

Case Study 3. Nurse Creek Rock Fill Ford

Location

Southwest Oregon. Umpqua National Forest, Diamond Lake Ranger District, north of Toketee Ranger Station. Nurse Creek, tributary to the North Umpqua River.

Crossing Description

This ford was constructed in 1981 on Nurse Creek, a perennial tributary to the North Umpqua River. To create an acceptable vertical curve crossing this steep, entrenched channel, the channel was filled with large angular rock. Water flows over and through the rock fill. The large riprap necessary for this structure was obtained from nearby roadcuts. The crossing is on a closed road, and has needed no maintenance since it was built.



Figure A11. Nurse Creek rock fill ford in 1988

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Setting

Western Cascades Section (M242-B). The section is an uplifted sequence of volcanic and volcanoclastic rocks, interspersed with intrusives that have been dissected by large order riverine systems such as the Umpqua River. Soils have organic matter rich topsoil, and contain volcanic ash. The predominant forests are silver fir-Douglas fir and fir-hemlock. Western red cedar occurs in drainages. This area is about 35 air miles northwest of Crater Lake.

Why Was This Structure Selected?

This structure was selected for low maintenance and to protect downstream water quality and fish habitat. If the structure should wash out, there is no fine sediment in the fill to damage fish habitat in the North Umpqua River.

Crossing Site History

The previous structure at this location, an under-sized corrugated metal pipe, had been overtopped and was washing out.

Road Management Objectives

This road is closed to all motorized use (maintenance level 1). After the timber sale that reconstructed this crossing, the road was gated. No further activities are planned in the area in the foreseeable future.

Stream Environment

Hydrology: Nurse Creek is a perennial stream tributary to the North Umpqua River. The watershed above this crossing location (3,520 feet elevation) is approximately 353 acres (0.55 square miles). Peak runoff occurs during snowmelt. Calculated discharges for the 25-, 50-, and 100-year events are 103, 119, and 136 cubic feet per second respectively.

Channel Description: This is a steep drainage. It is a Rosgen channel type Aa+, with an estimated slope of 15 percent. Banks are stable and riparian vegetation includes brush and conifers. The channel is moderately confined between valley walls, and is both vertically and laterally stable. Basaltic bedrock outcrops occur in the channel and along one bank a few hundred yards above the ford.

Aquatic Organisms: Nurse Creek is too steep to provide fish habitat, so fish passage is not an issue at this crossing. Passage for amphibians may be possible through and over the wet rocks, but this is unknown. A small pool at the upper end of the structure provides habitat for wildlife.

Structure Details

Water Quality: Water quality in the stream is high and this structure probably does not affect it at all. Large riprap and the 1.5-inch minus open-graded surfacing material do not contribute fine sediment. The road itself is aggregate-surfaced and outsloped, minimizing sediment delivery to the stream.

Structure: To construct this rock fill ford, 6 to 8 feet of the previously existing road surface were excavated and replaced with large riprap. The large rock was placed all the way down the fillslope to protect against undercutting. The splash apron also covers the approach fillslopes as they wrap around the steep drainage, so that high flows are focused back to the channel. The dip is designed to contain flows with return intervals exceeding 100 years.

Cost: The ford cost less than \$10,000 to construct in 1981.

Safety: The road is closed with a metal gate about 250 feet before the crossing.

Flood and Maintenance History

This structure went through large floods in 1996-97 with little or no damage. After more than 20 years and almost no maintenance, water still flows where it was designed to flow and vegetation has grown up all around the ford. Recently, a snag fell over the ford without damaging its function in any way (figure A12). A beaver has taken up residence in the pool at the inlet.



Figure A12. Snag fallen across the ford August 2004. Note beaver dam at upstream end of roadway.

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Summary and Recommendations

The structure is serving its intended purpose well. It is self-maintaining, and transmits high quality water to a downstream fishery stream. For long-term road closures and very steep streams where fish habitat is not an issue, this type of structure appears to fit the geomorphic and biologic environment well. It is clearly a highly stable choice. Figure A13, taken in August 2004 shows the foreslope riprap covered with moss and debris. If the crossing were a big culvert with a big fill, plugging due to the snag's fall could have caused overtopping and fill failure. Even if the existing rock structure should fail, the materials used in construction would not degrade either Nurse Creek or the North Umpqua River.



Figure A13. Stable, moss-covered rocks on the splash apron with pieces of fallen snag. Dashed line indicates approximate road surface.

Steve Nelson, supervisory forester on the Diamond Lake Ranger District, Umpqua National Forest, provided information and photos for this case study.

