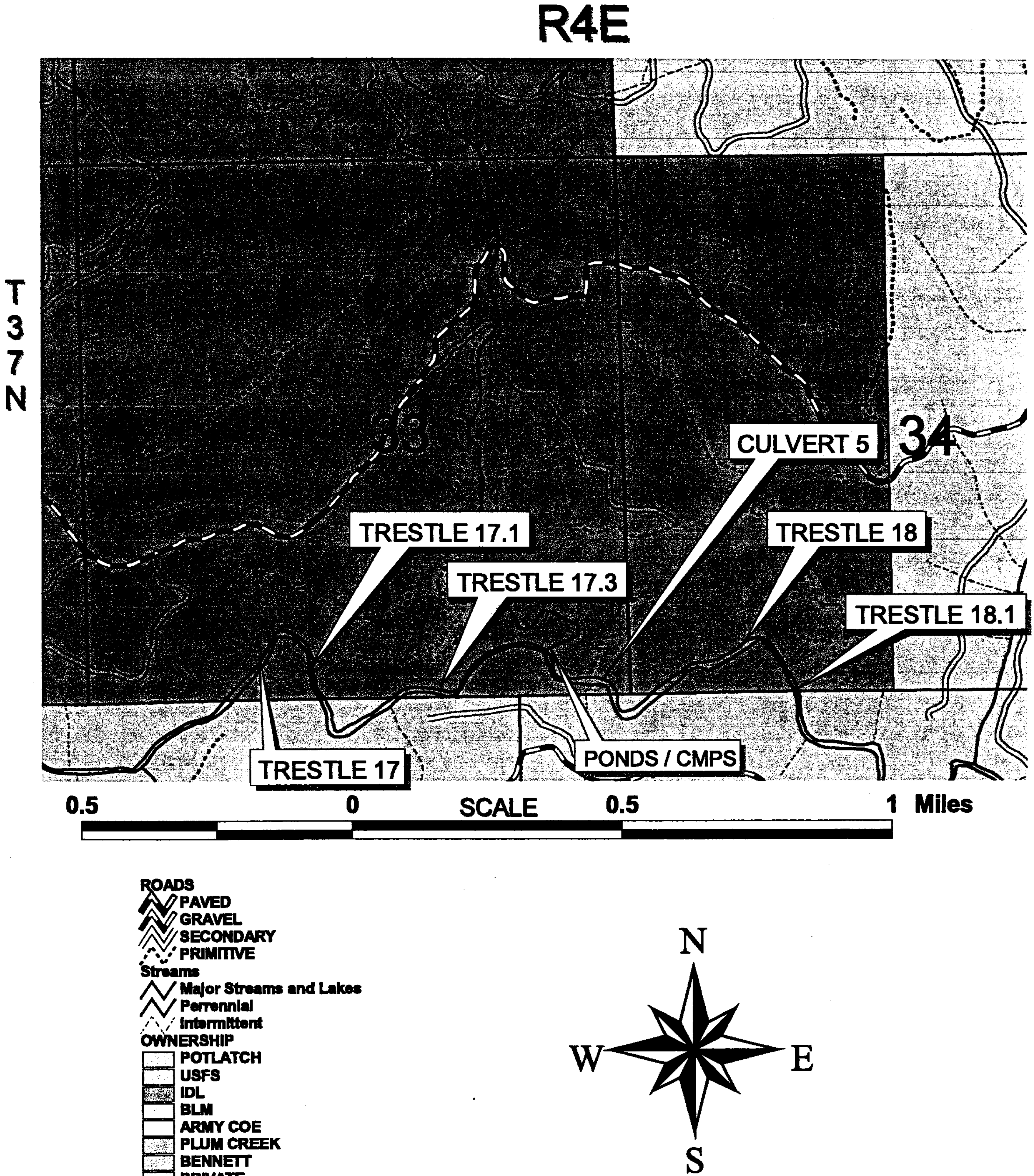
SIDE VIEW FROM WEST END OF TRESTLE

# RAILROAD ABANDONMENT
# LOWER COW CREEK SECTION
VICINITY MAP




KNR 04/21/04

# RAILROAD ABANDONMENT
# LOWER COW CREEK SECTION




KNR 04/21/04

CULVERT # 6

INLET

Culvert 24" x 24', Fill Depth approximately 3'. Culvert has some rust.
No water flowing at time of inspection. Probably only carries spring runoff.
Clean inlet area. Outlet filled with silt about 1/3 of diameter for a distance of 5'.

Location SWNE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 01.6", Longitude W 115° 54' 13.2" (Accuracy ± 25.8')

CULVERT # 6

OUTLET

CULVERT # 7

INLET

Culvert 36" x 40', Fill Depth approximately 4-5'.
Live Class II Stream tributary to Orofino Creek, Flow 5" wide X 2" deep.
Some brush in inlet area. Lower 1/2 of culvert filled about 1/4 diameter with small rocks.

Location SWNE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 16.8", Longitude W 115° 53' 54.2" (Accuracy ± 26.3')

CULVERT # 7

OUTLET

CULVERT # 8

OUTLET

Culvert 24" x 40', Fill Depth approximately 10'. No water present.
Brush in inlet area but culvert usable. No inlet picture due to brush.

