

**U.S DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE  
EASTERN OREGON STOCKWATER DESIGN**

**PRACTICE DOCUMENTATION AND CONSTRUCTION REQUIREMENTS  
FOR THE CONSTRUCTION OF LIVESTOCK WATERING FACILITIES:  
SURFACE WATER PUMP DIRECTLY TO CISTERN OR TROUGH**

Pump (533)  
Watering Facility or Cistern (614)  
Pipeline (516)

Project Name:	Ruth Bowman - Stockwater
Landowner/Operator:	Ruth Bowman
Township, Section, Range:	T4S, R35W, SEC 11 & 12
Address:	
County:	Union
Prepared By:	J. Collier, J. Killgore, S. Parker
Date:	07/24/2018

<b>Practice Approval:</b>								<b>Values for this design</b> <small>(Note values ONLY for components in the design.)</small>	
<b>SYSTEM COMPONENTS and CAPACITIES:</b>									
Conservation Practice	Controlling Factor	Units	Job Class and Upper Limits					Component Value	Job Class
			I	II	III	IV	V		
<b>533</b> Electric Submersible	Flow	gpm	10	50	200	<b>500</b>	<b>1,500</b>	<b>6.7</b>	<b>I</b>
	Head	ft	50	100	250	<b>400</b>	<b>500</b>	<b>370</b>	<b>IV</b>
<b>533</b> Centrifugal Pump	Flow	gpm	200	500	1500	<b>2500</b>	<b>3500</b>		
	Head	ft	50	100	200	<b>250</b>	<b>350</b>		
<b>614</b> Watering Facility	Volume	gal	500	1,000	2,000	<b>3,000</b>	all	<b>3,000</b>	<b>IV</b>
<b>516</b> Pipeline	1) Length	mi	1	2	5	<b>10</b>	<b>30</b>	<b>0.5</b>	<b>I</b>
	2) Diameter	in	1.25	2	3	<b>4</b>	<b>8</b>	<b>2</b>	<b>II</b>
	3) Velocity	fps	5	7	10	<b>12</b>	<b>15</b>	<b>&lt;5</b>	<b>I</b>
	4) Pressure	psi	50	80	100	<b>200</b>	all	<b>160</b>	<b>IV</b>

1. Job Class values shown as BOLD for the listed practices are considered an "engineering practice" by the State of Oregon. Approval authority for these practices must not be delegated to a non-federal employee unless that person is a licensed professional engineer.

Planner Assistance: Nick Vora

To the best of my professional knowledge, judgment and belief, this design, including report, calculations, drawings, specifications, inspection worksheets and operation and maintenance plan meet applicable NRCS Standards.

Designer: \_\_\_\_\_ Date: \_\_\_\_\_  
Signature

Design Reviewed: \_\_\_\_\_ Date: \_\_\_\_\_  
Signature

Design Approved: \_\_\_\_\_ Date: \_\_\_\_\_  
Signature

**IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.**

Installation shall be in accordance with the following drawings, specifications and special requirements. No changes are to be made in the drawings or specifications without prior approval of the NRCS Engineer or Designer.

This design may be used for surface or submersible Pumps delivering livestock water through simple pipelines directly to cisterns and troughs. This design report shall not be used for pressure tanks or wells.

**PASTURE INVENTORY AND EVALUATION:**

1. Pasture or Allotment Type: Mountain Rangeland
2. Months this System Would be Utilized: 6 during the spring summer
3. Other Available Sources of Water: Undeveloped low flow spring
4. Average Distance between Water Sources: over a mile
5. Animal Units (*Species, Type, and Number*): 60 pair
6. Wildlife Considerations: few deer and elk (negligible)
7. Maximum Daily Water Consumption/Head: 20 gal/day  
(*cows: 20 gal/day, horses: 12 gal/day, sheep/goats: 2 gal/day*)
8. Total Daily Water Consumption: 1200 gal
9. Other Considerations Concerning this Pasture: Cows will be fenced off from the river

**DESIGN:**

1. Description of the Job: A culvert will be placed in the slough with a submersible pump that will pump water to 4 troughs and a cistern at the top of the hill.
2. Design Objectives: Provide off stream water for livestock.
3. Water Source and Available Yield: Slough next to the highway, ample yield.
4. New or Existing Pump and Type: New Submersible solar pump.  
(*submersible, surface, grid, propane, or gas*)
5. Pump Control Method: Timer  
(*Timer, Float Switch, Manual ...*)
6. Flow Rate [gpm]: 6.7  
(*Daily Water Consumption / Pump Run Time [hr] / 60, grid run time is typically 3 hours per day*)
7. Water Elevation at Source [ft]: 3360
8. Elevation at Trough, Cistern, and Highest Point along Pipeline [ft]: Cistern, 3685

9. Pipe Length, Size, Type, & Class: 3600 ft. of 2in. – HDPE class 200 and 160

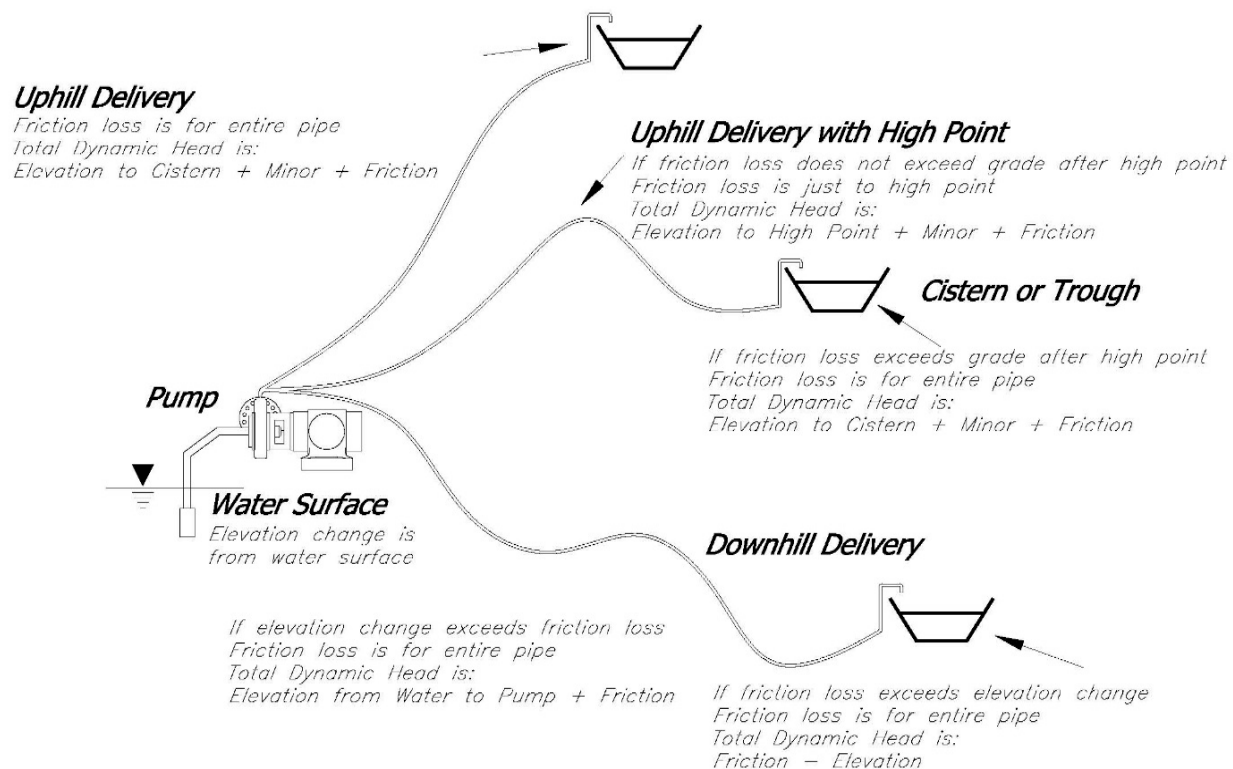
(1.5" in minimum dia, 2" recommended)

10. Minor Losses [ft]: 6 ft. for cistern height

(include 2 ft for trough height and add 23 ft of working pressure for float switch etc...)

11. Friction Loss from Pump to Cistern [ft]: 5 ft. (see hydraulic spread sheet)

(from Slide Rule, Chart, or Spreadsheet) (Maximum 5 fps fluid velocity)



12. Pump Total Dynamic Head [ft]: 370 ft. (added 34 ft. instead of 23 ft.)

(See Drawing Previous Page, option to add an extra 10 psi or 23 ft to operate float valve)

13. Pump Power [HP]: 0.75 hp

(Total Dynamic Head [ft] \* gpm / (3960 \* Eff.) Note: typical efficiency 0.80)

14. Cistern Storage: 3,000 gal.

(Type, Volume & Number of Cisterns)

15. Trough Storage: 1,600 gal. (two 800 gal troughs on one side of fence)

(Type, Volume & Number of Troughs)

16. Days of Storage: 3.8 days

(Total Storage / Daily Water Consumption) (NRCS Recommends 3 days if remote & no other source of water)

17. Elevation Change from Cistern (if used) to Trough: 25 ft.

(For pipe lengths less than ¼ mile and less than 10 gpm: Fall should be greater than 10 ft and less than 125 ft)

18. Appurtenances: Must have float valves on troughs with and overflow on cistern

(If Cistern used: Float Valves required on troughs and overflow required on cistern) (ARV / PRV, Drains, etc..)

(If Direct to trough: Overflow is required on Troughs)

19. Special Requirements and Items of Work for this Project: Attach an air vent to the pipe about half way to the cistern.

Estimated Quantities:

Item	Units	Cost/Unit	Planned QTY	Applied QTY
2 in. class 200 HDPE	Ft.		500	
2 in. class 160 HDPE	Ft.		3100	
800 gal. aluminum troughs	Ea.		4	
30 in. CMP culvert	Ft.		10 - 20	
¾ hp. Submersible pump	Ea.		1	
2 in. sch. 40 steel pipe	Ft.		100	
3,000 gal. Cistern	Ea.		1	
Solar Panel set up	Ea.		1	
1 in. air vent	Ea.		1	
Lid for culvert	Ea.		1	

U.S DEPARTMENT OF AGRICULTURE  
 NATURAL RESOURCES CONSERVATION SERVICE  
 Oregon – JDU/SR EQIP

**PRACTICE DOCUMENTATION AND CONSTRUCTION REQUIREMENTS:  
 FOR THE CONSTRUCTION OF LIVESTOCK WATERING FACILITIES**

Spring Development (574)  
 Watering Facility (614)  
 Pipeline (516)

Project Name:	Ruth Bowman Spring Development
Landowner/Operator:	Ruth Bowman
Township, Section, Range:	T4S, R35W, SEC 11 & 12
Address:	
County:	Union
Prepared By:	Jamie Killgore
Date:	August 2018

This Practice Documentation and Construction Requirements package has been developed for small, low risk spring development projects in Oregon funded through the EQIP funding pool.

**IT SHALL BE THE RESPONSIBILITY OF THE OWNER TO OBTAIN ALL NECESSARY PERMITS AND/OR RIGHTS, AND TO COMPLY WITH ALL ORDINANCES AND LAWS PERTAINING TO THIS INSTALLATION.**

Installation shall be in accordance with the following drawings, specifications and special requirements. NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF THE NRCS ENGINEER OR DESIGNER.

**PASTURE INVENTORY AND EVALUATION:**

- Pasture or Allotment Type: Mountain range land
- Months this System Would be Utilized: ~ 4 months
- Other Available Sources of Water: Yes – pump system in same design
- Average Distance between Water Sources: 1/2 mile
- Animal Units (*Species, Type, and Number*): 60 cows (supply for ~10)
- Wildlife Considerations: n/a
- Maximum Daily Water Consumption per Head: 20 gal per day
- Total Daily Water Consumption: 200 gal
- Other Considerations Concerning this Pasture: This spring development is supplementary to the proposed pipeline.

**DESIGN:**

*This design may be used for Spring Developments, Troughs, Cisterns and simple Pipelines from spring systems, cisterns, or other non-pump sources.*

20. Applicable NRCS Practice Standards: 574, 516, & 614

21. Description of the Job: Develop two springs and pipe to a single trough.

22. Design Objectives: Provide off stream water for livestock

23. Water Source and Available Yield: Spring – hoping for minimum 1 gpm

24. Type of Spring Collector or Collection Method: EZ drain (perforated) collector

25. Elevation at Source [ft]: 3675 ft

26. Elevation at Trough [ft]: 3665 ft max

27. Pipe Length, Size, Type, & Class: 2" SCH40 OR 160PSI HDPE

28. Friction Loss (*from Slide Rule, Chart, or Spreadsheet*) [ft]: about 1 ft

29. Minor Losses (*Include Height of Trough*) [ft]: about 2 ft

30. Available Head at Trough (*Elevation Change - Friction - Minor*) [ft]: 7 FT

31. Trough Storage (*Type, Volume [gal] & Number of Troughs*): One 800 gal aluminum trough

32. Cistern Storage: (*Type, Volume & Number of Cisterns*): n/a

33. Days of Storage (*Total Storage / Daily Water Consumption*): 4

34. Appurtenances (*Float Valves, Air-Vac/Pressure Relief Valves, Overflows, Drains, Thrust Blocks*):

No special ones outside the drawn components

35. Special Requirements and Items of Work for this Project (*Including Control Methods if Used or Not Apparent in this Package*):

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_





UNITED STATES DEPARTMENT OF AGRICULTURE  
NATURAL RESOURCES CONSERVATION SERVICE  
OREGON

**GENERAL REQUIREMENTS**

This construction plan sets forth the requirements for this installation as shown on the drawings and described in the specifications. The project shall be constructed at the location and to the lines and grades as shown on the drawings in accordance with the specifications.

**Responsibilities:**

- a. **Owner/Operator:** The owner/operator is the official spokesperson for this project. The owner/operator is the person who reviewed the construction plan, made all contractual agreements, ensures construction is in accordance with the requirements as set forth in the plans, obtains all permits and is financially responsible. The owner/operator is the sole person who can authorize any changes during construction that incur financial obligations.
- b. **Inspector / Technician:** The inspector / technician is the NRCS representative who has the authority to review the practice during construction and make necessary tests to ensure that all work is in compliance with the construction plan. The inspector / technician reviews all construction changes and insures that the owner/operator approves prior to installation. The inspector /technician maintains a job diary and prepares as-built drawings of the project.
- c. **Contractor:** The contractor has a contractual agreement with the owner/operator for the project installation as set forth in the construction plan. The contractor shall not make changes to the construction plan without NRCS review and owner/operator approval. The contractor shall comply with all applicable permits and conduct the work in a safe manner.

**Construction Plan:**

- a. **Specifications:** The practice construction and materials specifications describe minimum acceptable quality of work and materials for the project. The material specifications may also reference a commercial standard such as the American Society of Testing Materials, ASTM, which identifies materials. Commercial standards set forth the minimum acceptable quality of identified materials within the industry. If a conflict arises between the drawings and specifications, the specification governs the work and/or material.
- b. **Drawings:** The drawings are a visual representation to supplement construction and material specifications. The drawings include location, profiles, sections, details and notes necessary to describe the work.

**NO CHANGES ARE TO BE MADE IN THE DRAWINGS OR SPECIFICATIONS WITHOUT PRIOR APPROVAL OF NRCS.**

**Permits:**

All permits, rights of ways, and/or easements that are applicable for the construction and/or operation are the responsibility of the owner/operator and shall be available for review by the NRCS prior to the start of construction.

**Safety:**

The contractor is responsible for compliance with all state and local laws, ordinances, codes, and/or regulations applicable for the installation. The inspector will document any safety violations witnessed.

**Owner/Operator Acknowledgement:**

The owner/operator acknowledges that:

- a. They have received a copy of the construction drawings and specifications, and that they have an understanding of the contents, and the requirements.
- b. They have obtained all the necessary permits.
- c. They understand that NRCS makes no representation as to the existence or non-existence of utilities. It is the responsibility of landowners, operators and contractors to comply with the provisions of ORS 757.541 to 757.571. Landowners, operators and contractors will be liable for any damage resulting from disruption of service caused by construction activities. **The phone number for the utility location service in Oregon is 1-800-332-2344.**
- d. They understand that maintenance of the installed work is necessary for proper performance during the project life.
- e. No changes will be made in the installation of the job without prior concurrence of the NRCS technician.

Accepted by: \_\_\_\_\_ Date: \_\_\_\_\_

**Practice certification and acceptance:**

The NRCS acceptance of the project will be performed by the inspector during construction and after the work has been completed. If deficiencies are found, the NRCS inspector may prepare a written report.

I have made an on-site inspection of the site (or I am accepting owner/contractor documentation USING THE ATTACHED PROJECT INSPECTION WORKSHEETS), and have determined that the job as installed does conform to the drawings and practice specifications.

Completion Certified By: \_\_\_\_\_ Date: \_\_\_\_\_  
NRCS Signature

Title: \_\_\_\_\_

CONSTRUCTION SPECIFICATION  
SITE PREPARATION AND RESTORATION

**1. Fire prevention measures shall be taken to prevent the start or spreading of wildfires that may result from project activities. Firebreaks or guards shall be constructed and maintained at locations shown on the drawings.**

**2. MOBILIZATION AND DEMOBILIZATION:** The work consists of the mobilization and demobilization of the contractor's forces and equipment necessary for performing the work required as well as any work required to remove excess materials and equipment from the work site once the project is complete.

a. Mobilization shall include all activities involved in the transportation of contractor's personnel, equipment, and operating supplies to the site; establishment of offices, buildings, and other necessary general facilities for the contractor's operations at the site; any permits, insurance, and/or bonds required to do the work.

b. Demobilization shall include all activities involved in the transportation of personnel, equipment, and supplies not required or included in the contract from the site; including the disassembly, removal, and site cleanup of offices, buildings, and other facilities

c. The Contractor is required to attend a pre-construction meeting with the landowner and NRCS prior to mobilization.

d. The Contractor shall exercise care to protect and maintain existing trees and vegetation in the project area.

e. Upon completion of demobilization activities, the Contractor shall perform site restoration including: scarifying areas and routes compacted through heavy travel and seeding all disturbed areas.

f. Construction operations shall be done in a manner that erosion, and air and water pollution are minimized and held within legal limits. The owner, operator, Contractor or other persons will conduct all work and operations in accordance with the proper safety codes for the types of construction being performed with due regard to the safety of all persons and property. The completed job shall be workmanlike and present a good appearance

**3. POLLUTION CONTROL:** The work consists of installing measures or performing work to control erosion and minimize the production of sediment and other pollutants to water and air from construction activities. All pollution control measures and temporary works shall be adequately maintained in a functional condition for the duration of the construction period. All temporary measures shall be removed and the site restored to near original condition. The measures and works shall include, but are not limited to, the following:

a. **Staging of earthwork activities, movement of construction equipment and the excavation and moving of soil** materials shall be scheduled to minimize soil, water, and air pollution. Construction activities shall minimize the size of areas disturbed and unprotected from erosion for the shortest reasonable time.

b. **Seeding** to protect disturbed areas shall occur as soon as reasonably possible following completion of that earthwork activity.

c. **Mulching** to provide temporary protection of the soil surface from erosion.

d. **Diversions** to divert water from work areas and to collect water from work areas for treatment and safe disposition. They are temporary and shall be removed and the area restored to its near original condition when the diversions are no longer required or when permanent measures are installed.

e. **Stream crossings** — Culverts or bridges where equipment must cross streams. They are temporary and shall be removed and the area restored to its near original condition when the crossings are no longer required or when permanent measures are installed.

f. **Sediment basins** to collect, settle, and eliminate sediment from eroding areas from impacting properties and streams below the construction site(s). These basins are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

g. **Sediment filters** — Straw bale filters or geotextile sediment fences trap sediment from areas of limited runoff. Sediment filters shall be properly anchored to prevent erosion under or around them. These filters are temporary and shall be removed and the area restored to its original condition when they are no longer required or when permanent measures are installed.

h. **Waterways** — Waterways for the safe disposal of runoff from fields, diversions, and other structures or measures. These works are temporary and shall be removed and the area restored to its original condition

when they are no longer required or when permanent measures are installed.

i. **Air pollution** - The burning of brush or slash and the disposal of other materials shall adhere to state and local regulations.

j. **Dust Control** - All public access or haul roads used by the contractor during construction of the project shall be sprinkled or otherwise treated to fully suppress dust. All dust control methods shall ensure safe construction operations at all times. If chemical dust suppressants are applied, the material shall be a commercially available product specifically designed for dust suppression and the application shall follow manufacturer's requirements and recommendations. A copy of the product data sheet and manufacturer's recommended application procedures shall be provided to the engineer 5 working days before the first application.

k. **Storage of Fuel and Lubricants** - All fuel and lubricants shall be stored in containers and areas that are in conformance with the Oregon State Department of Environmental Quality and local regulations. If a spill of chemical pollutants such as fuel or hydraulic fluid should occur, immediately attempt to contain the spilled material. The following procedures shall be followed:

i. For spillage on land, construct earthen berms or use other suitable barricade material of sufficient size to contain the spill and keep it from spreading.

ii. For spillage on water, attempt to isolate and contain the spilled material. Commercial booms or other suitable materials shall be kept on site during construction to contain fuel and oil spills on water.

iii. Call the Oregon Emergency Response System (ORES) at (800)452-0311.

l. **Servicing and Refueling Equipment** - All fuel and lubricants used in the servicing of construction equipment shall be done in a manner that avoids spills and over filling. The Oregon State Department of Environmental Quality shall be notified immediately of any spill and the operator shall contain the spillage.

m. **Sanitary Facilities** - Sanitary facilities such as chemical toilets shall be located at least 100 feet from water bodies to prevent contamination of surface or subsurface water.

n. **Environmentally Sensitive Areas** - All environmentally sensitive areas, as shown on the drawings or as flagged at the construction site, shall be avoided. If human remains are discovered stop construction immediately, secure the site and contact the County Sheriff. If cultural materials are discovered stop construction immediately and contact the NRCS Cultural Resources Specialist. The contractor shall be responsible for mitigating any damages to sensitive areas that are a result of construction activities not approved by the NRCS Engineer.

