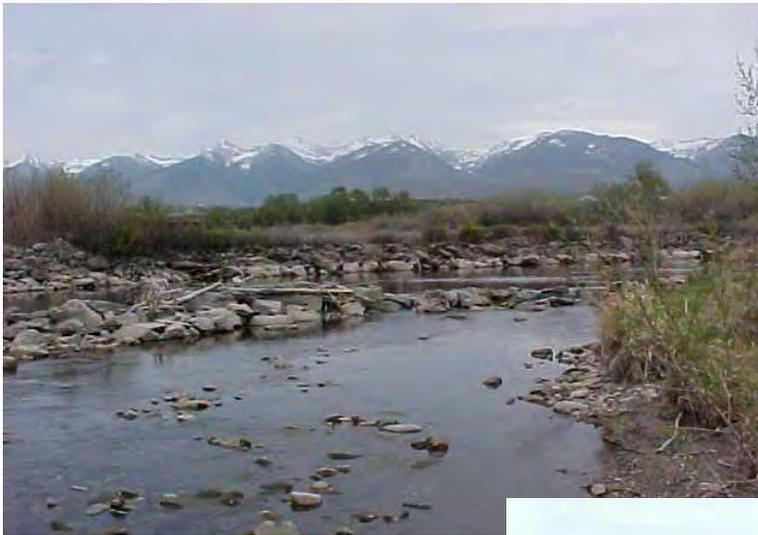
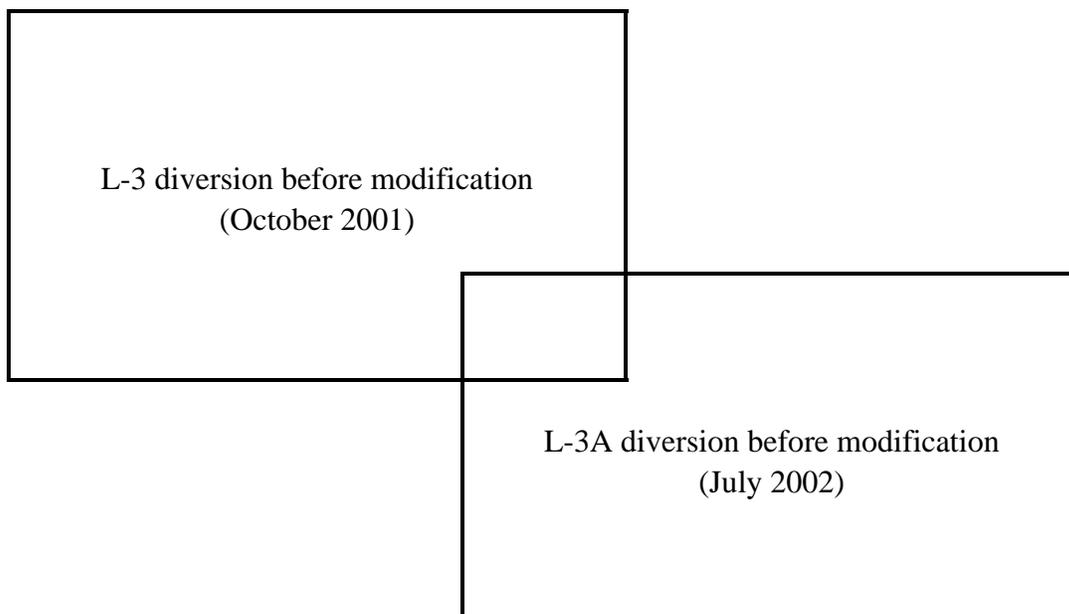


**Completion Report  
L-3 and L-3A  
Irrigation Diversion Replacement  
Lemhi River Subbasin  
Salmon, Idaho**



Prepared by  
Bureau of Reclamation  
Pacific Northwest Region  
Snake River Area Office  
Salmon Field Office

**May 2007**



This project was initiated and completed through the combined efforts of many entities, public and private. The purpose of the project was to provide for continued use of water while enhancing conditions for anadromous fish listed under the Endangered Species Act. The Bureau of Reclamation prepared this completion report in accordance with the 2004 National Marine Fisheries Service Federal Columbia River Power System Biological Opinion to describe the design and construction of this project.

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## Attachments

Attachment A: Construction Photographs

Attachment B: Location Map and Final Design Drawings



# 1. Introduction

Throughout the Lemhi River subbasin, irrigation diversions, combined with other domestic uses of water, have negatively affected salmonids by reducing water flow, impeding upstream migration, and entrapping juvenile fish in the unscreened diversions as they migrate downstream. In the summer of 2001 near Salmon, Idaho, two existing rock weir (push-up) dam diversions in the Lemhi River were identified by Idaho Department of Fish and Game (IDFG) as having potential for impeding migration and causing harm to resident and migratory fish. The two diversions, L-3 and L-3A (cover photos), were replaced in 2003 with rock weirs that allow for passage of all species and life stages of migratory and resident fish while still meeting irrigation delivery requirements.

The primary objective of these projects was to implement actions to improve the passage of adult and juvenile salmon and steelhead in the Lemhi River at the location of two irrigation diversions. The Lemhi River provides habitat for several species of fish listed as either threatened or endangered under the Endangered Species Act (ESA), as well as resident fish. Section 7(a)(2) of the ESA requires that all Federal agencies consult with the National Marine Fisheries Services (NMFS), or the U.S. Fish and Wildlife Service (USFWS), to ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in adversely modifying their critical habitat. The NMFS oversees the implementation of the ESA for certain listed species including anadromous salmon and steelhead.

Currently, there are 12 listed anadromous evolutionarily significant units (ESU) and one ESU proposed for listing within the Columbia River. Consultation with NMFS was completed on these ESUs and a Biological Opinion (BiOp) was issued in 2002 and a subsequent BiOp issued on November 30, 2004.<sup>1</sup> This consultation contained an Updated Proposed Action by the action agencies including a Tributary Habitat Program.<sup>2</sup>

## 1.1 Background

In early 2001, under Section 7.6 of the Northwest Power Planning Council 1994 Columbia Basin Fish and Wildlife Program, Bonneville Power Administration (BPA) issued an emergency solicitation of proposals to provide funding for fish passage projects

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<sup>1</sup> Biological Opinion on the Operation of the Federal Columbia River Power System including the 19 Bureau of Reclamation Projects in the Columbia Basin, November 30, 2004 (revised and reissued pursuant to court order, *NWF v. NMFS*, Civ. No. CV 01-640-RE (D. Oregon)).

<sup>2</sup> Final Updated Proposed Action for the FCRPS Biological Opinion Remand, U.S. Army Corps of Engineers, Bureau of Reclamation, and Bonneville Power Administration, November 24, 2004.

that were locally identified as “high priority” with an urgent need for completion. Additionally, funding for these projects was only available for a specified period of time and intended for projects for which design, environmental compliance, etc., were substantially complete. The Idaho Office of Species Conservation (OSC), Lemhi Soil and Water Conservation Districts (LSWCD), and IDFG presented L-3 and L-3A diversions to BPA as ready for implementation.

Upon approval of funding from BPA, Reclamation was asked by project sponsors to provide technical assistance with design and construction of new “fish friendly” diversion structures at L-3 and L-3A. Reclamation approached the irrigators and landowners about diversion replacement and obtained permission to pursue these projects. This required coordination with irrigators, landowners, consulting agencies, and other interested parties to develop structure designs that were acceptable for each diversion. Preliminary and draft designs were widely circulated for review and comment prior to implementation.

## **1.2 Problems and Solutions**

Irrigation diversions have long been identified as having potential for causing harm to resident and migratory fish. Irrigators in the Lemhi subbasin typically use push-up diversion dams to raise water levels and/or direct water into irrigation conveyance canals or “ditches.” Push-up diversion dams are usually constructed out of large rock or streambed material that is pushed up in a linear fashion across the stream channel. Water diverted from the river or creek channel is then conveyed via the ditch and distributed to agricultural fields.

The L-3 and L-3A diversions each spanned the entire width of the river channel and contributed to fish passage problems such as stream channel dewatering, migration impediment, and entrainment of fish in ditches. Each diversion also required entering the river channel with heavy equipment to conduct annual maintenance or reconstruction. Existing fish screens in the ditches of each diversion were compliant with NMFS screening criteria.

The L-3 rock weir diversion was relatively stable, required little annual maintenance by the irrigators, and effectively diverted water into the ditch. However, streamflow depletion, structure porosity, and absence of a fish passageway resulted in severe depletion of water in the river channel below this diversion and hindered the ability of adult fish to migrate upstream. The headgate at the ditch inlet was in good condition and adequate to meet the irrigator's needs and therefore was left in place.

At L-3A, the rock weir diversion was less stable and seasonal maintenance to add or remove rock was needed to divert water and reduce ice formation and flooding. Also, there was no headgate at the inlet to the ditch. Streamflow depletion, absence of a fish passageway, and structure porosity were also problems with this diversion. Inflow into

the irrigation ditch was controlled by the semi-annual construction and removal of an earthen berm near the inlet. An additional problem existed with a fish ladder-headgate structure located in the ditch just upstream of the fish screen. The structure was used to control diverted water that was in excess of what the fish screens could effectively pass. The excess water went over a fish ladder and into a channel that conveyed the water back to the river. Local biologists felt that return flow in the wasteway channel created a false attraction to migrating fish and the ladder structure was ineffective for allowing fish passage.

### **1.3 Participation and Cooperation**

Reclamation implemented the Tributary Habitat Program for the Lemhi River subbasin, as set forth in the Updated Proposed Action, as a conservation measure to provide for early actions to assist with recovery of the ESUs within the Columbia River. The upper Salmon and Lemhi subbasin ESUs include the Snake River steelhead and the Snake River spring/summer Chinook. Within these conservation measures, Reclamation addresses limiting factors such as instream flow, barriers, channel morphology, and entrainment. For this program, Reclamation works with willing partners to provide technical assistance and logistical help with implementation of habitat projects leading to correction of tributary and spawning and rearing deficiencies associated with these limiting factors.

Reclamation's participation in the L-3 and L-3A projects was funded under the direction of the Tributary Habitat Program. Technical assistance provided by Reclamation included project coordination, environmental compliance, inspection, and development of contract design documents.

As previously mentioned, funding for construction was provided by BPA. The OSC and LSWCD were the project sponsors. Distribution and administration of BPA funding during construction was provided by the LSWCD and the Natural Resources Conservation Service (NRCS). Landowners and irrigators provided access to their private property and participated in design and construction meetings.