Location SENE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 30.4", Longitude W 115° 53' 37.9" (Accuracy ± 19.9')

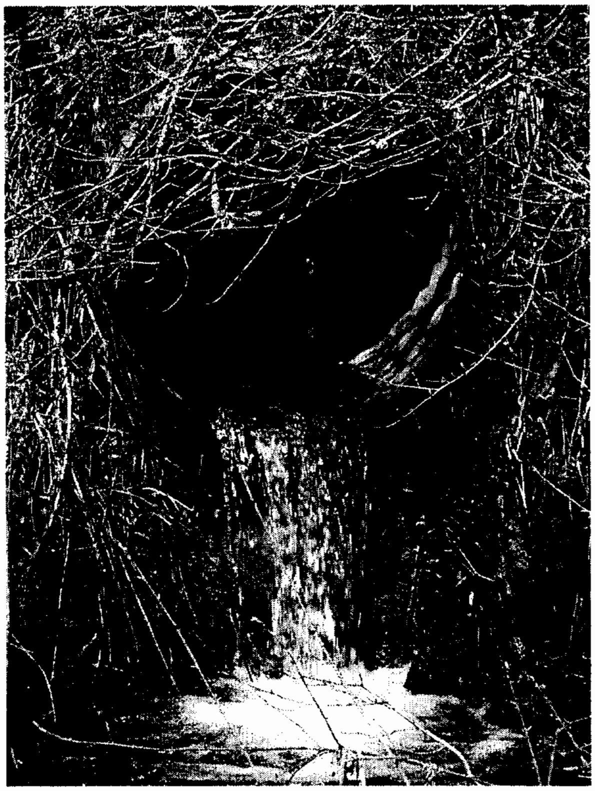
CULVERT # 9

INLET

Diagonal culvert 36" x 74', Fill Depth approximately 6-8'.
Live Class II Stream tributary to Orofino Creek, Flow 12" wide X 3" deep.
Maximum use appears to be 1/4 culvert diameter.

Location SENE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 31.6", Longitude W 115° 53' 30.4" (Accuracy ± 30.3')



CULVERT # 9

OUTLET

CULVERT # 9 OUTLET POOL

CULVERT # 10

INLET

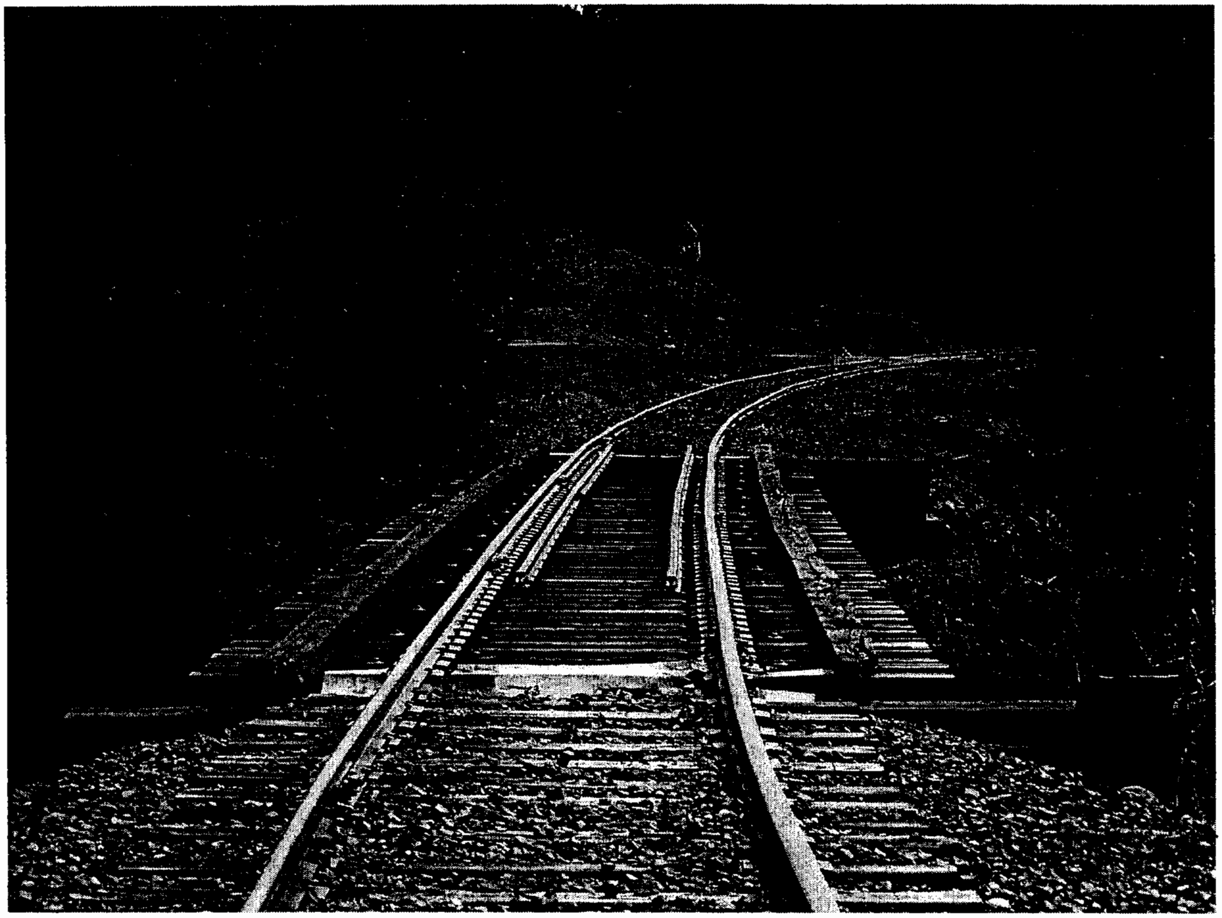
Culvert 24" x 36', Fill Depth approximately 6'. Culvert in good shape.
Spring, flow of 3" X 1" at time of inspection.

