

COMPLETION REPORT
LOWER STOKES
FISH PASSAGE IMPROVEMENT PROJECT
BEAVER CREEK,
METHOW SUBBASIN, WASHINGTON
MARCH 2004



On the Cover

Cover Photo A. Lower Stokes Fish Passage Improvement Project — The original Lower Stokes Diversion Dam just prior to removal; the dam height is about 3½ feet (also shown as Appendix Photo A-1).

Cover Photo B. Lower Stokes Fish Passage Improvement Project — Weirs No. 3 and No. 2 following completion of construction. The site of the former diversion dam is between the two. Weir No. 1, the new point of diversion, and the entrance to the irrigation ditch are just upstream around the bend.

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Appendix A. Construction Photographs (color)

All photographs by U.S. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho, PN-3400/Design Group, Boise, Idaho, September 2003 (except as noted)

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1. INTRODUCTION AND BACKGROUND

In the fall of 2003, the Lower Stokes Diversion Dam, identified by the Washington Department of Fish and Wildlife (WDFW) as a barrier to fish movement, was replaced by three rock weirs. These allow fish passage for all species and life stages, meet diversion flow requirements for the landowner, and are less noticeable. The Lower Stokes fish passage improvement project, the first of three in the area, is located on Beaver Creek, a tributary of the Methow River in Okanogan County, Washington. This report explains the design process and regulatory requirements leading to the new diversion and documents the construction that took place. To better illustrate what was accomplished, there are two appendices. Appendix A shows a series of photographs documenting the work that was done. Appendix B contains “as-built” drawings of the project.

1.1 ENDANGERED SPECIES ACT (ESA)

The ESA requires all Federal agencies, including the Bureau of Reclamation (Reclamation), to take actions that will assist in the protection of “listed” species. Under the ESA, NOAA Fisheries (formerly the National Marine Fisheries Service or NMFS) oversees the protection and recovery of certain “endangered” or “threatened” species, including salmon and steelhead. NOAA Fisheries’ judgment of how to protect these species is presented in a “biological opinion” (BiOp) issued to Federal agencies. A BiOp is a detailed description of the present situation and includes actions which Federal agencies are required to take.

The Federal Columbia River Power System (FCRPS) consists of 14 dams and related facilities operated by the U.S. Army Corps of Engineers (ACOE) and Reclamation; the Bonneville Power Administration (BPA) markets the power from these facilities. In December 2000, NMFS issued its “2000 FCRPS BiOp” containing 199 actions that BPA, ACOE, and Reclamation must implement. These actions are intended to avoid jeopardy to the continued survival of 8 stocks of salmon and steelhead in the Columbia River Basin.

The responsibilities for habitat improvement are shared among the FCRPS agencies. Reclamation is currently working on fish passage improvements in nine tributary subbasins in Idaho, Oregon, and Washington, including the Methow River subbasin. There are no authorized Bureau of Reclamation projects in these subbasins. Actions identified in these subbasins are “off-site” from Reclamation’s projects and are designed to improve survival of fish during spawning and rearing life stages. Reclamation’s charge for its nine subbasins is to work with willing partners on non-Federal lands to correct fish screen deficiencies, provide for fish passage at instream diversion barriers, and secure adequate instream flow for the listed fish.

1.2 PROBLEMS AND SOLUTIONS

The project is one of a series of voluntary efforts by various Beaver Creek landowners implemented by and through the Twin Creeks Coordinated Resources Management (CRM) process. The original surveys and the initial design work were provided by the USDA National Resources Conservation Service (NRCS). At the request of Beaver Creek landowners, Reclamation reviewed the NRCS design and continued on with the design work. The projects continued to evolve over time in response to landowner and permitting agency comments.

The Twin Creeks CRM meetings were an important tool, particularly during the early phases of the design process. (The meetings are held as necessary, usually about every six weeks.) Landowners in the Beaver Creek watershed, other interested parties, and all local, State, and Federal agencies with resource management responsibilities were invited to the Twin Creeks CRM meetings. The venue was used to explain and discuss the issues and processes involved in such projects. It was also a good forum to keep people informed of issues in the watershed and ongoing progress with project and grant applications. The meetings are an ongoing program and are coordinated by the Okanogan Conservation District (OCD).

Based on the early designs, OCD obtained funding for the project through a grant from the State of Washington Salmon Recovery Funding Board (SRFB, informally called the “Surf Board”). In addition, the district coordinated and administered the contracting process between the landowner and the construction company. OCD received and held the SRFB grant funds. When provided with paid invoices, the district reimbursed the landowner for contractor payments and for construction materials (such as pipe and the concrete diversion structure). The district also provided materials and manpower for restoration of the construction site. As part of the SRFB agreement, OCD will continue its participation by monitoring its restoration efforts.

1.3 PARTICIPATION AND COOPERATION

The Lower Stokes fish passage improvement project was successful because of the teamwork of the willing participants. The involvement of the owner of the Lower Stokes Diversion Dam was the key, because it was his ranch the dam supplied with water. He provided a great deal of site and water-flow information during the design phase of the project. He also supplied from his property the large-diameter rocks that were used for the three weirs. In addition, his farm equipment was used to unload and load trucks in designated staging areas on his property. These staging areas were used to store materials not only for his project, but other fish passage projects in the Beaver Creek basin.

Another important aspect of this project was the cooperation and coordination between the various permitting agencies; this was fostered in large part by their participation in the Twin Creeks CRM. As a result, the permitting agencies were involved with the design concepts from the beginning; this led to expedited permit issuance and no unpleasant surprises during construction. WDFW and the Okanogan National Forest provided valuable on-site assistance and advice during fish-salvage operations at no cost to the landowner.

Boulder Creek Contracting, locally owned by Pete and Patti DeLange, performed construction work. The firm provided all heavy equipment and various other items, including a dewatering pump, motorized hand compactor, welding equipment, and hand tools.

1.4 PERMITTING

Because the State of Washington SRFB funding originated from Federal sources, consultation was required with NOAA Fisheries and with the U.S. Fish and Wildlife Service (FWS) under Section 7 of the ESA.

To save time and money, OCD prepared a single plan that combined six proposed projects on Beaver Creek and submitted one “biological assessment” (BA) to NOAA Fisheries and to FWS in March 2003. Reclamation provided technical assistance to OCD during consultation. NOAA Fisheries issued a single BiOp for all six projects on August 6, 2003, along with a letter of concurrence from FWS.