### **1.4 Environmental Compliance**

The Snake River Area Office (SRAO) staff person in the Salmon Field Office assisted BPA with completion of the National Environmental Policy Act (NEPA) documents and Section 7 ESA consultation. The LSWCD contracted with a local consulting firm on behalf of BPA to prepare a Biological Assessment for ESA consultation with NMFS and USFWS. Work in the river to replace the diversions and construct new headworks was authorized pursuant to the Clean Water Act (CWA) and Idaho Department of Water Resources (IDWR) permit exemptions. This exemption, referred to locally as the "irrigator's exemption," authorizes irrigators or their assigns to perform maintenance on

diversions or appurtenances without need for permits from the Army Corps of Engineers (Corps) or IDWR.

## **1.5 Contract Specifications and Bidding**

Reclamation's Pacific Northwest (PN) Region design office developed and provided to LSWCD separate draft and final project drawings and contract specifications for construction of the following features at each project location:

- L-3: modification of the existing rock weir diversion structure and excavation of a shallow fish passage channel in the thalweg of the river
- L-3A: three, rock "A" weir diversion and river grade control structures and concrete headworks.

The two projects were bid separately but advertised simultaneously by the LSWCD. Westfall Construction of Salmon, Idaho, was the successful low bidder for both projects.

## **2. Project Description**

The two projects are located on the Lemhi River in central Idaho, approximately 3 miles southeast of the town of Salmon, in Lemhi County (Drawing 1678-100-207, Attachment B). The projects encompass the following two irrigation diversion structures: L-3 located at river mile (RM) 3.5 and L-3A at RM 5.2. Both diversions are located on privately-owned land.

The primary purpose of the L-3 and L-3A diversion replacement was to provide fish passage for all species of migratory and resident fish and still meet irrigation delivery requirement.

### **2.1 L-3 Diversion**

#### **2.1.1 Construction**

During construction of the L-3 diversion, Reclamation provided an inspector from the Yakima Construction Office. Construction oversight was provided by Reclamation's Salmon office. Close coordination between Reclamation, the irrigator representative, and landowner was necessary to ensure the successful completion of this project. Reclamation staff from the Salmon, Boise, and Yakima offices were involved throughout construction.

Construction of L-3 began in the fall of 2002 prior to termination of the irrigation season. The contractor was able to provide irrigation water during construction by obtaining permission from the landowner to utilize an existing upstream diversion and ditch to temporarily deliver irrigation water into the L-3 ditch. Fish passage during construction was maintained via excavation of a temporary river bypass channel. Construction continued throughout the fall and was completed in the winter prior to the beginning of the 2003 irrigation season.

Major project features for the L-3 construction included:

- Excavation of a temporary bypass channel to convey river flow around the construction site
- Construction of a temporary cofferdam in the river channel to divert water into the bypass channel
- Removal of rock from the upstream face of the old L-3 rock weir/diversion
- Placement of a rigid, high-density polyethylene (HDPE) cutoff wall installed vertically along the entire centerline of the weir
- Placement of geomembrane/geotextile liner on the upstream face of the rigid cutoff wall to provide protection against water seepage through the rock weir
- Placement of rock on the top and both sides of the liner and HDPE plate material to provide additional protection and structural support

In the middle of the weir structure, two notched plates were inserted and drop pools constructed to concentrate flow for fish passage in compliance with NMFS passage criteria. A narrow channel of streambed was deepened below the fish passage notch to concentrate flow and provide sufficient channel depth for fish passage in low stream flow conditions.

The reshaping and placement of liner in the bottom of a section of ditch was necessary to reduce seepage, risk of embankment failure, and need for spilling excess flow over a wasteway structure. The risk of injury to fish being spilled over the wasteway structure onto the rocks below was a cause for concern to local fishery biologists.

Measures taken to mitigate for construction impacts included removal of the cofferdam and filling of the temporary bypass channel; reseeding adjacent pasture and river banks; replacement of a short section of pasture fence; installation of a 16-foot gate to exclude cattle from the construction site and facilitate construction access, and salvage of fish from the river and bypass channels. Several contract/design modifications were necessary to address irrigator and local fish passage concerns. They included substitution of HDPE for steel for the rigid cutoff wall and fish passage notches to address irrigator concerns for corrosion of submerged steel. Also, placement of liner material in the ditch near the

wasteway was necessary to reduce ditch seepage loss through the embankment and spillage of fish over a wasteway structure.

## **2.1.2 Conclusion**

Overall, the outcome of the L-3 diversion replacement project was positive and provided benefit to both fish and irrigators. The project resulted in the improved conditions for fish passage at this diversion location in the lower reach of the Lemhi River. However, the potential still exists for this diversion to present a barrier to fish migration if river flow is low, irrigation withdrawals excessive, and too little water flows through the fish passage notch. Risks to fish associated with entering the river channel annually with heavy equipment to replace rock has been eliminated since the project was completed. Benefits to the irrigators include weir stabilization, reduced annual maintenance costs, improved diversion and control of irrigation water, and compliance with NMFS passage criteria.

## **2.2 L-3A Diversion**

### **2.2.1 Construction**

During construction of the L-3A diversion/grade control weirs and headworks, a Reclamation inspector was provided by the Yakima Construction Office and construction oversight was made available out of the Salmon Field Office. Reclamation staff from the Salmon, Boise, and Yakima offices were involved throughout construction.

L-3A construction began the fall of 2002 prior to termination of the irrigation season. The contractor was able to provide irrigation water during construction by utilizing the temporary river bypass channel to supply water into the L-3A irrigation ditch. Construction continued throughout the fall and was completed in the winter prior to the beginning of the 2003 spring irrigation season.

Major project features for the L-3A construction included:

- Excavation of a temporary bypass channel to convey river flow around the construction site
- Construction of a temporary cofferdam in the river to divert water into the bypass channel
- Removal of the existing rock diversion weir
- Demolition and removal of the headgate/fish ladder structure and closure of the wasteway channel

- Construction of one rock “A” weir diversion structure and two “A” weir grade control weir structures. Each weir had two, HDPE notched plates and step pools constructed to concentrate flow and provide fish passage. HDPE crest plates were suspended along the centerline of each weir for elevation grade control.
- Installation of geotextile/geomembrane to the crest plates on the upstream face of the rock weirs to reduce water seepage
- Placement of large rock on the sides and top of the geotextile/geomembrane to prevent dislocation and provide structural stability
- Installation of a concrete headgate structure with sluiceway
- Installation of two metal culverts
- Canal excavation and reshaping

Measures taken to mitigate for construction impacts included removal of the cofferdam and filling of the temporary bypass channel, reseeding adjacent pasture and river banks, armoring the river bank with riprap, and salvage of fish from the river and bypass channels. Contract and design modification included contractor substitution of HDPE instead of steel for the crest plate and notched fish passage plates.

## **2.2.2 Conclusion**

During the first winter and subsequent spring runoff following completion of construction at L-3A, ice and high flow caused damage to the rock weirs. High flows also overtopped the headgate and eroded the fill around the headgate. Corrective measures entailed placement of additional, large rock on the weirs, and pouring concrete to increase the height of the headgate. Additional fill and rock was placed around the eroded headgate. BPA provided funding for the necessary repairs. Repairs were made in the winter of 2003 and early spring of 2004. Since the repairs were made, no further problems have either been observed or reported by the irrigator.

Overall, the construction of weirs and subsequent repair at L-3A has improved fish passage, improved control and delivery of irrigation water, and eliminated a hazardous wasteway. In the future, substitution of HDPE for the specified steel crest plate and fish passage plates is not recommended for similar projects. As discovered at L-3 and L-3A, substituting HDPE for steel made construction more difficult. HDPE is less rigid and therefore, more difficult to work with and less effective for passage notches, cutoff walls, and crest plates. Also, rock large enough to resist displacement by normal high flows should be used for rock weir construction.

### 3. Summary

The L-3 and L-3A were the only BPA "high priority" projects completed in the upper Salmon subbasin. Completion of these two projects has improved conditions for fish passage in the lower Lemhi River. Depending on river flow and irrigation need, potential still exists for diversion withdrawal to exceed bypass flow amounts necessary for adequate function of the fish passage notches. Since completion of these two projects, cooperative efforts between irrigators, State, Federal (including Reclamation), and local entities to lease water during the irrigation season and maintain a minimum flow for fish in the lower reach of the Lemhi River, have been successful in mitigating the effects of irrigation diversion.

The "A" weirs constructed at L-3A were the first of this type to be constructed in the Lemhi River. So far the diversion weirs at L-3 and L-3A have functioned very well. While designed to withstand normal flood events, engineered rock weirs of any design constructed in stream channels should not be expected to be permanent structures. Monitoring of rock weirs after a period of operation and/or high flows has shown that occasional maintenance or modification is often necessary. Engineered rock weirs are a vast improvement over the push-up dams they replace, both for diverting water and maintaining fish passage. However, considering the dynamics of river systems and the difficulty of finding adequate size rock, future maintenance or repair should be expected.

Reclamation is grateful for the assistance provided by the LSWCD and NRCS. Additional thanks go to local employees of the IDFG, NMFS, and USFWS for providing assistance with project review and fish salvage. Reclamation also wishes to thank the BPA for providing the funding necessary for the construction of these two diversion projects. Special thanks go to the landowners and irrigators that provided access and cooperation in the completion of these two projects.