Location SENE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 31.4", Longitude W 115° 53' 27.3" (Accuracy ± 30.2')

CULVERT # 10

OUTLET



TRESTLE # 21

Trestle 12.3' wide X 75' long, maximum depth to water 21'.

Live Class I Stream tributary to Orofino Creek, Flow 5' wide X 2-3' deep.

Abutments 3' tall on each end. Trestle has 4 piers comprised of five single round post pilings. Two pilings in water, two are on dry ground.
Trestle is 65' west of the ownership line.

Location SENE Section 36, Township 37 North, Range 4 East.

Latitude N 46° 30' 28.2", Longitude W 115° 53' 07.0" (Accuracy ± 25.3')

TRESTLE # 21

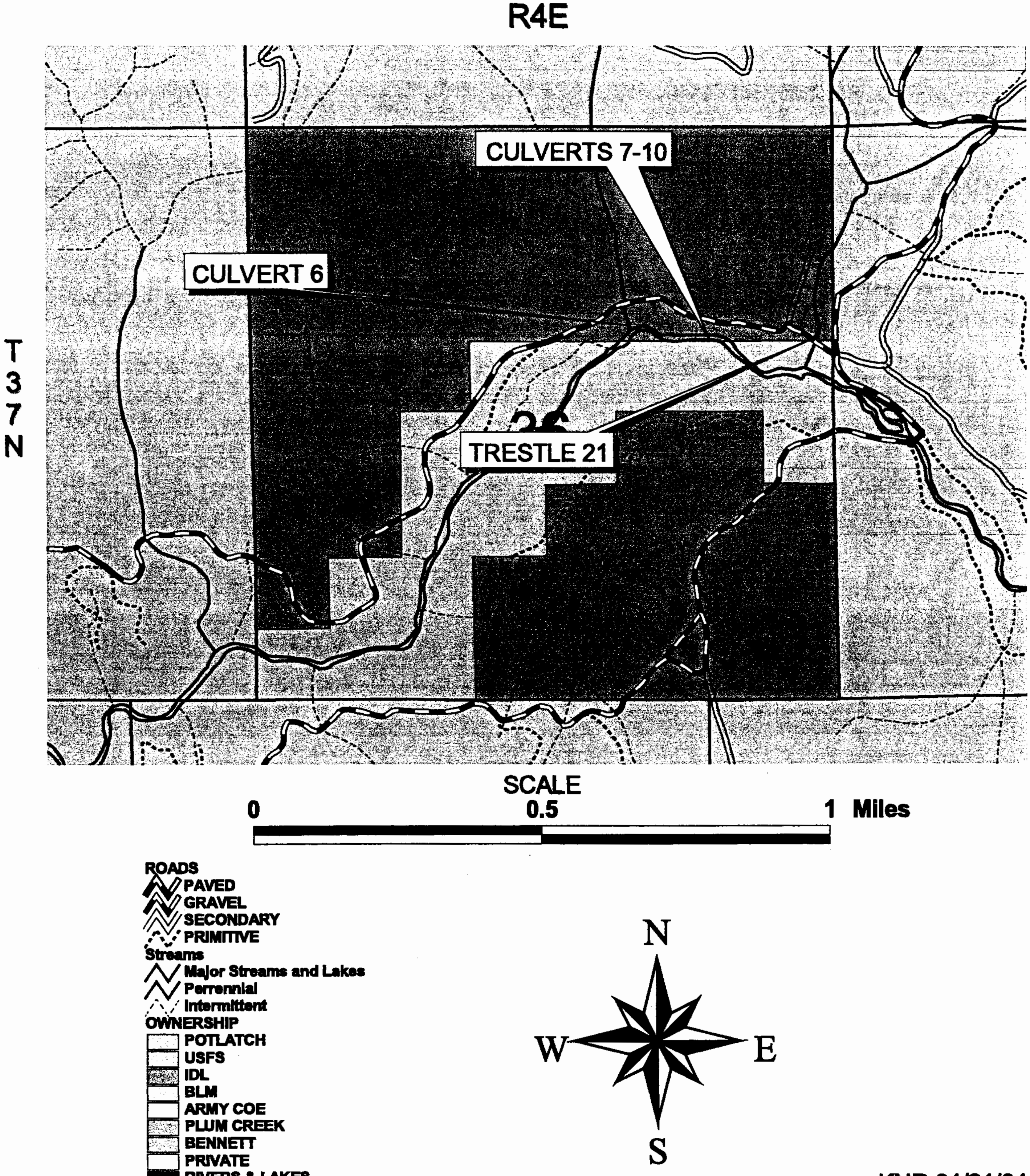
SIDE VIEW

TRESTLE # 21

PICTURE OF WATER FLOW FROM CLASS I TRIBUTARY

# RAILROAD ABANDONMENT

## RUDE-COW SECTION




KNR 04/21/04

TRESTLE # 24

Straight Trestle 155' Long X 12.3' Wide, Maximum depth to water 34'.