WDFW administers a coordinated interagency permitting process (Joint Aquatic Resource Permit Application, or “JARPA”). As part of this process, a “Hydraulic Project Approval” (HPA) was required from WDFW prior to construction. An HPA has specific requirements for the protection of aquatic habitat, streambank vegetation, prevention of oil and gas spills from equipment, and requirements for site restoration. A separate HPA is required for each project; the HPA for the Lower Stokes project was issued on September 6, 2003.

1.5 CONTRACTS SPECIFICATIONS AND BIDDING

Technical specifications and contract language for the project were completed by Reclamation using standard NRCS format and language; the landowner, who was responsible for contract administration, reviewed and concurred with the document. The specifications for the Lower Stokes project were sent by the landowner to nine contractors at the end of May 2003. Proposals from the contractors were due on June 20, 2003; three were received.

For the Lower Stokes project, the contract for construction was between the landowner and the construction company. OCD received and held the SRFB grant funds. When provided with paid invoices, the district reimbursed the landowner for contractor payments and construction materials (such as pipe and the concrete diversion structure). During construction, Reclamation had no contractual relationship or other obligations with the contractor or OCD.

2. PROJECT DESCRIPTION

The purpose of the Lower Stokes project was to improve fish passage. This was accomplished by the removal of the old diversion dam and the construction of a new diversion facility upstream with water supplied by a fish-friendly weir.

The 3½-foot-high diversion dam, made of stacked logs and lined with plastic (photo A-1), was removed entirely. To replace it, a so-called “Rosgen” rock vortex weir (Weir No. 1) was installed at the site of the new point of diversion (photo A-13). The weir formed a small pool at a higher elevation, and this allows sufficient water to be diverted into the irrigation ditch to meet the water right. The water drop over the new weir is 0.8 feet, which meets State standards for fish passage. Because the large rocks establish a hardened point, Weir No. 1 provides “grade control” which means the stream is unable to downcut its bed over time .

A new diversion box and headgate was installed at Weir No. 1. From the headgate to the existing ditch just upstream of the fish screen, an 18-inch-diameter conveyance pipe was installed. The old headgate was removed. A small portion of the ditch from the site of the former diversion dam was no longer needed and filled in.

Downstream, near the location of the former diversion dam, two more vortex rock weirs, No. 2 and No. 3, were constructed; these stabilized the slope and energy of stream in this reach. These structures were designed to provide grade control and eliminate “headcutting” (the large, downward movement of a streambed that results when a stream is steepened). See Photo A-24.

2.1 PROJECT MATERIALS, QUANTITIES, AND SUPPLIERS

Other than the large rocks supplied by the landowner, the materials used for the project were ordered or supplied separately from the construction contract. Invoices for materials were sent to the landowner who made payment to the suppliers; he was then reimbursed by OCD from the SRFB funds.

The concrete diversion box — including the headgate, trashrack, grating, and pipe stub — was pre-cast locally and delivered to the site by Arm and Hammer Construction Company of Twisp. The diversion box was built to the dimensions shown on the drawings with minor changes (the method of attaching the trashrack to the concrete box). The diversion box grating is standard 1-inch grate and galvanized as a unit (see photo A-14.) The trashrack was fabricated as a unit and also galvanized.

The headgate is a standard, 18-inch-diameter, Waterman Industries C-10 slide gate. The 3-foot pipe “stub” (a connector from within the box to the pipeline) is 125 psi “PIP” (plastic irrigation pipe, a specific type and class of PVC pipe). The 18-inch conveyance pipe is also PIP and rated for 63 psi. About 190 linear feet of pipe was installed with one 45-degree fitting. The total drop of the pipe is about 1 foot, an average slope of about 0.5 percent. The soils in which the pipe was placed were very sandy with minimal cobbles. The average depth of fill over the pipe is about 30 inches. All pipe for this project was supplied by Cascade Pipe and Feed Supply of Twisp

The 30-inch-diameter dewatering pipe used to temporarily route the creek around the worksite (photos A-4, A-5, and A-6) is a double-walled HDPE (high density polyethylene) pipe with watertight gaskets manufactured. It was supplied off the shelf by the ADS Company. OCD purchased 200 feet of dewatering pipe and two 45-degree fittings. A combined total of about 125 feet of dewatering pipe was used for each of the two stages at the Lower Stokes project. Surface excavation ranging in depth from 1 to 5 feet was need to ensure proper grade. The dewatering pipeline was not backfilled unless necessary for weight on the pipe or where the equipment needed to cross. The dewatering pipe was used for other Beaver Creek projects and OCD divided the cost among them.

Most of the large-diameter rocks used in this project were provided by the landowner and gathered from other areas of the property. After inspection and selection, about 125 rocks of various sizes were brought to the site in early summer. The landowner-supplied rocks were slightly rounded and granitic, ranging from just less than 2 feet in average diameter to over 4 feet. The estimated weights of the rocks ranged from 600 to 4,000 pounds.

In addition, two truckloads of rocks — about 20 cubic yards — were purchased from a local quarry and delivered to the site. The rocks were deemed unacceptable due to the presence of calcite seams that facilitated cracking of the larger rocks. Fewer than six of the quarry rocks were used. About 15 of the landowner’s rocks were not used and were removed from the site. Each of the three rock weirs required about 40 rocks to complete.

The material excavated from each of the three rock weir sites was similar in composition and consisted of a sand-gravel-cobble mixture with an occasional boulder. Typically, the material was

“well graded” (evenly mixed); however, along the banks of the creek, there was some layering from flood deposits.

After the rocks for each weir were in place, an impervious “geocomposite” fabric was spread on the upstream side of each one. The purpose of the fabric was to reduce or prevent water from traveling underneath the large rocks and to encourage deposition of fine materials if small leaks through the backfill did occur. The fabric was placed in various configurations and was held in place by the weight of the large rocks and by fill material.

The fabric consists of two layers of “16-ounce” felt (weight per square yard) bonded to each side of a 50-mil-thick (about 1/20th of an inch), impermeable polyvinylacetate membrane. The fabric was manufactured by the Huesker Company (product number HGC-165016) and purchased directly from the company. About 1,800 square feet of material was installed at the Lower Stokes site. At Weir No. 1, where the diversion box is located and minimal seepage is preferred, the pool was fully lined. The lower two weirs (No. 2 and No. 3), primarily used for stabilization and low-flow fish passage, were only lined in the middle third of each.