**Completion Report  
Lemhi River L-3 and L-3A Irrigation Diversion  
Replacement  
Lemhi River Subbasin  
Salmon, Idaho**

**Attachment A  
Construction Photographs**

**Photographs by the Bureau of Reclamation  
Pacific Northwest Region Design Group  
Boise, Idaho  
and  
Salmon Field Office  
Salmon, Idaho**





**Figure 1. L-3 diversion, at low flow, looking downstream, before modification**



**Figure 2. L-3 diversion, at low flow, looking downstream, after modification**



**Figure 3. L-3 diversion, at low flow, looking downstream, after modification**



**Figure 4. L-3 diversion, fish passage notch at low flow**



**Figure 5. L-3 preparation for installatin of HDPE cutoff wall and liner**



**Figure 6. L-3 beginning installation of HDPE cutoff wall and geomembrane**



**Figure 8. L-3 installation of HDPE cutoff wall and geomembrane liner**



**Figure 7. L-3 fish passage notch plates installed**



**Figure 9. L-3A diversion at 10 cfs before modification**



**Figure 10. -3A diversion wasteway fish ladder before modification**



**Figure 11. L-3A earth berm blocking ditch inlet before modification**



**Figure 12. L-3A cofferdam and bypass channel**



**Figure 13. L-3A headgate construction**



**Figure 14. L-3A headgate construction**



**Figure 15. L-3A weirs under construction**



**Figure 16. L-3A weirs under construction; rock placement**



**Figure 17. L-3A repair construction**



**Figure 18. L-3A installing geomembrane and weir crest plate**



**Figure 19. L-3A installing geomembrane and weir crest plate**



**Figure 20. L-3A view of completed structures after cofferdam removal**



**Figure 22. L-3A view of all 3 completed weirs after cofferdam removal**



**Figure 21. L-3A view of all 3 completed weirs**



**Figure 23. L-3A site rehabilitation. Bypass channel filled and inlet riprapped.**



**Figure 24. L-3A headgate washout**



**Figure 25. L-3A repair - pouring concrete to raise headgate**



**Figure 26. L-3A headgate after repairs**



**Attachment B**

**Location Map and Final Design Drawings**

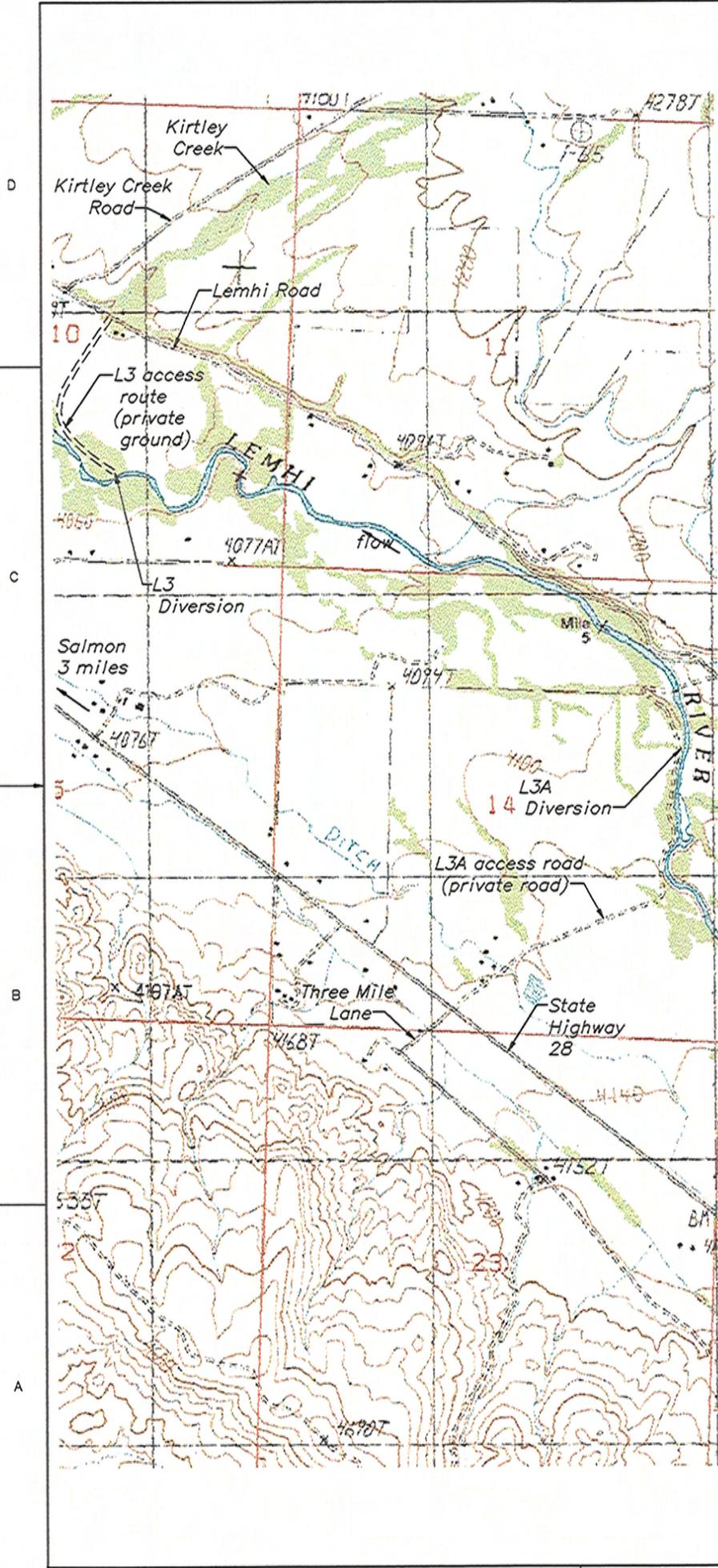


Final Design Drawings L-3 and L-3A Irrigation Diversion Replacement

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1678-100-207	Location Map
1678-100-212	L-3 Diversion Modifications – Site Plan
1678-100-216	L-3 Diversion Modifications – Plan, Sections, and Detail
1678-100-244	L-3 Diversion Modifications – Canal Repair, Plan and Section
1678-100-214	L-3A Diversion Modifications – Site Plan
1678-100-217	L-3A Diversion Modifications – Plan, Sections, and Detail
1678-100-218	L-3A Diversion Modifications – Plan and Sections
1678-100-219	L-3A Diversion Modifications – Headgate, Plan, Elevations, and Details
1678-100-220	L-3A Diversion Modifications – Canal Reshape, Plan and Profile
1678-100-261	L-3A Diversion Modifications – Concrete Headwall, Plan and Section







CP 3  
218.16'

CP 1  
192.67

CP 2

Lemhi Road 1/2 mile ±.  
End of existing farm  
road 1/4 mile ±.

Lemhi River  
Flow

Existing head gate  
structure and pipe  
to remain

Approximate limits of buried  
membrane and geotextile liner

Existing erosion protection  
rock on right bank of river  
not to be disturbed

Fish passage  
channel

See note 2

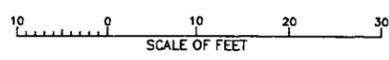
Fish passage  
weirs

Approximate alignment of  
crest of existing rock berm  
and revised river control  
structure crest

No rocks larger than 3 foot  
diameter on existing rock berm  
to be disturbed, adjust crest  
plate alignment and fish passage  
weir locations to avoid large  
existing rocks

Approximate limits of  
existing rock berm  
and river control  
structure

- NOTES:
- Coordinates and elevations based on local datum.
  - Extend liner 15' beyond El. 3995 bank elev. on each side of river and for 15' upstream.



SURVEY CONTROL POINTS				
Description	Northing	Easting	Elevation	Description
CP1	10000.00	10000.00	4000.00	CP 1 L3
CP2	9930.95	9820.13	3998.05	CP 2 L3
CP3	9808.84	10148.83	3998.77	CP 3 L3

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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT

**L3 DIVERSION MODIFICATIONS**

SITE PLAN

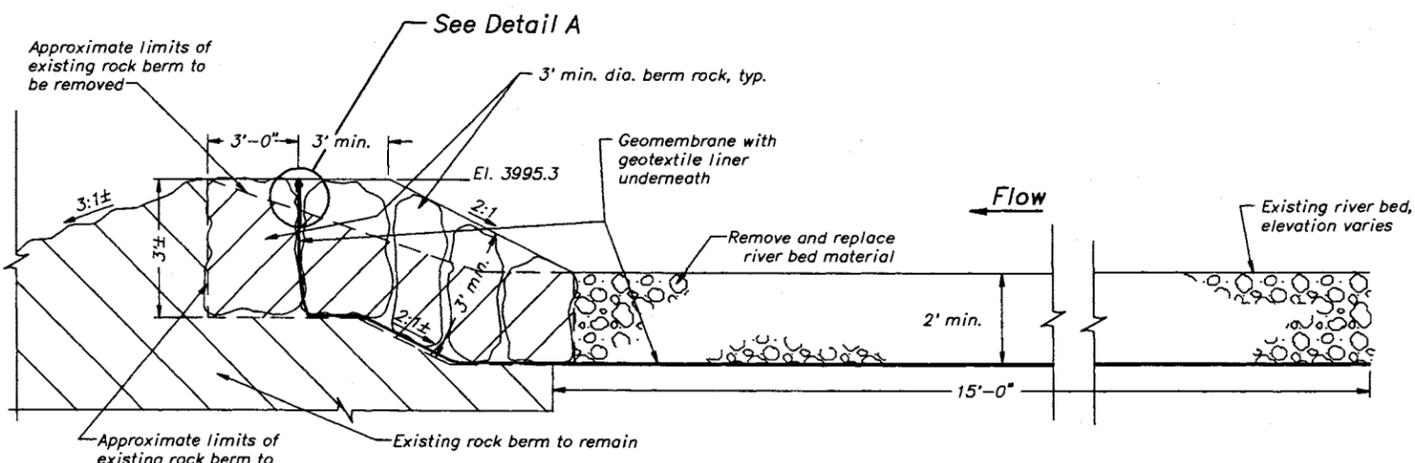
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DESIGNED Phil Mann CHECKED Phil Mann

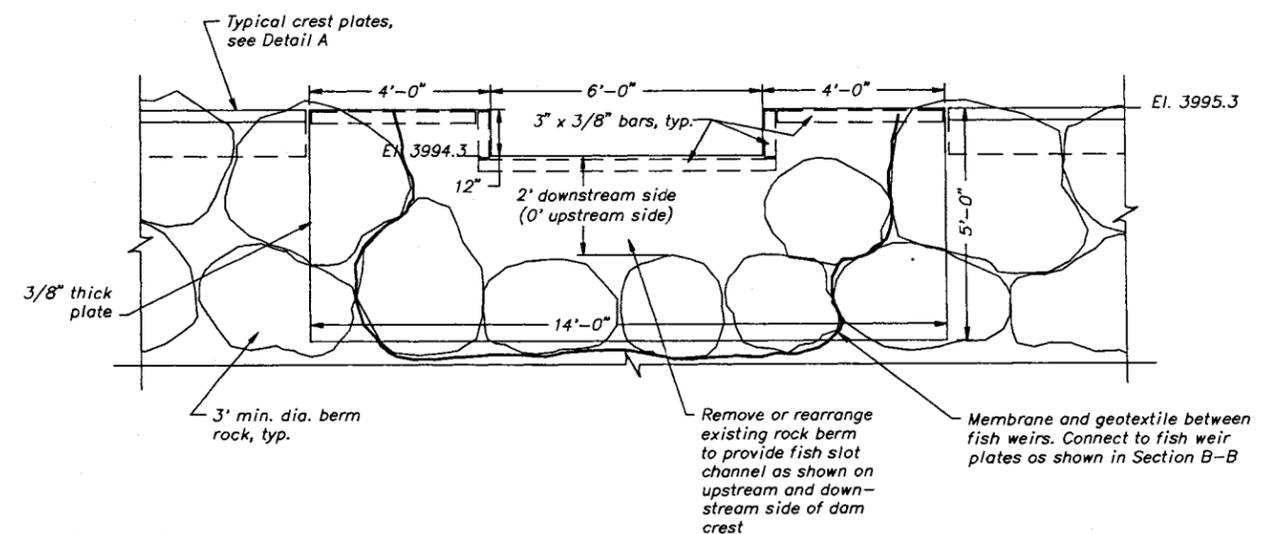
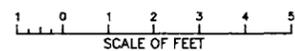
DRAWN Ed Morshorst TECH. APPROVAL Dave Jennings