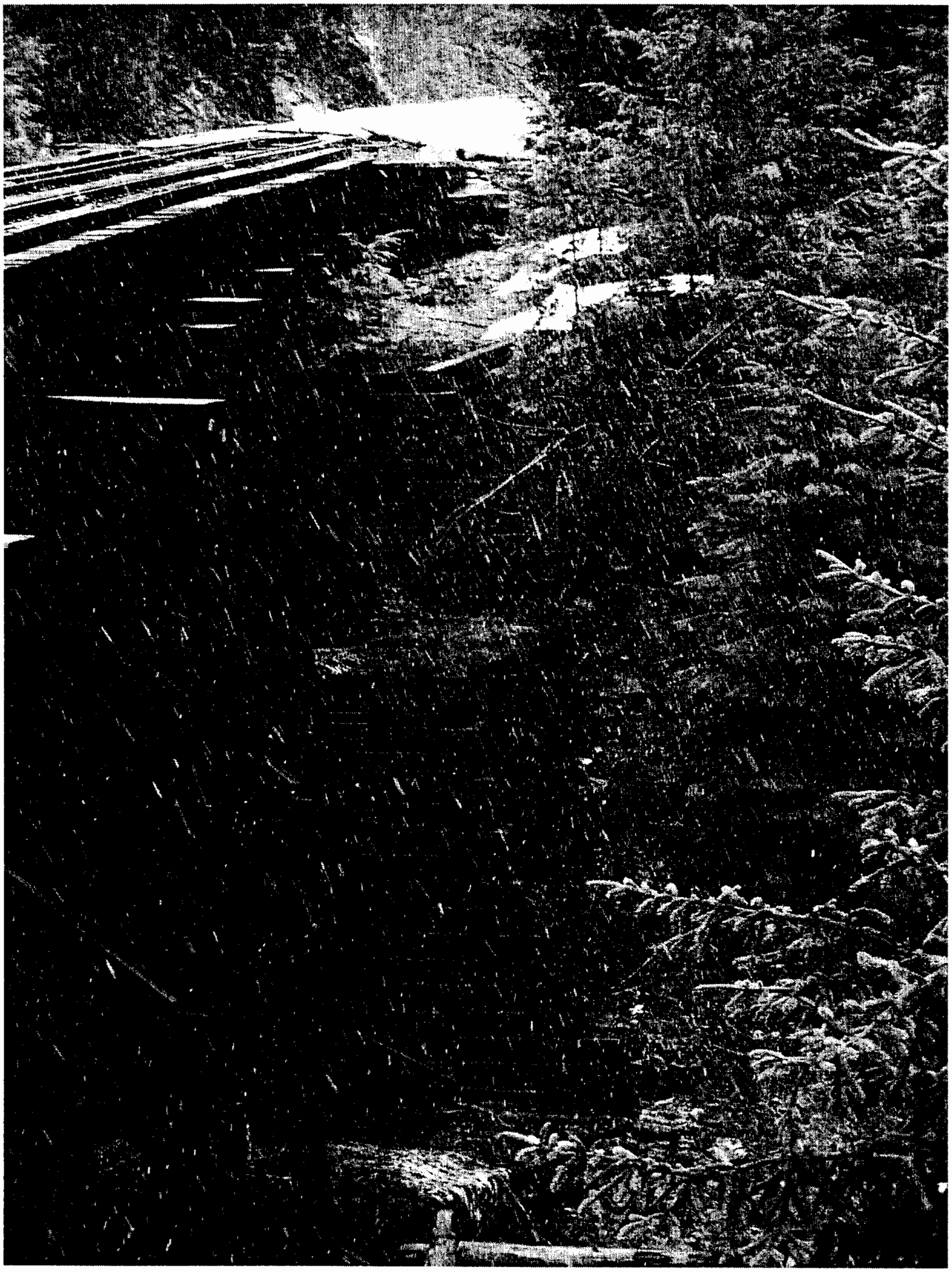
Crosses Orofino Creek.
Abutments 4' tall on each end. Trestle has 3 single stringers, a double piling round post piling, a single piling, a double piling, and 2 single pilings - listed from west to east.
Extensive crib abutment on west end of trestle.

Location NWNW Section 4, Township 36 North, Range 5 East.

Latitude N 46° 29' 55.1", Longitude W 115° 50' 49.1" (Accuracy ± 22.9')

TRESTLE # 24

SIDE VIEW



TRESTLE # 24 ABUTMENT

TRESTLE # 24.1 (?)

Curved Trestle 157' Long X 12.3' Wide, Maximum depth to water 34'.
Crosses Orofino Creek.

Abutments 4' tall on each end. Trestle has all round pilings listed as follows from west to east - single, 4 double, and 3 single pilings.
Extensive crib abutment on west end of trestle.

Location NWNW Section 4, Township 36 North, Range 5 East.

Latitude N 46° 29' 54.5", Longitude W 115° 50' 43.5" (Accuracy ± 22.9')

TRESTLE # 24.1 (?)

SIDE VIEW

NOTE BANK STABILIZATION ON EAST ABUTMENT

CULVERT # 11

INLET

Culvert 24" X 80' (approximately). Runs diagonally upstream. Flow 4' deep X 6" wide.
Fill 4' at inlet and 12' at outlet. Outlet not visible (buried in rocks).

Location SESE Section 33, Township 37 North, Range 5 East.

Latitude N 46° 30' 07.3", Longitude W 115° 49' 25.0" (Accuracy ± 19.1')

CULVERT # 11

OUTLET AREA ( CULVERT NOT VISIBLE)

TRESTLE # 25

Straight Trestle 168' Long X 12.3' Wide, Maximum depth to water 20.5'.
Crosses Orofino Creek.

Abutments 3' tall on each end. Trestle has all pilings listed as follows from west to east - 2 single pilings, 5 double pilings, and 1 single piling.

Location SESW Section 34, Township 37 North, Range 5 East.

Latitude N 46° 30' 06.1", Longitude W 115° 49' 11.3" (Accuracy ± 24.2')

TRESTLE # 25—SIDE VIEW OF WEST AND EAST END OF TRESTLE

## TRESTLE (NO NUMBER)

Curved Trestle 174' Long X 12.3' Wide, Maximum depth to water 23.5'.

Crosses Orofino Creek.
Abutments 3' tall on each end. Trestle has 2 single stringers, a double stringer, 3 double pilings, a double stringer, and 2 single stringers - listed from west to east.

