on KRN website

EXHIBIT 4
DATE 1-27-05
HB 277

Grave Creek is a major bull trout and westslope cutthroat trout spawning and rearing tributary to Lake Koocanusa. It is the only significant bull trout spawning stream within the Upper Kootenai River, south of the Canadian border, and it supports a healthy, genetically pure westslope cutthroat trout population.

The Grave Creek drainage encompasses approximately 48,200 acres, the majority of which is high elevation, densely timbered land. The lower three miles of Grave Creek flows through private farmlands, and is characterized as Rosgen "C" and "D" type stream channel, with a low gradient and a moderate to high sinuosity (Rosgen 1996). The upper reaches of the stream are classified as Rosgen "B" channel type, with moderate gradient (>2%), and a moderate entrenchment ratio of 1.4 to 2.2.

The Glen Lake irrigation diversion is located on Grave Creek, four miles upstream from the confluence of Grave Creek with the Tobacco River. It is approximately 8 miles southeast of Eureka, Montana, within the SW ¼ of Section 6, Township 35N, Range 25W.

The Glen Lake irrigation ditch was constructed in 1915 to supply irrigation water to much of the farm and ranch land throughout the Tobacco Valley. In 1923, the Glen Lake Irrigation District (GLID) constructed a log diversion dam across Grave Creek and a headgate at the ditch intake to enhance their water drawing capabilities. The point of diversion is located on U.S. Forest Service (USFS) property, and GLID was required to obtain a special use permit. This permit mandates that GLID supply and maintain fish passage over the dam, and screen the ditch to prevent entrainment of fish into the ditch.

Prior to the 1970's, the fish passage and screening requirements were virtually unmet. In 1976, Montana Fish, Wildlife & Parks (MFWP) collaborated with USFS and USFWS to modify the diversion dam for the purpose of providing fish passage over the structure. This modification did appear to provide some fish passage, but the dam was still considered to be a partial barrier for upstream migrants. The ditch, however, remained unscreened. In 1985, planning and design for a new headgate with a removable screen occurred and in 1986 the modifications were made. The screen was partially employed for one season, but was not used after the first season due to maintenance problems and flow restrictions.

In 1998 GLID, MFWP, USFWS and USFS worked collaboratively to evaluate alternatives to modify the structure in order to meet fish passage and water usage needs. USFS hydrologists identified that the existing diversion dam had elevated the base level of the stream approximately 7 feet, which caused a large amount of aggradation in the streambed, and allowed the deposition of nearly 2,000 cubic yards of bed material behind the dam (Figure 1). This, in turn, converted into an unstable channel, which promoted scour on a large mass-wasting bank, and increased the sediment supply within the stream. The old log diversion dam was showing signs of deterioration, and potential for failure. This was a major concern, because failure of the dam would allow the release of the massive amount of bedload deposited behind the dam into Grave Creek, and would likely cause additional hydrologic problems downstream of the project.

MFWP, GLID, USFWS and USFS formulated a proposal that would alleviate the problems and meet all of the project goals. This proposal consisted of four steps: removal of the existing log dam; construction of a proper functioning stream channel through the site that would have the ability to maintain its natural channel dimension and effectively transports sediment; development of an efficient water delivery system for the ditch that would allow for better upstream fish migration; and installation of an efficient, self-maintaining fish screen in the ditch.

In order to accomplish partnering of various sources of funding, the Kootenai River Network (KRN) was approached and requested to consider sponsoring the project. The board of directors approved the request, and all finances and coordination were handled by KRN.

Project implementation began in the fall of 2000 and was completed in the spring of 2001. The stream channel reconstruction entailed removal of approximately 2,000 cubic yards of bedload that had been deposited behind the dam, and construction of approximately 300 feet of stable Rosgen type "B" channel with a 50 foot bankfull width through the project site (Figure 1). The stream construction also included installation of 4 rock cross-vanes in the new channel (Figure 1), which allows for effective water delivery to the ditch system, and helps maintain the proper stream dimension, pattern and profile required for appropriate sediment transport. This new channel construction greatly enhanced upstream migration for fish, because it replaced the 7 foot high jump with four; 1-1.5 foot, low-grade steps with a 4 to 7 foot deep plunge pool below each step.