PROGRAM MANAGER

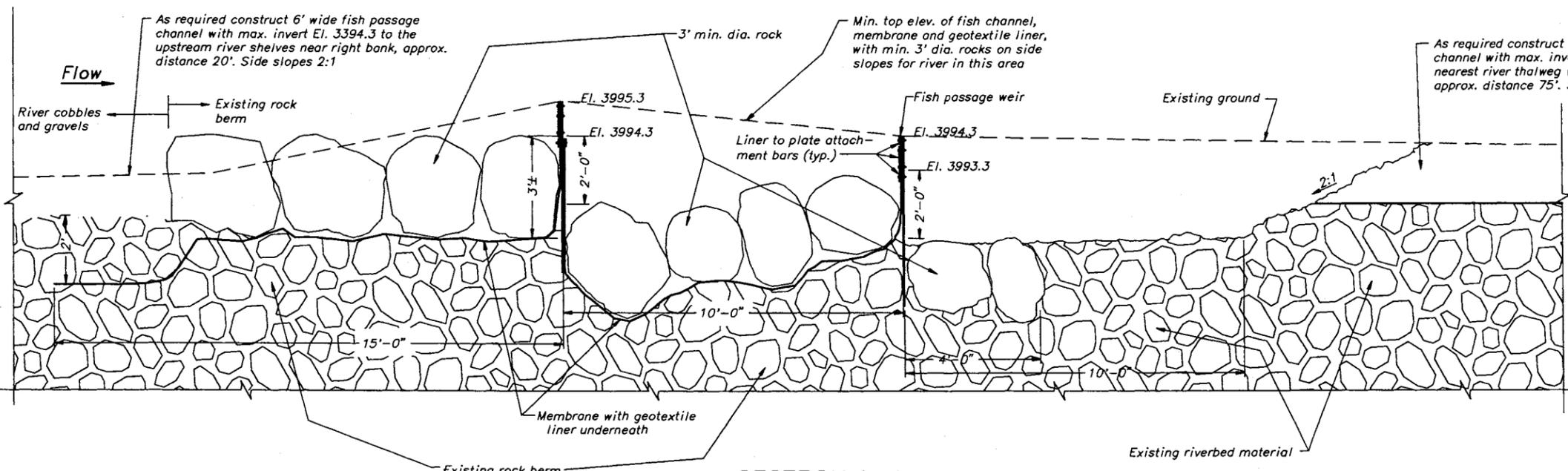
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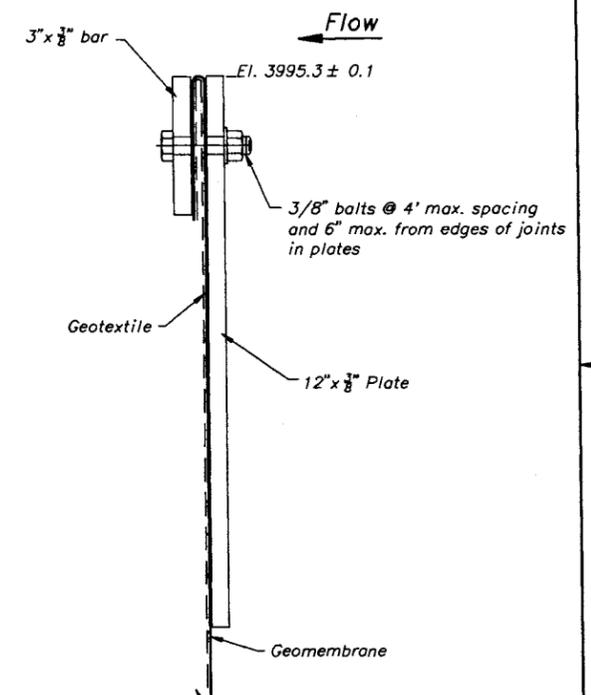
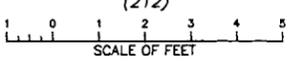
RIVER CONTROL STRUCTURE - TYPICAL SECTION



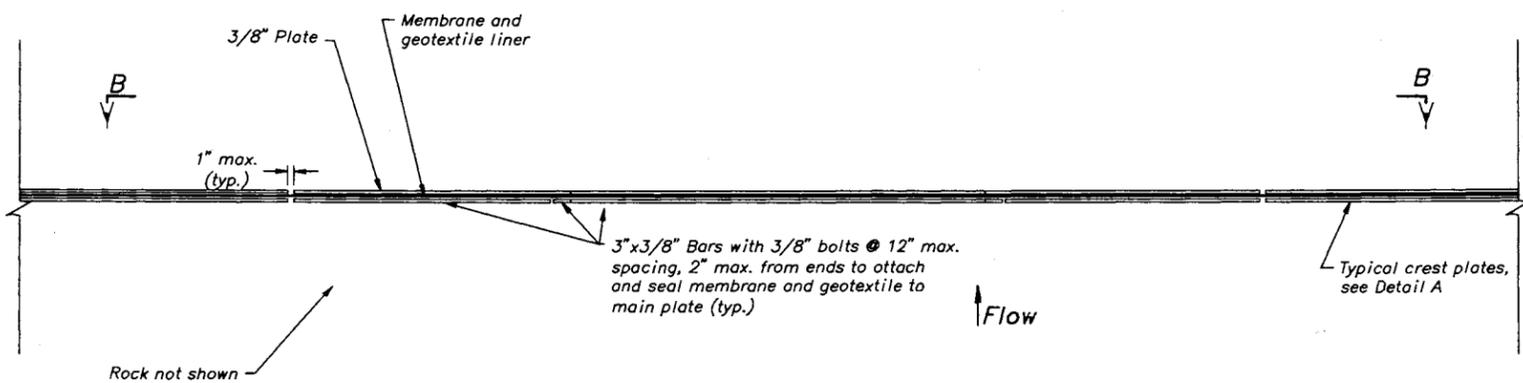
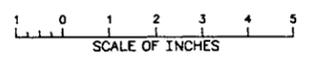
SECTION B-B



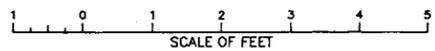
SECTION A-A (212)



DETAIL A



PLAN - TYPICAL FISH PASSAGE WEIR



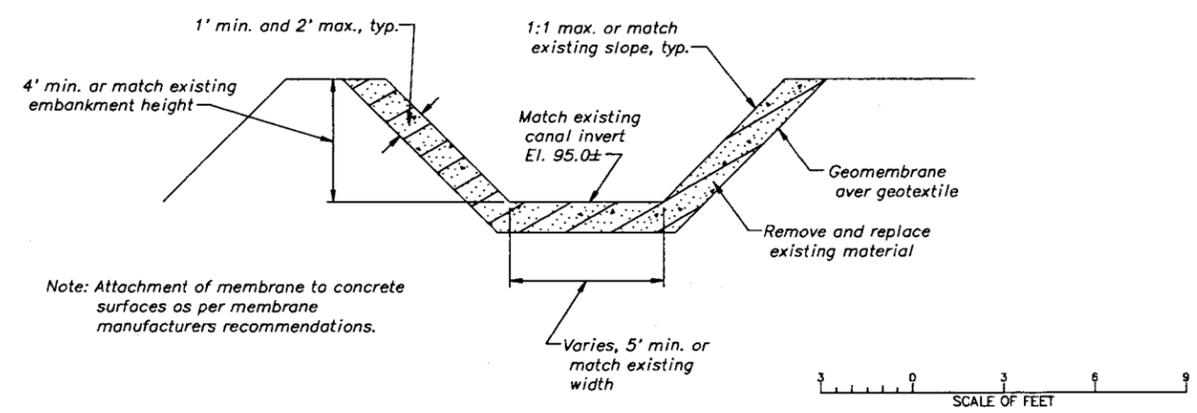
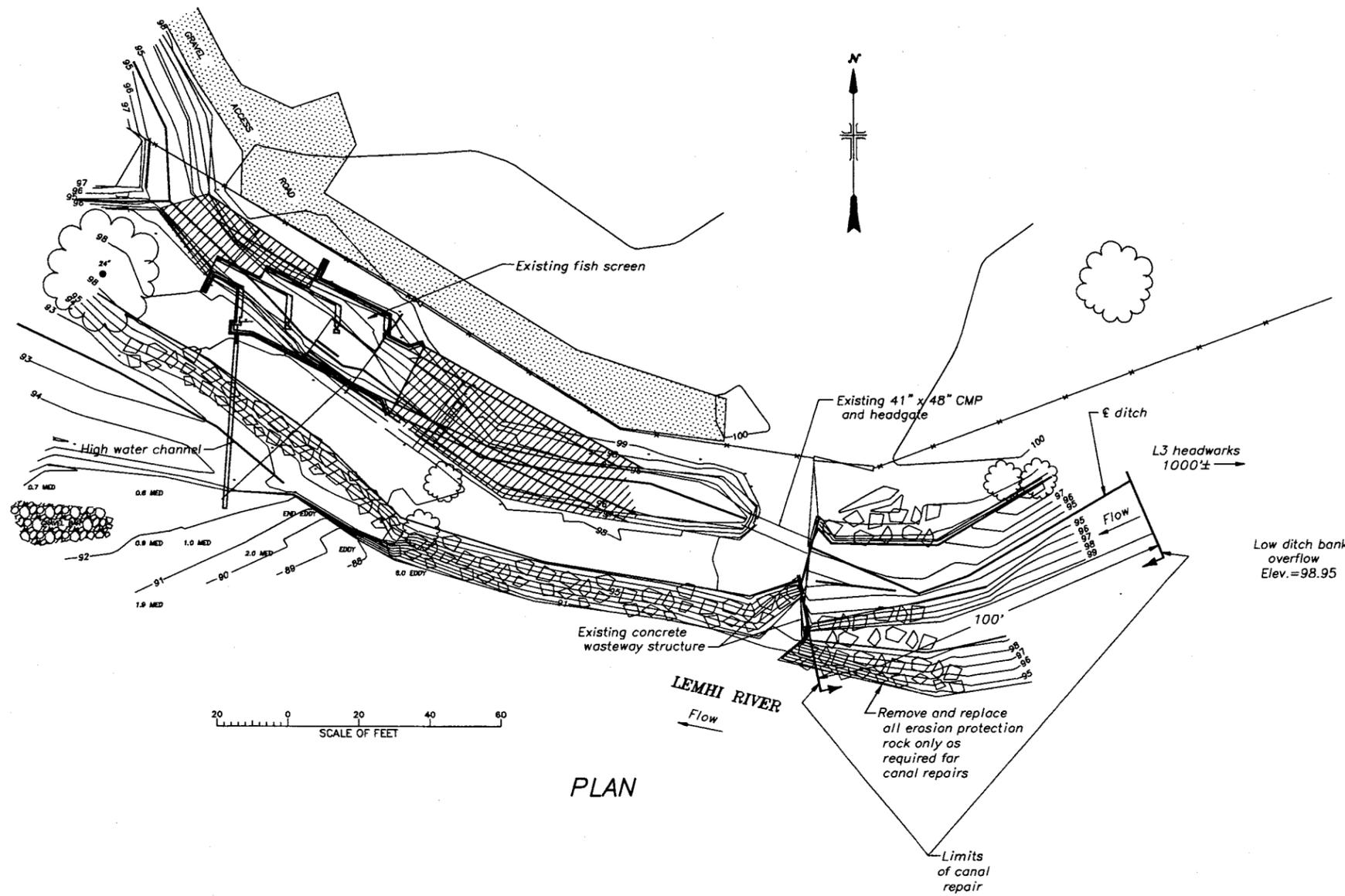
NOTES:

1. All plates 3/8" thick.
2. All metal connections 3/8" full length fillet welds each side.
3. All metal edges exposed to possible fish contact shall be smoothed to not less than 1/64" radius.
4. No rocks larger than 3 foot diameter on existing rock berm to be disturbed, adjust crest plate alignment and fish passage weir locations to avoid large existing rocks.

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UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION  
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
L3 DIVERSION MODIFICATIONS  
PLAN, SECTIONS, AND DETAIL

DESIGNED Phil Mann CHECKED Phil Mann  
DRAWN GAM/EDM TECH. APPROVAL Dave Jennings  
PROGRAM MANAGER  
CADD SYSTEM AutoCAD Rev. 15.06 CADD FILENAME 1678-100-216.DWG  
BOISE, IDAHO DECEMBER 2001 1678-100-216



**ALWAYS THINK SAFETY**

UNITED STATES  
DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION

COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT

**L3 DIVERSION MODIFICATIONS**  
CANAL REPAIR  
PLAN AND SECTION

DESIGNED Phil Mann CHECKED Phil Mann

DRAWN Ed Mordhorst TECH. APPROVAL Dave Jennings

PROGRAM MANAGER

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BOYSE, IDAHO MARCH 18, 2002 1678-100-244

PLOTTED BY EMORHORST

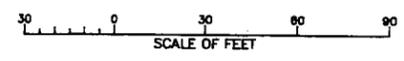
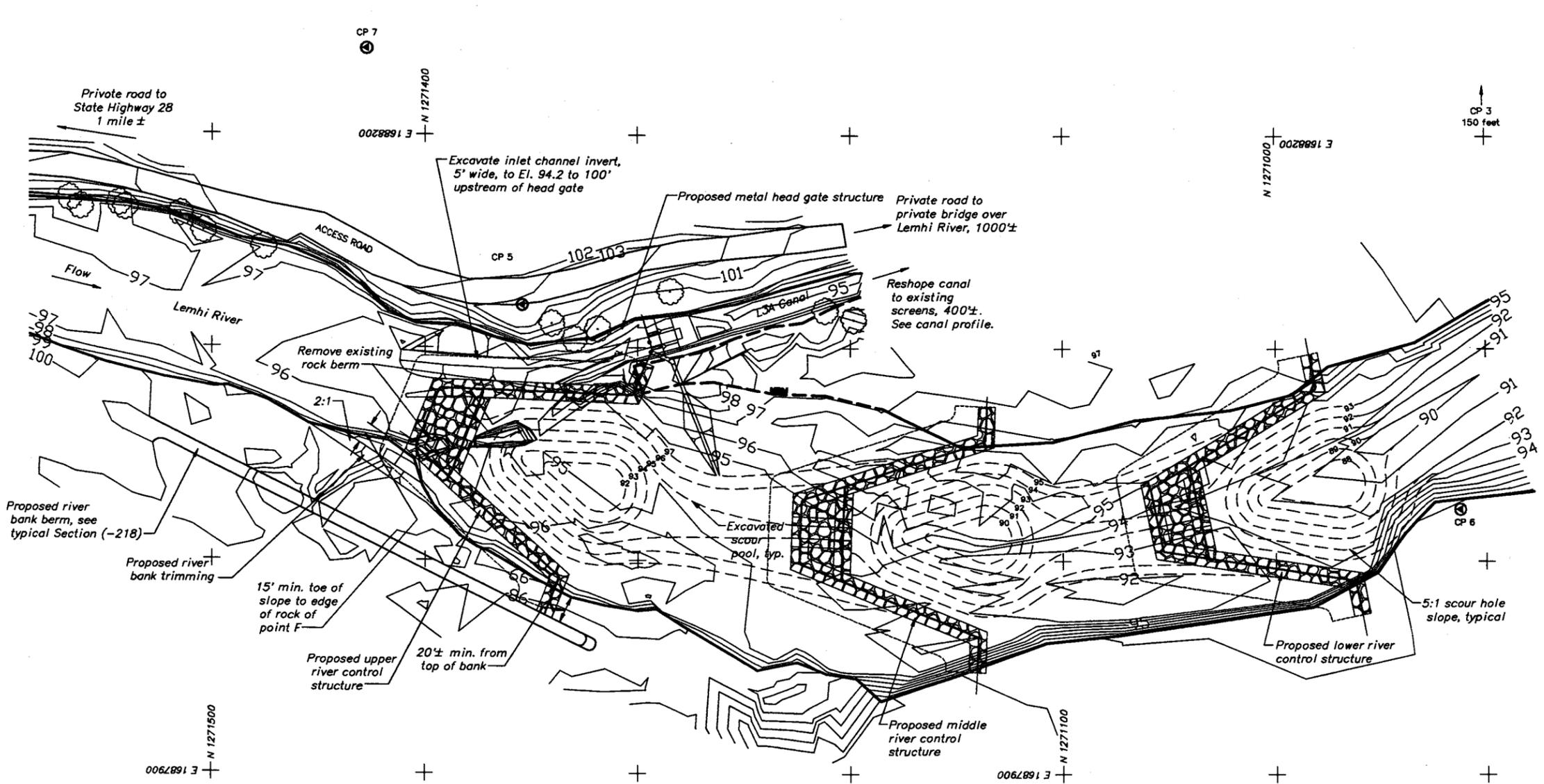


STRUCTURE TABLE		STRUCTURE CONTROL POINTS											
		A	B	C	D	E	F	G	H	I	J	K	L
Upper Weir	Northing	--	1271302.9	1271393.7	--	--	1271405.2	1271337.2	--	--	--	--	--
	Easting	--	1688076.9	1688081.0	--	--	1688053.3	1687990.7	--	--	--	--	--
Middle Weir	Elevation	100.0	100.0	97.8	97.5	97.5	97.8	100.0	100.0	98.2	96.5	96.5	98.2
	Northing	--	1271136.7	1271223.6	--	--	1271225.1	1271139.9	--	--	--	--	--
Lower Weir	Easting	--	1688055.5	1688028.7	--	--	1687998.8	1687962.7	--	--	--	--	--
	Elevation	98.0	98.0	95.8	95.5	95.5	95.8	98.0	98.0	96.2	94.5	94.5	96.2
Lower Weir	Northing	--	1270981.2	1271059.2	--	--	1271053.5	1270962.1	--	--	--	--	--
	Easting	--	1688080.5	1688033.7	--	--	1688004.3	1687989.7	--	--	--	--	--
Lower Weir	Elevation	96.0	96.0	93.8	93.5	93.5	93.8	96.0	96.0	94.2	92.5	92.5	94.2

Note: for structure central point locations, see dwg. -217, Sections B-B and C-C.

SURVEY CONTROL POINTS			
Description	Northing	Easting	Elevation
1	1270783.80	1688252.04	94.99
3	1270900.59	1688373.71	96.08
5	1271354.25	1688120.05	103.26
6	1270912.20	1688024.32	99.11
7	1271427.52	1688240.16	100.31

Note: Coordinates and elevations based on local datum.



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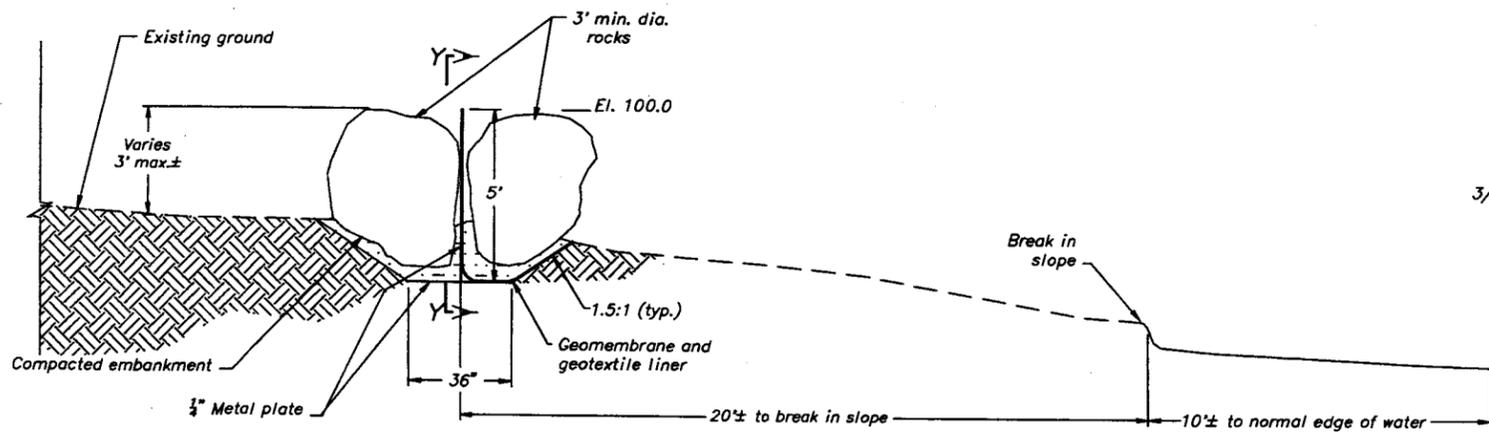
COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
**L3A DIVERSION MODIFICATIONS**  
SITE PLAN

