PUMP SYSTEM DETAILED EVALUATION
PUMP SYSTEM WORKSHEET

Land user _____ Field Office _____
Field name/number _____
Lateral number _____ Lateral location in field _____
Observer _____ Date _____ Checked by _____ Date _____
Acres irrigated _____

HARDWARE INVENTORY

Power plant:

Electric Motor:	Main pump	Booster (if used)
Make		
Model		
Rated RPM		
Rated HP		

Internal Combustion Engine:

Make _____
Model _____
Continuous rated HP at output shaft _____ HP at _____ RPM
Comments about condition of power plant _____
_____

Gear or Belt Drive Mechanism:

Type: Direct drive _____, Gear drive _____, Belt drive _____
_____ RPM at driver = _____ RPM at pump

Pumps	Main pump	Booster (if used)
Type: (Centrifugal, turbine, submersible		
Make		
Model		
Impeller size		
Number of impellers		
Rated flow rate (gpm)		
at head of (ft)		
at RPM		

Pump curves: Attached _____, Not attached _____

Comments about condition of equipment _____
_____
_____
_____

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Existing Suction or Turbine Column Set-up (Sketch with dimensions)

Existing Discharge Set-up (Sketch with dimensions)

DATA AND COMPUTATIONS

Total Dynamic Head (TDH):

Elevation difference--water surface to pump outlet_____ft
Pressure reading at pump outlet_____psi
Pressure at pump inlet (where supply is pressurized)_____psi
Estimated friction loss in suction pipe or pump column_____ft

TDH = Elevation difference + (Discharge pressure x 2.31) – (Pressure at inlet x 2.31)
+ Estimated suction pipe friction loss =

_____ = _____ft

Flow Rate:

Flow rate = _____gpm

Velocity meter:

Pipe I.D._____in
Velocity_____ft/sec
Flow rate = Velocity (ft/sec) x 2.45 x $(I.D.)^2$ =
= _____ = _____gpm

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Water Horsepower:

$$WHP = \frac{\text{Flow rate (gpm) x TDH (ft)}}{3960} = \_\_\_\_\_ = \_\_\_\_\_ HP$$

Energy Input:

Electric:

Disk revolutions_____
Time: min_____ sec_____ = _____sec
Meter constant (Kh)_____
PTR (Power transformer ratio – usually 1)_____ 1/
CTR (Current transformer ratio – usually 1)_____ 1/

$$KW = \frac{3.6 \times \text{Disk rev.} \times Kh \times PTR \times CTR}{\text{Time (sec)}} = \_\_\_\_\_ = \_\_\_\_\_ (kwh/h)$$

Diesel:

Evaluation time: hr_____ min_____ = _____hr
Fuel use_____gallons (a small quantity of fuel may also be weighed --7.05 lbs/gal)

$$\text{Fuel use (gal)} = \frac{\text{Fuel use (gal)}}{\text{Time (hr)}} = \_\_\_\_\_ = \_\_\_\_\_ gal/hr$$

Propane:

Evaluation time: hr_____ min_____ = _____hr
Fuel use_____lb (weigh fuel used from small portable tank)

$$\frac{\text{Fuel use (lb)}}{4.25 \text{ lb/gal} \times \text{Time (hr)}} = \_\_\_\_\_ = \_\_\_\_\_ gal/hr$$

Natural gas:

Evaluation time: hr_____ min_____ = _____hr
Meter reading: Start_____ – End _____ = _____mcf

$$\text{Fuel use (mcf)} = \frac{\text{Fuel use (mcf)}}{\text{Time (hr)}} = \_\_\_\_\_ = \_\_\_\_\_ = \_\_\_\_\_ mcf/hr$$

1/ Some power companies use a type of meter that requires a PTR or CTR correction factor. Check with power company in your area.

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In the next step, the efficiency of the power plant and pump, as a unit is compared to the Nebraska Standards for irrigation pumping plants. The Nebraska standard is for a good condition, properly operated plant. If the comparison comes out less than 100%, there is room for improvement.

Nebraska Performance Rating:

Nebraska Pumping Plant Performance Criteria

Energy Source	Pump and Power Plant WHP–h/unit of energy	Energy unit
Diesel	12.5	gallon
Propane	6.89	gallon
Natural Gas	61.7	mcf
Electricity	0.885	KW = kwh/hr
Gasoline	8.66	gallon

The Nebraska standards assume 75% pump and 88% electric motor efficiency.

Percent of Nebraska performance rating

$$= \frac{\text{WHP x 100}}{\text{Energy input x Nebraska criteria (WHP–h/unit)}} = \_\_\_\_\_$$

= _____%

Horsepower input:

Electric:

$$\frac{\text{Input KW}}{0.746} = \_\_\_\_\_ = \_\_\_\_\_ \text{BHP}$$

Diesel:

16.66 x Energy input (gal/hr) = _____ = _____BHP

Propane:

9.20 x Energy input (gal/hr) = _____ = _____BHP

Natural gas:

82.20 x Energy input (mcf/hr) = _____ = _____BHP

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Pumping Plant Efficiency:

Epp = Water Horsepower output (WHP) x 100 = _____ = _____%
Brake Horsepower input (BHP)

Energy Cost Per Acre-Foot:

Fuel cost per unit ($/KW–hr, $/gal, $/mcf)

Cost/AF = 5431 x Fuel cost ($/unit) x Energy input (KW, gal/hr, mcf/hr)
Flow rate (gpm)

= _____ = $_____/AF

RECOMMENDATIONS