**4. CLEARING AND GRUBBING:** The work consists of clearing and grubbing and disposal of trees, snags, logs, brush, stumps, shrubs, and rubbish from the designated areas. All roots 1-inch or larger in diameter that are cut, broken, or otherwise severed during construction operations shall have the end smoothly cut perpendicular to the root. Roots exposed during excavation or other operations shall be covered with moist earth or backfilled as soon as possible to prevent the roots from drying out. All trees not marked for preservation and all snags, logs, brush, stumps, shrubs, rubbish, and similar materials shall be cleared from within the limits of the designated areas. Unless otherwise specified, all stumps, roots, and root clusters that have a diameter of 1 inch or larger shall be grubbed out to a depth of at least 2 feet below subgrade for concrete structures and 1 foot below the ground surface at embankment sites and other designated areas.

a. **PROTECTION OF EXISTING VEGETATION:** Trees and other vegetation designated to remain undisturbed shall be protected from damage throughout the duration of the construction period. Any damages resulting from the contractor's operations or neglect shall be repaired by the contractor. Earthfill, stockpiling of materials, vehicular parking, and excessive foot or vehicular traffic shall not be allowed within the drip line of vegetation designated to remain in place. Vegetation damaged by any of these or similar actions shall be replaced with viable vegetation of the same species, similar condition, and like size unless otherwise approved by the contracting officer. Any cuts, skins, scrapes, or bruises to the bark of the vegetation shall be carefully trimmed and local nursery accepted procedures used to seal damaged bark. Any limbs or branches 0.5 inch or larger in diameter that are broken, severed, or otherwise seriously damaged during construction shall be cut off at the base of the damaged limb or branch flush with the adjacent limb or tree trunk.

b. DISPOSAL: All materials cleared and grubbed from the designated areas shall be disposed of at locations shown on the drawings and/or in a manner that complies with federal, state, and county permits and requirements. The contractor is responsible for complying with all local rules and regulations and the payment of any and all fees that may result from disposal at locations away from the project site.

**5. VEGETATION OF CONSTRUCTION SITES:** The work shall consist of furnishing seed and fertilizer, seedbed preparation, and seeding of all areas which were disturbed during construction or on specific areas which are shown the drawings. After completion of construction, the Contractor shall seed all disturbed areas using a native seed mix approved by NRCS.

a. Fertilizer shall be applied at the minimum rates of 30 lbs/ac of actual nitrogen. Other elements may be applied at the rate as determined by soil testing. If the fertilizer is applied to the surface, it shall be mixed with the soil prior to seeding. If fertilizer other than nitrogen at the rate of 30 lbs/ac is to be applied, the fertilizer and application rate will be indicated in the Special Requirements and Items of Work for this Project.

b. The areas shall be seeded to a grass species or mixture of grasses or legumes at the rate of pure live seed per acre as indicated in the Special Requirements and Items of Work for this Project.

c. The seeding will be performed when moisture is adequate for germination and establishment. Prepare the seedbed as for pasture and hayland plantings as common for the climatic area. The seeding will be accomplished in the seeding dates as common for the area unless otherwise specified in the Special Requirements and Items of Work for this Project.

d. When broadcasting, the seeded area will be mulched with 2,000 pounds of grain straw per acre. Grain straw will be used, unless other mulching material and application rate is indicated in the Special Requirements and Items of Work for this Project.

## PRACTICE SPECIFICATION

**PIPELINE (516)**

- 1. SCOPE:** The work shall consist of furnishing and installing pipe including appurtenances at locations and to lines, grades, and elevations as shown on the drawings or as staked in the field.
- 2. PLACEMENT:** Pipelines shall be placed with adequate protection against hazards imposed by traffic, farming operations, freezing temperatures, or soil cracking. Other means of protection must be provided if the depth required for protection is impracticable because of shallow soils over rock or for other reasons. Abrupt changes in grade must be avoided to prevent rupture or collapse of the pipeline. Trenches for plastic pipelines shall be free of rocks and other sharp-edged materials. The pipe shall be carefully placed to prevent damage. Plastic pipelines may be placed by plow in equipment if soils are suitable and rocks and boulders will not damage the pipe or restrict capacity.
- 3. EXCAVATION:** The work shall consist of the excavation required by the drawings and specifications and disposal of the excavated materials. Excavations shall comply with OSHA Construction Industry Standards (29CFR Part 1926) Subpart P, Excavations, Trenching, and Shoring. All excavations shall be completed and maintained in a safe and stable condition throughout the total construction phase. Structure and trench excavations shall be completed to the specified elevations and to the length and width required to safely install, adjust, and remove any forms, bracing, or supports necessary for the installation of the work. Excavations outside the lines and limits shown on the drawings or specified herein required to meet safety requirements shall be the responsibility of the contractor in constructing and maintaining a safe and stable excavation.
  - a. **TRENCHES:** Excavated trenches shall be within state and local laws and regulations for trenching. When trench excavation is necessary for installation of pipeline, the trenches will be excavated to a minimum depth of 2 ft. Trenches shall be supported as necessary to safeguard the work and workers. Trench supports shall prevent sliding or settling of the adjacent ground and avoid damage to improvements. The width of the excavation shall be increased, if necessary, to provide space for sheeting, bracing, shoring, and other supporting installations. The bottom width, side slopes, and gradeline of the trench excavation shall be to the dimensions and lines shown on the drawings.
  - b. **FOUNDATION:** The pipe foundation shall be excavated a minimum of 4 inches lower than the pipe grade shown on the drawings or staked in the field whenever bedrock, boulders, cobbles, or other material that may cause pipe damage is encountered at planned pipe grade.
  - c. **USE OF EXCAVATED MATERIALS:** All surplus or unsuitable excavated materials are designated as waste and shall be disposed of by the contractor at sites of his own choosing away from the site of the work. The disposal shall be in an environmentally acceptable manner that does not violate local rules and regulations.
  - d. **EXCAVATION IN EARTH BEYOND THE SPECIFIED LINES AND GRADES** shall be corrected by filling the resulting voids with approved, compacted earthfill. The exception to this is that if the earth is to become the subgrade for riprap, rockfill, sand or gravel bedding, or drainfill, the voids may be filled with material conforming to the specifications for the riprap, rockfill, bedding, or drainfill. Before correcting an over excavation condition, the contractor shall review the planned corrective action with the engineer and obtain approval of the corrective measures.
- 4. BEDDING:** Bedding materials shall be used on foundations containing material larger than ½ inch in diameter. Bedding may be either granular material conforming to ASTM C-33 gradation 7 or 8, or select earthfill material approved by the NRCS Engineer. The pipe shall be firmly and uniformly placed on compacted bedding of ample bearing strength to support the pipe without noticeable settlement. The material on which the pipe is placed shall be of uniform density to prevent differential settlement. Unless otherwise specified, a groove that closely conforms to the outside surface of the pipe shall be formed in the bedding. The depth of the groove shall be equal to or greater than 0.3 of the pipe diameter. Bedding material shall be durable, non-compressible and be within the grading limits of the Unified Soil Classification System, USCS. The ASTM specifications for classifying soils are: ASTM D-2487, Classification of Soils for Engineering Purposes, and ASTM D-2488, Standard Practice for Description and Identification of Soils (Visual Manual Procedure). The following table lists some general properties of materials suitable for bedding. Gradation is unique for each soil in the USCS.

Material	USCS	S.G. (Min.)	Size (Max.)
Soil	SW,SP,SM,SC,ML,CL	1.75	#10 Sieve
Fine Gravel	SW,SP,SM,SC	2.00	3/4-inch
Coarse Gravel	GW,GP,GM,GC	2.40	3-inch
	SW,SP,SM,SC		

**5. INSTALLATION:** The pipe shall be installed so that there is no reversal of grade between joints unless otherwise shown on the drawings. The pipe shall not be dropped or dumped on the bedding or into the pipe trench. The trench and adjacent ground surface shall be free from rock and stones greater than 1 inch in diameter. This ensures that rock will not be displaced and impact the pipe. Just before placement, each pipe section shall be inspected to ensure that all foreign material is removed from inside the pipe. The pipe ends and the couplings shall be free of foreign material when assembled. At the completion of a work shift, all open ends of the pipeline shall be temporarily closed off using a suitable cover or plug.

- a. **EXTREME WEATHER:** Care shall be taken to prevent distortion and damage during hot or cold weather. During unusually hot weather (daytime high temperature of more than 90 °F), the pipe assembled in the trench shall be lightly backfilled or shaded to keep it as near to ground temperature as possible until final backfill is placed. Backfill operations should be performed during daily construction periods when the ground temperature and the temperature of the pipe do not vary more than 40 degrees Fahrenheit.
- b. **PERFORATED PIPE** shall be installed with the perforations down and oriented symmetrically about the vertical centerline. Perforations shall be clear of any obstructions on the inside and outside of the pipe when the pipe is approved by the engineer for backfill.
- c. During installation, the pipe shall be firmly and uniformly bedded throughout its entire length, to the depth and in the manner specified on the drawings. Bell-holes shall be placed in bedding material under bells, couplings, and other fittings to assure the pipe is uniformly supported throughout its entire length. Blocking or mounding beneath the pipe to bring the pipe to final grade is not permitted.

**6. BACKFILL:** Backfill material shall contain no frozen soil, sod, brush, roots, or other perishable material. Rock fragments greater than 3 inches shall not be placed within 2 feet of the pipe. During backfilling the pipe shall be sufficiently loaded around the sides to prevent its separation from the bedding.

- a. **INITIAL BACKFILL** to 6 inches above the top of the conduit is required. Initial backfill shall be placed in two stages. In the first stage (haunching), backfill is placed to the pipe spring line (center of pipe). In the second stage, it is placed to 6 inches above the top of the pipe. Earth haunching and initial backfill material shall consist of soil material that is free of rocks, stones, or hard clods more than 1 inch in diameter. During compaction operations, care shall be taken to ensure that the tamping or vibratory equipment does not come in contact with the pipe and the pipe is not deformed or displaced.
- b. **FINAL BACKFILL** shall consist of placing the remaining material required to complete the backfill from the top of the initial backfill to the ground surface, including mounding at the top of the trench. Final backfill material within 2 feet of the top of the pipe shall be free of debris or rocks larger than 3 inches nominal diameter. Final backfill shall be placed in approximately uniform, compacted layers. The minimum depth of cover on all pipelines shall be as shown on the drawings. All backfilling shall be completed before the line is placed in service.
- c. Deformation or displacement of the pipe must not occur during backfilling. Plastic pipelines installed by the plow-in method require surface compaction and shaping in addition to normal plow in operations.
- d. Vehicles or construction equipment shall not be allowed to cross the pipe until the minimum earth cover and required density have been achieved.

**7. MATERIAL:**

- a. **PIPE:** Refer to Material Specifications OR-547 PLASTIC PIPE; OR-548 CORRUGATED POLYETHYLENE PIPE; and OR-554 STEEL PIPE.
- b. **VALVES AND METERS:** Refer to Material Specification OR-303 VALVES AND METERS.

**8. TESTING:** Pipelines shall be pressure tested by the following method: Before backfilling, fill the pipe with water and test at the design working head or at a minimum head of 10 feet, whichever is greater. All leaks must be repaired, and the test repeated before backfilling.

**9. VALVES, VENTS, JOINTS:** Valves or unions shall be installed at low points in the pipeline so that the line can be drained. Air Vents shall be installed at the locations shown on the drawings. Watertight joints that have a strength equal to that of the pipe shall be used. Couplings must be of material compatible with that of the pipe. If the fittings are made of material susceptible to corrosion, provisions must be made for protection.

a. PLASTIC PIPE joints shall be either bell and spigot type with elastomeric gaskets, coupling type, solvent cement bell and spigot, or jointed by butt heat fusion. When a lubricant is required to facilitate joint assembly, it shall be a type having no deleterious effects on the gasket or pipe material. Pipe joints shall be watertight at the pressures specified except where unsealed joints are indicated.

b. Pipe shall be installed and joined in accordance with the manufacturer's recommendations. Laying deflections and joint fitting or stab depths shall be within the manufacturer's recommended tolerances. When solvent cement joints are specified for PVC or ABS pipe and fittings, they shall be made in accordance with the following ASTMs and the related appendix of each ASTM; D 2855 for PVC pipe and fittings and D 2235 for ABS pipe and fittings.

c. Flanged, banded, heat-fusion, or elastomeric-sealed mechanical joints shall be used when joining polyethylene (PE) and high density polyethylene (HDPE) pipe and fittings unless otherwise specified or as shown on the drawings. Pipe ends shall be cut square and be deburred to provide a uniform, smooth surface for the jointing process. Reference marks shall be placed on the spigot ends to assist in determining when proper seating depth has been achieved within the joint.

**10. FITTINGS** - steel fittings, valves, and bolted connections shall be painted or coated as recommended by the manufacturer. Fittings for non-pressure pipe shall be of the same or similar material as the pipe and shall provide the same durability, water-tightness, and strength as the pipe unless otherwise specified.

**11. BASIS OF ACCEPTANCE:** Acceptability of the pipeline shall be determined by inspections to insure compliance with all the provisions of this specification and the construction drawings with respect to the design of the pipeline, the pipe and pipe markings, appurtenances, and minimum installation requirements. The installing contractor or owner shall certify that the installation complies with requirements of the specification and construction drawings. A written guarantee shall be furnished by the contractor that protects the owner against defective workmanship and materials for not less than 1 year. The certification identifies the manufacturer and markings of the pipe used.

**12. OPERATION AND MAINTENANCE ITEMS:** A properly operated and maintained pipeline is an asset to the farm. This pipeline was designed and installed to transfer water to where it may be better utilized. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program. This practice will require performance of periodic maintenance and may also require operational items to maintain satisfactory performance. Recommendations are:

- a. Check to make sure all valves and air vents are in and set at the operating condition.
- b. Maintain the design depth of cover over the pipeline. Limit traffic over the pipeline to designated sections that were designed for traffic loads. Avoid travel over pipelines by tillage equipment when the soil is saturated.
- c. Avoid any sub soil operation that may disturb the pipeline.
- d. Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control height.
- e. Remove all foreign debris that hinders system operation.
- f. Drain all system components in areas that are subject to freezing. If parts of the system cannot be drained, an anti-freeze solution that is harmless to livestock and humans may be added.
- g. Eradicate or otherwise remove all rodents or burrowing animals that can potentially damage or displace the pipeline. Immediately repair any damage caused by their activity.
- h. Immediately repair any vandalism, vehicular, or livestock damage to outlets and appurtenances.

## PRACTICE SPECIFICATION

## STOCKWATER PUMPING PLANT (533)

- 1. SCOPE:** The work shall consist of installing a stockwater pump as shown on the drawings.
- 2. PERMITS:** Water rights are not required for watering livestock, if livestock is the only use. Owner is responsible for all permitting concerning wells and any structures placed in a stream corridor. Prior to installation, owner to provide all documentation to NRCS personnel.
- 3. PUMP SELECTION:** Pumps and power units shall be selected to match the pumping requirements within the range of conditions. The pumping plant shall be sized to meet the pressure, flowrate, horsepower, efficiency, service factor and physical or environmental considerations.
- 4. WATER SOURCE:** Prior to pump installation the source of water must be inspected or if new then fully develop to ensure screens, filters, trash racks, and other devices shall be installed to prevent the intake of sand, gravel, debris and objectionable material. Intake screens shall be installed according to all applicable Federal and State guidelines to avoid entrainment or trapping aquatic organisms.
  - a. **WELLS:** Placement and installation of a pump within a well must be in accordance with all Oregon Water Resource Department requirements. A well log with a well test shall be provided to NRCS.
  - b. **SUMPS:** Placement and installation of a pumping plant within a sump or structure collecting a water source must first insure that the structure itself has been constructed in accordance with all Federal, State, and local requirements. Any new structure placed in the plane of a high water mark of a live stream or water of the State shall follow all applicable Federal, State, and local requirements.
  - c. **OPEN WATER:** Placement of a portable pump or a suction line within an open body of water such as a pond or within a live stream must be done with NRCS approval and removed in a timely manner if high water occurs or NRCS specified a timeline for limited use of operation within the operations and maintenance or construction drawings.
- 5. PUMP PLACEMENT:** The placement and installation of pumps shall be in accordance with the construction drawings. Appurtenances such as gate valves, check valves, pressure regulating valves, pipe connections, pressure gauges and other protective or control devices shall be included to meet the requirements for this installation. Installation of pumps shall follow all applicable manufacturer guidelines.
  - a. **SUBMERSIBLE PUMPS:** To prevent running dry or ingesting sand or debris: installed depth of pump shall be designed to account for draw down, static water level, tested flowrate, and the depth to the floor of water source.
  - b. **SURFACE & RADIAL FLOW PUMPS:** To prevent cavitation: suction and discharge pipes shall be designed to account for suction lift, net positive suction head, pipe size, friction losses, possibility of draw down, temperature, and altitude.
  - c. **GENERAL:** The owner, operator, contractor, or other persons will conduct all work and operations in accordance with proper safety and applicable electrical codes with due regards to the safety of all persons and property.
- 6. SOLAR PANEL PLACEMENT:** All electrical work shall be in full accordance with Federal, State, and local code. The photovoltaic array shall be sized using the manufacturer's recommendations for the location and time of year to provide the power necessary to operate the pump at the design flowrate and pressure considering a minimum panel degradation of 10 years. Fixed arrays shall be oriented to receive maximum sunlight at latitude and time of year. Panels shall be mounted securely to resist environmental considerations.
- 7. PROTECTIVE MEASURES:** All works shall be adequately protected from physical damage by freezing, flooding, water hammer, sun UV degradation, vandalism, vehicle traffic, and animals including livestock. Electrical panels, solar panels, and any surface component shall have a fence constructed around it of steel panels or of hard fence construction.
- 8. BASIS OF ACCEPTANCE:** Acceptability of the pump installation shall be determined by inspections to insure compliance with all the provisions of this specification and the construction drawings with respect to the design of the pipeline, troughs, appurtenances, and minimum installation requirements. The installing contractor or owner shall certify that the installation complies with requirements of the specification and the construction drawings. A written guarantee shall be furnished by the contractor that protects the owner against defective workmanship and materials for not less than 1 year. The certification identifies the manufacturer and markings of the pump used.

**9. OPERATION AND MAINTENANCE:** A properly operated and maintained livestock pumping plant is an asset to the farm. This pump was designed and installed to provide and transfer water to where it may be better utilized. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program. This practice will require performance of periodic maintenance and may also require operational items to maintain satisfactory performance. Recommendations are:

- a. Maintain pumps, motors, and electrical controls in a good operating condition per specific recommendations by the manufacturer.
- b. Follow proper start up and shut down procedures.
- c. Inspect or test all pumping plant components on a regular schedule and perform routine maintenance.
- d. Check, clean, and remove debris from screens or filters regularly and remove sediment build-up in pumping bays.
- e. Routinely test and inspect electrical switches, controls, safety features, automated components, and pressure tank switches to ensure proper function.
- f. Perform routine inspection of photovoltaic panels and mounting if installed.
- g. Follow the necessary procedures to prevent freezing.
- h. Prior to retrofitting or repairing any component, disconnect the power supply first.
- i. Immediately repair all vandalism, vehicular or livestock damage.