DESIGNED Phil Mann CHECKED Phil Mann  
DRAWN Ed Mardharal TECH. APPROVAL Dave Jennings  
PROGRAM MANAGER

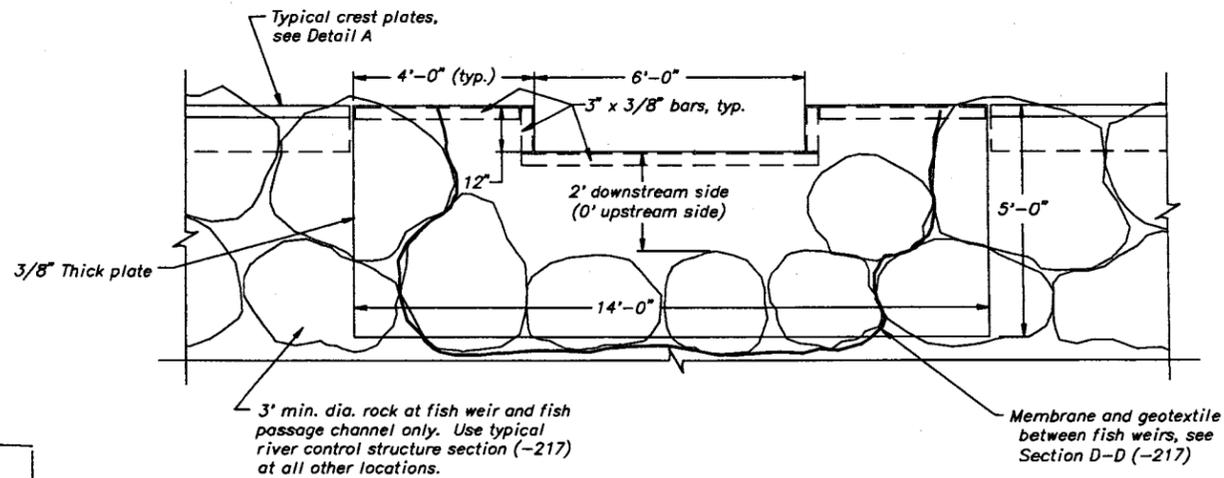
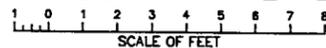
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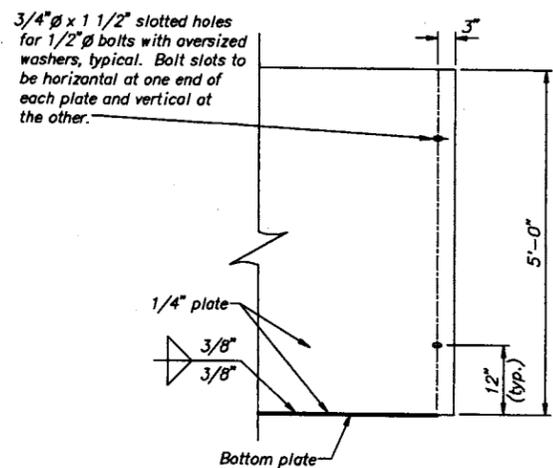
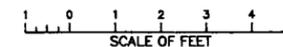




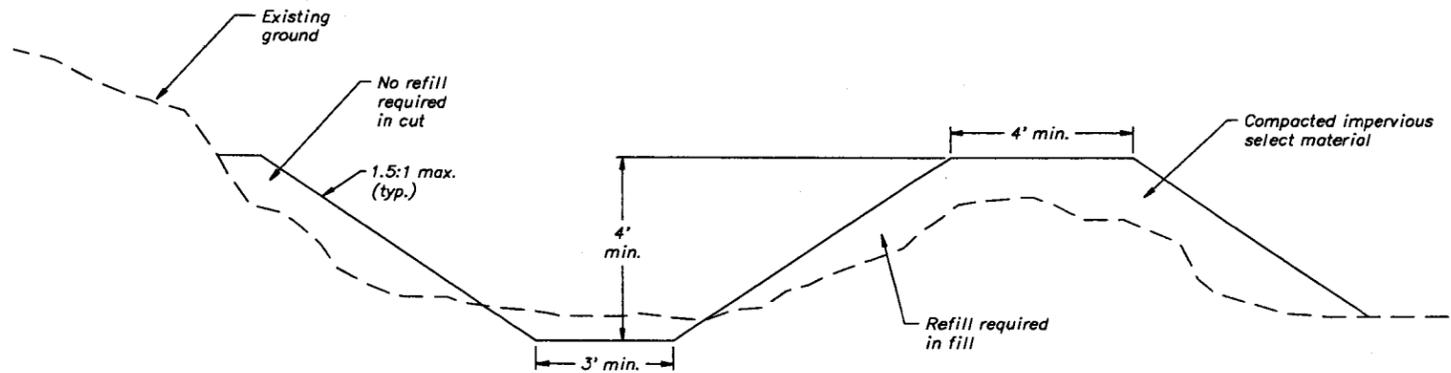
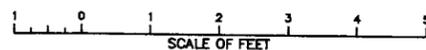
TYPICAL SECTION - RIVER BANK BERM



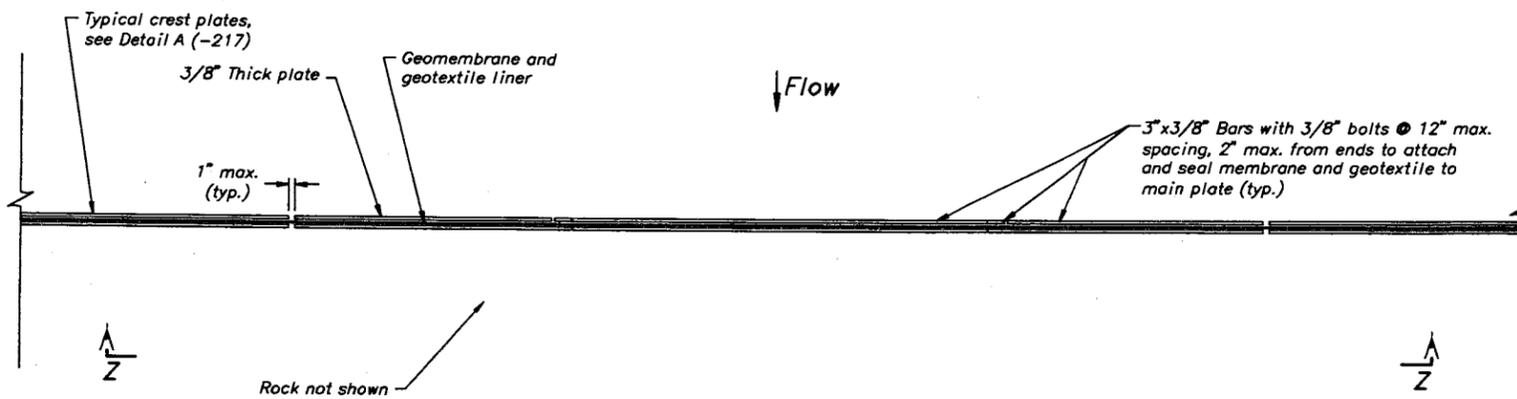
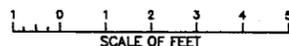
SECTION Z-Z



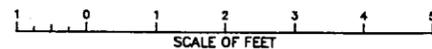
SECTION Y-Y TYPICAL END VIEW



CANAL RESHAPE - TYPICAL SECTION



PLAN - TYPICAL FISH PASSAGE WEIR



NOTES:

1. All plates 3/8" thick unless noted otherwise.
2. All metal-to-metal joints use full length fillet welds each side.
3. Use 5', 4', and 20' bottom widths at headgate CMP outlet, squash CMP inlet and outlet, and screen inlet, respectively, with 10' transition at CMPs and 30' transitions at screen.
4. All metal edges exposed to possible fish contact shall be smoothed to not less than 1/64" radius.

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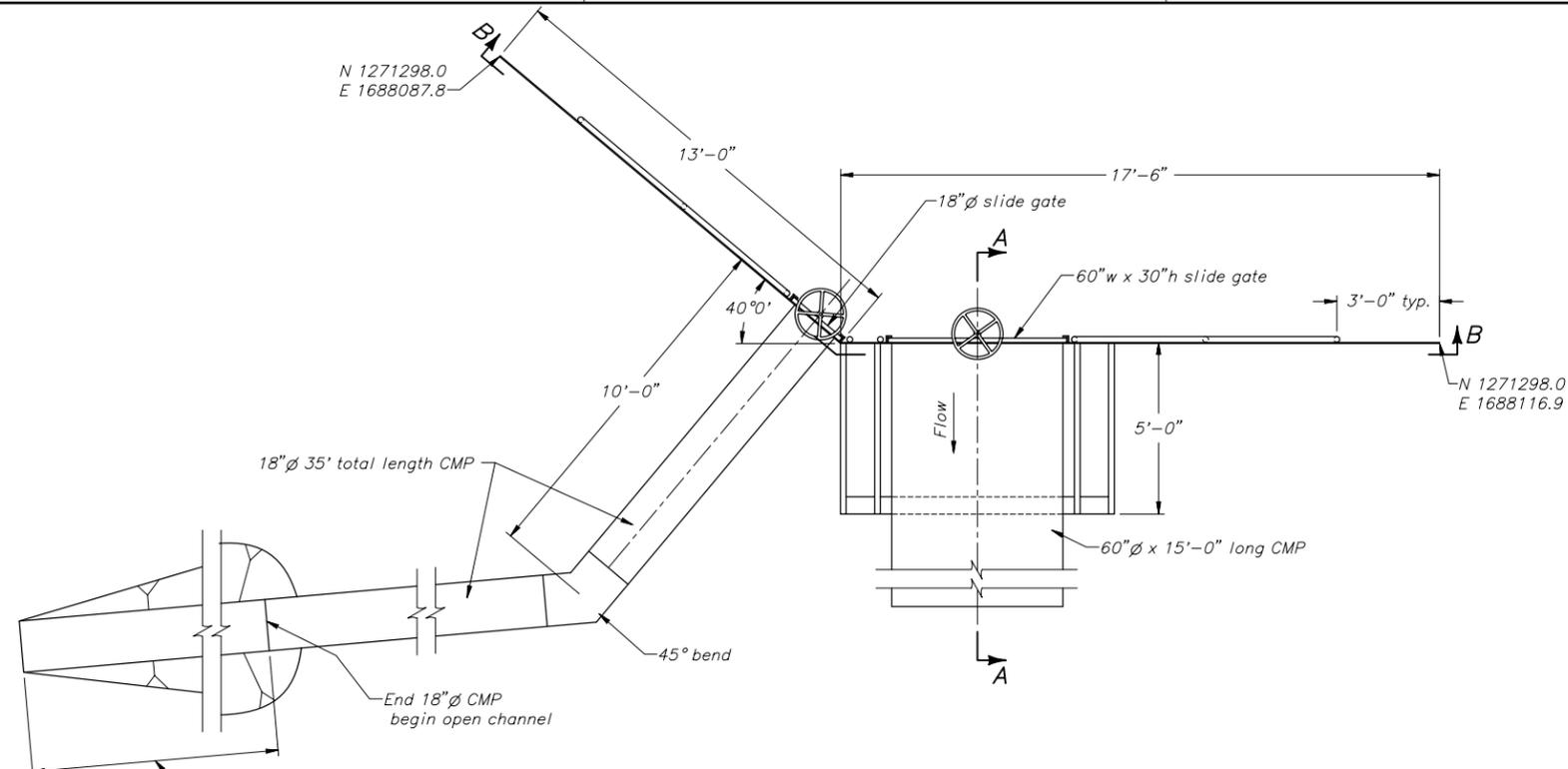
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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT

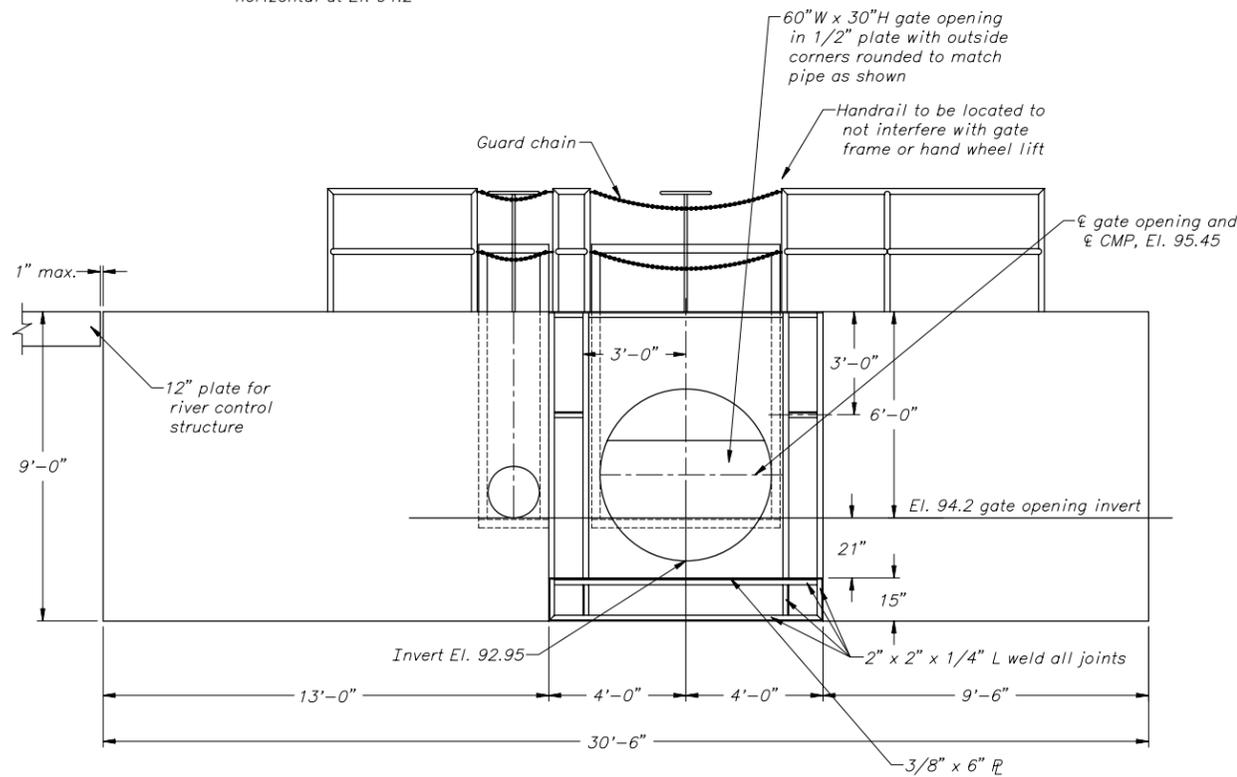
L3A DIVERSION MODIFICATIONS PLAN AND SECTIONS

DESIGNED: Phil Mann CHECKED: Phil Mann  
 DRAWN: GML/EDM TECH. APPROVAL: Dave Jennings  
 PROGRAM MANAGER

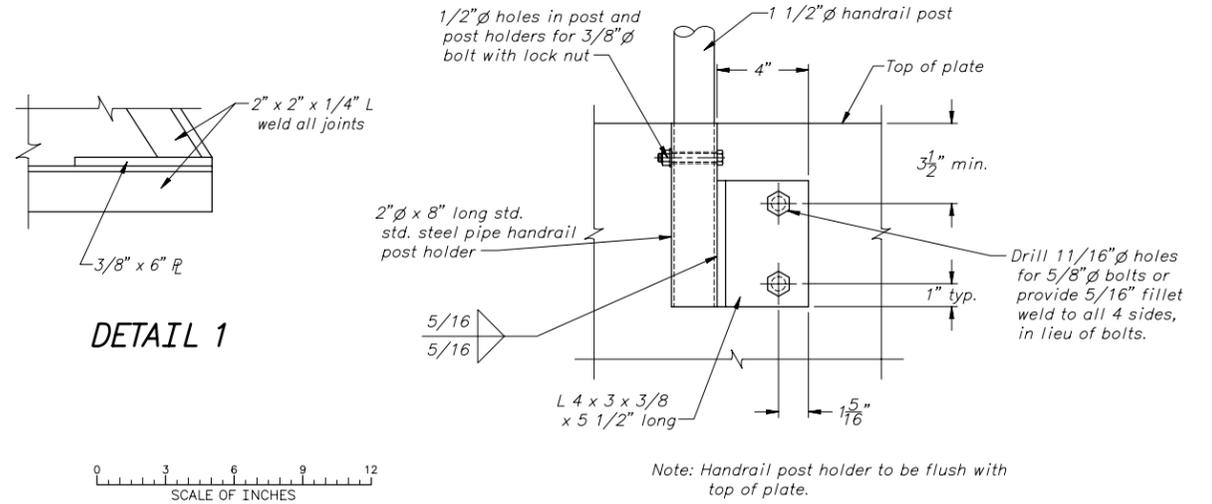
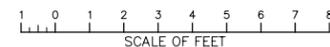
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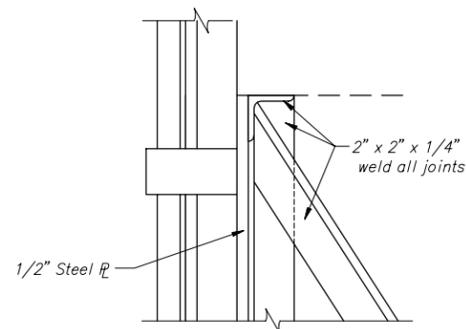
PLAN VIEW



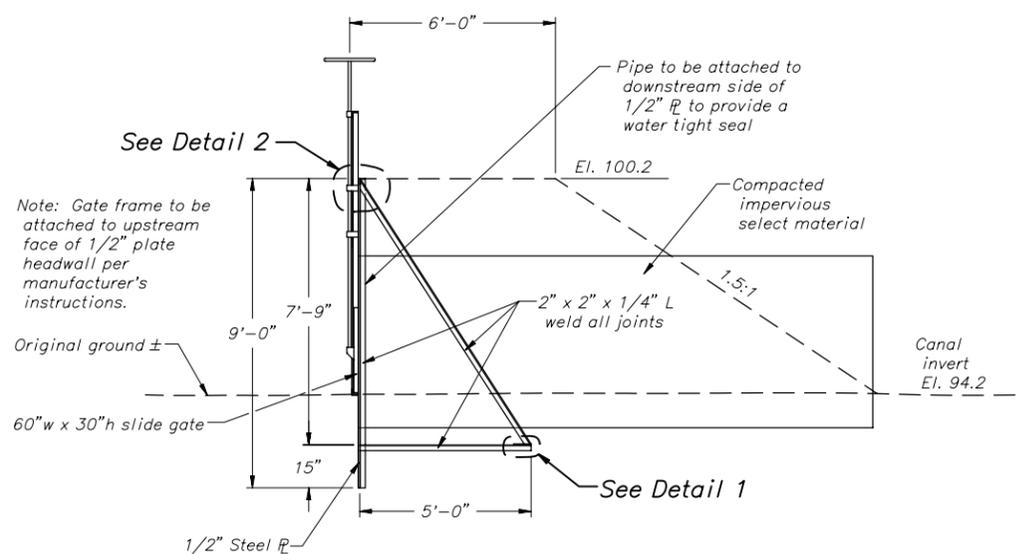
SECTION B-B



ELEVATION  
HANDRAIL POST HOLDER



DETAIL 2



SECTION A-A

NOTES:

1. Welding symbols apply to the joints of all members of similar identification.
2. Weld all pipe joints with 1/8" reinforced welds and dress smooth.
3. All handrails shall be fabricated with new standard weight black pipe or tubing of sizes as specified.
4. Corners and edges of all plates, bars, and pipe ends shall be free of burs.
5. All screws, riveting material, and bolts shall be provided as required for complete installation.
6. Standard handrail rail heights to be 21" and 42" above deck levels.
7. Splice handrail at 16' max. intervals or where shown.
8. Handrail posts and rails to be 1 1/2" std. wt. steel pipe unless otherwise specified.
9. Splice required adjacent to all interior angles of 90° or less and at changes from concrete to metal post supports.
10. Removable handrail post spacing is 8' maximum.
11. Galvanize all metal work unless otherwise specified.
12. Guard chain to be 1/4" dia. min. with heavy duty chain snap and 3/8" min. dia. chain eyes welded to posts.
13. For concrete version of headwall see drawing 5a (-261).

