Appendix A

WORKSHEETS

APPENDIX A

WORKSHEETS

MO-ENG-100 Documentation Checklist

MO-ENG-101 Livestock Watering Practice

MO-ENG-102 Livestock Watering Practice Checkout

MO-ENG-103 Stockwater Pipeline Resource Inventory Worksheet

MO-ENG-104 Automatic Pressure Stockwater Pipeline Hydraulic Computation Worksheet

MO-ENG-105 Manual or Timer Operated Stockwater Pipeline Pumped Segment Hydraulic Computation Worksheet

MO-ENG-106 Gravity Stockwater Pipeline Hydraulic Computation Worksheet

MO-ENG-107 Lateral Stockwater Pipeline Hydraulic Computation Worksheet

MO-ENG-108 Operation and Maintenance Guide for Stockwater Pipeline and Tanks (2 sheets)

DOCUMENTATION CHECKLIST

ITEMS THAT WILL BE DOCUMENTED ARE:

NRCS-CPA-52 completed _____

Survey Notes and Benchmark description completed _____

Profiles plotted _____

Data sheet completed _____

Computations checked _____

Engineering Job Class noted _____

Construction Plans and Specifications Completed _____

Conservation Practice Installation Check (MO-ENG-74) attached _____

ACP practices recorded on LTP-4 (if applicable) _____

AD-862 (or equivalent) and drawings and specifications attached _____

LTA work identified by agreement item number (if applicable) _____

Practices identified by job number _____

Completed practices recorded on plan map _____

Assistance Notes recorded (NRCS-CPA-6) _____

SCS-ENG-5 or Missouri One Call System, Inc. (if Needed) _____

FOCS progress entered _____

Name of Producer _____

Type of Practice _____

Date _____

Responsible Technician _____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOUCES CONSERVATION SERVICE

MO-ENG-101
07-97
File Code - Coop Folder

Livestock Watering Practice

Landowner Name:_____
Address:_____ Field #_____

Completed by:_____ ***Checked by:_____*** ***Approved by:_____***

Date:_____ ***Date:_____*** ***Date:_____***

_____ *Low PSI in pressure tank*
_____ *Average pressure tank outflow (gpm)*
_____ *Estimated springflow in gpm(or N/A)*
_____ *No. of Cattle*
_____*Sketch of pipeline location attached*

CALL BEFORE DIGGING
1-800-344-7484
MISSOURI ONE CALL SYSTEM, INC.

==========

Sizing Pipe for pressure systems:

h_f = Head = Well El.+(Low PSI x 2.31) - Tank El.
Distance Distance in Feet

h_f = (_____) + ((_____) x (2.31)) - (_____)

(_____)

h_f = _____ Feet of Head
Feet of Pipe

Use h_f and MLWSH, Chapter 5 (or applicable charts) to determine size of pipe:

Use_____ inch diameter pipe

Flow through pipe is_____gpm

Sizing Tank:

If enough water cannot be provided using a pipeline, size tank reservoir to provide adequate water:

A cow will drink about 5 gallons each trip to the water source. (Use the 5 gallons per drink even for calves and smaller animals). Size the tank for one "drink" for the whole herd:

Water Needed = (No. of Cattle)x(5 gallons/drink)

Water Needed = _____ x _____
Tank Size = Water Needed = _____ Gal.

Sizing Pipe for spring systems

Use maximum springflow (or provide overflow)

hf= feet of fall = _____
length of pipe

Provide water at a rate of not less than 2 gpm times the number of cattle that can drink. For example, a two hole waterer needs at least 4 gpm. Don't exceed 12 gpm without checking output of well and planned tank.

Use____ gpm delivery rate per drinking fountain.