#### PRACTICE SPECIFICATION WATERING FACILITY (614)

**1. SCOPE:** The work shall consist of furnishing materials and constructing a water tank and/or a watering trough with appurtenances to the dimensions and elevations as shown on the drawings or as staked in the field.

**2. SITE PREPARATION:** The foundation area shall be cleared of all trees, brush, weeds, loose rocks and other materials not suitable for the subgrade. All loose surface soil shall be removed to undisturbed material.

**3. FOUNDATION PREPARATION:** The surface earth materials shall be compacted, and when specified, the bedding materials shall be placed and spread to the thickness as shown on the drawings. After the underground pipes are installed, the trenches shall be backfilled and compacted to the same density as the undisturbed earth.

**4. TYPES OF TANKS:** The type of tank shall be one of the following:

- Type A - Steel Rim with a concrete floor
- Type B - Galvanized steel rim with either a galvanized steel floor or a concrete floor
- Type C - Concrete tanks
- Type D - Plastic or Fiberglass tanks
- Type E - Redwood lumber
- TIRE
- Welded Aluminum

**5. MATERIALS:** Galvanized steel tanks shall conform to the manufacturer's recommendations. Steel rims shall conform to the requirements as specified on the drawings. Concrete shall conform to Construction Specification CS-221 CONCRETE FOR MINOR STRUCTURES. Plastic or Fiberglass tanks shall conform to the manufacturer's recommendations. Redwood shall be sound and free of cracks. Tanks must be constructed of new and/or durable used materials. Used materials must be inspected and accepted by NRCS prior to installation.

**6. BEDDING:** Material shall be clean granular materials of the gradation and thickness shown on the drawings.

**7. APPURTENANCES:** Troughs shall conform to one of the types as shown on the drawings including the required foundation area treatment. Piping for filling, operating, draining, and cleaning shall conform to the size and type as shown on the drawings. Pipeline for connecting the tanks/troughs shall conform to Practice Specification, 516 - Pipeline.

- a. All above ground piping shall be galvanized steel or HDPE pipe.

b. Automatic water level control and overflow facilities shall be installed as specified on the drawings.

**8. INSTALLATION:** The type of tank and trough to be installed will be as specified on the construction drawings. After the foundation has been prepared, and all pipes installed, the foundation shall be inspected by the Inspector/Technician. The placement and installation of the tank shall conform to the manufacturer's recommendations. Tanks requiring anchoring will be secured as noted on the drawings, or as recommended by the manufacturer. After the tank and trough have been installed, the earth surface adjacent to the tank and trough shall be graded to convey any surface runoff away from the structures.

**9. SPECIAL MEASURES:** Some Fencing and/or Guard rails maybe required to protect the structures from animals. These measures will be as staked in the field by the Inspector/Technician. Measures and construction methods shall be incorporated as planned to maintain or enhance wildlife values.

**10. BASIS OF ACCEPTANCE:** Acceptability of the watering facility shall be determined by inspections to insure compliance with all the provisions of this specification and the construction drawings with respect to the design of the tank/trough, pipe, appurtenances, and minimum installation requirements. The installing contractor or owner shall certify that the installation complies with requirements of the specification and the construction drawings. A written guarantee shall be furnished by the contractor that protects the owner against defective workmanship and materials for not less than 1 year. The certification identifies the manufacturer and markings of the trough/tank used.

**11. OPERATION AND MAINTENANCE REQUIREMENTS:** A properly operated and maintained watering facility is an asset to the farm. This system was designed and installed to transfer water to where it may be better utilized. The estimated life span of this installation is at least 10 years. The life of this installation can be assured and usually increased by developing and carrying out a good operation and maintenance program. This practice will require performance of periodic maintenance and may also require operational items to maintain satisfactory performance. Recommendations are:

- a. Check all above ground connections, valves, gates, rodent guards, inlets and outlets to make sure they are functioning properly.
- b. Check troughs and tanks for leaks or cracks and repair or replace immediately, if necessary.
- c. Make certain the area adjacent to the trough is well protected with gravel, paving, or good cover.
- d. Be sure that the outlet pipe has a free outlet and is not causing any serious erosion problems.
- e. Check periodically to see if debris has fallen into the trough or tank that may restrict inflow or planned functions of the outflow system.
- f. Clean the entire system periodically and remove moss, algae growth, and/or sludge. Chemicals such as copper sulfate and chlorine can be used to prevent moss and algae growth. Local rules and regulations are to be followed when recommending chemicals making sure any used are safe for animals.
- g. Maintain, where necessary, coverings and insulation to prevent-damage by freezing.
- h. Maintain vigorous growth of vegetative coverings. This includes reseeding, fertilization and application of herbicides when necessary. Periodic mowing may also be needed to control growth.
- i. Eradicate or otherwise remove all rodents or burrowing animals. Immediately repair any damage caused by their activity.
- j. Immediately repair any vandalism, vehicular or livestock damage.

**MATERIAL SPECIFICATION  
MS-OR-303 VALVES AND METERS**

**1. SCOPE:** This material specification governs the quality of valves and meters for use in water distribution systems.

**2. MATERIALS:** The material used in manufacturing valves and meters shall conform to the following requirements:

- a. Gate Valves: AWWA Standard C500 or Federal Specification WW-V-58.
- b. Butterfly Valves: AWWA Standard C504 for Rubber-Seated Butterfly Valves.
- c. Air-Release Valves, Air-Vacuum Relief Valves, Combination Air and Vacuum Relief Valves, Pressure Reducing Valves, and Pressure Relief Valves:

<u>Material</u>	<u>Specification</u>
Cast Iron	ASTM A-48, Class 30 or ASTM A-126, Class B
Bronze	ASTM-B-61 or ASTM B-62, Grade I
Brass	Federal Specification QQ-B-626
Stainless Steel	ASTM A-167, A-276, A-582 Type 302, 303, 304 or 304L
Cast Aluminum	ASTM B-179, C-355 or C-356

- d. Meters: AWWA Standard C-704.

**3. FITTINGS:** Fittings shall conform to the following requirements:

ASTM F 405	3-6 inch diameter pipe and fittings
ASTM F 667	8-, 10-, 12-, 15-, 18-, and 24-inch diameter pipe and fittings
ASTM F 894	18- to 120-inch diameter pipe and fittings
AASHTO M 2523-	to 10-inch diameter pipe and fittings
AASHTO M 29412-	to 36-inch diameter pipe and fittings

**4. PIPE:** Corrugated polyethylene pipe shall conform to the requirements of ASTM F 405, ASTM F 667, ASTM F 894, AASHTO M 252, or AASHTO M 294 for the appropriate pipe sizes and fittings.

**MATERIAL SPECIFICATION  
MS-OR-547 PLASTIC PIPE**

**1. SCOPE:** This material specification covers the quality of Poly Vinyl Chloride (PVC), Polyethylene (PE), High Density Polyethylene (HDPE), and Acrylonitrile-Butadiene-Styrene (ABS) plastic pipe, fittings, and joint materials.

**2. MATERIAL:** The pipe shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. The dimensions of the pipe shall be measured as prescribed in ASTM D 2122. Unless otherwise specified, the pipe shall conform to the requirements listed in this specification and the applicable reference specifications in table 547-2, the requirements specified in Practice Specification 516 Pipeline, and the requirements shown on the drawings.

a. **FITTINGS AND JOINTS** shall be of a schedule, SDR or DR, pressure class, external load carrying capacity, or pipe stiffness that equals or exceeds that of the plastic pipe. The dimensions of fittings and joints shall be compatible with the pipe and measured in accordance with ASTM D 2122. Joint and fitting material shall be compatible with the pipe material. The joints and fittings shall be as uniform as commercially practicable in color, opaqueness, density, and other specified physical properties. It shall be free from visible cracks, holes, foreign inclusions, or other defects. Fittings and joints shall conform to the requirements listed in this specification, the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, the requirements specified in Practice Specification 516 Pipeline, and the requirements shown on the drawings.

b. **SOLVENTS** for solvent welded pipe joints shall be compatible with the plastic pipe used and shall conform to the requirements of the applicable specification referenced in the ASTM or AWWA specification for the pipe, fitting, or joints.

c. **RUBBER GASKETS** for pipe joints shall conform to the requirements of ASTM F 477, Elastomeric Seals (Gaskets) for Jointing Plastic Pipe.

<b>Pipe</b>		<b>Specification</b>
Poly vinyl chloride (PVC) pipe	Plastic pipe - Schedules 40, 80, 120	ASTM D 1785 ASTM D 2466
	Pressure rated pipe - SDR Series	AWWA C 900 ASTM D 2241
	Plastic drain, waste, and vent pipe and fittings	ASTM D 2665
	Joints for IPS PVC pipe using solvent weld cement	ASTM D 2672
	Composite sewer pipe	ASTM D 2680
	Profile gravity sewer pipe and fittings based on controlled inside dia.	ASTM F 794
	Corrugated sewer pipe with a smooth interior and fittings	ASTM F 949
	Pressure pipe, 4-inch through 12-inch for water distribution	AWWA C 900
Polyethylene (PE) plastic pipe	Schedule 40	ASTM D 2104
	SIDR-PR based on controlled inside diameter	ASTM D 2239
	Schedules 40 and 80 Based on outside diameter	ASTM D 2447
	SDR-PR based on controlled outside diameter	ASTM D 3035
High density polyethylene (HDPE) plastic pipe	Plastic pipe and fittings	ASTM D 3350
	SDR-PR based on controlled outside diameter	ASTM F 714
	Heat joining polyolefin pipe and fittings	ASTM D 2657
Acrylonitrile-butadiene-styrene (ABS) pipe	Plastic pipe, schedules 40 and 80	ASTM D 1527
	Composite sewer pipe	ASTM D 2680

3. **PERFORATIONS:** When perforated pipe is specified, perforations shall conform to the following requirements unless otherwise specified in Practice Specification 516 Pipeline or shown on the drawings:

a. Perforations shall be either circular or slots.

b. Circular perforations shall be  $1/4 \pm 1/16$ -inch diameter holes arranged in rows parallel to the axis of the pipe. Perforations shall be evenly spaced along each row such that the center-to-center distance between perforations is not less than eight times the perforation diameter. Perforations may appear at the ends of short and random lengths. The min. perforation opening per foot of pipe shall be as shown in table 547-1.

Nominal Pipe Size (in)	Minimum Number of Rows		Minimum Opening/Foot (in <sup>2</sup> )
	Circular	Slot	
4	2	2	0.22
6	4	2	0.44
8	4	2	0.44
10	4	2	0.44
12	6	2	0.66

Rows shall be arranged in two equal groups at equal distance from the bottom on each side of the vertical centerline of the pipe. The lowermost rows of perforations shall be separated by an arc of not less than 60 degrees or more than 125 degrees. The uppermost rows of perforations shall be separated by an arc not to exceed 166 degrees. The spacing of rows between these limits shall be uniform. The minimum number of rows shall be as shown in table 547-1.

- c. Slot perforations shall be symmetrically located in two rows, one on each side of the pipe centerline. Slot perforations shall be located within the lower quadrants of the pipe with slots no wider than 1/8 inch and spaced not to exceed 11 times the perforation width. Minimum perforation opening per lineal foot of pipe shall be as shown in table 547-1.
- d. On both the inside and outside of the pipe, perforations shall be free of cuttings or frayed edges and of any material that would reduce the effective opening.

**MATERIAL SPECIFICATION  
MS-OR-548 CORRUGATED POLYETHYLENE PIPE**

- 1. SCOPE:** The material specification covers the quality of corrugated polyethylene pipe and fittings.
- 2. PIPE:** Corrugated polyethylene pipe shall conform to the requirements of ASTM F 405, ASTM F 667, ASTM F 894, AASHTO M 252, or AASHTO M 294 for the appropriate pipe sizes and fittings.
- 3. FITTINGS:**
- |              |  |
|--------------|--|
| ASTM F 405   | 3-6 inch diameter pipe and fittings                            |
| ASTM F 667   | 8-, 10-, 12-, 15-, 18-, and 24-inch diameter pipe and fittings |
| ASTM F 894   | 18- to 120-inch diameter pipe and fittings                     |
| AASHTO M 252 | 3- to 10-inch diameter pipe and fittings                       |
| AASHTO M 294 | 12- to 36-inch diameter pipe and fittings                      |

**MATERIAL SPECIFICATION  
MS-OR-554 STEEL PIPE**

- 1. SCOPE:** This specification covers the quality of steel pipe and fittings.
- 2. PIPE:** Steel pipe shall conform to the requirements of the applicable specification listed below for the kind of pipe and the type, weight, grade, and finish specified:

<b>TABLE 554-1</b>	
<b>Pipe</b>	<b>ASTM Specification</b>
Steel, black and hot-dipped, zinc-coated welded and seamless	A 53
Steel, electric-fusion (ARC)-welded (sizes NPS 16 and over)	A 134
Electric-resistance-welded steel	A 135
Electric-fusion (ARC)-welded steel (NPS 4 and over)	A 139
<b>Pipe</b>	<b>AWWA Standard</b>
Steel water pipe, 6 inches and larger	C 200

- 3. FITTINGS:** Fittings shall conform to the requirements for the types and kinds specified.

<b>TABLE 554-2</b>	
<b>Fittings</b>	<b>ASTM Specification</b>
Heat-treated carbon steel fittings or low-temperature and corrosive service	A 858
Threaded couplings, steel, black or zinc-coated (galvanized) welded or seamless, for use in steel pipe joints	A 865

**PROJECT INSPECTION WORKSHEET**  
**To be completed on-site and included in the As-Built Record**  
**516 PIPELINE**

The following items of work are to be inspected and certified by the installer or cooperator for compliance with the requirements of the design, construction drawings and specifications.

*Provide pictures to NRCS to supplement documentation for all items checked.*

Timing	Items (checked <input checked="" type="checkbox"/> and noted items to be photo documented)	Inspection Certification
Prior to all excavation and/or site preparation	<input type="checkbox"/> Conference with NRCS, cooperator, and contractor to review basic requirements and plans. <input type="checkbox"/> Contact the local NRCS office <u>prior to</u> construction.	Signature _____ Date _____
Delivery of materials	<input type="checkbox"/> Check pipe components and appurtenances for sizing, and materials specifications and requirements.	Signature _____ Date _____
Prior to pipe placement	<input type="checkbox"/> Check alignment, grade and pipeline bedding in excavation including any road and creek crossings.	Signature _____ Date _____
During pipeline placement and prior to backfill	<input type="checkbox"/> Confirm pipeline alignment and grade prior to placement of backfill. <input type="checkbox"/> Check pipeline and appurtenances for placement, sizing, pressure rating, and materials specifications and requirements. <input type="checkbox"/> Check placement of all thrust blocks including alignment and size.	Signature _____ Date _____
During backfill	<input type="checkbox"/> Inspect backfilling operations including initial and final backfill, pipe bedding, final alignment, and placement of pipe and appurtenances.	Signature _____ Date _____
Installation of valves and controls	<input type="checkbox"/> Inspect all valves (air relief, air release, vacuum, pressure relief, pressure release and control valves) and their installation. <input type="checkbox"/> Inspect placement of any vaults and valve covers.	Signature _____ Date _____
Pipeline filling	Observe pipeline filling and operation including: <input type="checkbox"/> Leaks <input type="checkbox"/> Structural integrity throughout the system <input type="checkbox"/> Proper operation of all valves	Signature _____ Date _____
Project completion	<input type="checkbox"/> Final elevations and grades. <input type="checkbox"/> Preparation and seeding of disturbed areas.	Signature _____ Date _____
Operational test	<input type="checkbox"/> Certify operational test at design pressure and flow rate with the local NRCS office at the completion of operational test.	Signature _____ Date _____

**Cooperator's Final Certification Statement:**

*I certify that all the above inspections were completed for each item, and all items of work were installed in accordance with the design plans, drawings, and specifications prepared for this project by an approved designer and/or NRCS. All "as built" changes & modifications have been approved and documented by the designer and/or NRCS prior to installation.*

\_\_\_\_\_  
Cooperator's Signature

\_\_\_\_\_  
Date

**PROJECT INSPECTION WORKSHEET**  
*To be completed on-site and included in the As-Built Record*

**614 WATERING FACILITY**

The following items of work are to be inspected and certified by the installer or cooperater for compliance with the requirements of the design, construction drawings and specifications.

*Provide pictures to NRCS to supplement documentation for all items checked.*

Timing	Items (checked <input checked="" type="checkbox"/> and noted items to be photo documented)	Inspection Certification
Prior to all excavation and/or site preparation	<input type="checkbox"/> Conference with NRCS, cooperater, and contractor to review basic requirements and plans.	Signature _____ Date _____
	<input type="checkbox"/> Check pipeline and appurtenances, including all storage facilities, for sizing, and materials specifications and requirements.	Signature _____ Date _____
Prior to pipe/ trough placement	<input type="checkbox"/> Ensure foundation is cleared of all trees, brush, weeds, loose rock. <input type="checkbox"/> Ensure foundation surface is compacted to same density as undisturbed earth.	Signature _____ Date _____
During trough placement	<input type="checkbox"/> Confirm structure alignment and grade prior to placement of backfill. <input type="checkbox"/> Check structures and appurtenances for placement, sizing, and materials specifications and requirements. <input type="checkbox"/> Check placement of all trough and tank anchors including alignment and size.	Signature _____ Date _____
During backfill	<input type="checkbox"/> Inspect backfilling operations to ensure that all surface water will be directed away from structure. <input type="checkbox"/> Inspect guard rails (fencing) to ensure facility will not be damaged by animals.	Signature _____ Date _____
Installation of valves and controls	<input type="checkbox"/> Inspect all valves (air relief, air release, vacuum, pressure relief, pressure release and control valves) and their installation. <input type="checkbox"/> Inspect placement of any CMP to over flow areas to ensure proper drainage.	Signature _____ Date _____
Pipeline filling	<input type="checkbox"/> Observe pipeline/tank/trough filling including 1. Leaks 2. Structural integrity throughout the system 3. Proper operation of all valves	Signature _____ Date _____
Project completion	<input type="checkbox"/> Final elevations and grades. <input type="checkbox"/> Preparation and seeding of disturbed areas.	Signature _____ Date _____

**Cooperator's Final Certification Statement:**

*I certify that all the above inspections were completed for each item, and all items of work were installed in accordance with the design plans, drawings, and specifications prepared for this project by an approved designer and/or NRCS. All "as built" changes & modifications have been approved and documented by the designer and/or NRCS prior to installation.*

\_\_\_\_\_  
Cooperator's Signature

\_\_\_\_\_  
Date

## PROJECT INSPECTION WORKSHEET

*To be completed on-site and included in the As-Built Record*

### 533 – PUMPING PLANT FOR WATER CONTROL

Cooperator: \_\_\_\_\_ Tract/Fields: \_\_\_\_\_

The following items of work are to be inspected and certified by the installer or cooperator for compliance with the requirements of the design, construction drawings and specifications.

*Provide pictures to NRCS to supplement documentation for all items checked.*

<i>Timing</i>	Items (checked <input checked="" type="checkbox"/> and noted items to be photo documented)	Inspection/Certification
Prior to all excavation	<input type="checkbox"/> Conference with client and NRCS to review the EQIP contract and the project budget. <input type="checkbox"/> Conference with vendor, client, and contractor to review basic requirements and plans. <input type="checkbox"/> Contact the local NRCS office <u>prior</u> to construction.	Signature _____ Date _____
	<input type="checkbox"/> Design layout including staking locations of structures and power supply lines if appropriate.	Signature _____ Date _____
Prior to placement of concrete pump pad	<input type="checkbox"/> Confirm concrete for pump pad meets construction specifications. <input type="checkbox"/> Check reinforcing steel type, condition, spacing, size, anchoring, etc.	Signature _____ Date _____
During pump placement and prior to any backfill	<input type="checkbox"/> Confirm nameplate data on pump and motor. <input type="checkbox"/> Confirm locations and alignment of all structures and appurtenances. <input type="checkbox"/> If required, check pump inlet to assure available NPSH is sufficient. <input type="checkbox"/> Check associated pipeline and appurtenances for placement, sizing, and materials specifications and requirements. <input type="checkbox"/> Check placement of any thrust blocks including alignment and size.	Signature _____ Date _____
Prior to pump operation and initial start-up	<input type="checkbox"/> Inspect all hydraulic components. <input type="checkbox"/> Inlet and discharge connections are adequately supported. <input type="checkbox"/> Check safety devices to assure that they are operational.	Signature _____ Date _____
Operational test	<input type="checkbox"/> Certify proper operation at design flow rate and pressure with the local NRCS office at the completion of operational test.	Signature _____ Date _____

**Cooperator's Final Certification Statement:**

*I certify that all the above inspections were completed for each item, and all items of work were installed in accordance with the design plans, drawings, and specifications prepared for this project by an approved designer and/or NRCS. All "as built" changes & modifications have been approved and documented by the designer and/or NRCS, prior to installation.*

\_\_\_\_\_  
Cooperator's Signature

\_\_\_\_\_  
Date

**PROJECT INSPECTION WORKSHEET**  
*To be completed on-site and included in the As-Built Record*

**574 SPRING DEVELOPMENT**

The following items of work are to be inspected and certified by the installer or cooperator for compliance with the requirements of the design, construction drawings and specifications.