2.2 CONSTRUCTION TIMELINE

Construction on the project began on the morning of September 8, 2003 with the excavation for the dewatering pipe trench for the upper weir. The last of the cleanup was completed on September 19. The weather was very good with moderate temperature and very little rainfall. Creek flows stayed consistent and were estimated to range between 3 and 6 cfs. Revegetation will be completed in the spring of 2004 and will be monitored by OCD; informal site monitoring by the landowner, OCD, and Reclamation will continue through the years.

The project was built in the following steps:

1. Installation of 120 feet of dewatering pipe around site of Weir No. 1, the new point of diversion (1 day); Photos A-4, A-5, and A-6.
2. Installation of (upstream) Cofferdam A, made of earth material covered with geocomposite fabric and plastic; electroshocking and removal of resident fish from site (1 day).
3. Construction of Weir No. 1, including geocomposite liner and backfill (2 days); Photos A-8, A-9, and A10.
4. Installation of diversion box and backfill (1day).
5. Removal of upstream cofferdam and dewatering pipe (½ day); Photo A-13.
6. Installation of 18-inch-diameter conveyance pipe (1 day).
7. Test of capacity of diversion box and conveyance pipe; Photo A-14.

8. Installation of dewatering pipe to bypass construction site of Weirs No. 2 and No. 3 (1 day).
9. Installation of ecology-block-and-plastic-liner cofferdam; electroshocking and removal of resident fish (1 day); Photos A-17 and A-18.
10. Deconstruction of log-and-plastic diversion dam; Photo A-19.
11. Construction of Weir No. 3 and backfill (1½ days); Photos A-20, A-21, and A-22.
12. Construction of (middle) Weir No. 2 and backfill (1 day).
13. Removal of (lower) Cofferdam B and completion of minor items (½ day).
14. Completion of cleanup, regrading, removal of materials, etc.; initial revegetation (½ day).

A walkthrough was conducted on September 18 by the landowner, OCD, the contractor, and Reclamation. They reached agreement on final grading and cleanup and discussed revegetation, including the type of and number of plants, and the schedule for work. A few “punchlist” items (minor post-project completion work) were identified, including removal of the rebar lifting eyes from the new diversion box, a change in the attachment bolts for the trashrack to make it easier to remove, and additional trimming of the grate to allow the full range of operation of the slide gate. The punchlist items were completed by October 15, 2003.

A final walkthrough of the project by the landowner, OCD, and Reclamation is scheduled to occur sometime in July 2004. By that time, the new structures should have been tested by snowmelt and the high-water season. Any additional punchlist items or required repairs can be discussed at that time, including items related to revegetation. Once it has been determined that the project has performed well and is delivering the required amount of water to the ditch, the parties involved in project implementation will then sign a “turnover” agreement. This is yet to be developed, but it will establish the landowner’s responsibility for maintenance of the project and any necessary repairs to the facilities. If specific repairs or punchlist items are identified by that time, they will be addressed prior to signing. It is anticipated that the landowner, OCD, and Reclamation will each sign the agreement.

Basic monitoring will occur over the next couple of years to make sure the project is functioning satisfactorily. In addition to that type of sporadic monitoring, Reclamation has proposed a long-term plan to monitor the effectiveness of the actions taken throughout the Beaver Creek watershed. The plan is being drafted by Reclamation’s Methow subbasin liaison, who is working with the landowners and various agencies to make sure the monitoring meets the needs of all concerned.

3. CONCLUSIONS

So far, the Lower Stokes Fish Passage Improvement project has been successful. It has yet to be tested by seasonal high flows. Weir No. 1 and the diversion box appear to deliver required water flows to the ditch while providing fish passage that meets all appropriate standards. The maintenance of the new rock structures and headworks should be minimal for the landowner. The revegetation program will be completed in the spring and plant growth will be monitored. A turnover document will be signed by the landowner, OCD, and Reclamation after the first high-water season has passed and any necessary repairs or changes are made.

Lower Stokes Fish Passage Improvement Project

Appendix A.

Construction Photographs (color)

All photographs by U.S. Bureau of Reclamation, Pacific Northwest Region, Boise, Idaho, PN-3400/Design Group Survey Team, Boise, Idaho, September 2003 (except as noted)



Photo A-1. Original Lower Stokes Diversion Dam just prior to removal; the dam height is about 3½ feet. Compare the concrete wing wall behind worker and the water elevations to that shown in Photo A-20.



Photo A-2. Preliminary layout of upper weir (Weir No. 1); flow is from left to right.



Photo A-3. Looking upstream at Weir No. 1 showing the drop to pool. The height of the riffle (± 10 inches) equals the amount of headloss available to deliver the irrigation water.



Photo A-4. Looking downstream at entrance to dewatering pipe and the Weir No. 1 layout. The cofferdam will be located between the pipe and the layout.



Photo A-5. Excavation crew checking for proper slope of dewatering pipe.



Photo A-6. Downstream end of dewatering pipe with fabric for erosion control.



Photo A-7. Straw bales below Weir No. 1 construction area prior to dewatering. The straw bales help filter silt during and after construction.



Photo A-8. Installation of geotextile fabric behind first arm of Weir No. 1. Attached to the hose is a trash pump, sending the muddy water up onto the shore so the silt can settle out while the water returns. Note the downstream straw bales.



Photo A-9. Looking upstream at base rocks of Weir No. 1. To prevent downstream movement, the rocks on the top layers are behind the base rocks.



Photo A-10. Backfilling the left-bank weir arm. Note the even slope of the weir arm toward the center of the structure and the lack of spaces between rocks.



Photo A-11. Looking downstream at completed Weir No. 1 (trash pump hose in foreground).



Photo A-12. Completed Weir No. 1. The new diversion box (at lower left) was placed so that it will draw water at low flows but not block water from the right-side weir arm area (foreground).



Photo A-13. Looking upstream at newly completed Weir No. 1 and the partially breached cofferdam A. To avoid releasing the backed-up water all at once, the cofferdam is breached in small sections.



Photo A-14. The newly installed diversion box was tested and satisfied the flow requirement for the landowner's water right.



Photo A-15. Looking downstream at Weir No. 1 (center) from the remains of Cofferdam A. The new diversion box is at center right.



Photo A-16. Looking upstream at Weir No. 1 after Cofferdam A has been removed.



Photo A-17. Concrete “ecology blocks” were used as the core of Cofferdam B, which dewatered the construction sites for Weirs No. 2 and 3. They are cast from leftover concrete batches, reducing waste; note the rebar “lifting eyes” for placement and removal.