Bill of Materials

_____No. of Tanks ***Tank Description_____***
_____Freezeproof Hydrants ***_____ Ft. of Fencing***
_____Ft. of _____dia. Schedule 40 Pipe ***_____ Ft. of _____dia. Schedule 40 Pipe***
_____ C.Y. of concrete in pad ***_____ Tons/C.Y. of gravel in pad and base***
_____Ft. of Ultraviolet Stabilized Aboveground Pipe ***_____ Check valve for Rural Water***
Plus plumbing and fitting requirements. Other miscellaneous items listed below or attached
_____
_____

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

MO-ENG 102
09-97
File code - Coop folder

Livestock Watering Practice Checkout

*Landowner Name:*_____ *Practice Description:*_____
*Field #(s):*_____ *Acres Served:*_____

Pipeline Components:

_____Ft. of_____inch diameter pipe ASTM# _____
_____Ft. of_____inch diameter pipe ASTM# _____

Installation of Ultraviolet Stabilized Aboveground Pipe(2% Carbon Black), ASTM # D2239 or AWWA C901:
_____Ft. of _____inch dia., _____ psi pipe
_____Ft. of _____inch dia., _____ psi pipe

Pipe is buried 18 inches or more: yes no N/A

Trench is backfilled, graded, and seeded: yes no N/A

If pipe is hooked to rural water, has required check valve been installed: yes no N/***A***

Tank Components: Concrete Freezeproof

_____ No. of Tanks(or N/A) _____ No. of hydrants(or N/A)

Pad installed at least 2' out from all sides of tank: yes no N/A

Pad is: gravel concrete (circle one) Is gravel retained by Ties or similar material: yes no

Pad computations: ____ (L) x ____(W) = ____S. F. x _____(D) = _____ C.Y. (Volume)

or converting to tons: _____C.Y. x 1.4 = _____tons

Retaining wall installed and buried portion fenced from cattle: yes no

Is overflow pipe protected: yes no N/A

Tank Components: Energy Free

_____ No. of Tanks(or N/A) _____ No. of hydrants(or N/A)

Pad installed at least 2' out from all sides of tank: yes no N/A

Pad is: gravel concrete (circle one) Is gravel retained by Ties or similar material? yes no

Pad computations:____ (L) x ____(W) = ____S. F. x _____(Dpth) = _____ C.Y. (Volume)

or: converting to tons: _____C.Y. x 1.4 = _____tons

Miscellaneous:

Cross fencing has been installed to provide grazing distribution improvement: yes no N/A

If cost shared, has landowner supplied the field office the tickets for materials: yes no N/A

Pipeline and Tank Installation meet all NRCS Specifications

Completed by_____ ***Approved by:***_____
Date:_____ ***Date***_____

USDA - NRCS

MO-ENG-103
07-97
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STOCKWATER PIPELINE
RESOURCE INVENTORY WORKSHEET

Land user
_____

Job description
_____

Farm No. _____ Tract No. _____ Field No. _____ County
_____

Planner _____ Date _____ Checked by _____ Date
_____

Type of livestock _____

Type of grazing system: /__/ Conventional /__/ Intensive

Maximum number of livestock (No.) _____

Typical dates stock will be in field: From _____ to _____

Water requirements per head (V) _____gal/day/head at peak use. (See Pipeline Standard 516)

Total usage per day (T) = no x V = _____ x _____ = _____ gal/day..

Add 10% for evaporation and spillage: (GT) = T + 10% T (optional)
GT = _____ + .10 x _____ = _____ gal/day

Minimum required flow rate (Qm) = $\frac{GT}{1440}$ = $\frac{\_\_\_\_\_}{1440}$ = _____gpm

Desired number of hours for entire days needs to be delivered:
TT =_____hrs

Design Flow Rate: (Q) = $\frac{24}{TT}$ x Qm

Q = $\frac{24}{\_\_\_\_\_}$ x _____ = _____gpm

Desired reserve storage time (RST) = _____ days

Total reserve storage required (RS) = RST x GT
RS = _____ x_____ = _____ gallons total storage in pasture.