*Provide pictures to NRCS to supplement documentation for all items checked.*

<b>Timing</b>	<b>Items (checked <input checked="" type="checkbox"/> and noted items to be photo documented)</b>	<b>Inspection Certification</b>
Prior to all excavation and/or site preparation	<input type="checkbox"/> Conference with NRCS, cooperator, and contractor to review basic requirements and plans	Signature _____ Date _____
	<input type="checkbox"/> Check all materials, pipe, and appurtenances sizing and materials specifications and requirements	Signature _____ Date _____
Prior to pipe placement	<input type="checkbox"/> Ensure trench is located properly to collect emerging water <input type="checkbox"/> Ensure trench depth reaches an impermeable layer <input type="checkbox"/> Ensure trench length is the minimum size to collect the required flow	Signature _____ Date _____
During pipeline and spring box placement	<input type="checkbox"/> Confirm pipeline alignment and grade prior to placement of backfill <input type="checkbox"/> Confirm spring box elevation and alignment prior to placement of backfill <input type="checkbox"/> Check pipeline, erosion fabric and appurtenances for placement, sizing, and materials specifications and requirements <input type="checkbox"/> Check placement of gravel and soil backfill	Signature _____ Date _____
During backfill	<input type="checkbox"/> Inspect backfilling operations to ensure that all surface water will be directed away from development <input type="checkbox"/> Inspect air vent and clay dam placement	Signature _____ Date _____
Project completion	<input type="checkbox"/> Final elevations and grades <input type="checkbox"/> Preparation and seeding	Signature _____ Date _____

**Cooperator's Final Certification Statement:**

*I certify that all the above inspections were completed for each item, and all items of work were installed in accordance with the design plans, drawings, and specifications prepared for this project by an approved designer and/or NRCS. All "as built" changes & modifications have been approved and documented by the designer and/or NRCS prior to installation.*

\_\_\_\_\_  
Cooperator's Signature

\_\_\_\_\_  
Date

**PIPELINE DESIGN PARAMETERS**

Landowner/Operator: Hendricks  
 Job: \_\_\_\_\_

Depth of pipe cover (in) = **30**

Notes:

Mainline
Worst Case

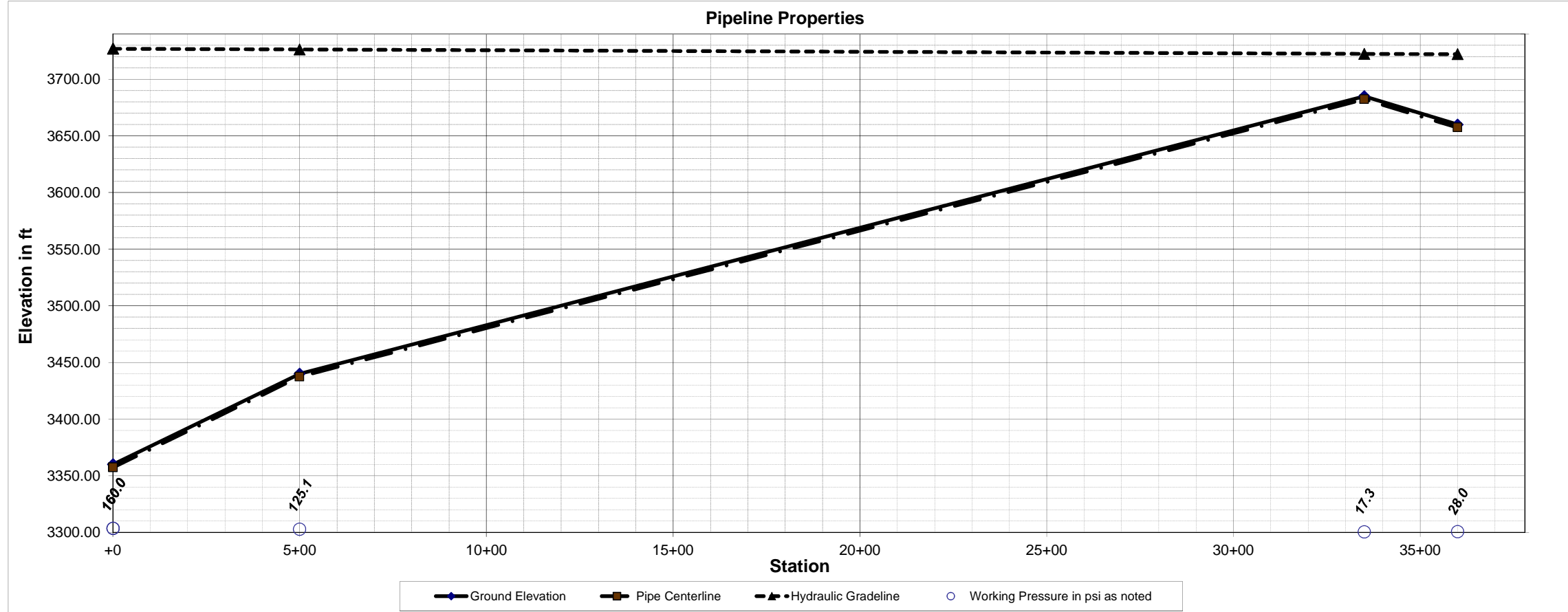
Working Pressure at pipeline inlet: **160.0** psi

Static Pressure at pipeline inlet: **160.0** psi

Governing Reach No.: \_\_\_\_\_

Required Working Pressure at downstream end of governing reach: \_\_\_\_\_ psi

COMPONENT DESCRIPTION	REACH No.	STATION	GROUND ELEVATION	REACH LENGTH	PIPE CENTERLINE ELEVATION	PIPE INVERT ELEVATION	FLOW RATE	PIPE TYPE	NOMINAL PIPE DIAMETER	PIPE CLASS	SDR	HAZEN-WILLIAMS COEFF.	FLOW VELOCITY	HEAD LOSS RATE	FRICTION HEAD LOSS	MINOR LOSS K factor	MINOR LOSSES	INCREMENT HEADLOSS	CUMULATIVE HEADLOSS	HYDRAULIC GRADELINE AT WORK	WORKING PRESSURE	STATIC PRESSURE	PRESSURE CHECK
UNITS -->		(ft)	(ft)	(ft)	(ft)	(ft)	(gpm)		(Inches)	(Press Rating)		(CH)	(ft/s)	(ft/100 ft)	(ft)	K = $h_L/(V^2/2g)$	(ft)	(ft)	(ft)	(ft)	(psi)	(psi)	(Note comment)
(Data Entry)		(Data Entry)	(Data Entry)		(Note comment)		(Data Entry)		(Data Entry)	(Data Entry)		(Data Entry)				(Data Entry)		(Friction + Minor)					(Note comment)
<b>INLET</b>		<b>+0</b>	<b>3360.00</b>		3357.40	3357.30														<b>3727.00</b>	<b>160.0</b>	<b>160.0</b>	Pressure Danger
Pump	1	+1	3360.00	1.00	3357.40	3357.30	6.7	HDPE	2 IPS	200	9.0	150	0.82	0.176	0.00	1.00	0.01	0.01	0.01	3726.99	160.0	160.0	Pressure Danger
transition	2	5+00	3440.00	499.00	3437.40	3437.30	6.7	HDPE	2 IPS	160	11.0	150	0.74	0.136	0.68	1.00	0.01	0.69	0.70	3726.30	125.1	125.4	Pressure Danger
Cistern	3	33+50	3685.00	2850.00	3682.40	3682.30	6.7	HDPE	2 IPS	160	11.0	150	0.74	0.136	3.86	1.00	0.01	3.87	4.57	3722.43	17.3	19.3	OK
Trough	4	36+00	3660.00	250.00	3657.40	3657.30	6.7	HDPE	2 IPS	160	11.0	150	0.74	0.136	0.34	1.00	0.01	0.35	4.92	3722.08	28.0	30.1	OK
	5																						
	6																						
	7																						
	8																						
	9																						
	10																						
	11																						
	12																						
	13																						
	14																						
<b>Totals</b>				<b>3,600</b>																			



**Friction Loss Characteristics**

**PVC Schedule 40 IPS Plastic Pipe**

(1120, 1220) C=150

psi Loss Per 100 Feet of Pipe (psi/100 ft.)

Sizes 1/2" through 6" Flow 1 through 600 GPM

Size	1/2"		3/4"		1"		1 1/4"		1 1/2"		2"		2 1/2"		3"		4"		6"	
O.D.	0.840		1.050		1.315		1.660		1.900		2.375		2.875		3.500		4.500		6.625	
I.D.	0.622		0.824		1.049		1.380		1.610		2.067		2.469		3.068		4.026		6.065	
Wall Thk	0.109		0.113		0.133		0.140		0.145		0.154		0.203		0.216		0.237		0.280	
Flow GPM	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss	Velocity fps	psi Loss
1	1.05	0.43	0.60	0.11	0.37	0.03	0.21	0.01	0.15	0.00										
2	2.11	1.55	1.20	0.39	0.74	0.12	0.42	0.03	0.31	0.02	0.19	0.00								
3	3.16	3.28	1.80	0.84	1.11	0.26	0.64	0.07	0.47	0.03	0.28	0.01	0.20	0.00						
4	4.22	5.60	2.40	1.42	1.48	0.44	0.85	0.12	0.62	0.05	0.38	0.02	0.26	0.01						
5	5.27	8.46	3.00	2.15	1.85	0.66	1.07	0.18	0.78	0.08	0.47	0.02	0.33	0.01	0.21	0.00				
6	6.33	11.86	3.60	3.02	2.22	0.93	1.28	0.25	0.94	0.12	0.57	0.03	0.40	0.01	0.26	0.01				
7	7.38	15.77	4.20	4.01	2.59	1.24	1.49	0.33	1.10	0.15	0.66	0.05	0.46	0.02	0.30	0.01				
8	8.44	20.20	4.80	5.14	2.96	1.59	1.71	0.42	1.25	0.20	0.76	0.06	0.53	0.02	0.34	0.01				
9	9.49	25.12	5.40	6.39	3.33	1.97	1.92	0.52	1.41	0.25	0.85	0.07	0.60	0.03	0.39	0.01				
10	10.55	30.54	6.00	7.77	3.70	2.40	2.14	0.63	1.57	0.30	0.95	0.09	0.66	0.04	0.43	0.01				
11	11.60	36.43	6.60	9.27	4.07	2.86	2.35	0.75	1.73	0.36	1.05	0.11	0.73	0.04	0.47	0.02				
12	12.65	42.80	7.21	10.89	4.44	3.36	2.57	0.89	1.88	0.42	1.14	0.12	0.80	0.05	0.52	0.02	0.30	0.00		
14	14.76	56.94	8.41	14.48	5.19	4.47	2.99	1.18	2.20	0.56	1.33	0.17	0.93	0.07	0.60	0.02	0.35	0.01		
16	16.87	72.92	9.61	18.55	5.93	5.73	3.42	1.51	2.51	0.71	1.52	0.21	1.07	0.09	0.69	0.03	0.40	0.01		
18	18.98	90.69	10.81	23.07	6.67	7.13	3.85	1.88	2.83	0.89	1.71	0.26	1.20	0.11	0.78	0.04	0.45	0.01		
20	21.09	110.23	12.01	28.04	7.41	8.66	4.28	2.28	3.14	1.08	1.90	0.32	1.33	0.13	0.86	0.05	0.50	0.01		
22			13.21	33.45	8.15	10.33	4.71	2.72	3.46	1.29	2.10	0.38	1.47	0.16	0.95	0.06	0.55	0.01		
24			14.42	39.30	8.89	12.14	5.14	3.20	3.77	1.51	2.29	0.45	1.60	0.19	1.04	0.07	0.60	0.02		
26			15.62	45.58	9.64	14.08	5.57	3.17	4.09	1.75	2.48	0.52	1.74	0.22	1.12	0.08	0.65	0.02		
28			16.82	52.28	10.38	16.15	5.99	4.25	4.40	2.01	2.67	0.60	1.87	0.25	1.21	0.09	0.70	0.02		
30			18.02	59.41	11.12	18.35	6.42	4.83	4.72	2.28	2.86	0.68	2.00	0.29	1.30	0.10	0.75	0.03		
35					12.97	24.42	7.49	6.43	5.50	3.04	3.34	0.90	2.34	0.38	1.51	0.13	0.88	0.04	0.38	0.00
40					14.83	31.27	8.56	8.23	6.29	3.89	3.81	1.15	2.67	0.49	1.73	0.17	1.00	0.04	0.44	0.01
45					16.68	38.89	9.64	10.24	7.08	4.84	4.29	1.43	3.01	0.60	1.95	0.21	1.13	0.06	0.49	0.01
50					18.53	47.27	10.71	12.45	7.87	5.88	4.77	1.74	3.34	0.73	2.16	0.26	1.25	0.07	0.55	0.01
55						11.78	14.85	8.65	7.01	5.25	2.08	3.68	0.88	2.38	0.30	1.38	0.08	0.61	0.01	
60						12.85	17.45	9.44	8.24	5.72	2.44	4.01	1.03	2.60	0.36	1.51	0.10	0.66	0.01	
65						13.92	20.23	10.23	9.56	6.20	2.83	4.35	1.19	2.81	0.41	1.63	0.11	0.72	0.02	
70						14.99	23.21	11.01	10.96	6.68	3.25	4.68	1.37	3.03	0.48	1.76	0.13	0.77	0.02	
75						16.06	26.37	11.80	12.46	7.16	3.69	5.01	1.56	3.25	0.54	1.88	0.14	0.83	0.02	
80						17.13	29.72	12.59	14.04	7.63	4.16	5.35	1.75	3.46	0.61	2.01	0.16	0.88	0.02	
85						18.21	33.26	13.37	15.71	8.11	4.66	5.68	1.96	3.68	0.68	2.13	0.18	0.94	0.02	
90						19.28	36.97	14.16	17.46	8.59	5.18	6.02	2.18	3.90	0.76	2.26	0.20	0.99	0.03	
95								14.95	19.30	9.07	5.72	6.35	2.41	4.11	0.84	2.39	0.22	1.05	0.03	
100								15.74	21.22	9.54	6.29	6.69	2.65	4.33	0.92	2.51	0.25	1.10	0.03	
110								17.31	25.32	10.50	7.51	7.36	3.16	4.76	1.10	2.76	0.29	1.22	0.04	
120								18.88	29.75	11.45	8.82	8.03	3.72	5.20	1.29	3.02	0.34	1.33	0.05	
130										12.41	10.23	8.70	4.31	5.63	1.50	3.27	0.40	1.44	0.05	
140										13.36	11.74	9.37	4.94	6.06	1.72	3.52	0.46	1.55	0.06	
150										14.32	13.33	10.03	5.62	6.50	1.95	3.77	0.52	1.66	0.07	
160										15.27	15.03	10.70	6.33	6.93	2.20	4.02	0.59	1.77	0.08	
170										16.23	16.81	11.37	7.08	7.36	2.46	4.27	0.66	1.88	0.09	
180										17.18	18.69	12.04	7.87	7.80	2.74	4.53	0.73	1.99	0.10	
190										18.14	20.66	12.71	8.70	8.23	3.02	4.78	0.81	2.10	0.11	
200										19.09	22.72	13.38	9.57	8.66	3.33	5.03	0.89	2.21	0.12	
225												15.05	11.90	9.75	4.14	5.66	1.10	2.49	0.15	
250												16.73	14.47	10.83	5.03	6.29	1.34	2.77	0.18	
275												18.40	17.26	11.92	6.00	6.92	1.60	3.05	0.22	
300														13.00	7.05	7.55	1.88	3.32	0.26	
325														14.08	8.17	8.18	2.18	3.60	0.30	
350														15.17	9.38	8.81	2.50	3.88	0.34	
375														16.25	10.65	9.43	2.84	4.15	0.39	
400														17.33	12.01	10.06	3.20	4.43	0.44	
425														18.42	13.43	10.69	3.58	4.71	0.49	
450														19.50	14.93	11.32	3.98	4.99	0.54	
475															11.95	4.40	5.26	0.60		
500															12.58	4.84	5.54	0.66		
550															13.84	5.77	6.10	0.79		
600															15.10	6.78	6.65	0.92		

Note: Dark shaded area of chart indicates velocities over 5' per second. Use with caution.

Velocity of flow values are computed from the general equation  $V = .408 \frac{Q}{d^2}$

Friction pressure loss values are computed from the equation:  $[hf = 0.2083 \left(\frac{100}{c}\right)^{1.852} \frac{0.1852}{0.4866} ] \times 4.33$  for psi loss per 100' of pipe





# Oregon Solar-Powered Pump System Calculator

The following analysis references the Oregon Engineering Technical Note 28: Design of Small Photovoltaic (PVC) Solar-Powered Water Pump Systems Issued October 2010.

## 1. Determine water requirements

1a.	Water Usage (gal/day)	Number/Quantity	Total
Livestock	20	60	1,200
Wildlife			
Plants/crops			
Other (fill-in)			
Other (fill-in)			
Other (fill-in)			
Other (fill-in)			
<b>Total Water Requirement (gal/day)</b>			<b>1,200</b>

1b.	Days of storage (recommended min is 3)	3
	Water storage target (gallons)	<b>3,600</b>

Animal or Crop	Approximate Water Usage (gal/day) <sup>1</sup>	
	Western Oregon	Eastern Oregon
Milking Cow	20-25	20-25
Dry Cow	10-15	15-20
Calf	6-10	10-15
Cow-Calf Pair	15-20	20-25
Beef Cattle	8-12	20-25
Sheep or Goat	3-5	5-8
Horse	12	20-25
Swine, Finishing	3-5	3-5
Swine, Nursery	1	1
Swine, Sow and Litter	8	8
Swine, Gestating Sow	6	6
Elk	4	7
Deer	2-3	3
100 Chickens	9	9
100 Turkeys	15	15
Irrigated Crops	Use local crop consumptive use data.	
Young Trees (in dry weather)	15	15

## 2. Determine Total Storage

	Storage (gal)	Number	Total Storage
Tank (1) size	3,000	1	3,000
Tank (2) Size	800	4	3,200
Trough (1) Size			
Trough (2) size			
Trough (3) size			

2,600

Calculation Help

**= Total Water Stored - Total Water Needed**  
 green and positive indicates storage capacity is met. Red and negative indicates the storage capacity is insufficient

Total Water Storage (gal) **6,200**

## Oregon Solar-Powered Pump System Calculator

### 3. Determine the solar insolation values for the project site

Use Step 3a **OR** Step 3b to determine solar insolation values for project site

**3a** Site specific values may be obtained using NREL's PVWatts v.1 or v.2 as described on page 5 of the Technical Note.

[PVWatts v.1 \(Site Specific Data\)](#)

[PVWatts v.2 \(Grid Data\)](#)

**3b** The numbers below are solar insolation values obtained from the published WBAN for 8 fixed locations in and around OR.

Redmond ▼

Using (Latitude - 15 degrees) for "summer months" and (Latitude + 15 degrees) for "winter months". WBAN values were copied into worksheets contained in this spreadsheet.