Photo A-18. Cofferdam B with sandbags holding down geotextile tarp, which holds back water.



Photo No. 19. The Lower Stokes Diversion Dam was deconstructed in stages to facilitate electro-shocking and removal of fish from project area.



Photo A-20. Looking downstream at initial excavation of Weir No. 3. The concrete at right of photo is the upstream wall of the former diversion dam. The wall and the dam were about the same height (as shown in Photo A-1).



Photo A-21. Looking downstream at Weir No. 3 just prior to completion. The worker at center-left is filling the spaces between the large rocks with cobble-size material and fines.



Photo A-22. Looking downstream at Weir No. 3 about 3 hours after Photo A-21 above was taken. The weir has been backfilled and the scour hole excavated.



Photo A-23. Looking upstream at the lower weirs (Nos. 3 and 2).



Photo A-24. Looking upstream at Weirs No. 3 and No. 2 as water muddy from the removal of Cofferdam B flows past.



Photo A-25. This picture of Weir No. 1 was taken about mid-November 2003, about 2 months after completion. The weir was designed to pass a “bankfull” flow of 170 cfs and was tested with one minor event of about 30 cfs. The flow shown is about 6 cfs.



Photo A-26. The motley crew — one Contractor, two Okanogan Conservation District employees, and two from Reclamation (in no particular order).

Lower Stokes Fish Passage Improvement Project

Appendix B. As-Built Drawings

Figure B-1. Location Map: Upper and Lower Stokes Diversions (1678-100-272) (not included)

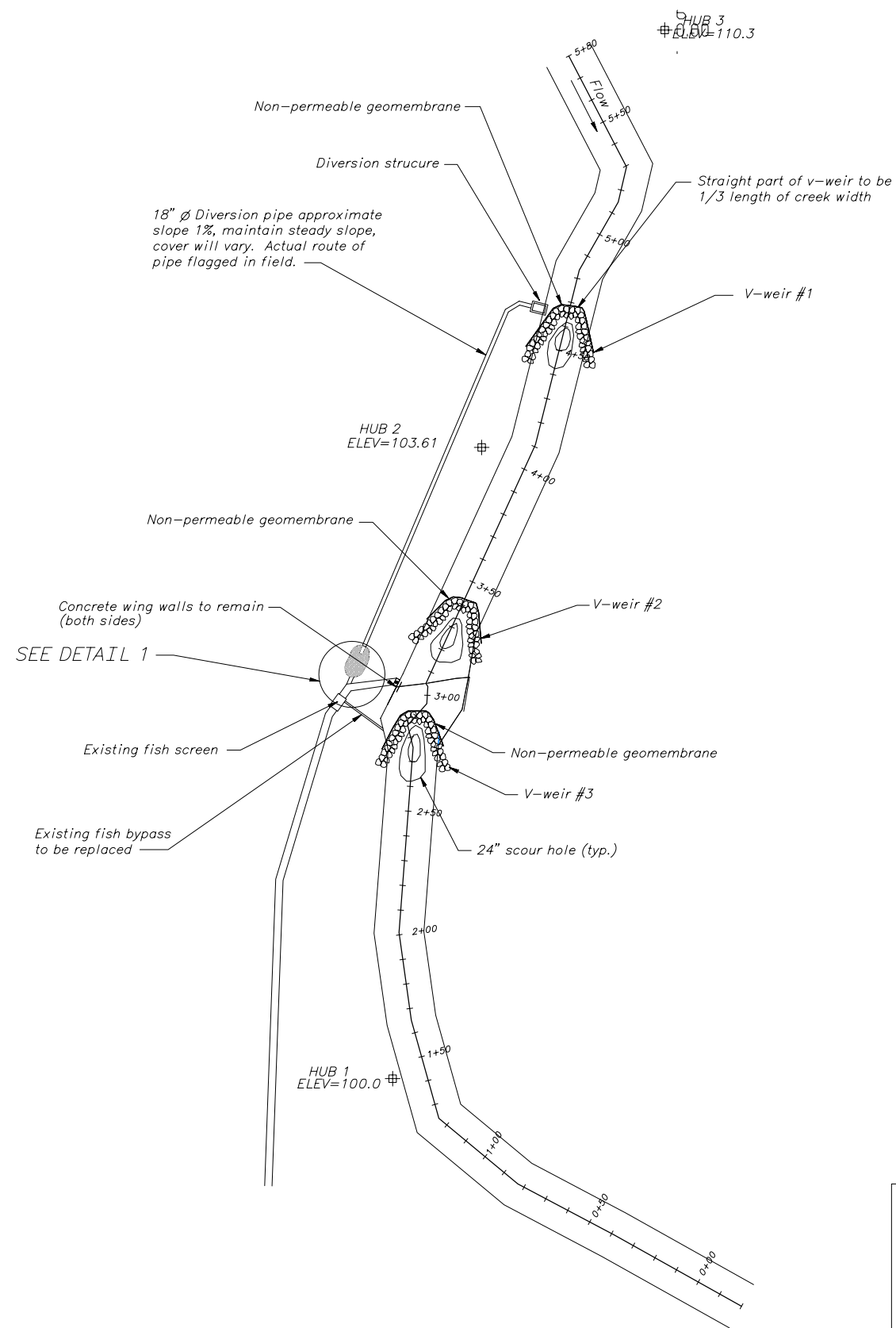
Figure B-2. Lower Stokes Diversion, Site Plan (1678-100-273)

Figure B-3. Lower Stokes Diversion, Profile and Section (1678-100-274)

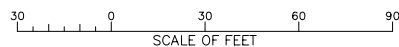
Figure B-4. Lower Stokes Diversion, Cross-Vane Weirs, Profiles and Sections (1678-100-275)

Figure B-5. Lower Stokes Diversion, Diversion Structure, Plan and Sections (1678-100-276)

Figure B-6. Lower Stokes Diversion, Dewatering Plan (1678-100-270)



