

# River Assessment Triage Team (RATT) Site Report

**Site: Eggie Diversion /Jim Ballard**  
**Impact: Flanked Irrigation Diversion Structure**  
**Date of Field Visit: October 18, 2011**  
**Latitude: 46.28524° Longitude: 108.84353°**

The following summary describes field observations of the 2011 flooding impacts and conceptual restoration considerations developed by the RATT team. The recommendations are conceptual in nature, and may require more detailed designs, background information to obtain necessary permits, and potential changes in points of diversion. This effort has not included detailed feasibility, design, or cost development. The recommendations are intended to help landowners plan voluntary projects at specific sites that were evaluated by the RATT team upon request.

## 1 Flood Impacts

The main impact at the site is the breaching of a concrete irrigation diversion dam around its right abutment (Figures 1 and 2). The dam structure is still in place, but the flanking has rerouted the river around the structure creating a new 120 foot wide channel. The structure feeds approximately 2 miles of ditch on the left (east) bank that irrigates about 150 acres. The flood also damaged portions of the ditch downstream. There is currently no power at the dam site, but it is nearby.

The dam is located on the downstream limb of a large meander bend. In the core of this bend, a field that is bound by a dike was irrigated by a pump site located on the upstream limb, approximately 1400 feet upstream of the dam. The pump was eroded out by the flood. Also, floodwaters overtopped the dike south of the pump site, sending water through an old river channel south of the field.

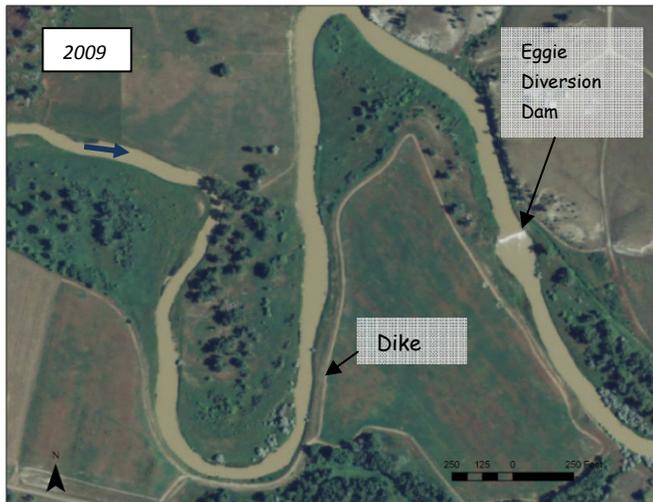


Figure 1. Pre-flood (2009) air photo of site.

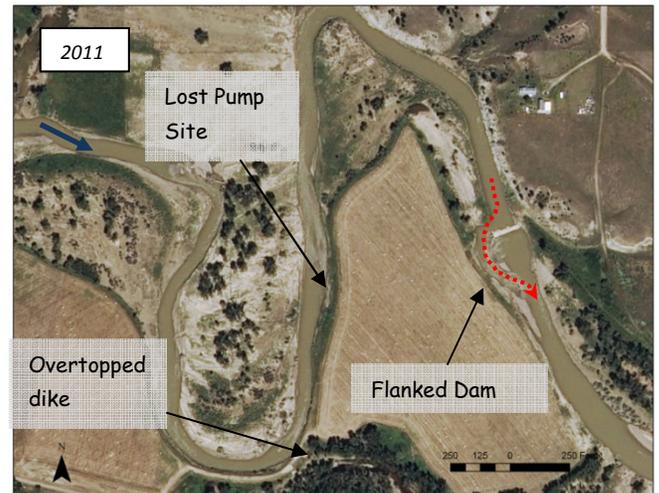


Figure 2. Post-flood (2011) air photo of site.

## 2 Alternatives

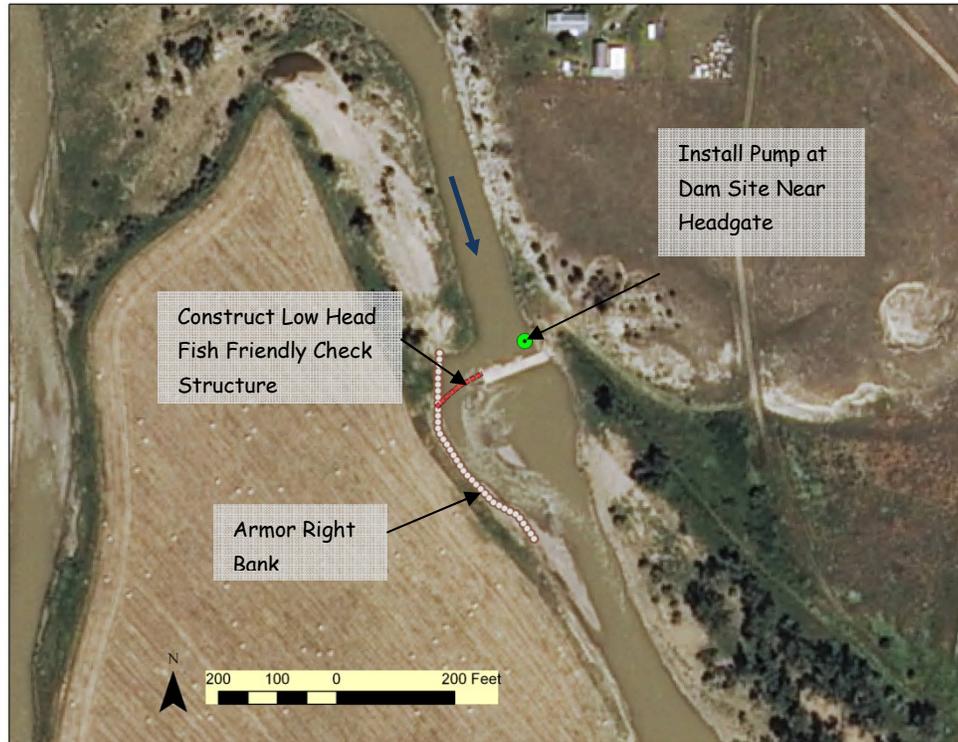
The alternatives considered for this site include:

1. Abandon dam and shift to pumps at dam site
2. Relocate upstream pump site, and
3. Control overflows into old swale behind dike.

### 2.1 Alternative 1: Abandon Dam and Shift to a Pump at the Dam Site

The flanking of Eggie Diversion Dam has resulted in extensive erosion around its right flank, downcutting of the channel, and perching of the headgate above the dam. Rerouting of the river back over the dam would require extensive reconstruction of the channel to its pre-flood configuration. Because of the severity of the flooding on the Musselshell, the system will continue to respond to the flood impacts over at least the next several runoff seasons, including adjustments in channel shape, and downstream gravel movement. Because of these ongoing responses, the reconstruction of instream structures will likely require substantial maintenance over the next several years. Reconstruction of the dam will also re-create a fish passage barrier and fish entrainment issue at the site that was removed by the flanking.

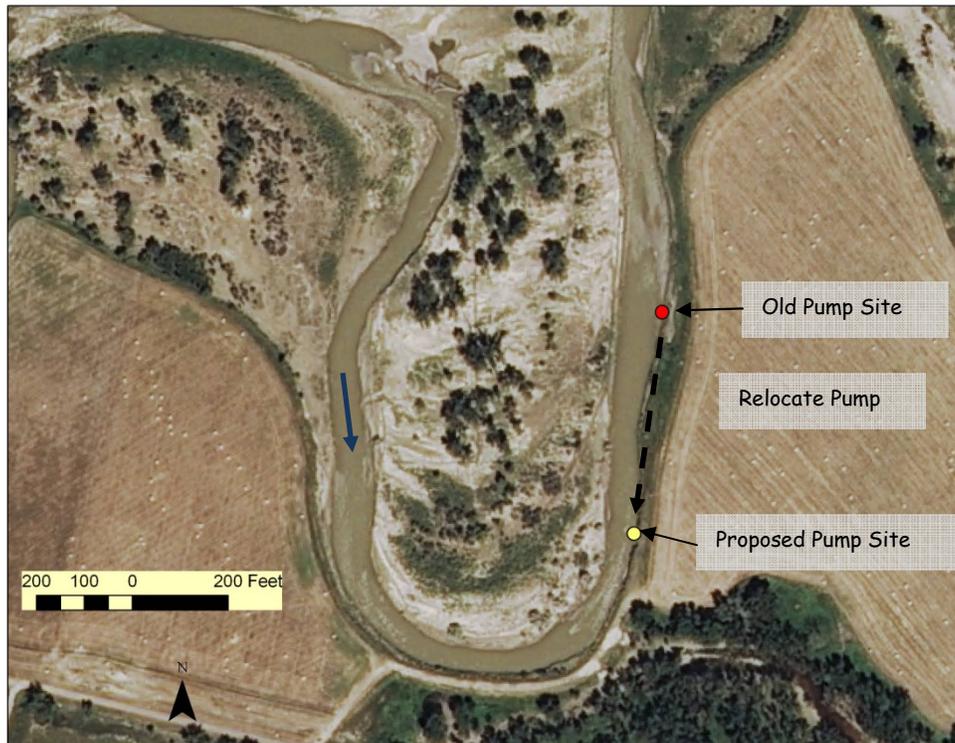
Another alternative for diverting water into the ditch at the site is to install a pump at the dam site (Figure 3). The hard dam structure will provide backwater and create local scour holes, and a portable pump could be easily moved to adapt to changes in the channel. A pump site would require power, which is not currently on-site although nearby. The costs of such bringing in power should be considered in selecting alternatives. The conversion to a pump on site may also require some erosion control on the right bank of the flanked channel section, and potentially a fish-friendly, low-head check structure that could be installed as either a permanent or seasonal structure. It would extend from the current dam across the new channel to ensure backwatering at the pump site during the irrigation season.