#### Solar Insolation Values for 6 "summer months" of solar panel usage (kWh/m<sup>2</sup>/day)

Average kWh/m <sup>2</sup> /day or peak sun hours per day	April	May	Jun	Jul	Aug	Sep	Avg. Peak Sun Hrs
	5.9	6.6	7	7.6	7.1	6.3	<b>6.8</b>

#### Solar Insolation Values for 6 "winter months" of solar panel usage (kWh/m<sup>2</sup>/day)

Average kWh/m <sup>2</sup> /day or peak sun hours per day	Oct	Nov	Dec	Jan	Feb	March	Avg. Off-Peak Sun Hrs
	5.1	3.3	2.9	3.1	3.9	4.8	3.9

### 3c Input solar insolation value to be used in the design

Design Solar Insolation Value (Kwh/m <sup>2</sup> /day) to be carried forward in step 6 to calculate the design flow rate for the pump.	3.0
---	-----

### 4. Design Flowrate for Pump

Daily Water Need (gal) divided by	1,200.0	Note: Design Peak Sun Hrs comes from Step 3c
(Design solar insolation*60min/hr)	180.0	

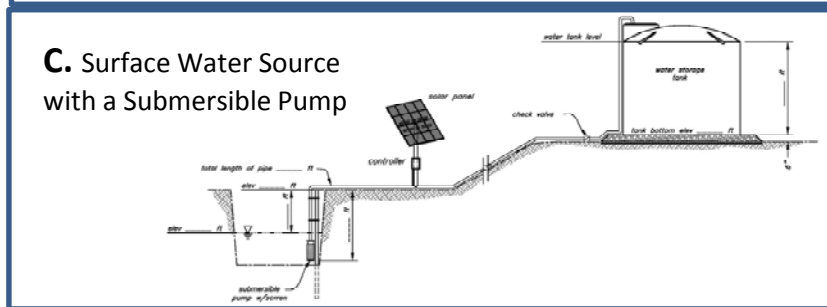
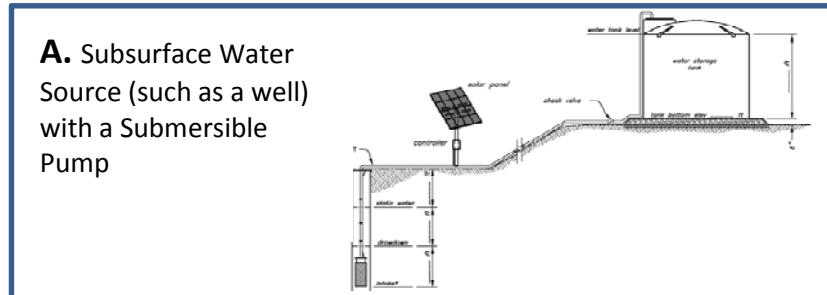
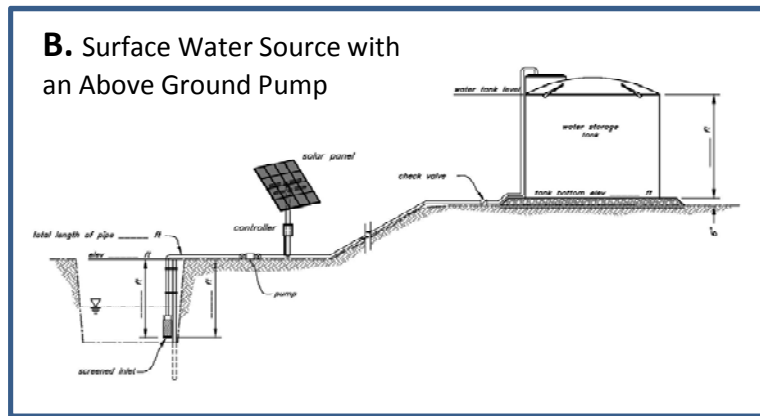
Avg Winter Sun Hrs * 60min/hr	231.0
<b>Design Flowrate for Pump (gpm)</b>	<b>6.7</b>

## Oregon Solar-Powered Pump System Calculator

### 5. Identify Water Source and System Layout

Select A, B, or C

click on an image to enter design values for proposed system



### 6. Determine Total Dynamic Head for the Pump

Vertical Lift (ft) <sup>1</sup>	331
Pressure Head (ft) <sup>2,3</sup>	34
Friction Loss estimate (ft) <sup>4</sup>	5
<b>TDH (ft)</b>	<b>370.0</b>
Design TDH (ft) <sup>5</sup>	370

<sup>5</sup> Design TDH is the value to be used in the selection of the pump. The design TDH may be equal to the calculated TDH above or adjusted to account for any additional losses not accounted for in the above calculations

## Oregon Solar-Powered Pump System Calculator

### 7. Selection of Solar Electric Pump

7a. Use the values listed below to select an appropriate pump from a manufacturer's pump curve

Flow Rate (gpm)	6.7
TDH (ft)	370

7b. Select number of pumps to be used in design

Single pump system ▼

Enter minimum power need as determined for selected pump (Watts)	563
Enter minimum current need as determined for selected pump (Amps)	23.5
Enter minimum voltage need as determined for selected pump (Volts)	24.0



Input the required watts, amps, and volts specified by the manufacturer. Note Watts = Amps\*Volts. An example of a manufacturer's pump curve is shown on page 13 of Technical Note 28.

### 8. Selection of PV Panel and Array Layout

8a. Minimum output needed (Watts)

Min power needed to operate pump (Watts)	562.5	<sup>6</sup> 25% increase based on manufacturer's recommendation to account for age, dust, deterioration, etc
Increase by 25% <sup>6</sup>	25%	
Min output needed (Watts)	703.1	

8b. Characteristics of Single PV Panel (determined from PV manufacturer's literature)

Peak Power Output (Watts)	96
Peak Output Current (Amps <sub>mp</sub> )	8
Peak Output Voltage (Volts <sub>mp</sub> )	12

} Note: Watts = Amps\*Volts.

**8c. Minimum number of panels needed to power pump**

	Watts	Amps	Volts	Minimum number of panels based on a simple series-parallel wiring configuration <b>8</b>
Min needed (from 7c and 8a for Watts)	703	23.5	24.0	
Peak output of one panel (from 8b)	96	8	12	
Number of panels needed <sup>7</sup> (line1/line2)	8	3	2	
Total Wattage of System	768	<sup>7</sup> If more than one panel is needed, go to Step 8d		

## Oregon Solar-Powered Pump System Calculator

**8d. Wiring (only necessary if more than 1 panel is needed as determined in step 8c)<sup>8</sup>**

- From Step 8c:
- If Panel Amps < Pump Amps, wire panels in parallel
  - If Panel Volts < Pump Volts, wire panels in series

Simple Series-Parallel configuration

[Appendix J:  
Solar Panel  
Wiring](#)

<sup>8</sup>This is a basic recommendation and represents only one possible configuration. It may not necessarily represent the optimum wiring configuration. Custom wiring may require the use of DC-AC inverters and/or transformers and is beyond the scope of this calculator.

**Series**

min. # of panels that will be wired together in series to meet pump requirements	2
Voltage of individual panel (Volts)	12
Output Voltage of System (Volts)	<b>24</b>

**Parallel**

min. # of panel series that will be wired together in parallel to meet pump requirements	4
Current of individual panel (Amps)	8
Output Current of System (Amps)	<b>32</b>

**9. Check pressure at point of delivery (livestock watering troughs)**

Elevation of trough (ft)	3660
Elevation of tank (ft)	3691
Distance from tank to trough (ft)	250
Tank Pressure Head (ft)	0.5
Friction Loss (ft) over 100 ft of pipe	0.0015
Pressure req. to activate float valve (psi)	1

Note this step is used as a check only

Assume 0.5 ft to conservatively assume the tank is near empty

-- converted to -->  ft

Pressure Head at the Trough =	(Elev + Tank Pressure Head) <sub>tank</sub> - (Elev) <sub>trough</sub> - friction loss
<b>31.5</b>	= 3691 + 0.5 - 3660 - 0.0

Pressure Head at Trough (ft)	31.5	Acceptable
Pressure required to activate float valve (ft)	2.3	

## Oregon Solar-Powered Pump System Calculator

### 10. Summary of Solar Panel Design Requirements and Mounting Details

10a. See standard drawings located in Appendix F of the Technical Note

10b. Input the following

Pump Name and Manufacturer

Pump	
563	Watts
23.5	Amps
24.0	Volts

AND

Wiring <sup>8</sup>	
4	parallel
2	series
	custom

Characteristics of Single PV Panel	
96.0	Watts
8.0	Amps
12.0	Volts
8	in the design based on Step 8c

<sup>8</sup>This is a basic recommendation based on a simple series-parallel wiring configuration and represents only one possible configuration. It may not represent the optimum wiring configuration. Custom wiring using DC-AC inverters and/or transformers is beyond the scope of this calculator.

10c. **Water Source:** Surface Water Source with Submersible Pump

10d. **See standard drawings in technical note for recommendations for mounting details**

# RUTH BOWMAN LIVESTOCK

UNION COUNTY, OREGON

PREPARED BY: NRCS LA GRANDE, OR FIELD OFFICE

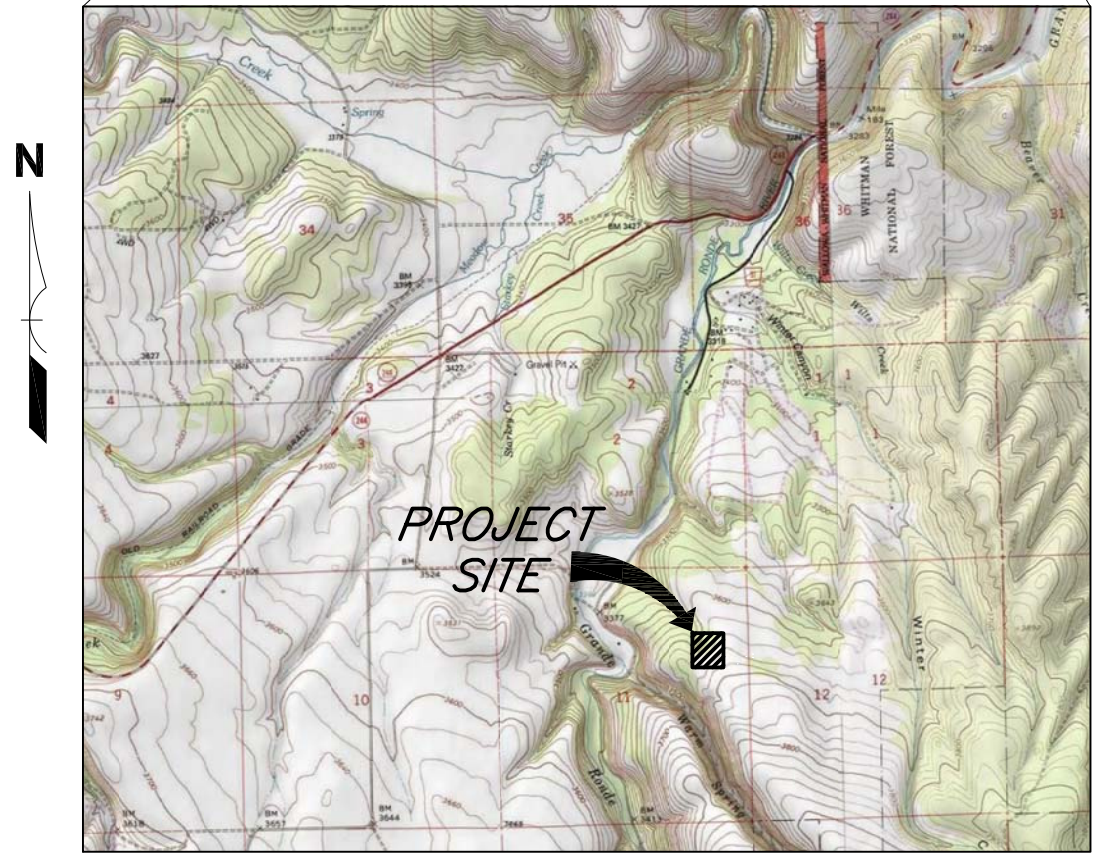
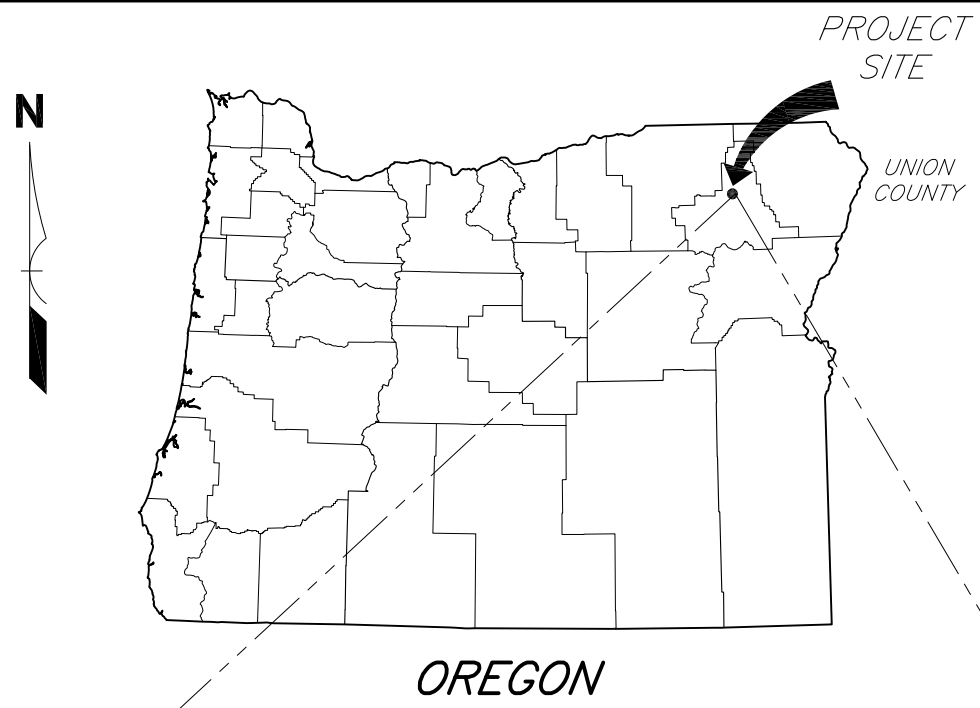
UNITED STATES DEPARTMENT OF AGRICULTURE NATURAL  
RESOURCES CONSERVATION SERVICE

Date \_\_\_\_\_  
Designed - JBK, STP \_\_\_\_\_ 08/18  
Drawn - JBK, STP \_\_\_\_\_ 08/18  
Checked - JIC \_\_\_\_\_ 08/18  
Approved \_\_\_\_\_  
Title \_\_\_\_\_

COVER SHEET  
RUTH BOWMAN LIVESTOCK  
JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

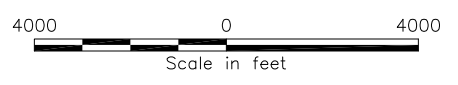
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Department of  
Agriculture  
Natural Resources  
Conservation Service

File Name  
RuthBowman  
Drawing No.  
Sheet 1 of 19



## LOCATION MAP

T4S, R35W, SEC 11 & 12  
WALLOWA COUNTY, OREGON



## INDEX OF DRAWINGS

SHEET NO.	TITLE
1.	Cover Sheet
2.	Plan View
3.	Plan and Profile 1
4.	Plan and Profile 2
5.	Plan and Profile 3
6.	Sump Detail
7-9.	Trough Details
10.	Cistern Details
11.	Trench and Drain Details
12.	Heavy Use Details
13-16.	Escape Ramp Details
17.	Solar Pump Details
18.	Watering Information
19-22.	Spring Development

## ESTIMATED QUANTITIES

2" Class 200 HDPE pipe	500 ft
2" Class 160 HDPE Pipe	3330 ft
800 gal. aluminum troughs	5
30 in. CMP culvert sump	10 - 20 ft
3/4 hp submersible pump	1
2" sch. 40 steel pipe	100
3000 gal. cistern	1
Solar panel set up	1
1" air vent	1
Lid for sump	1
Spring Development	2

Quantities are estimates only, based on topographic survey data and design drawings. The Contractor shall check quantities before entering into a contract with the landowner or NRCS.



## GENERAL NOTES

1. Contour interval on all drawings is 1 foot.
2. Elevations and coordinate locations are based on NAD 83.
3. All stationing refers to centerline of construction and is the measured horizontal distance.
4. Slopes designated as 2:1, 1.5:1, et cetera, are the ratios of horizontal distance to vertical distance.
5. All existing conditions are to be verified in the field prior to construction and any adjustments to the drawings shall be made as directed by the Project Engineer.
6. Dimensions are given in feet and tenths of a foot.
7. Topography and cross section ground lines are based on survey work performed in 07/2018.
8. Existing private improvements, which lie within the construction limits, unless otherwise noted will be removed by the owner prior to construction, or abandoned in place.
9. Protect all trees and land areas not located within the project construction or earthwork limit. Exercise care in areas not so marked to avoid unnecessary damage to natural vegetation.
10. Construction shall meet the requirements of OSHA. Actual slopes shall not exceed the slopes as indicated on drawings.
11. NRCS makes no representations as to the existence or non-existence of utilities. It is the responsibility of land owners or operators to comply with the provisions of ORS 757.541 to 757.571. Land owners or operators and contractors will be liable for any damage resulting from disruption of service caused by construction activities.
12. Contractor is required to attend a pre-construction meeting with NRCS and the landowner.

I UNDERSTAND THAT THIS IS MY PROJECT. I HAVE RECEIVED A COPY OF ALL DRAWINGS AND SPECIFICATIONS TO BE USED ON THIS PROJECT. I AGREE TO IMPLEMENT THE PROJECT IN ACCORDANCE WITH THE DRAWING SET AND SPECIFICATIONS PROVIDED. ANY ALTERATIONS TO THE DESIGN WILL BE APPROVED BY NRCS PRIOR TO INSTALLATION.

LANDOWNER SIGNATURE/DATE \_\_\_\_\_

ATTENTION: Construction must be in conformance with these NRCS-approved drawings and specifications. No changes or modifications shall be made to these designs without full prior approval of the designer. Any material deviation from these drawings and specifications may constitute a breach of contract resulting in a discharge of NRCS from its obligation to provide cost-share under terms of the NRCS contract.

N

**Construction Notes:**

1. Minimum 18 inch depth of cover over pipe, see Trench Detail, Sheet 11.
2. Size submersible pump for 6.7 gpm at 325 ft static head; Assuming 60 pair, 20 gal/day/cow, 1200 gal daily use, est. 3 hr pump time.
3. Pump shut-off control is required; use timer or telemetry float switch.
4. Sump max. 20 ft deep, min. 30 in diameter cmp, see Sump Detail, Sheet 6.
5. Cistern must have overflow and hardened foundation. See Cistern Detail, Sheet 10.
6. Troughs must have: float valves, animal escape ramp, hardened surface 8 ft out, all above surface pipe must be metal, and trough must be properly secured. See Trough Detail, Sheets 7-9.
7. Solar panels shall be fenced. NRCS recommends protecting panels from vandalism.