Other water sources available in the field: _____
_____

Dependability of water sources: _____
_____

Quality of water sources: _____
_____

Comments: _____
_____

AUTOMATIC PRESSURE STOCKWATER PIPELINE HYDRAULIC COMPUTATION WORKSHEET

Land user ______________________________

Job description ______________________________

Farm No.______________ Tract No. __________ Field No. _________ County______________

Designer _____________ Date______________ Checked by ____________ Date ______________

Water surface elevation during pumping (WS) _______

Critical point along profile (CP): Station __________ Elevation ___________

Clearance Head (CH) at critical point: _______ ft x .433 = _____ psi

Cut in/Cut out pressure range (PR): _______ psi x 2.31 + ______ ft

Losses in plumbing at pump (PL): _______ ft

Minimum ON elevation = CP elevation + CH ft = _____ + ______ = _______

ON elevation based on HGL = HGLpump + PL - (PR ft/2) = ________ + _____ - (_____/2)- ________

ON elevation used (greatest elevation of above alternatives): ________________

OFF elevation used = ON elevation + PR ft = _____ + ____ = __

Total Dynamic Head (TDH) = OFF elev - (PR ft/2) - WS = _____ - (____ /2) - ____ = ____ ft

Pump HP = __________HP (Select from pump curves)

(1) Station	(2) Reach Length (ft)	(3) Pipe Elevation	(4) Design Flow Rate (gpm)	(5) Nominal Pipe Diameter (in)	(6) Pipe Type	(7) Pipe Pressure Rating (psi)	(8) Friction Factor H_f/100ft (ft/100)	(9) Reach Total H_f (ft) (2) x (8)	(10) HGL Elev (from start HGL)	(11) Max Pressure on Pipe (psi) WS-(3)	Comments (slope %)
											at pump

MANUAL OR TIMER OPERATED STOCKWATER PIPELINE
PUMPED SEGMENT HYDRAULIC COMPUTATION WORKSHEET

Land user _____
Job description_____
Farm No. _____ Tract No._____ Field No._____ County _____
Designer _____ Date _____ Checked by_____ Date_____

Water surface elevation during pumping (WS) _____
Pumped segment end station critical point (CP): Station_____ Elevation ____
Clearance Head (CH) at critical point:_____ ft x .433 = _____ psi
Losses in plumbing at pump (PL): ____ ft
HGL at CP = CP elevation + CH ft = _____+ _____ = _____
HGLpump = HGL from profile = PL = _____ + _____ = _____
Total Dynamic Head (TDH) = HGLpump - WS= _____ - _____ = _____ ft
Pump HP _____HP (Select from pump curves)

(1) Station	(2) Reach Length (ft)	(3) Pipe Elevation	(4) Design Flow Rate (gpm)	(5) Nominal Pipe Diameter (in)	(6) Pipe Type	(7) Pipe Pressure Rating (psi)	(8) Friction Factor H_f/100ft (ft/100)	(9) Reach Total H_f (ft) (2) x (8)	(10) HGL Elev (from start HGL)	(11) Max Pressure on Pipe (psi) WS-(3)	Comments (slope %)
											at pump

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GRAVITY STOCKWATER PIPELINE
HYDRAULIC COMPUTATION WORKSHEET

Land user _____
Job description _____
Farm No. _____ Tract No._____ Field No _____ County _____
Designer _____ Date _____ Checked by_____ Date _____

Water surface elevation (WS) _____
Critical point along pipeline (CP): Station _____ Elevation _____
Clearance Head(CH) at critical point: _____ ft x .433= _____psi
Minimum required HGL at CP = CP elevation + CH ft = _____+_____=_____
Estimated pipeline entrance losses (EL) = _____ft
Starting HGL elevation = WS - EL = _____-_____=_____

(1) Station	(2) Reach Length (ft)	(3) Pipe Elevation	(4) Design Flow Rate (gpm)	(5) Nominal Pipe Diameter (in)	(6) Pipe Type	(7) Pipe Pressure Rating (psi)	(8) Friction Factor H_f/100ft (ft/100)	(9) Reach Total H_f (ft) (2) x (8)	(10) HGL Elev (from start HGL)	(11) Max Pressure on Pipe (psi) WS-(3)	Comments (slope %)
											at source