**Similar Structures in
Other Locations**

Rock fill fords have also been used successfully on the Klamath National Forest in steep drainages moving considerable woody debris after forest fires. Traffic delays and fish passage were not issues in those situations. Passage for other aquatic organisms was not considered when the fords were built, and it is unknown whether they are barriers or not. With time the voids between the rocks tend to plug so that less and less water filters through the structure and more water flows over the roadway (Harry Sampson, personal communication).

Figure A14 shows a similar rock structure built by the Idaho Panhandle National Forest in about 1996 to replace a culvert that washed out during a flood. The objective was to fortify the crossing to withstand culvert plugging and subsequent overflows. The fill is high and the structure is designed to withstand overflow (Jim Neiman, personal communication).

The Idaho Panhandle National Forest used a similar design to retrofit an undersized culvert that could not be replaced immediately (figure A15). Again, the goal was to prevent a catastrophic culvert failure during large floods that characteristically plug culverts with woody debris (Gary Harris, personal communication 2001). Plans called for removing fill to create a driveable dip over the culvert, and sizing the dip to contain the 100-year flow (assuming the culvert plugs). The roadway is outsloped over the dip, and up- and downstream fillslopes are riprapped with class V rock (maximum size 26 to 28 inches).

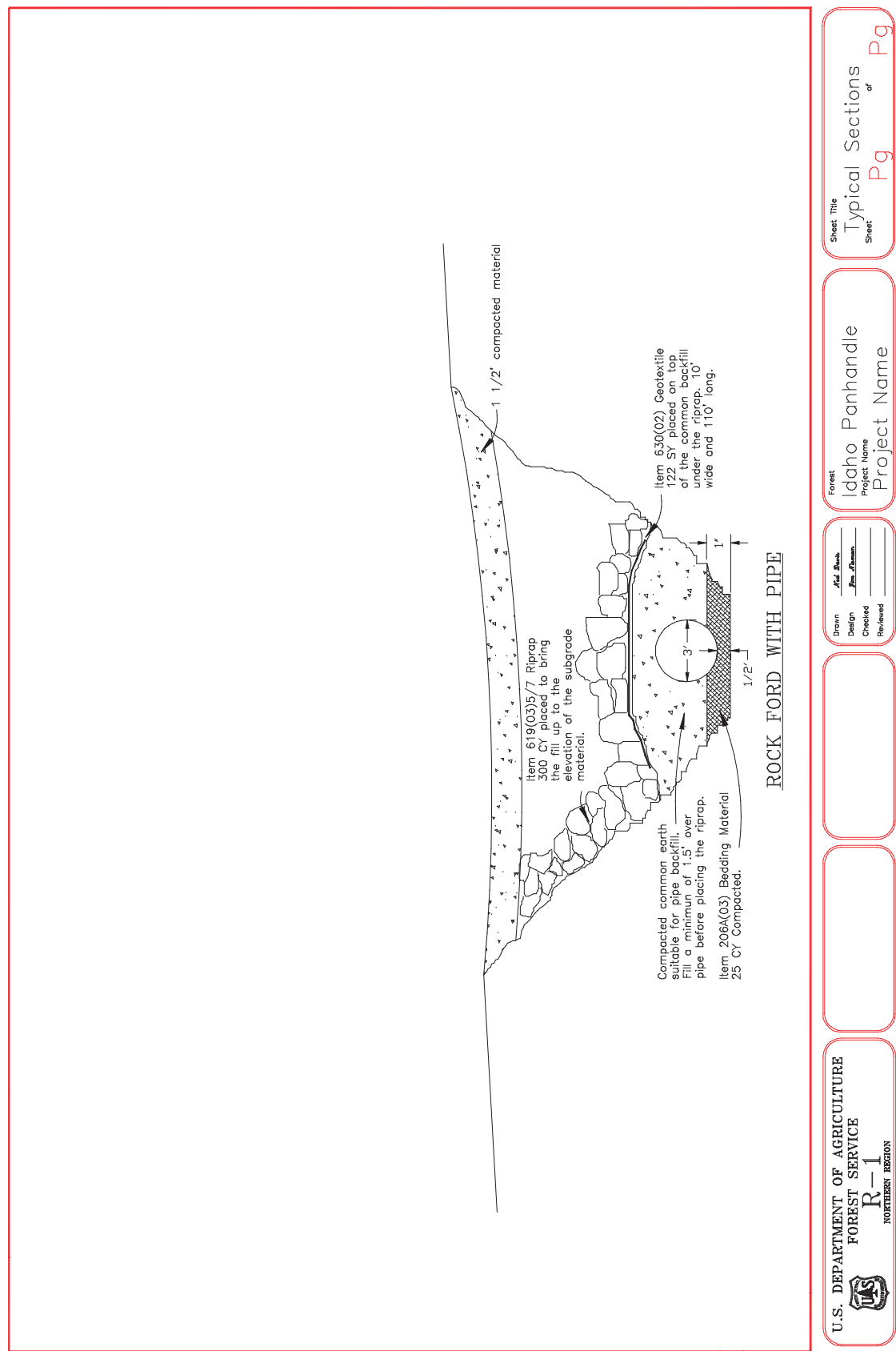


Figure A14. Rock ford with culvert, Idaho Panhandle National Forest.