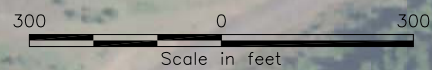
Pump  
Solar Panel  
20 ft cmp sump

500 ft - 2 in HDPE 200 psi  
3100 ft - 2 in HDPE 160 psi

Air valve

Four 800 gal  
aluminum  
troughs

3000 gal cistern

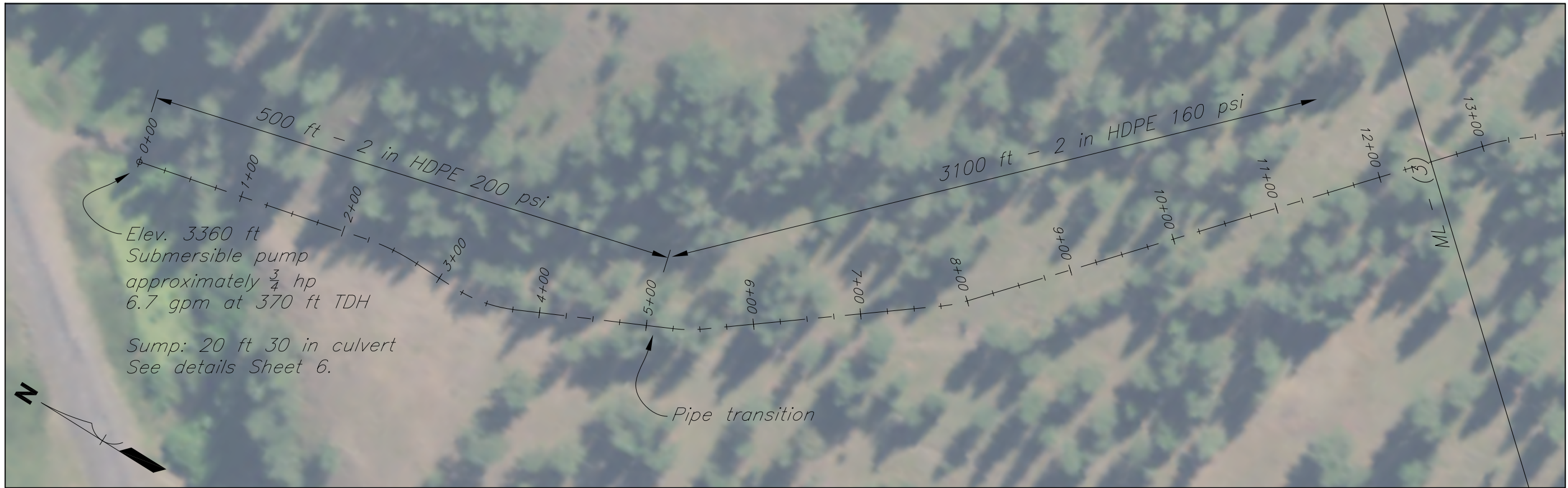


Date	08/18
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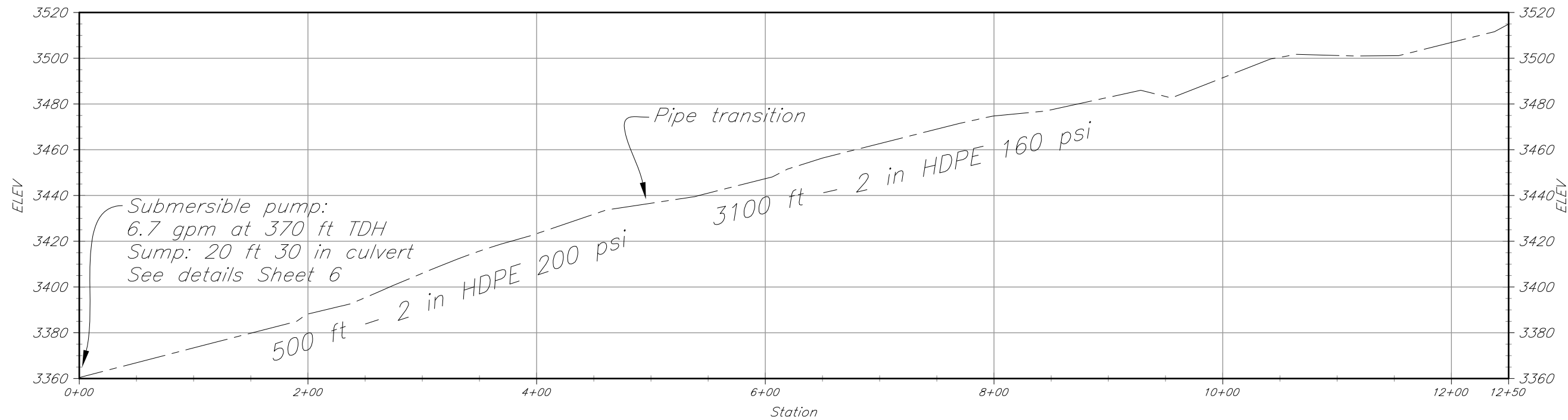
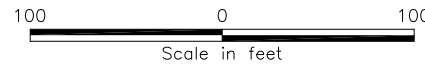
**PLAN VIEW**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY



File Name	RuthBowman
Drawing No.	



PLAN VIEW



PROFILE ALONG CENTERLINE

Date	08/18
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PLAN AND PROFILE 1

RUTH BOWMAN LIVESTOCK

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 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

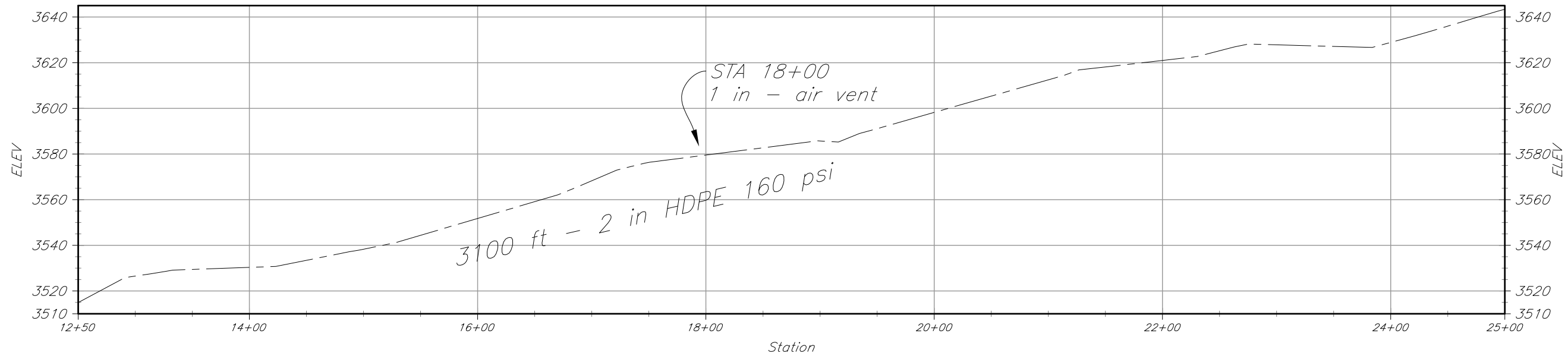
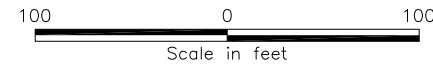
United States  
 Department of  
 Agriculture  
 Natural Resources  
 Conservation Service

File Name  
RuthBowman

Drawing No.



PLAN VIEW



PROFILE ALONG CENTERLINE

Date	08/18
Designed	JBK, STP
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Checked	JIC
Approved	
Title	

PLAN AND PROFILE 2

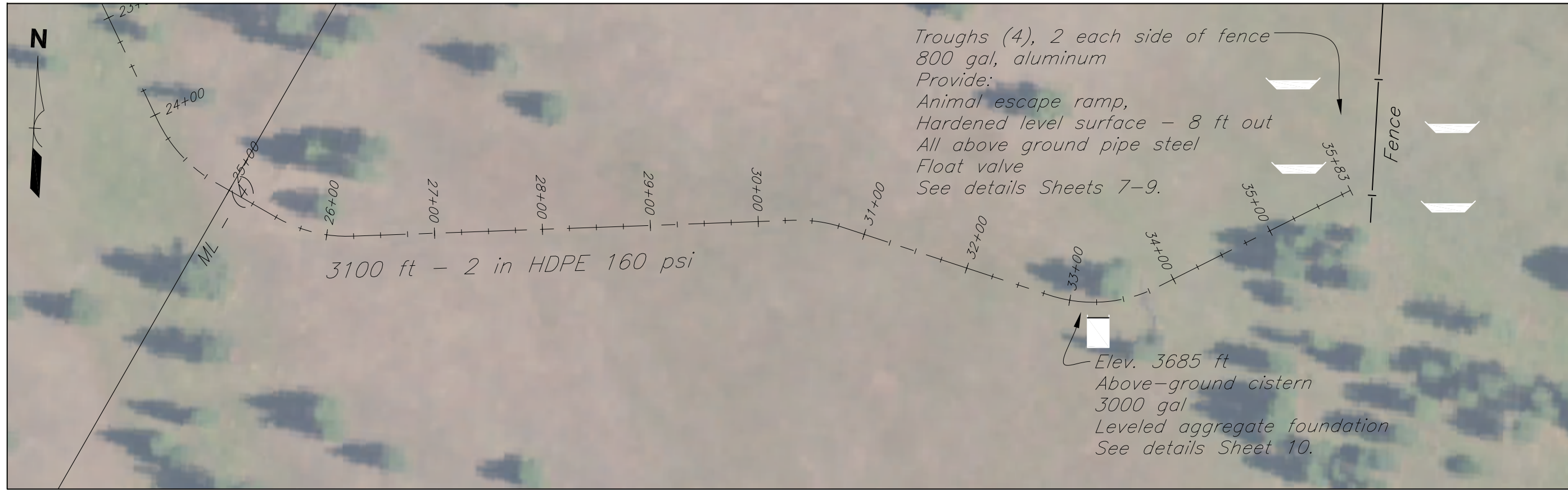
RUTH BOWMAN LIVESTOCK

JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

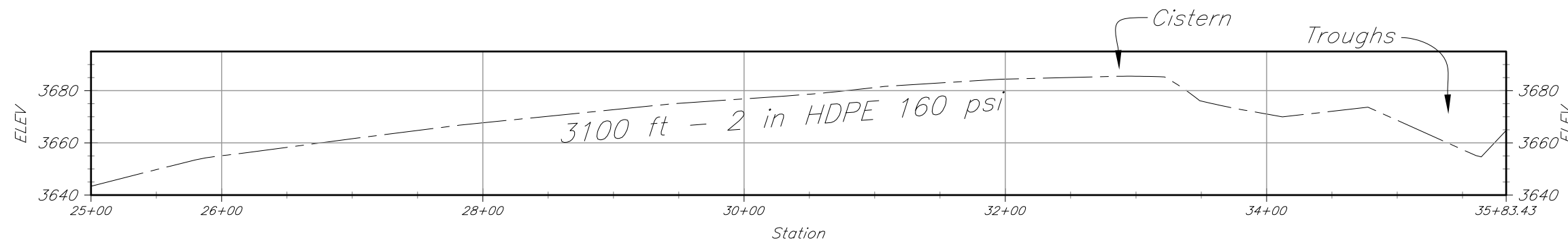
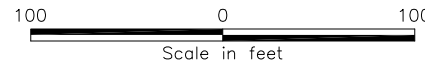


United States Department of Agriculture  
 Natural Resources Conservation Service

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Drawing No.	



**PLAN VIEW**



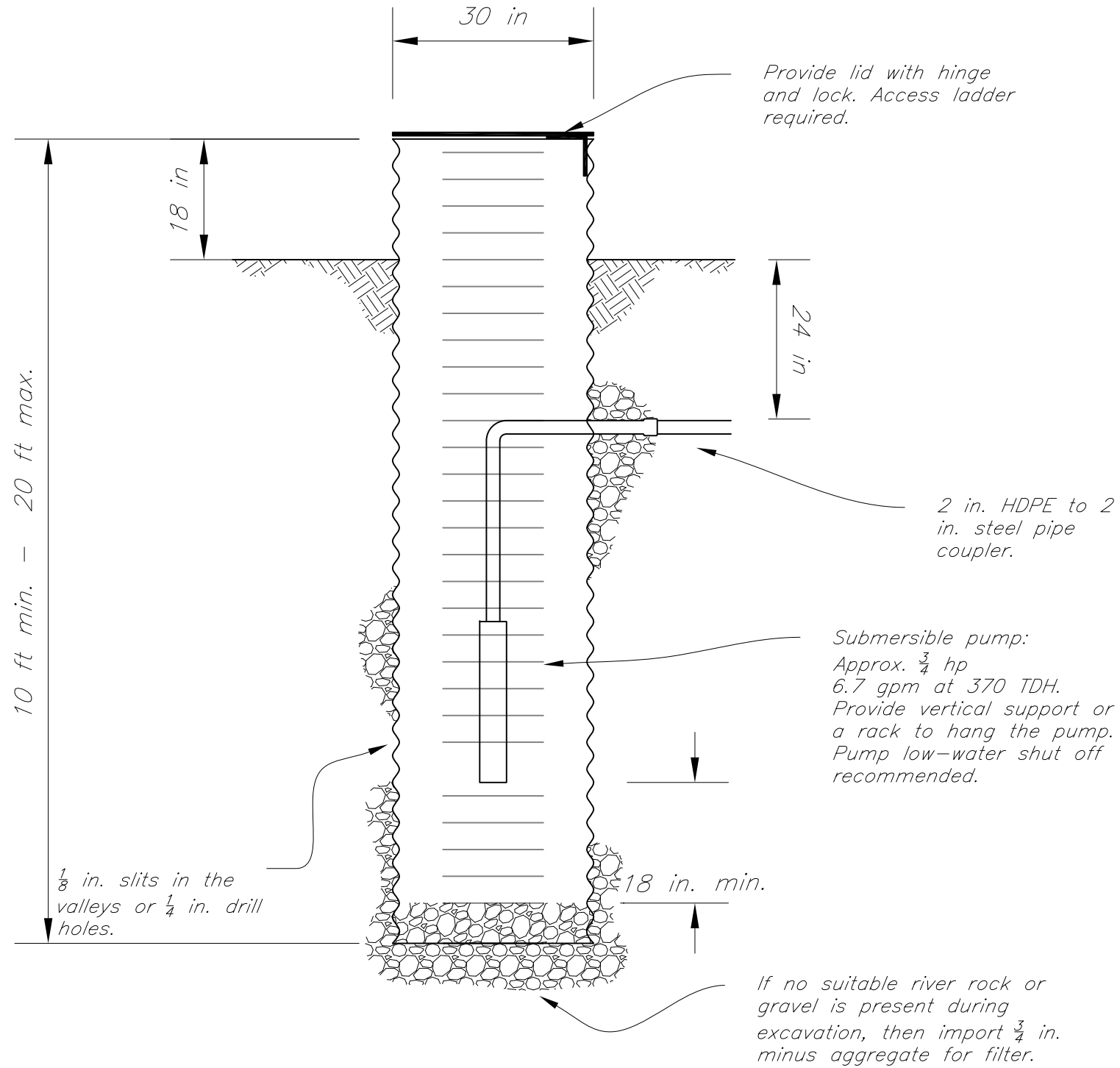
**PROFILE ALONG CENTERLINE**

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Title	

**PLAN AND PROFILE 3**  
**RUTH BOWMAN LIVESTOCK**  
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File Name	RuthBowman
Drawing No.	



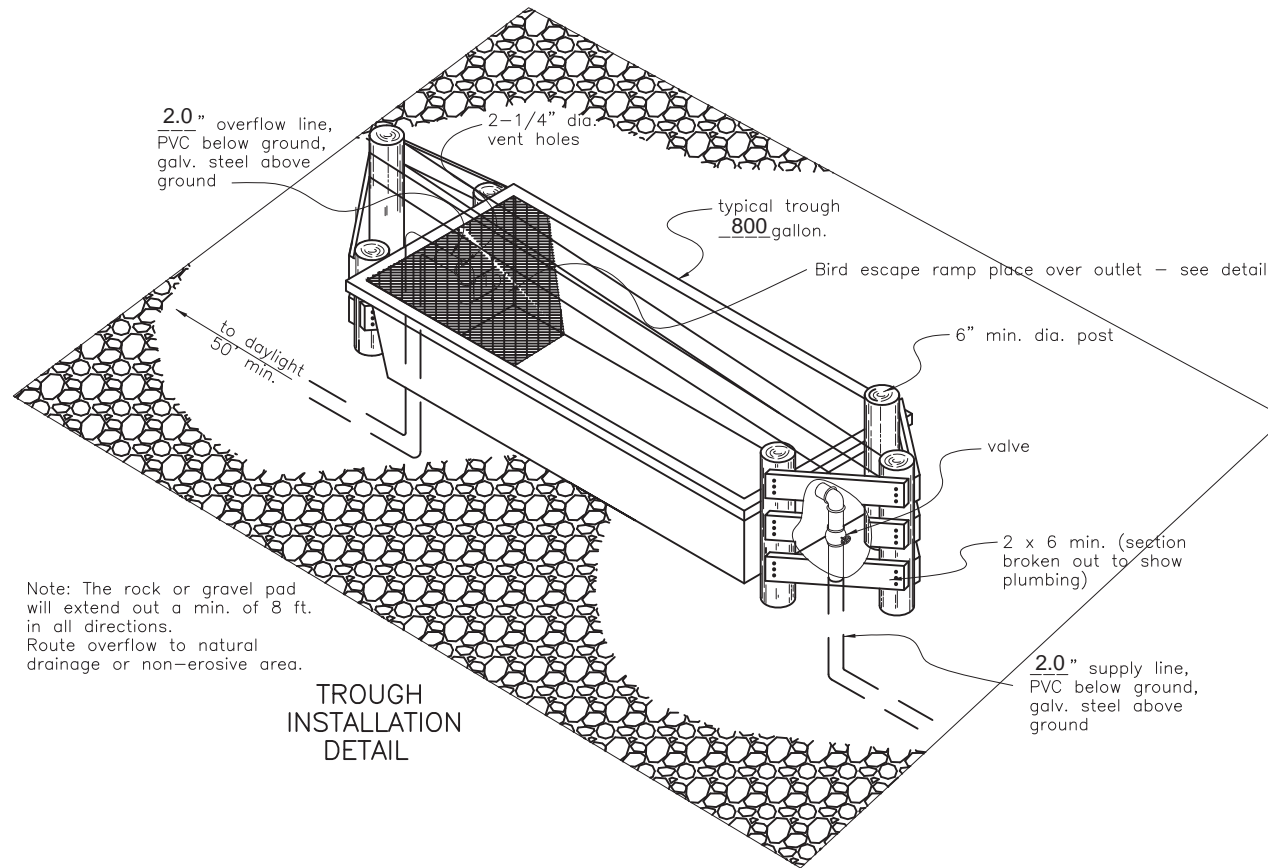
**SUMP DETAIL**  
NOT TO SCALE

Designed	JBK, STP	Date	08/18
Drawn	JBK, STP		08/18
Checked	JJC		08/18
Approved			
Title			

**SUMP DETAIL**  
RUTH BOWMAN LIVESTOCK  
JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

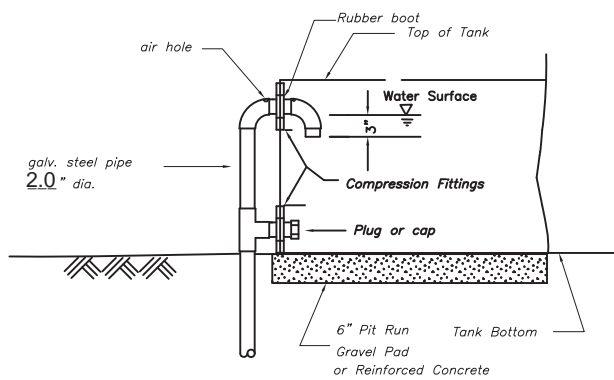
United States Department of Agriculture  
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Natural Resources  
Conservation Service

File Name	RuthBowman
Drawing No.	
Sheet	6 of 19

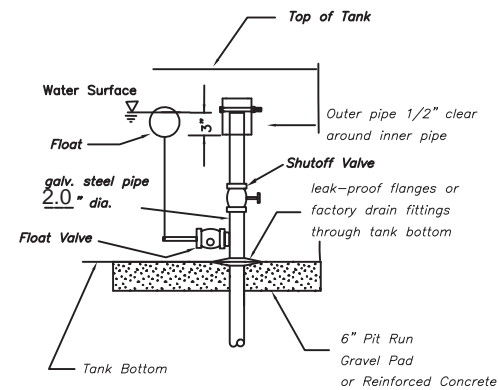


Note: The rock or gravel pad will extend out a min. of 8 ft. in all directions. Route overflow to natural drainage or non-erosive area.

TROUGH INSTALLATION DETAIL



TYPICAL SIDE MOUNT OVERFLOW & DRAIN

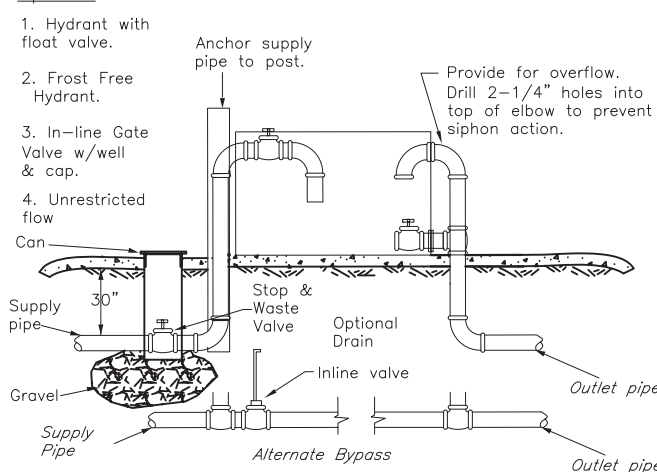


TYPICAL BOTTOM MOUNT INLET & FLOAT VALVE

Drawing Not to Scale

Trough Piping Detail

Valve options



SPECIAL PROVISIONS

1. All pipe installed above ground shall be galvanized steel. All pipe installed below ground shall be schedule 40 PVC.
2. Install a continuously acting Air/Vac valve after all float valve assemblies and at high points in the line if a constant grade can not be followed.
3. Install drain stations at all low points in the pipeline for winterization and pipeline cleaning.
4. Compacted rock pad for trough to be 4"-minus pit-run gravel. Grade to drain away from trough.