Location SESW Section 34, Township 37 North, Range 5 East.

Latitude N 46° 30' 06.5", Longitude W 115° 48' 52.5" (Accuracy ± 18.8')

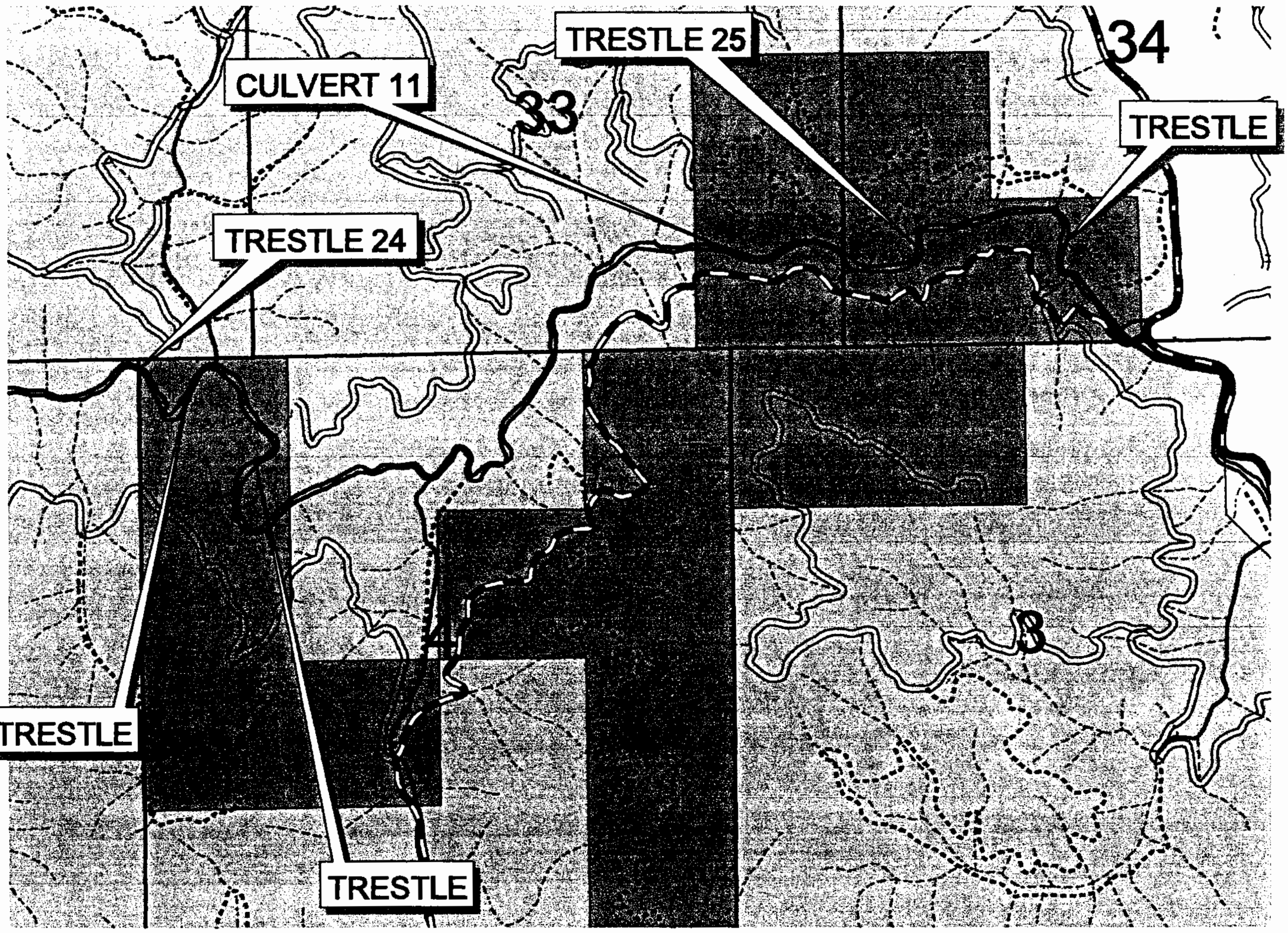
TRESTLE (NO NUMBER)

SIDE VIEW

# RAILROAD ABANDONMENT
## PIERCE SECTION

R5E

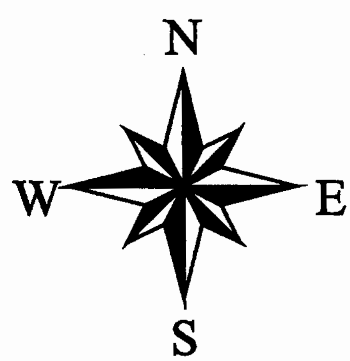
T 36 N




SCALE

0.25 0 0.25 0.5 0.75 Miles

ROADS
PAVED
GRAVEL
SECONDARY
PRIMITIVE
Streams
Major Streams and Lakes
Perrennial
Intermittent
OWNERSHIP
POTLATCH
USFS
IDL
BLM
ARMY COE
PLUM CREEK
BENNETT
PRIVATE
RIVERS & LAKES




KNR 04/21/04

# EXHIBIT E
# to State of Idaho's Comments on Environmental Assessment

Project Impact Clearwater County Meeting Notes, December 17, 2003

**Clearwater County**
# Meeting Notes

**Meeting Date:** December 17, 2003
**Location:** Ponderosa Restaurant
Orofino, ID
**Time:** 9 am – 10:30 am

**Those Present:**

| | | | |
|---|---|---|---|
| Stan Leach | Nick Albers | Paul Pippenger | John Cunningham |
| Cameron Eck | Anne Connor | Nancy Butler | Debi Ruppe |
| John Elliott | Mike Walk | Sharon Walk | Angela Vanderpas |
| Chris Lamont | Rob Simon | Bob McKnight | Jim Mallory |
| Howard Weeks | Rene'Gingrich | Shaun Maxey | Ed Ditonno |
| Lori Wright | Bruce Hanson | Michael Hoffman | Vern Bretz |
| Alex Irby | Mark Reaney | Dustan Bott | Christine Frei |
| Kevin Spradlin, guest | Michael Caughran | | |