During negotiations, GLID requested that the diversion and fish screen be capable of passing 80 cubic feet of water per second and still be relatively maintenance free. This request was consistent with GLID's legal water right. There were a number of options to produce a self-maintaining fish screen, but very few options would deliver the volume of water GLID requested and still stay within the allotted project budget. The technical work group therefore decided that the best alternative was a static screen system that would use flowing water to clean the screens. This design requires an off-stream channel capable of conveying nearly twice the flow desired in the ditch. Approximately 60 feet of static screens were then placed in the side channel immediately above the ditch, parallel to water flow direction in the side channel (Figure 1). This creates a water velocity differential where the water velocity traveling across the face of the screens is much greater than the velocity passing through the screens, creating high shear stresses across the screen face, and keeping it free of debris. The screens operate most efficiently when a minimum of 50% of the available water passes by the screen, hence the side channel must have twice the capacity of the ditch.

The side channel flows had to be controlled by a headgate located adjacent to the top cross-vane in the project. The headgate was placed 1 foot below the throat elevation of the top cross-vane structure to ensure flows in the side channel during low water conditions.

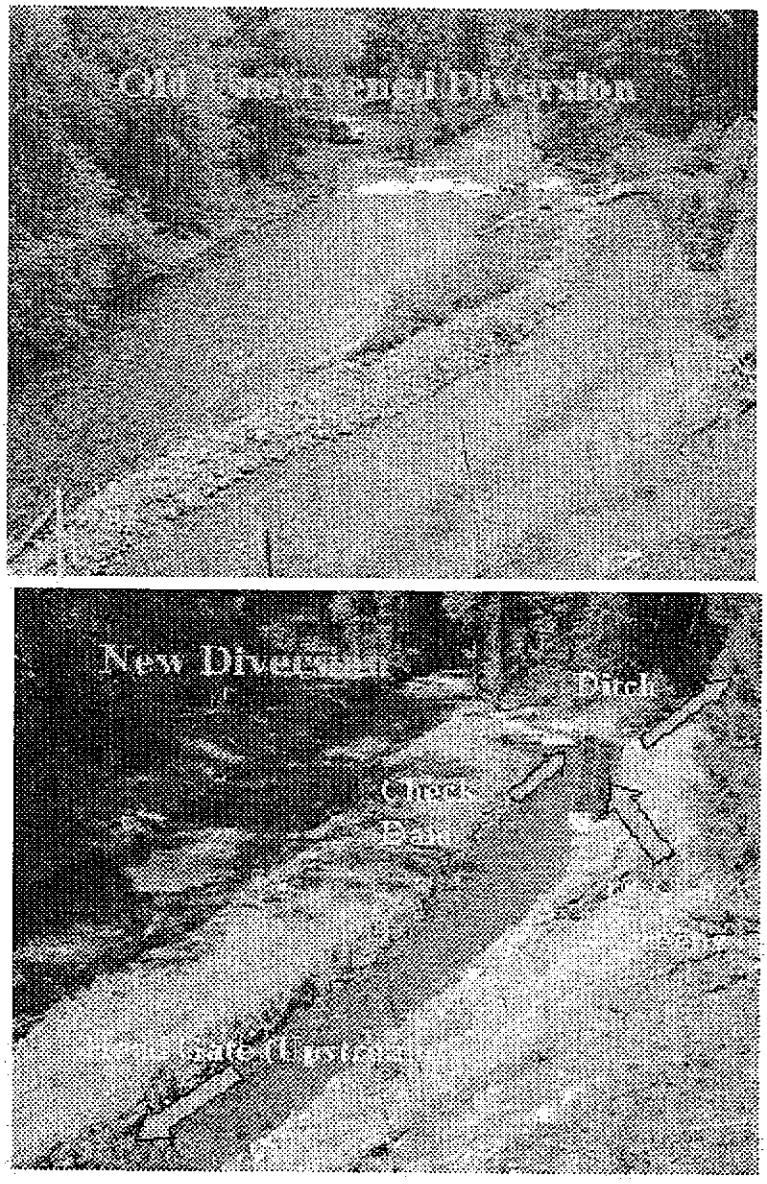
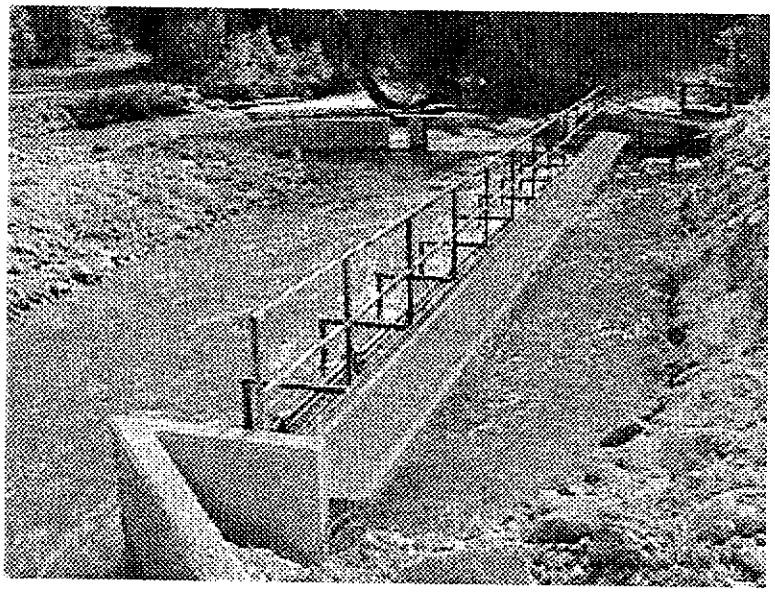
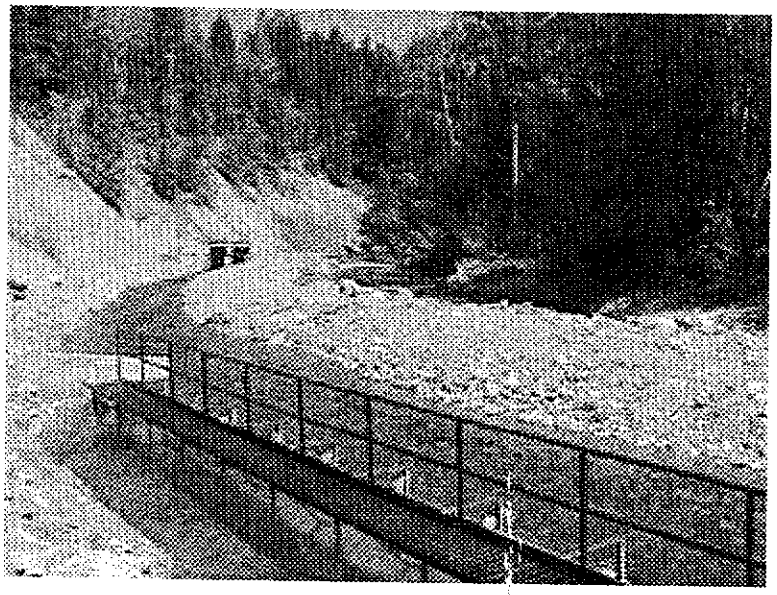


Figure 1. The upper photograph of the Glen Lake Irrigation District (GLID) the unscreened ditch. The lower photograph shows the new diversion side channel, fish screens, and check dam.

We also installed a check dam in the side channel below the screens to control the water head elevation at the screens (Figure 1). Since the diversion was designed to take the majority of the water at low stream flows it was essential to provide adequate passage for upstream migrating fish through the side channel. We accomplished this task by constructing a series of short, deep, step pools within the side channel and providing adequate flow and passage at the check dam structure (Figure 1). We will continue to monitor the project to ensure that it functions as intended.