RECTANGULAR TROUGH-

- 800 GALLON TROUGH - L = 10 FT, W = 4 FT, H = 2.5 FT
- PLACE TROUGH ON 6" COMPACTED 3 INCH MINUS GRAVEL PAD.
- PAD WILL EXTEND 8 FT FROM ALL EDGES OF TROUGH
- STAKE AND SECURE TROUGH TO PREVENT ANIMALS FROM SIFTING OR MOVING TROUGH
- ALL ABOVE GROUND PIPING WILL BE GALVANIZED STEEL. BELOW GROUND PIPING WILL BE 2.0" DIAMETER WITH A MINIMUM PRESSURE RATING OF 160 PSI PVC OR PE PIPE
- RETURN LINES WILL BE ROUTED BACK TO THE CREEK
- BIRD ESCAPE RAMP
  - EXPANDED METAL GRATE ON A 1/4"x1/2" METAL FRAME
  - HANG ESCAPE RAMP NEAR THE OVERFLOW DRAIN
  - ESCAPE RAMP WILL EXTEND DOWN TO MEET THE TROUGH FLOOR
  - ESCAPE RAMP WILL BE COATED IN ACCORDANCE WITH CS-55 - PAINTING METALWORK

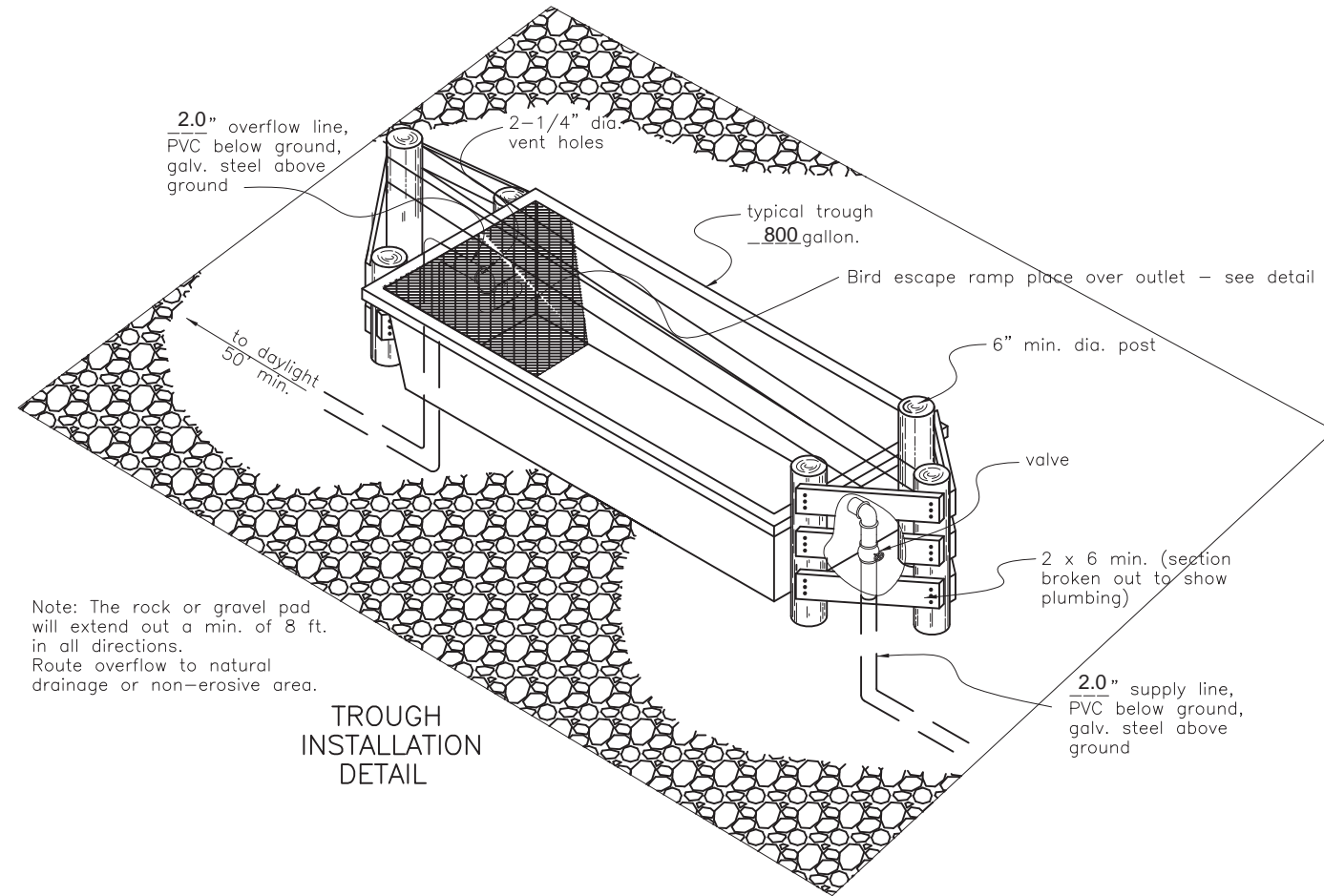
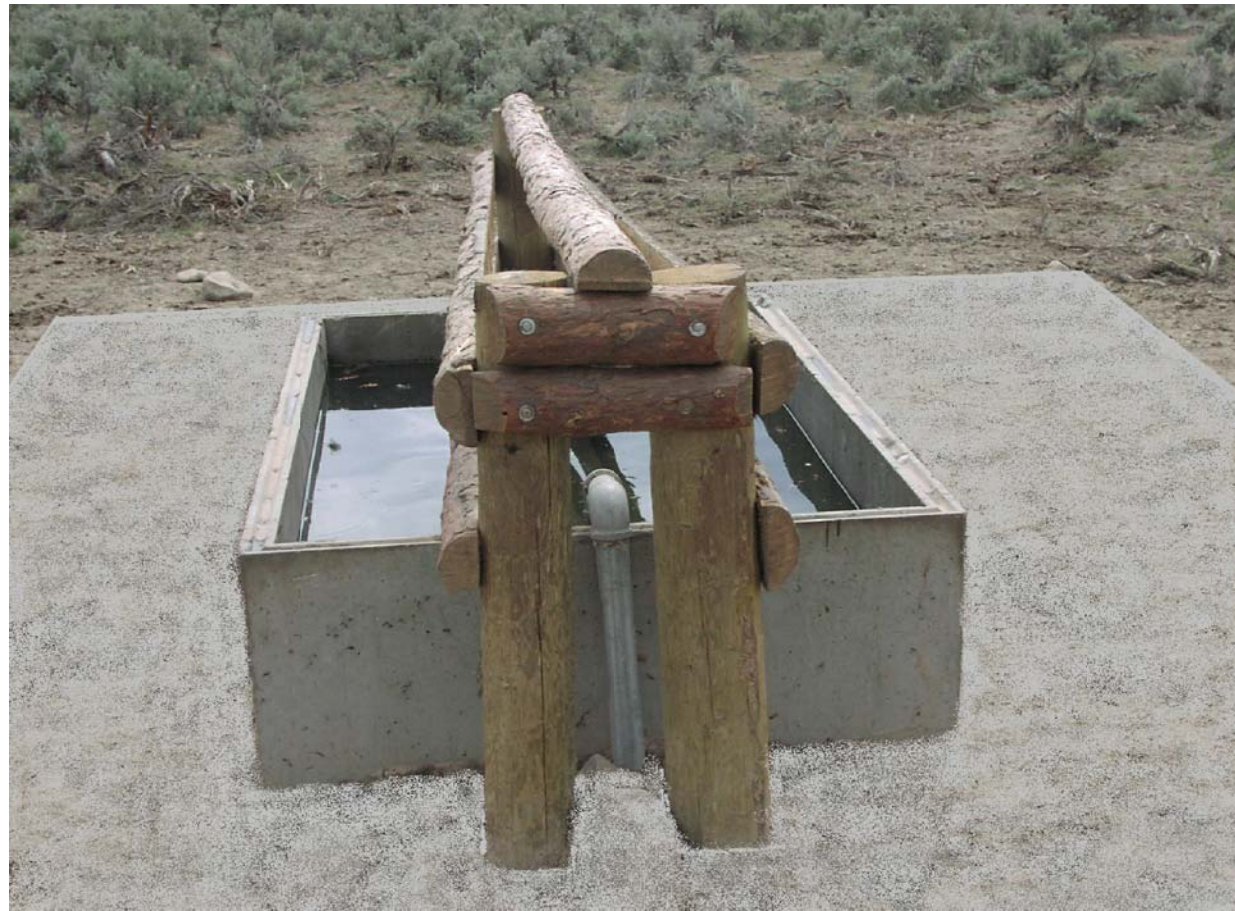
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**RECTANGULAR METAL TROUGH**  
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 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY



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Drawing No.

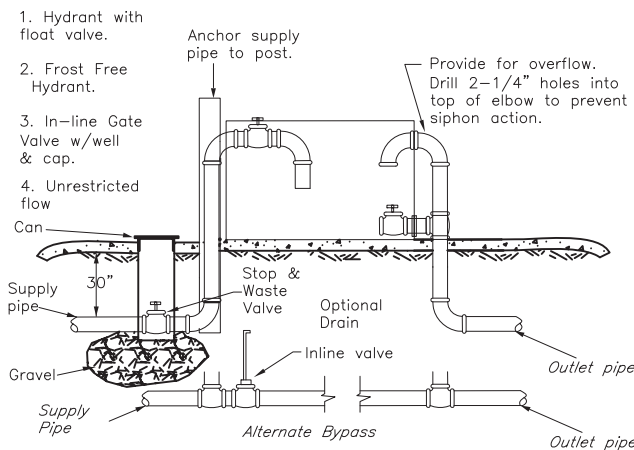


Note: The rock or gravel pad will extend out a min. of 8 ft. in all directions. Route overflow to natural drainage or non-erosive area.

TROUGH INSTALLATION DETAIL

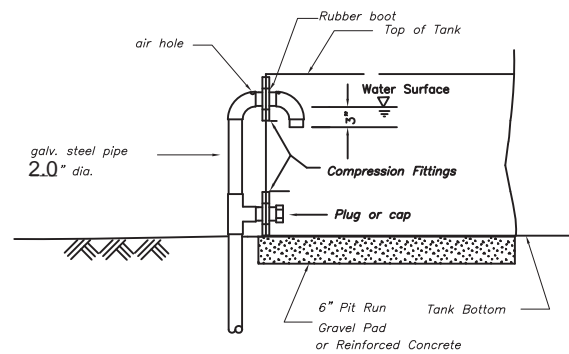
Trough Piping Detail

Valve options

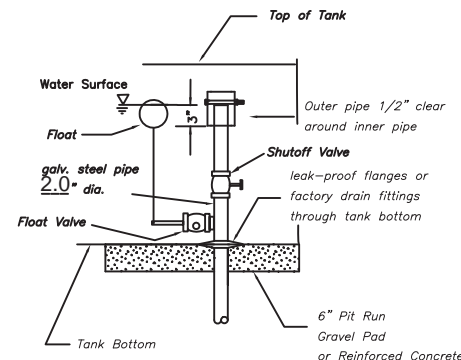


SPECIAL PROVISIONS

- All pipe installed above ground shall be galvanized steel. All pipe installed below ground shall be schedule 40 PVC.
- Install a continuously acting Air/Vac valve after all float valve assemblies and at high points in the line if a constant grade can not be followed.
- Install drain stations at all low points in the pipeline for winterization and pipeline cleaning.
- Compacted rock pad for trough to be 4"-minus pit-run gravel. Grade to drain away from trough.



TYPICAL SIDE MOUNT OVERFLOW & DRAIN



TYPICAL BOTTOM MOUNT INLET & FLOAT VALVE

Drawing Not to Scale

RECTANGULAR TROUGH-

800 GALLON TROUGH - L = 10 FT, W = 4 FT, H = 2.5 FT  
 6 SACK MIX WITH 1 BAG OF FIBER ADDED  
 AIR ENTRAINMENT = 5 TO 8 PERCENT OF THE VOLUME OF CONCRETE  
 STEEL - #4 REBAR ON A 12- 12 C-C SPACING  
 OUTLET NOTCHED AND GROUTED  
 PAINT TROUGH WITH AN EPOXY SEALANT INSIDE AND OUT  
 PROVIDE A BIRD ESCAPE RAMP - SEE DETAIL  
 ALL ABOVE GROUND PIPING WILL BE 2.0" GALVANIZED STEEL

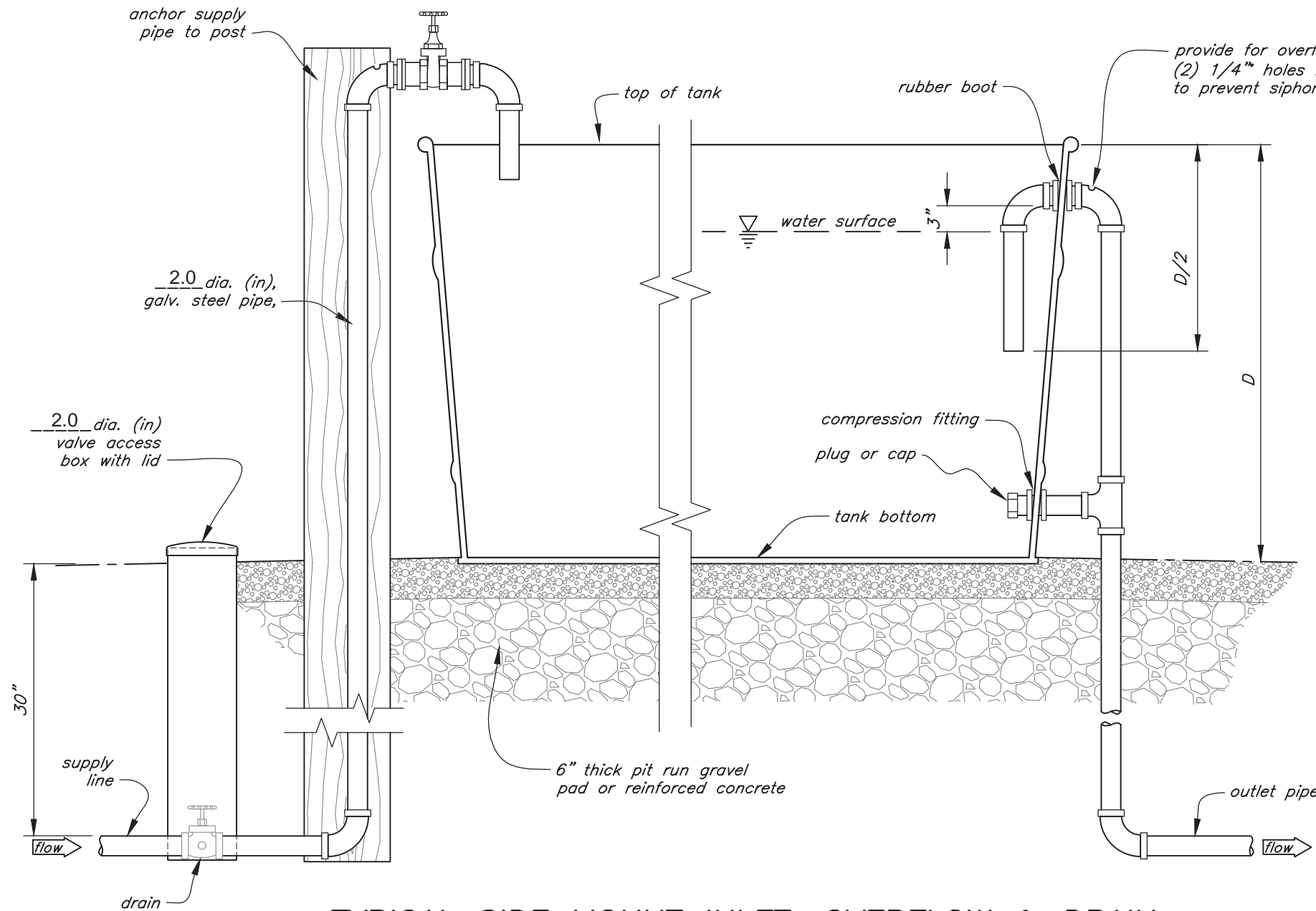
Date	08/18/18
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Checked	JIC
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**RECTANGULAR CONCRETE TROUGH**  
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 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY



File Name  
RuthBowman

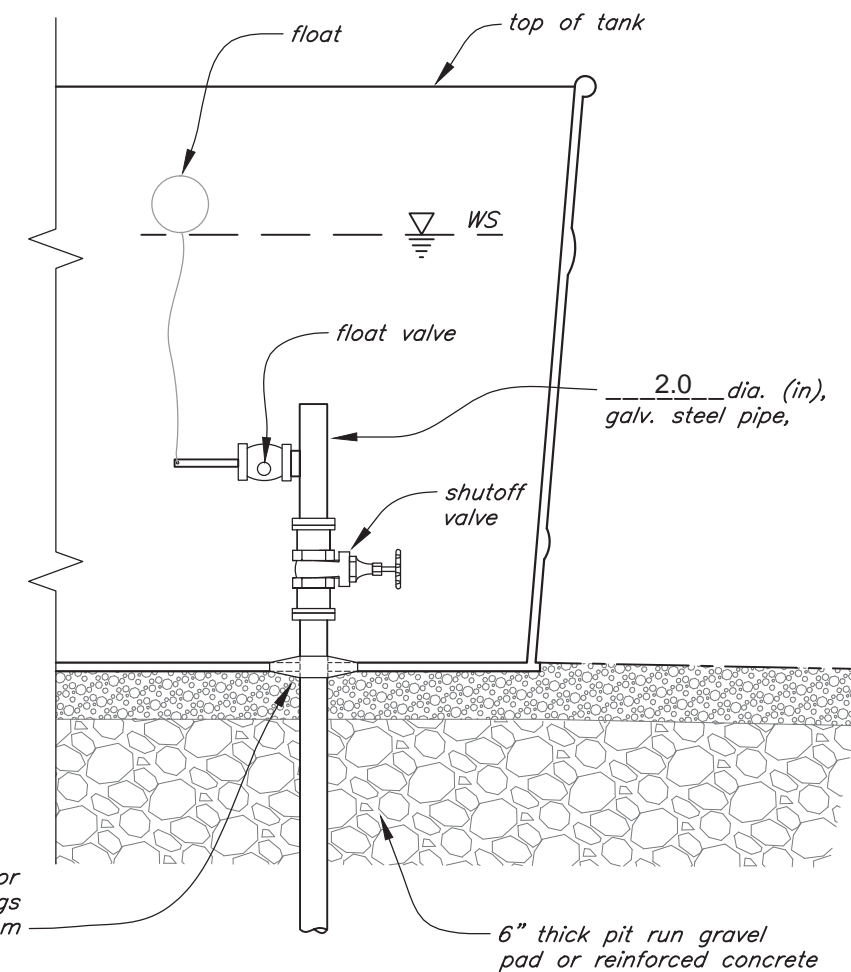
Drawing No.



**TYPICAL SIDE MOUNT INLET, OVERFLOW & DRAIN**

**NOTES:**

1. All pipe installed above ground and within 20 ft of the trough shall be galvanized steel. All pipe installed below ground shall be schedule 40 PVC or 160 psi PE.
2. Install a continuously acting Air/Vac valve at high points in the line if a constant grade can not be followed.
3. Install drain stations at all low points in the pipeline for winterization and pipeline cleaning.
4. Compacted rock pad for trough to be 3" minus pit-run/angular gravel. Grade to drain away from trough.



