

## **Big Hole Cooperative Ditch Company Diversion Project Field Review**

### **Summary:**

The Big Hole Cooperative Ditch Company Diversion Structure project was completed in late 2010. The project was developed with the intent of replacing the existing ditch company headgate structure and at the same time revising the diversion structure across the Big Hole River such that it would require less annual work in the river to keep the crest elevation established, and make possible a more fish and boat friendly diversion structure.

The design preliminary concept was developed through a preliminary design contract with Portage Engineering. This concept was used for the design of the weir system. Some changes were made in the design of the headgate structure and measuring flume. The final design and construction of the project was completed with a joint venture design-build contract with Gateway Engineering and Jeremy Miller, the Contractor.

The diversion weir portion of the project included four rock weirs in addition to the existing weir at the diversion site. Each weir is set at progressively lower elevations with the angle of the ends of the weirs directed upstream and the elevation of the weirs higher at the river bank and lower in the center. The intent of this approach was to direct the water, particularly in low flow periods, to the center of the weirs. By keeping the low flow channel concentrated in the center of the channel and having a gradual drop through the weirs fish would be able to pass over the diversion system and boaters would be able to float the river past the diversion safely.

### **Site Review:**

After hearing concerns about erosion along the river bank where the weirs were placed, I made a field review of the project. This review was completed on February 1, 2013. A follow-up inspection was completed on May 21, 2013. Following are my observations:

1. A very large flood event occurred on the river the first spring that the system was in place. It is this event that likely caused the initial erosion around the weirs probably starting at the first weir below the main diversion and progressing downstream. With the loss of the keyway into the bank due to high bank erosion the river was able to cut a channel along that bank relatively easily.
2. The upstream primary diversion weir at the diversion point appears to have not sustained any damage, however the lower four weirs have.
3. The river has eroded the bank on the west side and has separated the weirs from the bank. The original key into the bank is no longer in place. The erosion varied in distance from what appeared to be about 10 feet to as much as 30 feet in spots.
4. A high velocity channel has developed along the bank making more erosion likely in the future.

5. The remainder of the weirs appears to be in reasonably good shape. It did appear that the low flow channel in the center of the weirs was still functioning as intended. There is now a second such channel along the west bank.
6. It is not likely that the existing situation will correct itself. The purposes of the structure will eventually be lost even though the diversion itself will likely continue to be functional.

### **Conclusions & Recommendations:**

1. The west edge of the weir system was compromised by very high water in the first year of operation causing significant bank erosion along the west bank eroding around the end of the keyways which were constructed in the bank. The first year or two of the life of such a project is the most critical and in this case the very high river flow combined to damage the edge of the structures.
2. The result of the erosion is a primary channel along the west bank of the river in addition to the primary channel in the center which still remains. This channel will flow during all flow conditions and will continue to erode the bank and further isolate the weirs as well as damage the property adjacent to the west bank.
3. It is my opinion that the west end of each of the four weirs should have rock added to them and should be tied into the banks. While the entire bank would not need to be riprapped a section of riprap adjacent to each weir would be recommended. Stabilizing the bank is critical to eliminate the bank erosion.
4. It is my belief that if this is not done the project will not continue to function as intended and will not meet the objectives or intent of the project. While at this time the weirs are still functioning as intended and provide fish passage as well as boat passage capabilities, it is believed that with continued erosion along the west bank the west channel will become the primary channel and eventually leave the structure with similar issues to those that occurred before the project was installed. This would be in addition to the continued erosion of the bank.
5. River projects such as this do not function long term without significant maintenance especially following large events. What may be minor repairs initially become major if left undone. Following large events and at least once per year regardless of the event size, a thorough inspection of the project should be undertaken. Any needed repairs such as adding rock to the structure in weak places should be completed.

**Construction and Quantities:**

It is estimated that approximately 250 cubic yards would be required to repair the project at this point. Access is available from the west bank making placement of the rock relatively easy. For the most part the work could be completed without entering the river.

Prepared By:

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