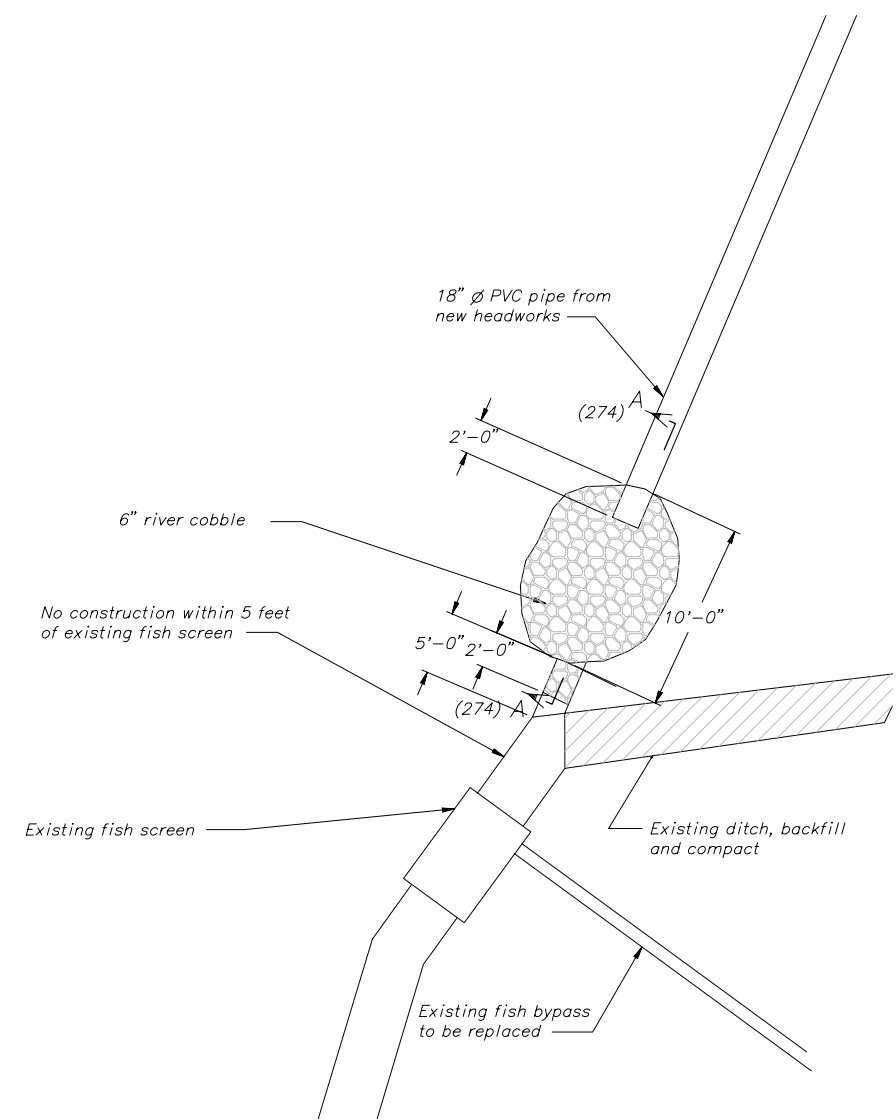
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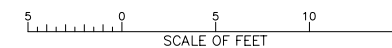
V-WEIR LOCATIONS

STATION	ELEVATION	DESCRIPTION
4+65	99.60	V- weir #1
3+40	98.63	V- weir #2
2+90	97.67	V- weir #3

Elevations and Stations are @ low point on weirs



DETAIL 1



NOTE:

- Existing survey hubs are not to be damaged or removed by Contractor.
- All materials including rocks are furnished by the district.
- All layout and surveys for the project are provided by the engineer.

