REMOVING/RELOCATING DRAINAGE LIFT STATIONS

TECHNICAL GUIDANCE DOCUMENT

Document No.: WRG 4A-5
Publication Date: 10/14/2015

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INTRODUCTION

Drainage of wetlands that exist in low lying landscape settings is often aided by the use of drainage lift stations. Lift stations are used where poor or inadequate natural gravity outlets exist for tile or ditch drained wetlands. Also known as pump stations, these mechanisms provide the "lift" needed to get drained water from a ditch or tile collection system up in elevation to a surface outlet.

A pump drainage system consists of a collection system or sump, a pump, and an outlet of some type. Pumps are typically operated by an electric control panel installed near the structure. In limited situations, tractor driven power take off units may be used to run the pump. A pump's sump is usually some type of reservoir system that subsurface drainage tile within the drained wetland discharge into. In some locations, an open ditch system serves as the sump for the pump system.

Levees, embankments, and ditch spoil banks are often used in conjunction with lift stations to limit or prevent the downstream riparian system (lake, river, or drainage ditch) from backing into and flooding the site.

Figure 1. Tile Drained Wetland Aided by Lift Station

When attempting to restore wetlands drained by lift stations, it will usually be necessary to disconnect the power supply and remove the lift station and sump. In some situations, it will also be necessary to construct an effective block between the planned wetland and its outlet to effectively cutoff drainage and successfully restore wetland hydrology.

Figure 2. Drainage Pump Powered by Tractor's PTO

APPLICATION

This Technical Guidance Document focuses on strategies to design effective wetland restorations through the removal or relocation of drainage lift stations. The restoration design will be influenced by the configuration of the lift station including its source of power, type of sump, and type of outlet system used to convey pump discharges to the downstream outlet. The design will also be influenced by the type of wetland being restored and the type, elevations, and general characteristics of the downstream outlet.

Restoring wetlands drained by lift stations is often fairly straightforward. This includes situations where the drainage systems that use and rely on the pump are wholly contained within the restoration site and when the restoration elevation for the planned wetland can be equal to or higher than the downstream outlet. In certain situations,

Figure 3. Low Lying Tile Drained Wetland Landscape Aided by Electrically Powered Lift Station

water elevations downstream of the planned wetland will control the wetland's restoration elevation, once the pump is removed. This often occurs where pump drained wetlands exist adjacent to natural riparian areas such as lakes or rivers.

Areas upstream of the restoration site may be benefitting from the drainage provided by the lift station. When that occurs, strategies to protect those drainage benefits need consideration as part of the project's design. In these situations the restoration design can become more difficult and perhaps not even feasible to consider. Strategies to protect drainage benefits of adjacent land areas can include **outletting** those drainage systems directly into the restoration site. When outletting an upstream drainage system is not possible or desired, an alternative restoration strategy may be to **reroute** the incoming drainage system around or away from the planned restoration areas. Additional information on these and other wetland restoration strategies can be found in Technical Guidance Documents as part of Appendix 4-A. Restoration strategies that include modifying incoming drainage systems need to consider cost and long term maintenance issues. These strategies should be considered only if feasible and no other more practical alternatives exist, such as additional land acquisition.

In some situations, an alternative restoration strategy to protecting adjoining properties may be to **relocate** the lift station to the upstream edge of the restoration site where it can continue to be used and possibly provide a sustainable source of hydrology for the planned wetland. This requires considerable discussion and coordination with the affected landowners regarding costs, legal drainage agreements, and long-term maintenance issues and responsibilities.

Because lift stations occasionally provide drainage benefits to more than just one property, drainage agreements may exist regarding their use. These legal agreements usually specify what lands can drain to and use the lift station and landowner responsibilities regarding its operation and maintenance. If a drainage agreement exists, it is important to understand early in the planning and design process the terms and conditions of the agreement with regard

Legal drainage agreements often exist when lift stations are used for drainage

Figure 4. Drainage Lift Station Relocated to Facilitate Restoration of Adjoining Wetland

to its use and description of lands that are to benefit from it. These agreements often need to be terminated or amended as part of planned restorations. Regardless of whether legal agreements exist or not, legal issues regarding drainage rights often exist when attempting to restore wetlands drained by lift stations. Proper planning and coordination with all involved parties in the early stages of design is critical to achieving successful outcomes.

> Caution is needed when gathering on-site lift station information

DESIGN CONSIDERATIONS

The restoration design of wetlands drained by lift stations should ensure long-term restoration success of wetland hydrology.

A functional design requires gathering enough site information to determine type of power supply to the pump, type of sump used to supply drainage waters to the pump, and type of outlet used to discharge pumped flows into the downstream riparian or drainage system. This includes determining sizes, locations, and elevations of all of these features. Note that extreme caution is needed when on-site and gathering lift station information due to the presence of electrical power and sump systems that are often deep and not always very secure or safe.