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LATERAL STOCKWATER PIPELINE
HYDRAULIC COMPUTATION WORKSHEET

Land user _____
Job description _____
Farm No. _____ Tract No._____ Field No _____ County _____
Designer _____ Date _____ Checked by_____ Date _____

HGL at mainline _____
Pump OFF elevation (Automatic pressure system only) _____
Flow in lateral - OFF elevation (manual, timed or gravity) _____ _____
Critical point along lateral (CP): Station _____ Elevation _____
Clearance Head (CH) at critical point: _____ ft x .433 = _____psi
Minimum required HGL at CP=CP elevation + CH ft = _____+_____ = _____

(1) Station	(2) Reach Length (ft)	(3) Pipe Elevation	(4) Design Flow Rate (gpm)	(5) Nominal Pipe Diameter (in)	(6) Pipe Type	(7) Pipe Pressure Rating (psi)	(8) Friction Factor H_f/100ft (ft/100)	(9) Reach Total H_f (ft) (2) x (8)	(10) HGL Elev (from start HGL)	(11) Max Pressure on Pipe (psi) WS-(3)	Comments (slope %)
											at main

OPERATION AND MAINTENANCE GUIDE FOR STOCKWATER PIPELINE AND TANKS

Operator: _____
Project: _____
Location: _____ Sec. _____, T. _____, R. _____
NRCS Office: _____ Phone: _____

A properly operated and maintained stockwater pipeline and tank system is an asset to your operation. This system was designed and installed as a permanent solution to stockwatering deficiencies. The estimated life span of the installation is at least 20 years and can be assured and usually increased by carrying out the following recommedations. This checklist is provided for your convenience in order to help you develop a good operation and maintenance plan.

OPERATION CHECKLIST

[ ] The system was designed for a maximum of _____ (number) of _____ (livestock). If the numbers are increased, additional water supplies may be needed during peak use periods.

[ ] Close all hydrants and valves slowly to prevent water hammer.

[ ] Make sure all pressure tanks, pressure relief valves and pressure reducer valves are operating within design pressure limits and are properly adjusted.

Properly operating pressure gauges at appropriate locations are a valuable aid in monitoring the system.

[ ] If this is an automatic pumped system, make sure the system does not cycle on and off more than _____times per hour. If rapid cycling is a problem, make operation adjustments or system modifications.

[ ] Drain the following sections of pipeline prior to the date shown:
Stations_____
Date _____

_____
_____
_____
_____

MAINTENANCE CHECKLIST

[ ] Inspect the system for sudden changes in quantity of water received from the source.

[ ] Check periodically to see if debris is restricting inflow or outflow to a tank trough.

[ ] Check tank overflow outlets. If the outlet being damaged by livestock, or a bog is creating a problem, protect the outlet with rocks, fencing, or other protective material.

[ ] Periodically check tank or trough for leaks and cracks and repair immediately as necessary.

[ ] Periodically check all aboveground facilities for physical damage and repair as necessary.

[ ] At the beginning of the year, inspect the entire length of the pipeline for any signs of leaks or pipe damage.

[ ] Once a year, inspect the entire length of pipeline for signs of erosion and pipeline trench settlement. This is particularly important for the first two or three years after installation.

Repair eroded areas and construct water bars (diversions) or other protective measures to keep water from running down trences or into the area around tanks

Add backfill where pipeline trenches have settled.

[ ] Check automatic water level devices to insure that they are operating properly. Adjust or repair as necessary.

[ ] Check air valves and vents periodically to make sure they are operating properly and are not leaking.

[ ] Check the area adjacent to troughs or tanks for erosion and wear-and-tear by stock. Use gravel, scoria, concrete, compacted earth or other durable material to build the area back up.

[ ] If algea and iron sludge in tanks or troughs is a problem consider using chemicals such as chlorine, copper sulfate, or adding small fish to the tank to keep it clean.

_____
_____
_____
_____
_____
_____