The following issues were discussed:

<u>All Hazard Mitigation Plan</u>

- Clearwater County received a grant through the Bureau of Disaster Services to complete an "All Hazard" Multi-Jurisdictional Mitigation plan.
- The County contracted with CEDA to complete the plan.
- The plan must include wildfire, landslide, wildfire and earthquake. It can include other hazards. The Steering Committee will determine the hazards.
- The County purchased the "Mitigation 20-20" software, a multi-layered database to assist in the development of the plan.
- Plan stages include: a citizens' survey, risk and vulnerability assessment, development of mitigation strategy and plan, the adoption of the plan by jurisdictions, and public meetings.
- Completion goal: November 1, 2003.

<u>Immediate Action items:</u>

1. Steering Committee: Decide on Hazards to include in the plan.
2. Christine: Review software and develop strategy for completing the plan.

<u>Weather Station/Stream Gauges</u>

Mike Hoffman and Nick Albers gave an update:

- RAWS Weather station is installed and will be kept in the Rudo area for one year.

- Two new stream gauges have been installed.
- In communication and working with Missoula Weather Station on project.
- Yet to be determined:
  1. Who keeps the data – USDA, Forest Service or Clearwater County
  2. What to expect out of the system and the value of the information being recorded.
  3. Consideration of multiple use, how information can assist wildfire mitigation.

Immediate Action items:

- Bring issues back to committee and see how best to tackle the project.
- Develop project to seek NFP grant for a permanent weather station.

Rural Addressing

Update by Angela Vanderpas.

- Parcel mapping complete.
- County has hired more staff; more time available for the project.
- Long-term project without a deadline – will need to work with fire agencies in the process.
- Currently concentrating on the road inventory.

Pierce Rail Line – Trestles

- Committee viewed a videotape of two of the trestles during the February 2003 high water event—showing debris behind the trestles and a failed trestle.
- Kevin Spradlin with Camas Prairie Railnet comments:
  1. The rail line has not been in use for almost two years and maintenance on an unused line is not cost effective.
  2. In October, a maintenance crew did go down the line from the Pierce side and cleaned out debris from behind the trestles. Although they were unable to get all the way down the line by rail, they did get to each trestle by other means.
  3. Does not know the future of the line. It will probably be either abandoned or sold. Camas Railnet is not necessarily obligated to pull out the bridges. Salvage companies normally take the rails, but often leave the bridges because they are not cost effective to remove.
- Committees comments:
  1. Concerned that a failed bridges could cause a "domino" effect during a highwater event. If an upper bridge fails, it could cause other bridges to fail and cause a flood event or compound a flood event.

2. If the rail line were abandoned, it would be more desirable from a flood mitigation standpoint to have the bridges removes.
3. Wondered what the liability of Camas Prairie Railnet would be if the bridges contributed to a flood event.
4. A monitoring process needs to be set up.
5. Kevin agreed to notify Clearwater County and the City of Orofino when the status of the Pierce Line changes.

Immediate Action items:
John Elliott and a County representative will meet with Kevin Spradlin to develop a monitoring process. They will report back to the committee mid-January.

Landslide
- Landslide hazard maps are at the County, but have not been incorporated into the system.
- Subcommittee, committee and the county need to be educated on the maps and become familiar with the data that is now available. This needs to be done before any plan is developed for use and implementation.
- Committee needs to touch base with Nez Perce County on their Landslide Hazard Mapping program.

Immediate Action items: Subcommittee to meet in January to review landslide map status. May need to discuss how the County could use Terry Howard's services to educate and implement program.

Wildfire
- Need to complete County's National Fire Plan grant. Will need to put out an RFQ or RFP for a consultant to complete a fuel hazard mapping plan.
- Christine to meet with C-PTPA to discuss the pending project.
- Need to identify water sources and develop water sites in areas of the county that lack sources.

Immediate Action items: Hire contractor and complete fuel hazard mapping plan.

Orofino Creek Master Plan
- Mouth Project – Phase I construction is complete; however, the Corp of Engineers is requiring the County to take some corrective measures. A portion of Phase I will be redesigned and the project will be completed with Phase II during the Summer 2004. Christine is locating grants to assist the county with Phase II.
- Brandt Cedar Mill Revegetation Project – The project is postponed until Summer 2004. Clearwater County and Dean Brandt is working with NOAA on revising the project. A preliminary cost estimate for the project that includes engineering and construction management has been

received from River Design Group. The County is working with FishAmerica to get an extension on the grant. Christine is seeking other grants to complete the project that will cover the cost of engineering design and construction management.

- Other Prioritized Projects – The Flood Committee identified subcommittee members for the Newman's Corner, Brandt Mill and Konkolville projects and determined that more public education needs to happen before planning for the channel reconstruction at Noah's Bridge, the Forest Street Bridge project and the Reach 6 – channel reconstruction project. Nothing has been done on these projects since June 2003.

  Immediate Action items: Flood committee needs to meet to prioritize projects and set up work sessions for the prioritized projects.