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DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Gene Humbles</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u> PEER REVIEWER/PROGRAM MANAGER	
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BOISE, IDAHO	OCTOBER 2002
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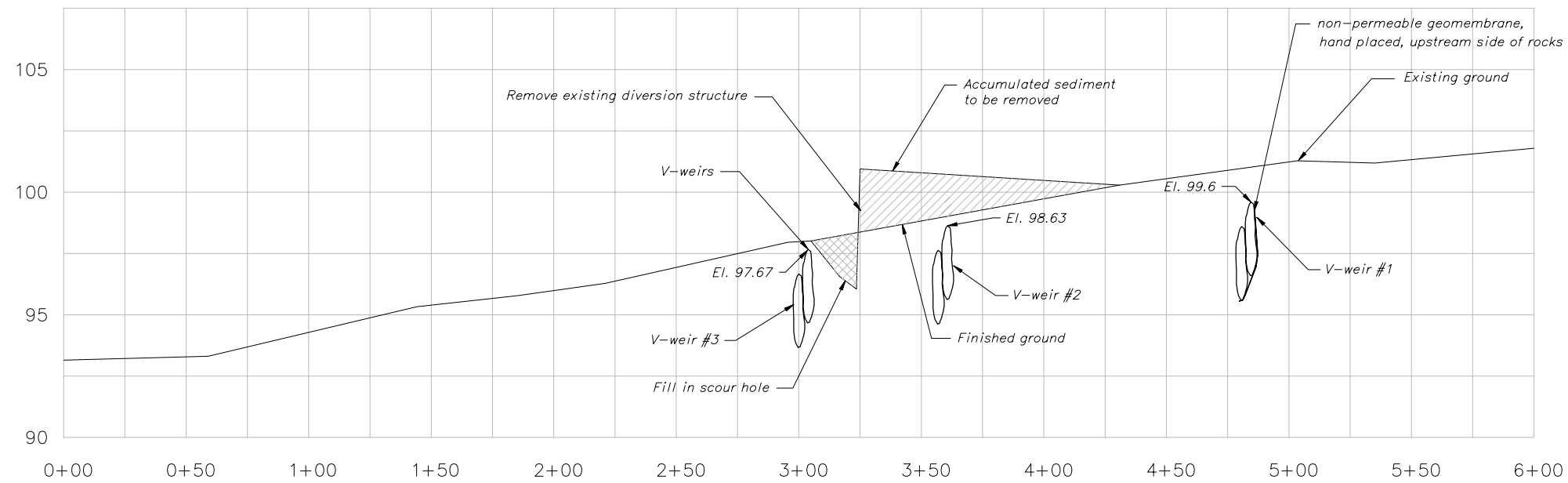
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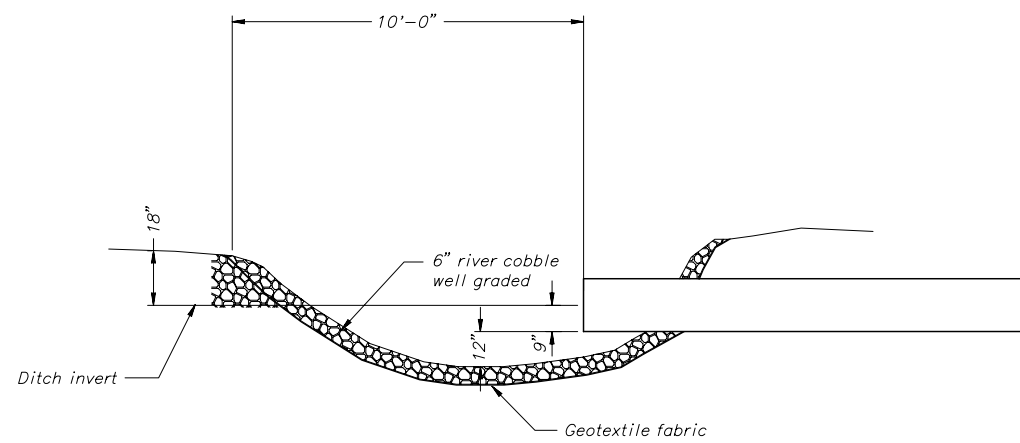
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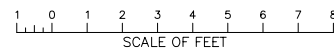
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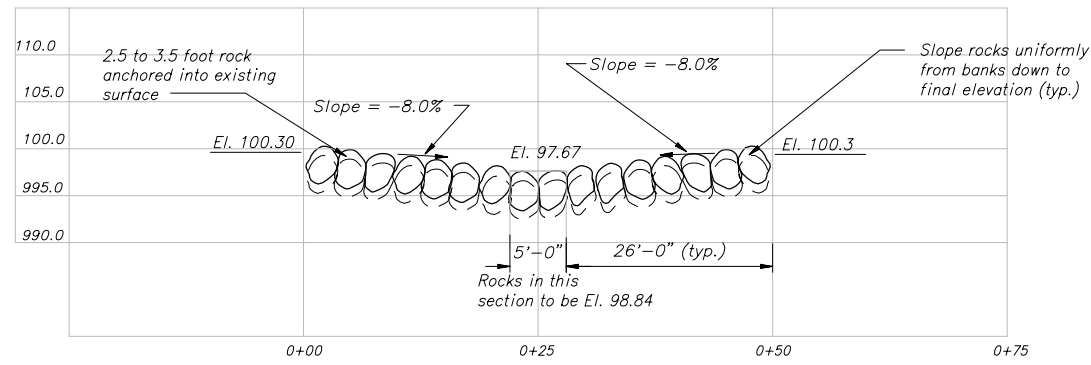
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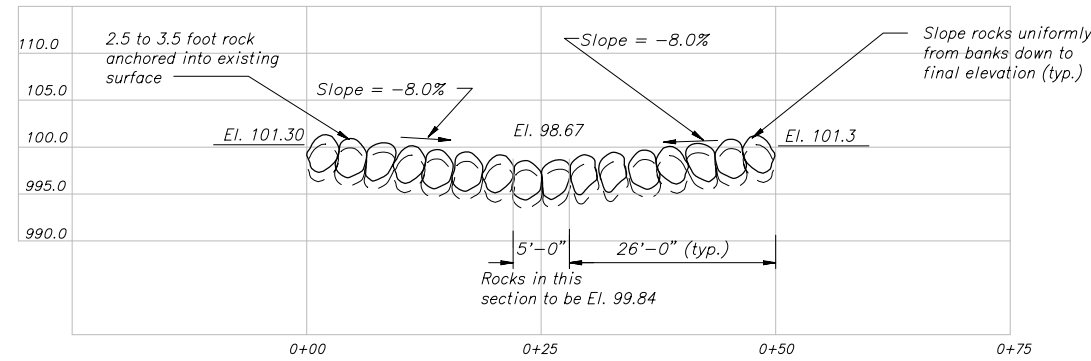
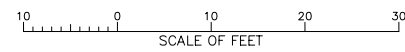
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Assumed local elevations used and are not based on sea level datum.

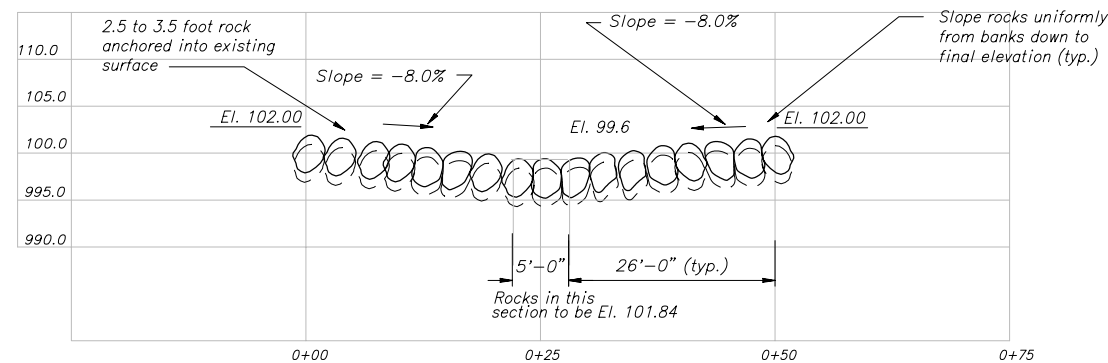
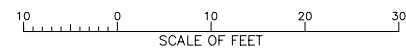
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SPECIFICATION #	1678-100-274



V - WEIR #3 PROFILE

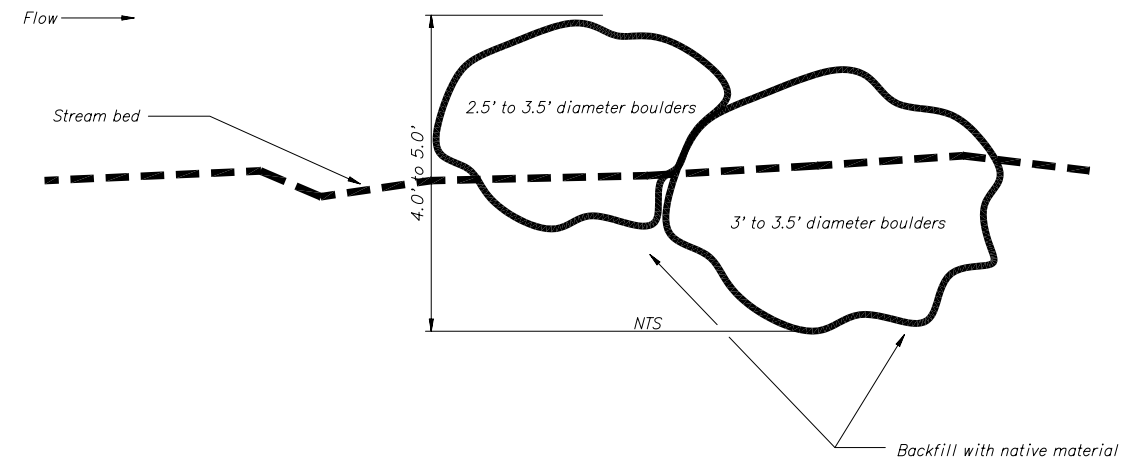
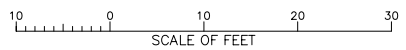