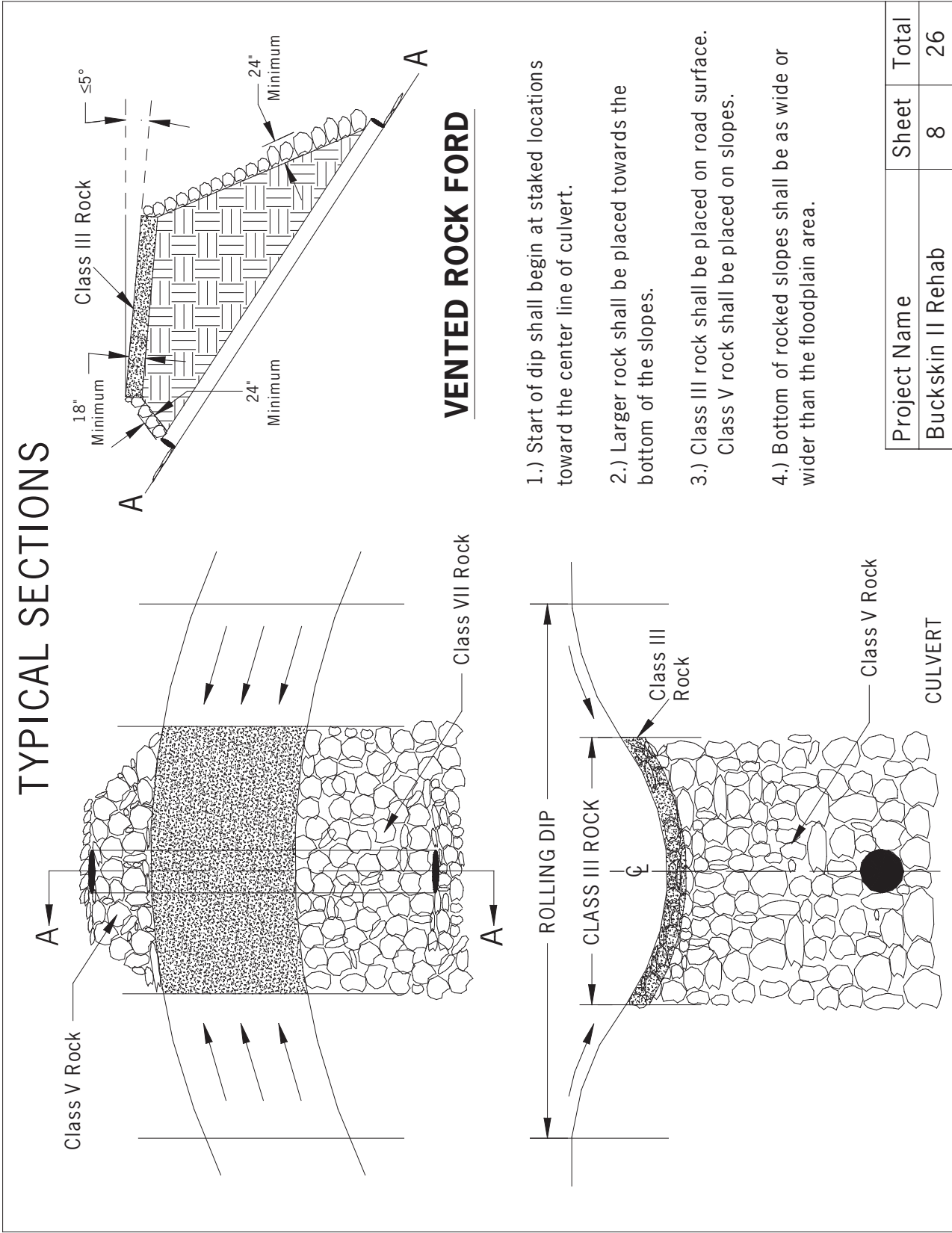


Figure A15. Vented rock ford, Idaho Pandhandle National Forest.