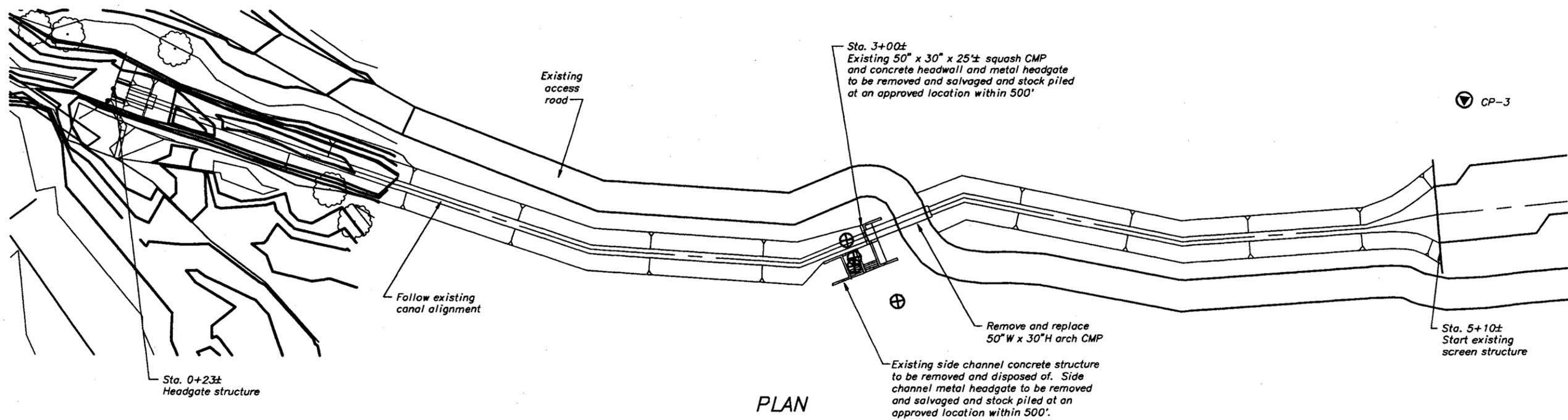
Rev. 10/1/02 Added note 13 and Sheet 1 of 2.  
100 EDM

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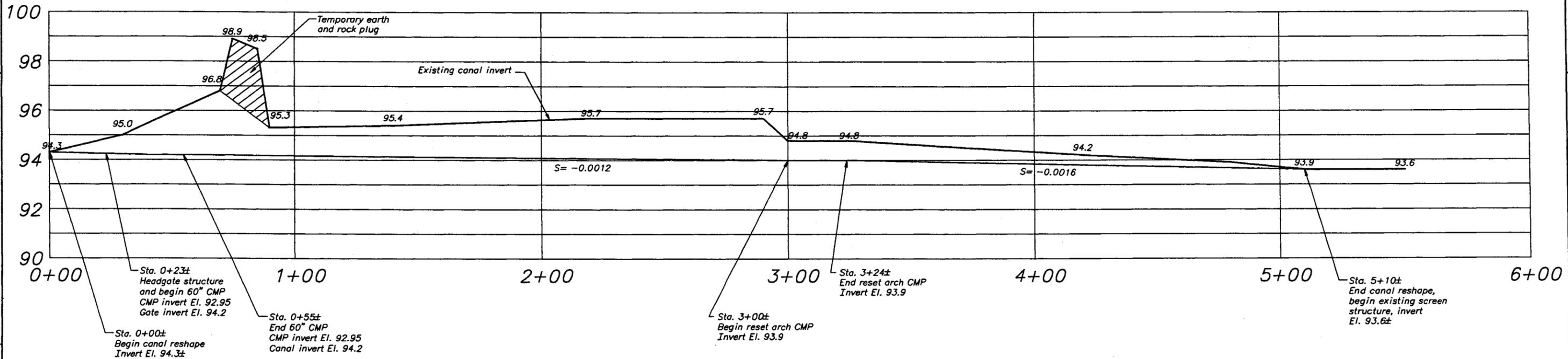
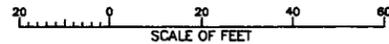
UNITED STATES  
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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
**L3A DIVERSION MODIFICATIONS**  
 HEADGATE  
 PLAN, ELEVATIONS, AND DETAILS

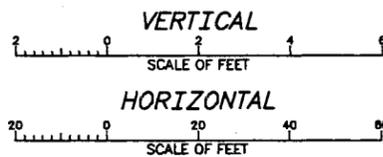
DESIGNED <i>Phil Mann</i>	CHECKED <i>Phil Mann</i>	PROGRAM MANAGER
DRAWN <i>Ed Mordhorst</i>	TECH. APPROVAL <i>Dave Jennings</i>	
CADD SYSTEM AutoCAD Rel. 16.2s	CADD FILENAME 1678-100-219.DWG	DATE AND TIME PLOTTED APRIL 26, 2007 10:57
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PLAN



PROFILE



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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
L3A DIVERSION MODIFICATIONS  
CANAL RESHAPE  
PLAN AND PROFILE

DESIGNED: Phil Mann CHECKED: Phil Mann  
DRAWN: GAN/EDM TECH. APPROVAL: Dave Jennings  
PROGRAM MANAGER

CADD SYSTEM: AutoCAD PLOT 15.06  
BOISE, IDAHO

CADD FILE NAME: 1678-100-220.DWG  
DECEMBER 2001

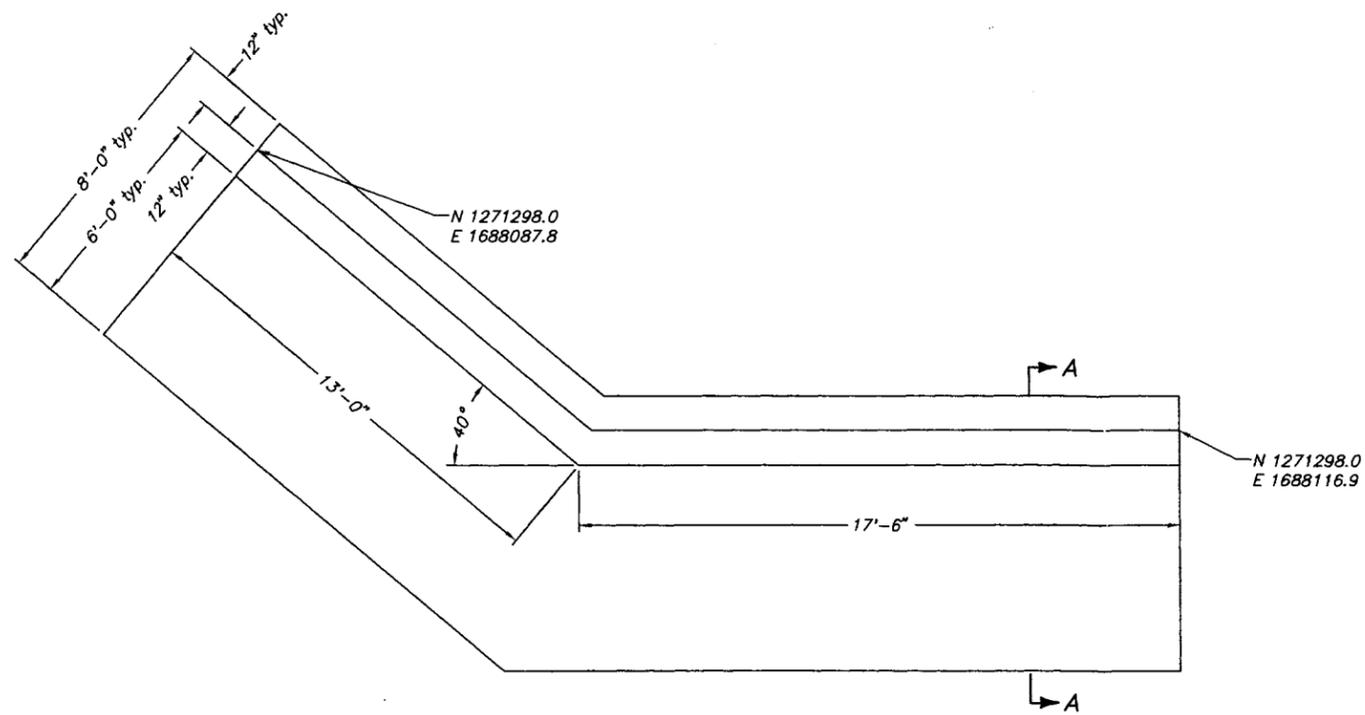
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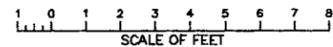
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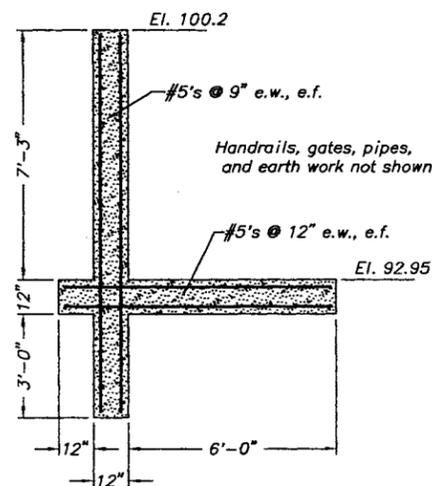
A



L3A CONCRETE HEADWALL - PLAN



- NOTES
- 1 - #5 hoops around pipe openings in wall.
  - 2 - 18" dia. CMP pipe embedded in wall.
  - 3 - 60" dia. pipe attached to downstream face of wall with water tight seal.
  - 4 - 60" w x 30" h gate opening in wall to have rounded edges to match pipe.
  - 5 - Handrail post connection bolts to have 6" minimum embed or anchor depth. Cinch anchors acceptable.
  - 6 - See dwg. 5 (-219) for other details.



SECTION A-A TYPICAL SECTION

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COLUMBIA/SNAKE RIVER SALMON RECOVERY PROJECT  
L3A DIVERSION MODIFICATIONS  
CONCRETE HEADWALL  
PLAN AND SECTION

DESIGNED \_\_\_\_\_ CHECKED \_\_\_\_\_  
DRAWN Ed Mordhorst \_\_\_\_\_ TECH. APPROVAL \_\_\_\_\_  
PROGRAM MANAGER \_\_\_\_\_

CADD SYSTEM AutoCAD Rev. 15.06 CADD FILENAME 1678-100-261.DWG  
BOISE, IDAHO OCTOBER 2002 SHEET 2 OF 2 1678-100-261