Other

- Public education committee needs to discuss the feasibility of sponsoring another high school mitigation workshop and fair. BDS has requested that Clearwater County submit a funding proposal for this project.
- The committee would like to invite Janet Hoyle, with the Clearwater Sub-basin Planning Group, to speak to the Flood Committee on the sub-basin draft plan.

Next Meeting(s)

Christine will get back to the committee after January 1, 2003.

# EXHIBIT F
# to State of Idaho's Comments on Environmental Assessment

Letter from Joe Pippenger, Mayor, City of Orofino to
Kevin Spradline, Camas Prairie RailNet, Inc.
October 27, 2003

217 First Street
P.O. Box 312
Orofino, ID 83544

Phone (208) 476-4725
Fax (208) 476-3634
email: council@clearwater.net

**City of Orofino**

COPY

October 27, 2003

Kevin Spradlin
Camas Prairie RailNet, Inc.
325 Mill Road
P.O. Box 1166
Lewiston, ID 83501

RE: Clearwater County, ID Railroad Trestles

Dear Kevin:

Clearwater County, Idaho recently completed a **"Watershed Assessment and Master Water Plan for Flood Mitigation and Stream Restoration on Lower Orofino Creek"** with grant funds from the Federal Emergency Management Agency (FEMA). The City of Orofino was an active participant and member of the Project Impact Committee who helped develop the Master Water Plan with an outside Engineering Firm who specializes in Flood Mitigation and Stream Restoration Projects. The Plan identifies the deteriorated and potentially hazard condition of many of Camas Prairie RailNet's trestles along the Orofino to Pierce Rail Line. We understand this section of your line is no longer being used by your company, which promulgates the problem identified in the Master Water Plan.

Specifically, it is the opinion of the Consultant, Clearwater County Commissioners, and the City of Orofino that the existing condition of the trestles in the middle watershed, which contains approximately twenty-railroad trestle stream crossings, is poorly maintained and in need of immediate maintenance. Our immediate concern however, is the amount of debris that is jammed behind the trestles. The debris is not only causing damage to your trestles, but poses a detriment to our community during high water flows. If these debris areas suddenly break loose after a high water flow, the after math of water and debris ends up in Orofino causing severe flood damage to private and public property.

The City is requesting that Camas Prairie RailNet address two issues of potential threat:

1. Examine and remove the debris that has piled up behind the trestles and that will continue to pile up as a result of high water.

2. Examine and repair, if necessary, the potential failure of trestles because of a lack of maintenance.

Both of these issues could easily contribute to a major flood event. The City would be happy to forward a copy of the Master Water and Mitigation Plan if you or other officials would like to review it. I realize what we are asking is not an easy issue to resolve. But being situated on the receiving end of a potential hazard is not a very refreshing thought. I would welcome a personal telephone conversation or a meeting to further discuss this matter at your earliest convenience. In the meantime, please do not hesitate to contact me if I can be of any assistance or answer any questions whatsoever.

Sincerely,

Joe Pippenger
Mayor

# EXHIBIT G
# to State of Idaho's Comments on Environmental Assessment

Letter from Stan Leach,
Chair, Clearwater County Commission,
to Kevin Spradline, Camas Prairie RailNet, Inc.
October 27, 2003

COPY

P.O. Box 586
Orofino, ID 83544

Phone: (208) 476-3615
Fax: (208) 476-3127

Commissioners

Stan Leach, Chair
J. P. "Pete" Curfman
Don Ebert

# Clearwater County Commissioners

October 27, 2003

Kevin Spradlin
Camas Prairie Railnet
325 Mill Road
P.O. Box 1166
Lewiston, ID 83501

Re: Railroad Trestles
Orofino to Pierce Rail Line

Dear Mr. Spradlin:

On August 25, 2003, the Clearwater County Commissioners participated in a natural hazard mitigation workshop that was hosted by the Clearwater County Project Impact Committee. Project Impact is a local stakeholder initiative that is sponsored by Clearwater County and focused on reducing the potential negative impact of flood, wildfire and landslide. At the workshop, Matt Daniels with River Design Group presented an overview of the newly completed *Watershed Assessment and Master Plan for Flood Mitigation and Stream Restoration on Lower Orofino Creek.* In addition, the Project Impact Committee showed a videotape of the January 2003 high-water event with footage of Orofino Creek at the site of one of the middle watershed trestles.

It is the opinion of the consultant, the Project Impact Flood Committee and the Clearwater County Commission that the existing condition of the trestles in the middle watershed poses a threat to the County. The following is an excerpt from Section 2.3.5 from the Orofino Creek Master Plan:

> Railroad trestles with numerous, closely-spaced piers present an especially dangerous scenario. The middle watershed is said to possess as many as 20

railroad trestle stream crossings. During a site visit to the middle watershed following a flood event, debris jams were observed at all three railroad trestles visited. The debris jams had forced water above and around the bridge and caused extensive scour as noted by the newly-formed downstream depositional bars and freshly-eroded banks. Since the railroad is abandoned and not maintained, the effects of debris jams and ice jams are likely to contribute excess sediment to the lower watershed and potentially generate surges of flood water, debris, sediment and ice as they become dislodged.

Although we are aware that this rail line has not yet been abandoned (as stated in the above quote), we are concerned that Camas Prairie Railnet may not be conducting regular rail line maintenance because there is currently no service provided on the line. From our standpoint, two issues are of potential threat: 1.) the debris that has piled up behind the trestles and that will continue to pile up as a result of high water. 2.) a structural failure because of the lack of maintenance. Both of these issues could easily contribute to a major flood event.

In the Orofino Creek Master Plan, section 5.5, it was recommended that a plan be developed to deal with the potential hazards caused by the railroad trestles in the middle watershed. We support that recommendation. In the short term, however, we are most interested in making sure the debris that is built up behind the trestles has been removed or will be removed before the next high water event.