**Figure 3. Conceptual schematic drawing of Alternative 1.**

## **2.2 Alternative 2: Relocate Upstream Pump Site**

The pump site located approximately 1400 feet of the dam was damaged by right bank erosion of the river towards the field dike. Fortunately, there appears to be an excellent pump site location a few hundred feet upstream. At this location, a hard bedrock shelf is exposed in the bed of the channel, and local scour on the downstream side of this shelf has created a deep, stable scour hole that would support a pump. The existing power line is close to the new site.



**Figure 4. Conceptual schematic drawing of Alternative 2.**

### **2.3 Alternative 3: Control Overflows into Overtopped Swale Behind Dike**

The flood event of 2011 resulted in overtopping of the field dike near the proposed new pump site, and flow of that water through an old channel path. As the route of these overflows across the core of the meander is much shorter than the channel path, the overflow path is steep, and flow velocities are higher than in the channel. This condition causes a risk of avulsion, or relocation of the main river channel into that shorter abandoned channel segment. If this were to happen, the irrigated field in the core of the bend would become isolated.

The floods of 2011 were so extreme that overtopping of the dike may be an extremely rare occurrence that does not create any concern at the moment. On the other hand, if there is concern that major flooding may occur again, or that changes in the river channel may cause more frequent overtopping of the dike, it may be appropriate to construct a controlled overflow at the head of the abandoned channel, to allow some flood water to go down that channel, but to prevent that channel from capturing the main river channel. This would consist of constructing an armored swale in the dike at the head of the overflow channel, the elevation of which would be designed to overtop at some acceptable flood condition (for example, the 10-year flood). It would also be important to determine if the lower end of the overflow channel, where it re-enters the Musselshell River, would require some grade control to prevent headcutting during floods.

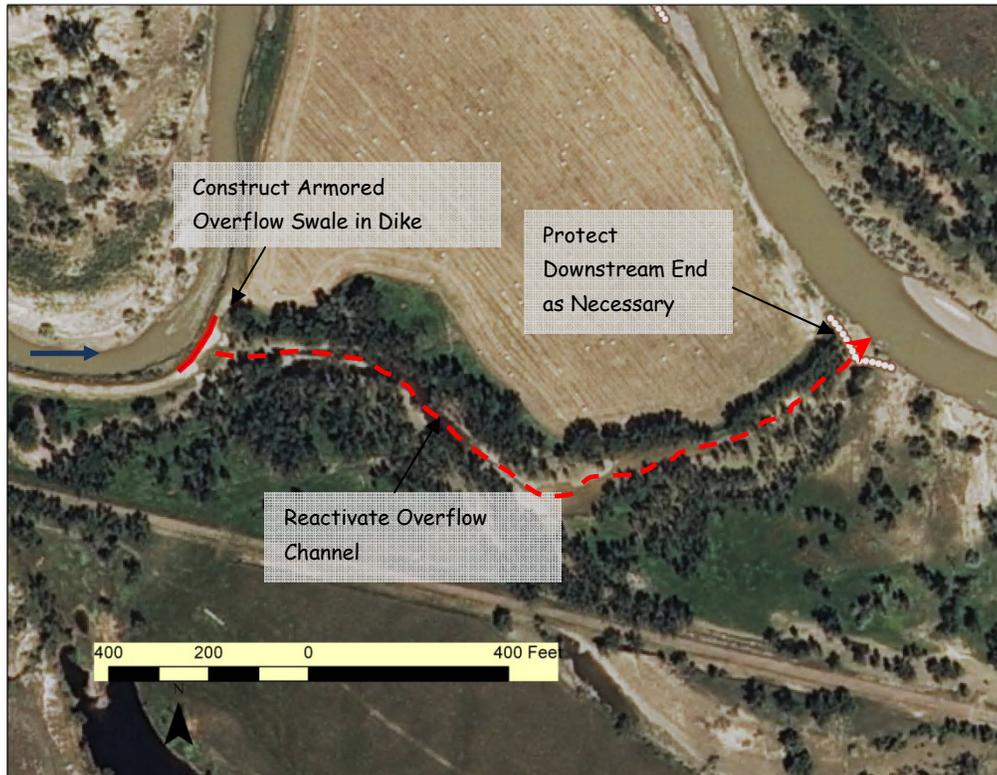


Figure 5. Conceptual schematic drawing of Alternative 3.

### 3 Water Rights Considerations

Alternative 1 would consist of conversion of the diversion dam to a pump at the same location. Alternative 2 consists of a change in point of diversion (POD). Each of these approaches has implications with respect to water rights. Prior to doing any work on site, DNRC should be contacted to identify what needs to be done to address these changes.

### 4 Conservation Opportunity

Several types of conservation benefit could be achieved in this site as part of the project, including the following:

- Removal of a fish passage barrier and entrainment issue;
- Providing flood energy/overflow relief through the abandoned channel which will help to restore floodplain access; and
- Creation of high flow secondary channel habitat that can be important to the fishery.



**View upstream showing flanked dam and right bank erosion.**



**View of scour hole at proposed pump site (Alternative 2).**



**View east down high flow channel.**