The design must consider and address all of the following conditions:

- How and when to disconnect electrical power and the power supply to the lift station
- Method to remove the lift station and either dispose or salvage it depending if the owner intends to retain any of the system components
- Method to remove, backfill, and compact the sump system
- Method to construct an effective block between the planned wetland and the downstream outlet, when needed
- Type of outlet used to convey runoff from the planned wetland to the downstream drainage or riparian system, when needed
- Strategies to construct tile blocks or ditch fills in other areas of the planned wetland or restoration site, when needed
- Strategies to protect drainage benefits of upstream, adjoining lands that drain into the restoration site, when needed

Most lift stations are powered by electricity and as part of the lift station's removal, the electrical line that powers it should be shut off and the lines removed, when possible. This is a function to be performed by the power company. Where power poles exist solely to provide power to a pump, a decision needs to be made as to whether they also should be removed as part of restoration. To improve construction conditions, it is recommended to keep the pump system operational right up until the start of construction. Coordination with the power company with regard to when to disconnect electrical service is therefore important.

In all cases, the parties that have an ownership interest in the lift station need to be consulted to determine what, if any, lift station components should be salvaged. Coordinate who is responsible (owner or contractor) for the removal of these salvageable components.

Lift stations will utilize a sump of some type to temporarily store water, allowing the pump to cycle and be more efficient. Vertical sumps are the most common and typically exist as a large pipe or container anywhere from 4 feet to 10 feet in diameter set on end usually with a grate or boards covering the top opening. These vertical sumps can

occasionally be quite deep. Horizontal sumps also exist as either a long large diameter pipe, series of pipes, or as an open ditch. The design must address the means to excavate, remove, and dispose of the sump materials as well as inlet or outlet pipes to the sump.

In some situations, the downstream outlet will be in close proximity to the planned, restored wetland. A levee along a riverine system or lake or a ditch bank may be all that separates the wetland from the adjoining downstream outlet or riparian system. When elevation differences exist between the planned wetland and the downstream riparian system, an outlet of some type is usually needed to safely convey wetland discharges into the lower elevation downstream system. The outlet's design must consider all hydrologic inputs; including potential drainage water that may be pumped into the restorations site should the existing lift station be moved or re-located as part of the project design. Additional discussion of wetland outlets can be found in other Technical Guidance Documents as part of Appendix 4-A as well as in Section 4-4 of the Guide.

In addition, it is possible that some form of earthen barrier currently exists in conjunction with the lift station and was constructed to keep the downstream riparian system or floodwaters from backing into the drained wetland. It is likely this earthen barrier was neither well-constructed nor will it be suitable for continuous long-term retention of wetland hydrology against it. The design must address these existing earthen features and include provisions for constructing a suitable hydrology barrier or block between the wetland and its outlet, when needed. The design and construction of earthen embankments for wetlands is discussed further in Section 4-5 of the Guide

CONSTRUCTION REQUIREMENTS

The success of restoring wetlands drained by lift stations will be affected by construction techniques used to remove or relocate the lift station and create an effective block and outlet between the wetland and its outlet. The construction plans that are prepared to address these items should include requirements and specifications for all related construction components including the excavation, backfill, and compaction requirements for the lift station and sump removal area.

OTHER CONSIDERATIONS

- Despite the best planning and site assessment efforts, sizes, grades, and locations of existing tile lines or even their existence altogether may be uncertain for many project sites. As such, certain assumptions may have to be made as part of the design. In such situations, the construction plan should ensure enough flexibility and funding exists as adjustments during construction are often needed. In other cases, tile investigations should be performed using a tile probe or excavation equipment to gather accurate information prior to completing the design.
- Considerations for stabilizing disturbed areas associated with construction are needed. Seed all disturbed areas with consideration for additional stabilization on slopes and in other areas where concentrated flow may occur. This can include the use of straw mulch, erosion control blankets, hydro mulching, etc.
- It will be important to understand the legal implications of any planned actions to remove or relocate drainage lift stations or to manipulate an existing drainage system. This includes determining whether the drainage system is part of a public drainage system or governed by a private drainage agreement. If so, certain legal and administrative functions may need to be addressed as part of the planning and design process. Additional discussion on this topic occurs in Section 4-9 Construction Related Laws, Regulations and Permits of the Guide.

COST

The cost to remove drainage lift stations and to backfill and compact the excavated area will be fairly inexpensive for most situations. Costs will increase, however, when additional earthwork and grading or outlet structures are needed as part of constructing a suitable outlet for the wetland. Costs will also increase should modifications be needed to incoming drainage systems to the restoration site.

If a drainage lift station is to be relocated or moved as part of the restoration design, consideration of costs and associated payment sources is needed

with respect to the situation and benefits provided.

MAINTENANCE

Periodic inspection and maintenance is needed to identify and correct any identified problems associated with removing drainage lift stations. Most problems will be related to other associated restoration strategies that are used such as tile blocks or embankment construction or to any outlets that are constructed to control water levels and manage wetland discharges.

Problems can occur, however, with excessive settlement of the pump/sump removal and backfill areas. Inspections should look for depressions or "sink holes" at the soil surface in the vicinity of that work.

ADDITIONAL REFERENCES

Other Related Technical Guidance Documents can be found in Appendix 4-A of the Minnesota Wetland Restoration Guide.

Standard Engineering Drawings to aide in the design of certain restoration strategies or outlets that may be used in conjunction with removing drainage lift stations are provided in Appendix 4-B**.**