V - WEIR #2 PROFILE



V - WEIR #1 PROFILE

Geomembrane this weir only, not shown



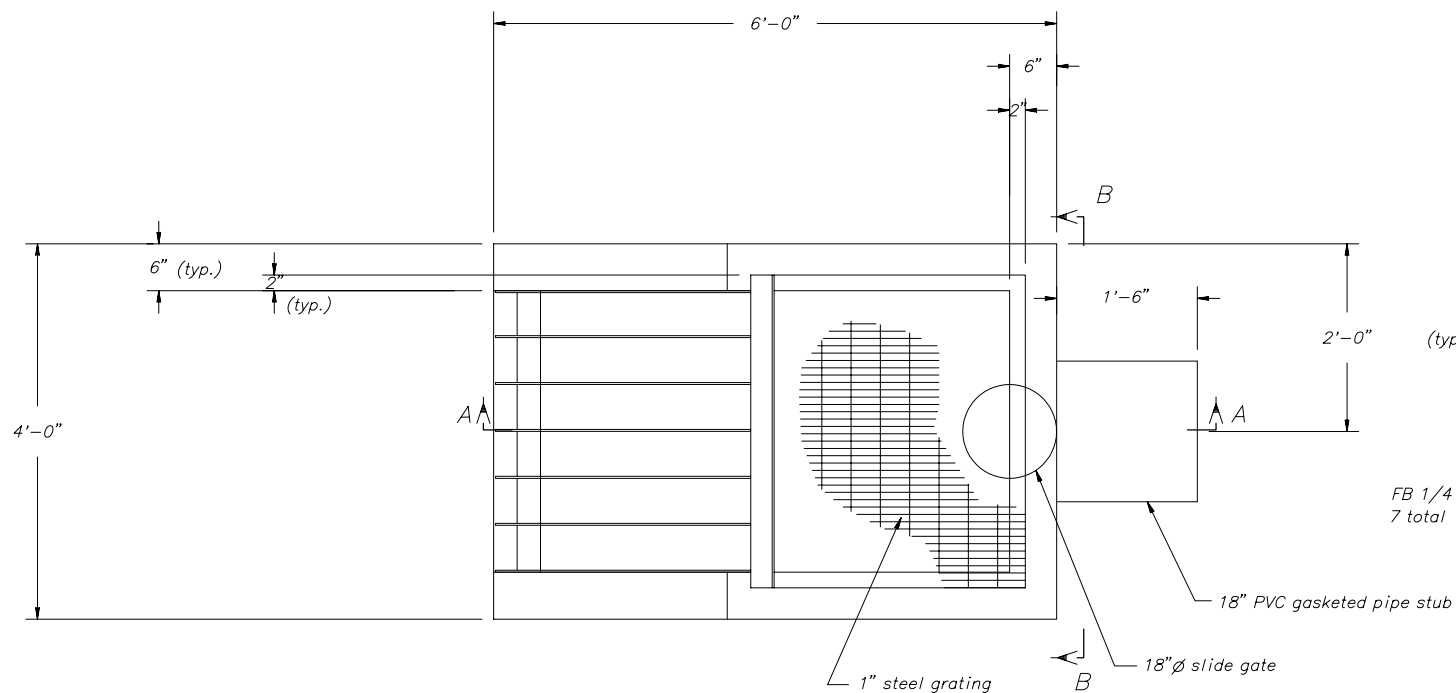
SECTION OF TYPICAL ROCK WEIR

NOTES:

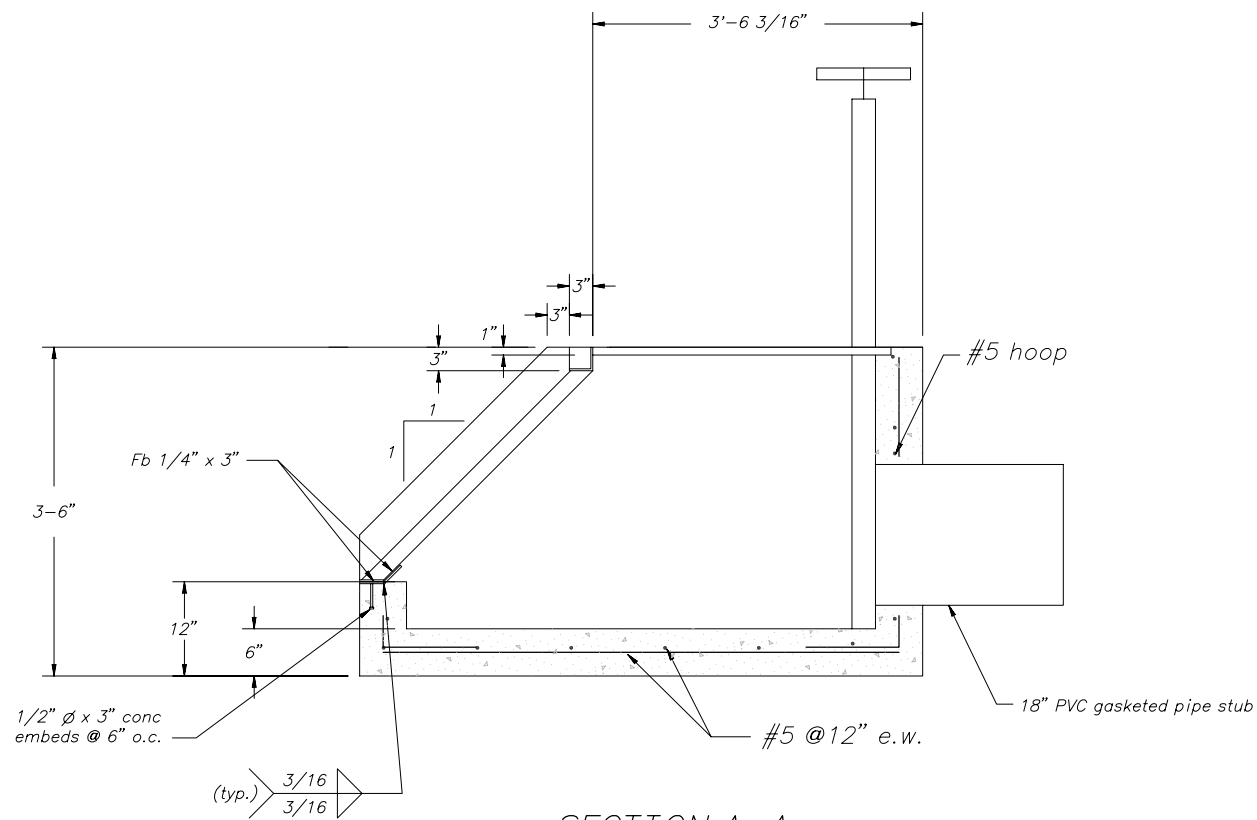
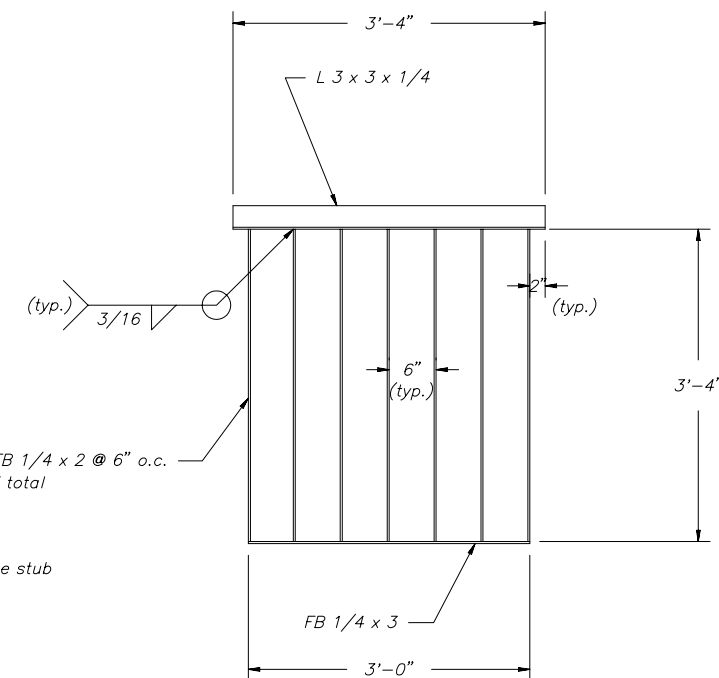
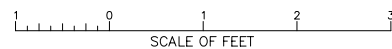
- 1. Local elevations used and are not based on sea level datum.

REV. 12/03	AS BUILT
100 JM	
ALWAYS THINK SAFETY	
UNITED STATES DEPARTMENT OF THE INTERIOR BUREAU OF RECLAMATION FORPS HABITAT IMPROVEMENT PROGRAM METHOW RIVER SUBBASIN LOWER STOKES DIVERSION CROSS-VANE WEIRS PROFILES AND SECTION	
DESIGNED <u>Jeff McLaughlin</u>	CHECKED <u>Gene Humbles</u>
DRAWN <u>Scott Weddle</u>	TECH. APPROVAL <u>Jeff McLaughlin</u>
APPROVED <u>Dave Jennings</u>	
PEER REVIEWER/PROGRAM MANAGER	
CADD SYSTEM AutoCAD Rel. 16.0	CADD FILENAME 1678-100-275.DWG
BOISE, IDAHO	JANUARY, 2003
SPECIFICATION #	1678-100-275

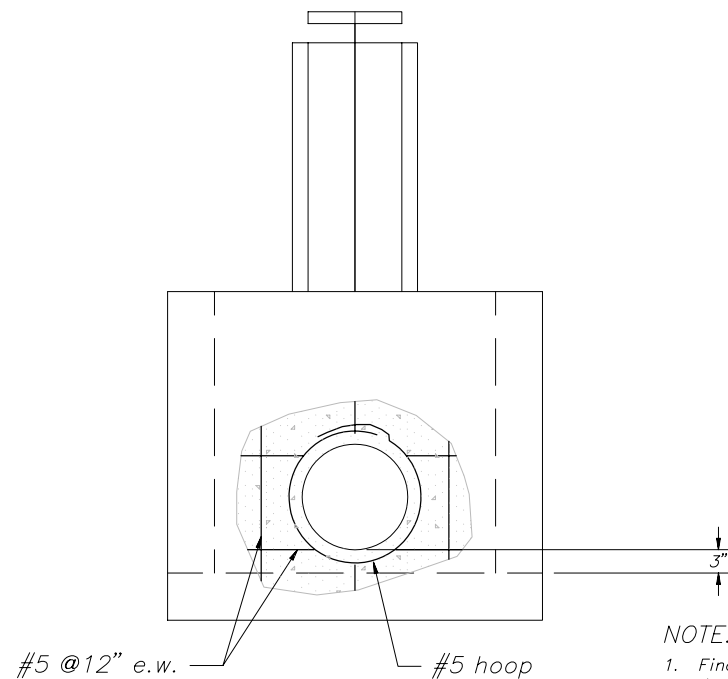
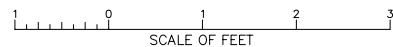
DATE AND TIME PLOTTED
MARCH 9, 2004, 10:08
PLOTTED BY
JWARD



PLAN



SECTION A-A



SECTION B-B

NOTE:

1. Final elevation of headgate structure determined in the field.
2. Grate to have a tolerance of $-.25"$ to allow grate to fit within design dimensions.
3. Add temporary lifting eyes or cables to structure.

ALWAYS THINK SAFETY

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION
CORPS HABITAT IMPROVEMENT PROGRAM
METHOW RIVER SUBBASIN

LOWER STOKES DIVERSION
DIVERSION STRUCTURE
PLAN AND SECTIONS

DESIGNED Jeff McLaughlin CHECKED Gene Humbles
DRAWN Scott Weddle TECH. APPROVAL Jeff McLaughlin
APPROVED Dave Jennings PEER REVIEWER/PROGRAM MANAGER
CADD SYSTEM AutoCAD Rel. 16.0 CADD FILENAME 1678-100-276.DWG
BOISE, IDAHO JANUARY 2002 1678-100-276

SPECIFICATION #