

Appendix M

Electrical Engineering

DRAFT

TABLE OF CONTENTS

1	Existing Conditions.....	1
1.1	Project Location and History.....	1
1.2	Existing Features.....	1
1.2.1	Well Pump.....	1
1.2.2	Utility Power	2
2	MEASURES.....	3
2.1	General Design Information.....	3
2.2	Pump Station.....	3
2.3	Well Pumps.....	3

DRAFT

1 EXISTING CONDITIONS

1.1 Project Location and History

Two Rivers National Wildlife Refuge includes approximately 12,473 acres of riverine and floodplain habitat along the Illinois and Mississippi Rivers. Yorkinut Slough consists of approximately 4,331 acres, of which 1,801 acres are bottomland forest and wetland, and is located on the right descending bank of the Illinois River between River Miles 5 and 11 in Calhoun County, Illinois.

The electrical power utility company in the area is Illinois Electric Co-Op out of Winchester, IL. Illinois Electric Co-Op currently provides electrical power to the existing USFWS Project Office at the Two Rivers National Wildlife Refuge. Illinois Electric Co-Op will be the power company providing power to the new site features including possible pump station(s) and additional well pumps.



Coordination with Illinois Electric Co-Op will be required during design phase to ensure Illinois Electric Co-Op's standards, as well as all local codes, ordinances and inspection authority requirements, and the latest National Electric Code are met, and power needs of the new site features can be provided by the utility company. A non-residential service request will be submitted to Illinois Electric Co-Op to initiate the process of obtaining electrical power during design phase.

1.2 Existing Features

Various well pumps consisting of hollow shafted pumps and mountable gearboxes are currently present in the Yorkinut Slough area. These existing well pumps pump ground water from 75 – 110ft down into desired ponding areas. The existing well pumps are operated via mobile engine, with electrical power not being necessary or provided to the well pumps.

1.2.1 Well Pump

Figure 1 illustrates a typical existing well pump consisting of a vertical hollow shaft pump and gear box. Each pump is powered by a USFS owned and operated mobile engine that is tied into a well pump's gear box when operation is necessary. Ducks Unlimited is currently constructing two new well pumps which will be electrically driven, include modern controls and pump protection devices; these pumps will be powered by new primary utility power.



Figure 1. Existing Well Pump

1.2.2 Utility Power

The existing utility power within the region is provided by Illinois Electric Co-Op. Local transformers do not currently exist at the well pump locations to step down the distribution voltage to 480V, 3-phase, except at the office well. A local transformer is located at the Two Rivers National Wildlife Refuge Project Office to step down to distribution voltage to 120V, 1-phase, which will power the office well. During a site visit it was observed that primary distribution power is available along Illinois River Road for all other well pump sites. Utility power in this area is not 3-phase distribution, however, well pump power will come from these locations since the well pumps are utilizing VFDs. Well Pump utility service estimates from Illinois Electric Co-Op have come back as \$10k-12k per site/well. Illinois Electric Co-Op is still processing the pump station request so a utility service estimate has not come back yet.

Coordination with Illinois Electric Co-Op will be required during design to evaluate existing primary grid including ratings and capacity. Upgrade of utility equipment could be necessary for the additional electrical loads of a new pump station and new well pumps.

2 MEASURES

2.1 General Design Information

All feature designs including new pump station and new well pumps will be in accordance with NFPA 70 National Electrical Code and all local utility codes.

All features of the project will be designed according to the applicable USACE Engineering Manuals and standard engineering practice. Lessons learned from prior Upper Mississippi River Restoration projects will be incorporated.

For proposed locations of the new pump station and new well pumps, see civil maps.

2.2 Pump Station

Should it be determined that the pump station would be electrically operated, electrical design will be based on the mechanical pumping capacity needs and the customer's electrical needs at the station for operation and maintenance. Considerations will be given to customer's needs for specific control features while maintaining a simple approach of design to ensure reliability and functionality. Standardization of components and readily available parts will be utilized. Motor branch circuit devices will be selected for greatest power efficiency while meeting the needs of the customer and withstanding the demands of the environment.

An arc-flash hazard analysis and power coordination study will be part of the design requirements.

2.3 Well Pumps

Well Pump design will be based on the Ducks Unlimited well pumps at the Office and Deer Plain wells, while utilizing modern components. Equipment and designs will consider the harsh outdoor environment the electrical equipment will be subject to. Control features such as electronic power meters useful for the customer include:

- Power Usage
- Voltage (volts)
- Current (amps)
- Elapsed Time
- Alarms

These features will be considered during design including the ability for the customer to pull this data from each well pump without exposing personnel to electrical hazards.