

Irrigation Pumps

Applicability

The following Irrigation Pump Best Management Practices (“BMPs”) are a series of recommended strategies related to irrigation pump operations that have been developed by the RATT team following site visits with producers in 2011 and 2013. The BMPs are intended to support the long-term functionality of pump sites on the Musselshell River, considering issues of pump site location, function, and portability. The information is based upon the discussions with producers on-site regarding their experiences during and following the 2011 flood. The information is intended for producers in the river corridor who currently irrigate with pumps, or for those who are considering converting to pump sites from other methods such as diversion dams. Prior to making any changes to existing operations, however, it is critical to recognize that modifications to existing diversions or pump site locations require a water rights application and authorization process with the Montana Department of Natural Resources and Conservation Lewistown Regional Office.



Figure 1. Newly reconstructed pump site downstream of Roundup.

Photo Credit: Karin Boyd.

Description

The Irrigation Pump BMPs reflect the experiences of producers in the corridor, and address the following issues:

- I. **Site Selection:** Consideration of site characteristics when placing a pump, including channel stability, water depths, and power availability.
- II. **Maintaining Water Depth at Pump:** Applying measures to achieve water depths necessary to maintain pump function
- III. **Permanent vs. Portable:** Benefits of portability or flexibility in certain locations
- IV. **Reducing fish Entrainment:** Pump considerations for screens to reduce fish entrainment into the irrigation system.
- V. **Permitting:** Determining what permits are necessary for pump site work.

I. Selecting a Pump Site

Ideally, pump sites will be located where the ***site is stable***, where ***water depths are sufficient for pumping***, and where the required ***power source is readily available***.

Site stability has been a significant problem for Musselshell river irrigators since 2011 flooding caused widespread bank instability. During the flood, dozens of pump sites were eroded out or abandoned by the river. When placing new pumps, landowners have found the following approaches to be beneficial.

Due to continued river adjustment to the flood, many irrigators have used **portable pumps** which allow for increased flexibility until the river re-stabilizes over the next several years. Many landowners use only portable pumps, some of which are floating, to allow for their relocations as necessary (flooding, bank instability, maintenance etc). Portable pumps are discussed in more detail below.



Figure 2. Pump site below highway bridge.

Photo credit: Karin Boyd.

b. Site Selection: *Bedrock bluffs* commonly provide both stable banklines and deep scour holes that can provide excellent pump sites. Areas where bedrock in the riverbed has scoured to create pools also provide good site potential.



Figure 2. Bedrock bluff with stable bank and deep scour hole.

Photo credit: Karin Boyd.

c. Site Selection: Where the deepest part of the river channel (the “thalweg”) flows along the bankline, pump sites can effectively access water at a wide range of flow conditions. These areas typically occur on river bends, where banks might be unstable, so *placing pump sites on active bendways* should include consideration of bank erosion rates at the site. The area just downstream of a meander apex tends to provide good pump sites, although some erosion control may be necessary to prevent high water scour and flanking.



Figure 3. Pump site on downstream limb of river bend.

Photo credit: Chris Boyer, Kestrel Aerial Services, Inc.



Figure 4. Power pole at reconstructed pump site. Photo credit: Karin Boyd.

d. Site Selection: Power source can influence site location if power is delivered by fixed infrastructure such as power poles or fuel lines. In that event, it is especially critical to select sites carefully, so that the stability of the infrastructure is not threatened by river change. Where possible, landowners should talk to the power provider to explain the rationale behind infrastructure placement with respect to long-term river stability and access.

II. Maintaining Water Depth and Pump Function

Selecting a site with persistently accessible water can be difficult where the river is constantly shifting, or where the channel has experienced significant flood-induced change. In 2011, some pumps became perched above the channel bed due to downcutting of the river. This can be caused by channel scour, flanked diversion structures downstream, or the loss of channel length due to meander cutoffs. The water depth necessary is a function of the type of pump used. Before placing a pump, irrigation equipment dealers should be consulted to identify the best pump type for the site conditions.



Figure 5. Perched pump site upstream of breached diversion dam.

In the event that stream conditions change making pumping impossible, options may include:

- a) Conversion to a portable pump;
- b) Constructed grade controls downstream of pump; or,
- c) Pump replacement or modification.

Where grade controls are constructed to increase water depths at a pump, maintaining fish passage should be an important component of project design and permitting. These check structures can be temporary and local, such as jersey barriers, or permanent, such as rock ramps.

Some producers have adopted the use of floating screens/intakes for centrifugal portable pumps that reduce the amount of silt pulled into the impellor, and reduce the depth of water needed for the suction hose. In the lower river, floating pumps have also proven to be very effective.

III. Portable Pumps

Portable pumps are very common within the Musselshell River corridor, and have proven to be very effective in terms of allowing increased flexibility in pump site management and reduced maintenance. Portable pumps can be pulled away from the river at high water or during periods of non-use, and can be relocated to accommodate river change. In addition to placing portable pumps, many producers have set buried pipelines back from the river bank to insure that it will remain functional as the river continues to move laterally. Pump relocation will require authorization to change point of diversion (POD) with the DNRC Regional Water Resources Office in Lewistown.



Figure 6. A series of portable pumps.

IV. Reducing Fish Entrainment

Certain pump screens can effectively reduce the entrainment of both fish and debris into the irrigation system. Some producers along the Musselshell River have put in rotating drum pumps that pull from the surface and have a self-cleaning screen that reduces entrainment.



Figure 7. Screened drum on floating pump.

V. Permit Requirements

Permits may be required for establishing pump sites or altering the bed or banks of the river, which includes the placement of temporary barriers in the river channel. Permits may be required from the Corps of Engineers (404), or from the State of Montana (310, 318). Local Conservation Districts should be contacted prior to any pump work to determine which permits are necessary for a given project. For local contacts regarding permits, see the Musselshell River Permit Contact Supplement available at the local conservation district office.