If possible, we would like to meet with you at one of our regularly scheduled Clearwater County Commission meetings. Please contact Lauri Stifanick or Cindy Barnett to set an appointment at your earliest convenience. They may be reached at (208)476-3615.

Thank you,

Stan Leach

Stan Leach, Chair
Clearwater County Commission

Joe Pippenger, Mayor, City of Orofino; Rick Laam, City Administrator, City of Orofino and Chair, Clearwater County Project Impact Flood Committee; Michael A. Austin, Camas Prairie Railnet, Inc., Ronald Kerr, Senior Transportation Planner for the State of Idaho Transportation Department; Rene'Gingrich, Economic Development Specialist, Clearwater County; Shaun Maxey, Economic Development Specialist, Ida-Lew Economic Development Council, Inc.; Chris Kuykendall, Economic Development Specialist, CEDA; Matt Daniels, River Design Group, Inc.; and Christine Frei, Community Development Specialist, CEDA/Clearwater County Project Impact Coordinator.

# EXHIBIT H
# to State of Idaho's Comments on Environmental Assessment

Letter from Flood Committee to
Stan Leach, Chair, Clearwater County Commission,
May 4, 2004

COPY

# Project Impact

*Building a Disaster Resistant Community*

**Clearwater County Project Impact Flood Committee**

May 4, 2004

The Honorable Stan Leach
Chair, Clearwater County Commissioners
P.O. Box 586
Orofino, ID 83544

Re: Konkolville-Jaype Spur Structures- Abandonment

Dear Commissioner Leach:

With reference to Watco's April 3, 2004 announcement in the Lewiston Morning Tribune to abandon the Konkolville-Jaype spur of the Great Northwest Railroad, we urge Clearwater County to request through Watco's environmental review that the salvage process include the removal of all existing rail line structures along the spur. As the Clearwater County Project Impact Flood Committee and your flood mitigation advisory group, we believe that non-maintained rail line structures on the Konkolville- Jaype spur pose a real and serious flood mitigation issue on Orofino Creek and a threat of life and property to Clearwater County.

Clearwater County experienced major flood events in 1933, 1948, 1964/65 and 1996. The majority of devastation occurred as the result of high-water events on Orofino Creek. With the Orofino Creek Master Plan for Flood Mitigation/Stream Restoration, the County set in motion a plan for mitigation on the lower 4.5 miles of the creek and is now developing projects and seeking funding. This is very positive; however, the County must continue to work on minimizing threat by looking at ALL potential threats. The non-maintained rail structures in the middle Orofino Creek watershed are a tremendous threat.

Concern for this issue became evident during the high-water event of January 2003 when Clearwater County staff observed what was happening to two of the lower trestles on Orofino Creek and video taped their observations. At the request of our committee, the stream restoration engineer working on the Orofino Creek Master Plan for Flood Mitigation/Stream Restoration walked several miles up Orofino Creek during April 2003. The following is an excerpt from Section 2.3.5 of the Orofino Creek Master Plan where the engineer addresses the threat:

> Railroad trestles with numerous, closely-spaced piers present an especially dangerous scenario. The middle watershed is said to possess as many as 20

railroad trestle stream crossings. During a site visit to the middle watershed following a flood event, debris jams were observed at all three railroad trestles visited. The debris jams had forced water above and around the bridge and caused extensive scour as noted by the newly-formed downstream depositional bars and freshly-eroded banks. Since the railroad is abandoned and not maintained, the effects of debris jams and ice jams are likely to contribute excess sediment to the lower watershed and potentially generate surges of flood water, debris, sediment and ice as they become dislodged.

Prior to the sale of the railroad to Watco, this committee worked with you to address the maintenance issue with Camas Railnet and supported your efforts in addressing the County's flood mitigation concern in your October 27 and October 29, 2003 letters to Camas Railnet. This prompted Camas Railnet to conduct maintenance on the line. At that time, Camas Railnet could not reach some of the structures because of the poor condition of the rail line. Then, the committee opened dialogue with Kevin Spradlin, Camas Railnet at the December 17, 2003 Project Impact Steering Committee meeting. As initially planned at the December 17th meeting, a tour of the rail line never occurred between Camas Railnet, the County and the City of Orofino due to the weather and the change in rail line ownership. The Flood Committee's diligence has not yet satisfactorily addressed this issue.

Although this committee has been unable to identify the exact numbers and types of rail line structures involved, we believe as many as forty structures may exist along the Konkolville-Jaype rail line. The Idaho Department of Lands has record that eleven (11) trestles and twelve (12) culverts exist on state land. As we understand the abandonment process, the maintenance responsibility for these structures shall reside with property owners. If the structures are not removed, the costs and liability shall impact many landowners over many years to come. The maintenance or removal costs for these structures will be costly and difficult to accomplish. Realistically, how well will structures be maintained if they are of little or no use to the property owner? What kind of costs will the property owner incur to remove the structures?

In this 120-day abandonment process, we urge you to act quickly and take a strong position on the rail line abandonment by requesting that all structures, including trestles, concrete box culverts, corrugated metal and arch pipe types, or any other appurtenance that affects the flow of water into Orofino Creek, be removed in the Konkolville-Jaype rail line salvage process. If you need our assistance in addressing this flood mitigation issue or in gathering more documentation, please let us know.

Sincerely,

The Clearwater County Project Impact Flood Committee

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Nancy Butler

Sandra J. Medley  Orofino Chamber of Commerce

Don D. Wright - Clearwater SWCD

Ole Toby  Konkolville LBR. Co. INC.

Floyd Williams, City of Orofino

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