**TYPICAL BOTTOM MOUNT INLET & FLOAT VALVE**

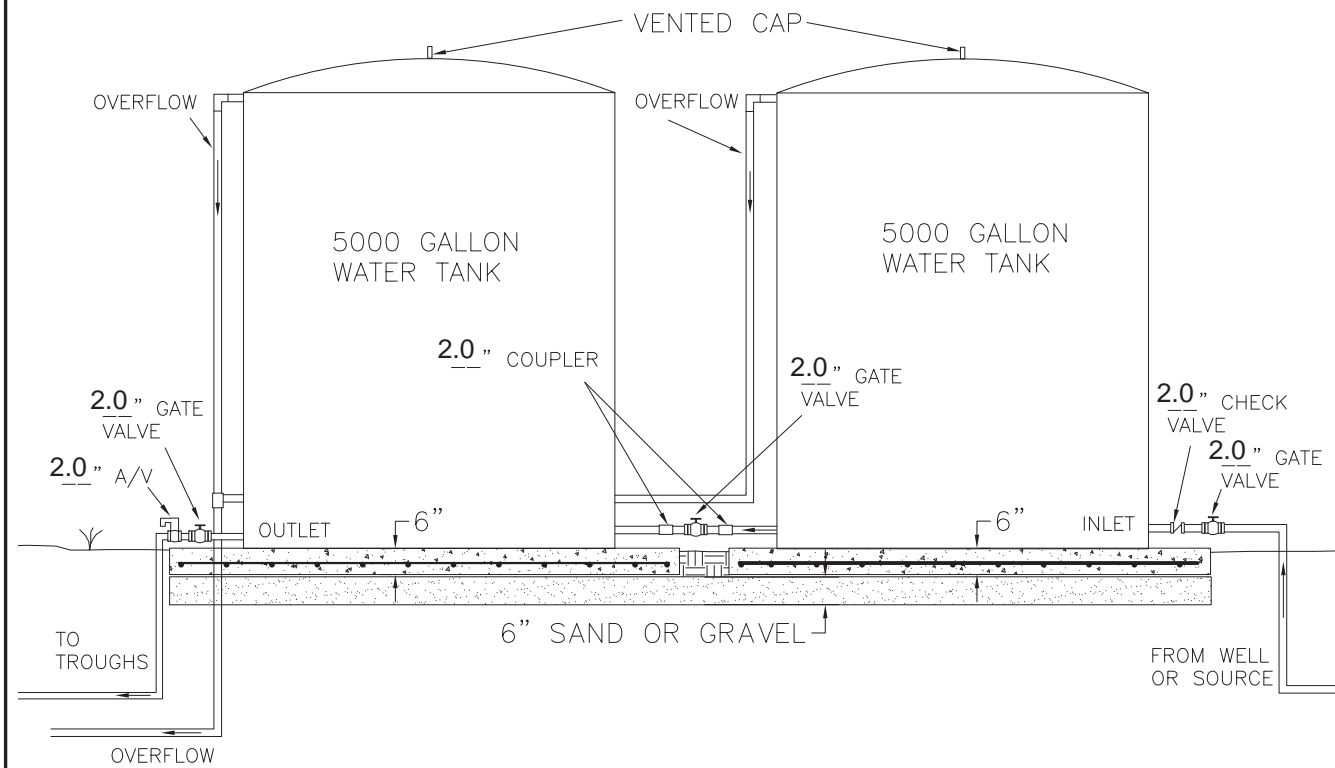
DRAWING NOT TO SCALE

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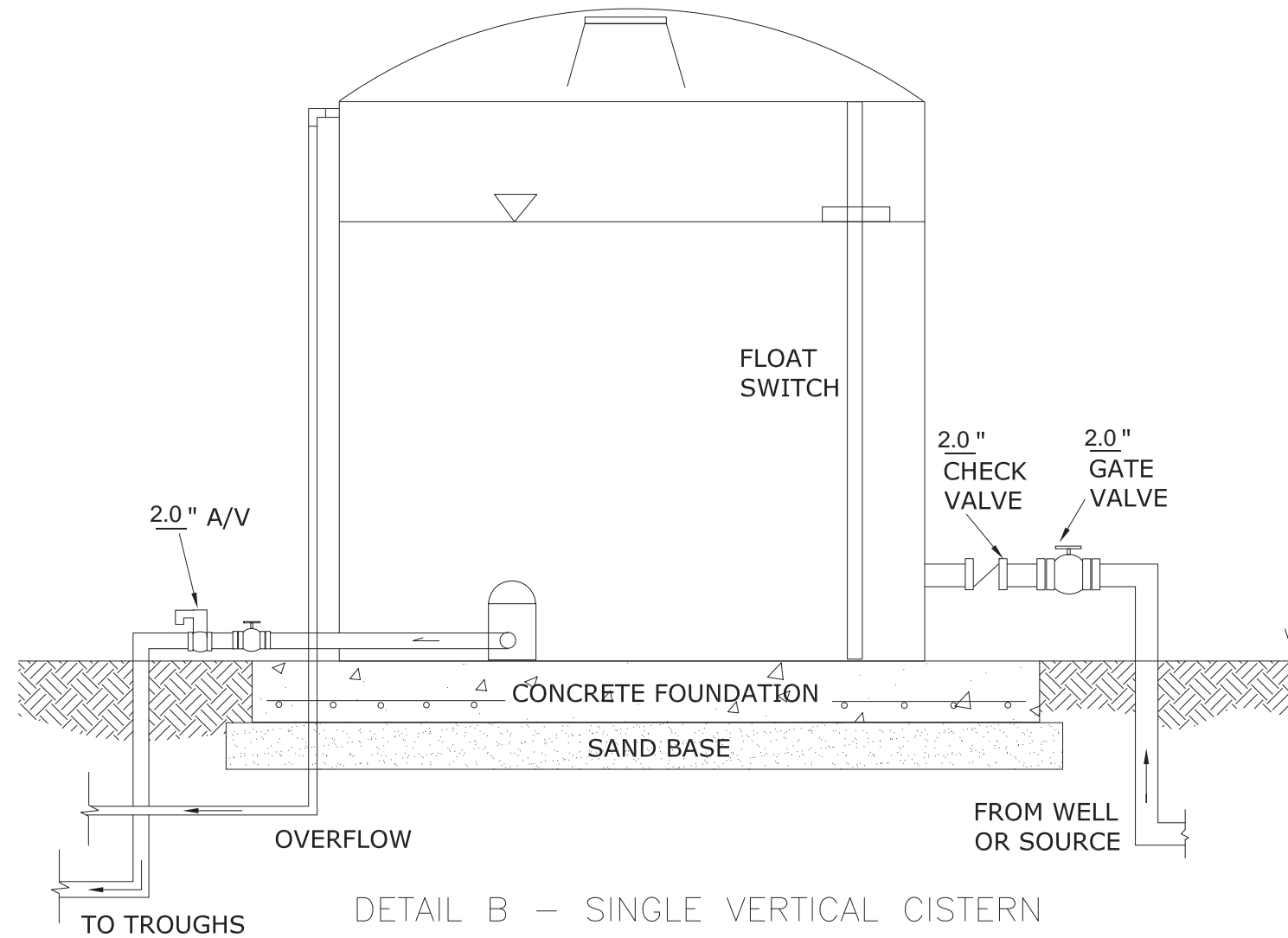
**TROUGH PLUMBING DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
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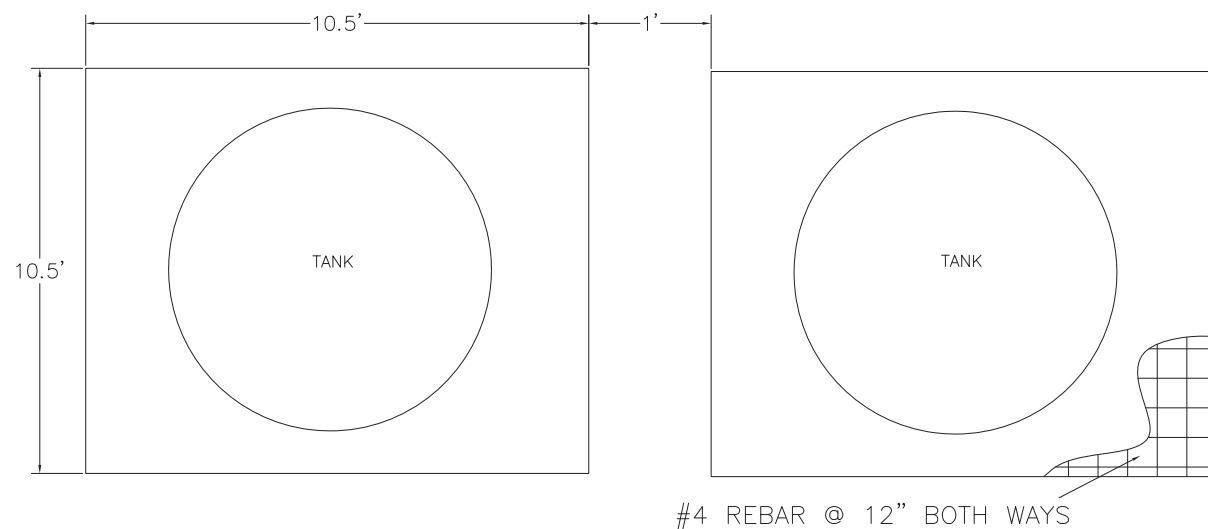
File Name  
 RuthBowman  
 Drawing No.



DETAIL A – DUAL VERTICAL CISTERN



DETAIL B – SINGLE VERTICAL CISTERN



DETAIL C – PLAN VIEW DUAL VERTICAL CISTERN

CONSTRUCTION NOTES

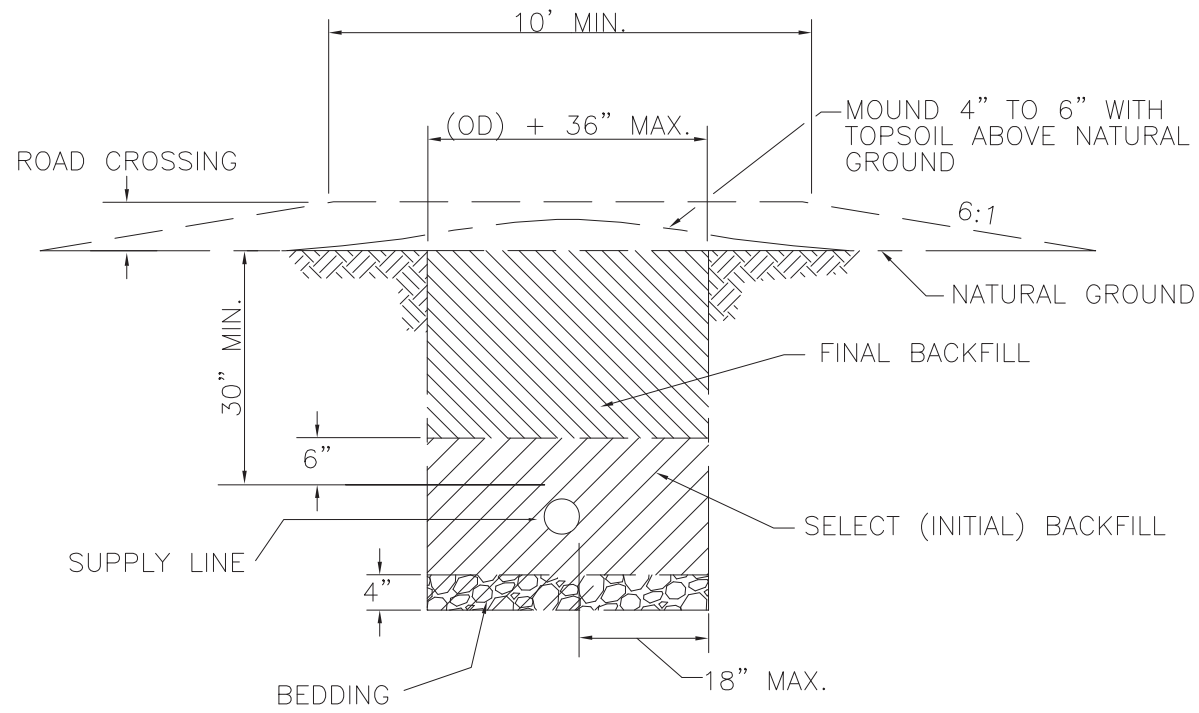
1. CONCRETE USED FOR PADS SHALL CONTAIN 5 1/2 SACKS OF CEMENT PER CUBIC YARD OF CONCRETE
2. A 2" THICK LAYER OF SAND SHALL BE PLACED BELOW ALL CONCRETE
3. ALL PIPE AND FITTING ABOVE GROUND SHALL BE 2" GALVANIZED STEEL PIPE (GSP) SCH 40 AND MEET ASTM-A-120
4. ALL PIPE BELOW GROUND WILL BE **2.0"** SCH40 PVC
5. ALL SUBGRADE AND REINFORCING STEEL SHALL BE INSPECTED BY THE ENGINEER OR NRCS PERSONNEL PRIOR TO CONCRETE POUR
6. ALL CONCRETE STEEL REINFORCEMENT SHALL BE COVERED BY A MINIMUM OF 2 INCHES OF CONCRETE IN ALL DIRECTIONS
7. ALL DISTURBED AREAS WILL BE REVEGETATED
8. OVERFLOW SHALL EXTEND TO A NATURAL DRAINAGEWAY OR A MINIMUM OF 50 FT AWAY FROM TANK
9. CLEAR A 50 FOOT AREA SURROUNDING CISTERNS TO ACT AND BE MAINTAINED AS A FIRE BREAK.

Date	08/18/18
Designed	JBK, STP
Drawn	JBK, STP
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Title	

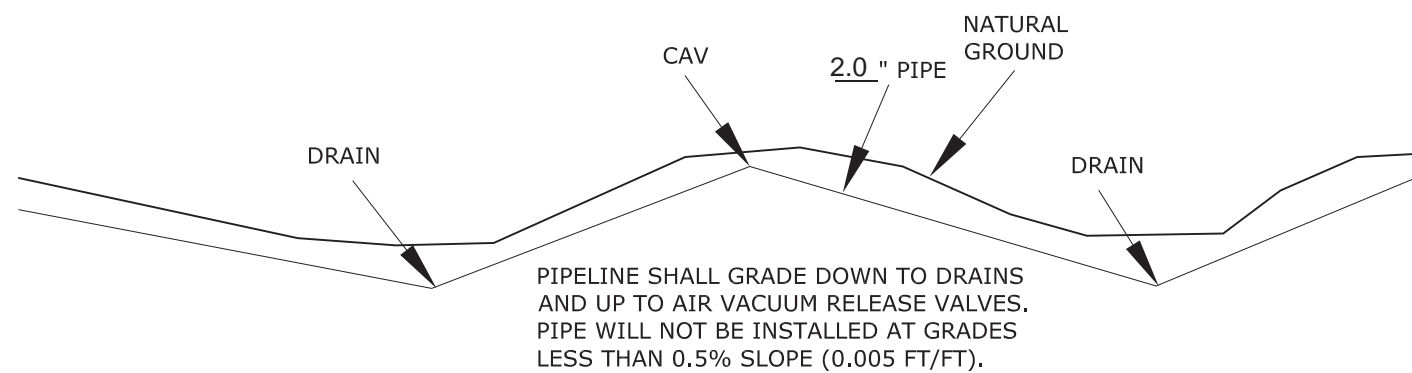
**VERTICAL CISTERN DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

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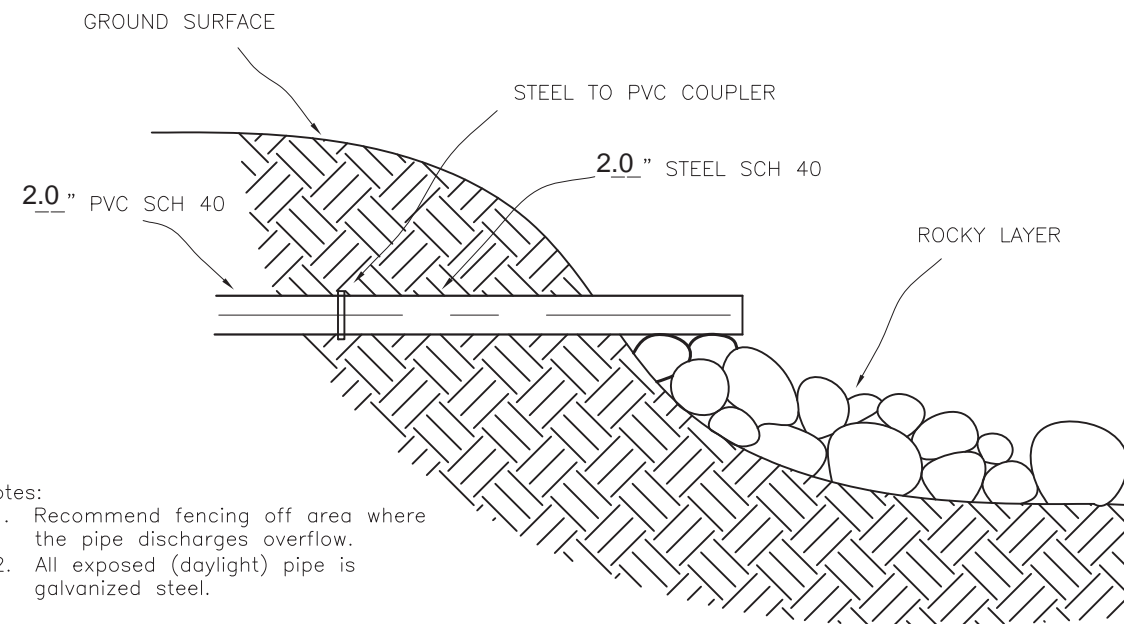
File Name	RuthBowman
Drawing No.	
Sheet	10 of 22



DETAIL TD – TYPICAL SUPPLY LINE & TRENCH CROSS SECTION

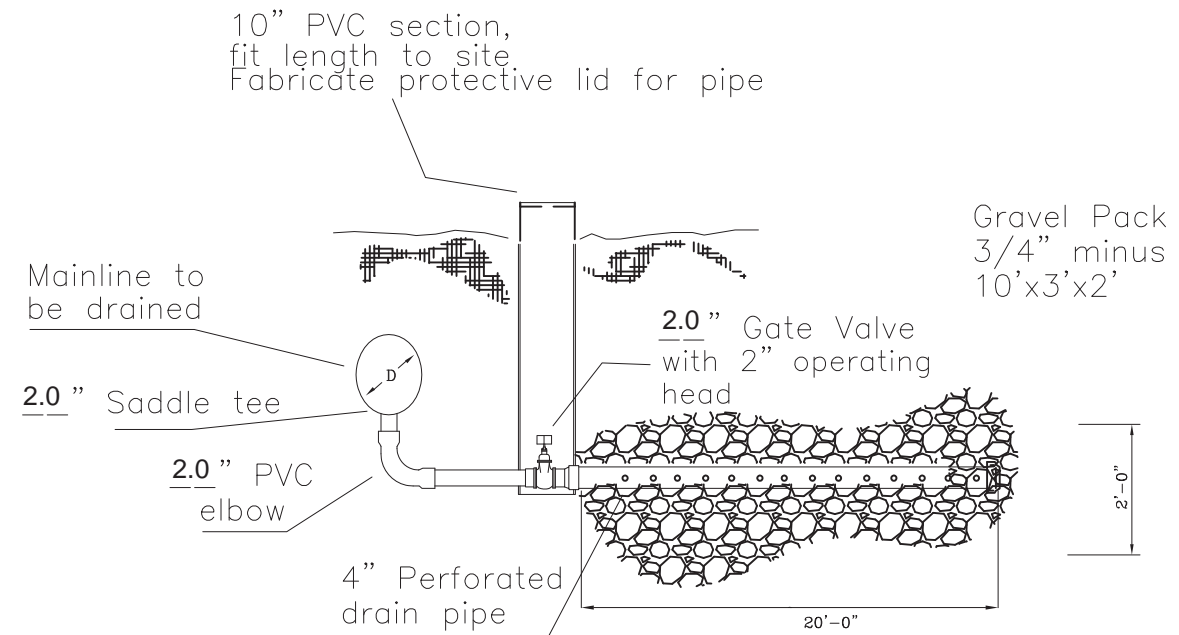


PIPE PLACEMENT DETAIL



- Notes:
1. Recommend fencing off area where the pipe discharges overflow.
  2. All exposed (daylight) pipe is galvanized steel.

DAYLIGHT OVERFLOW OUTLET PIPE



Drain Assembly

DAYLIGHT DRAIN OR DRAIN AS SHOWN

Scale as shown

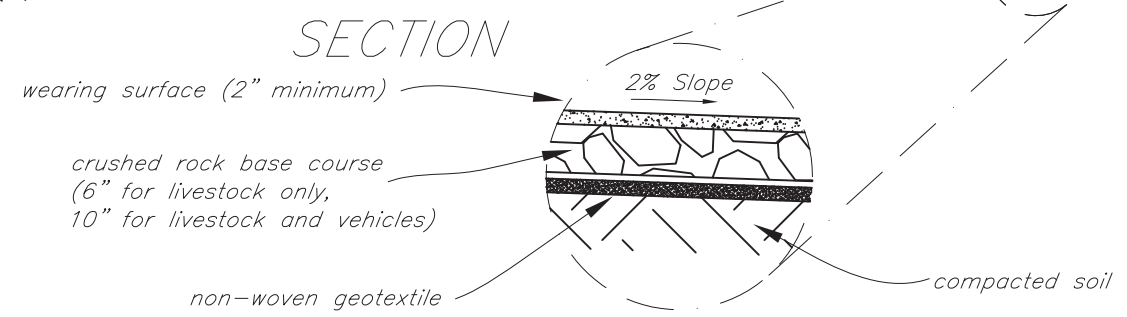
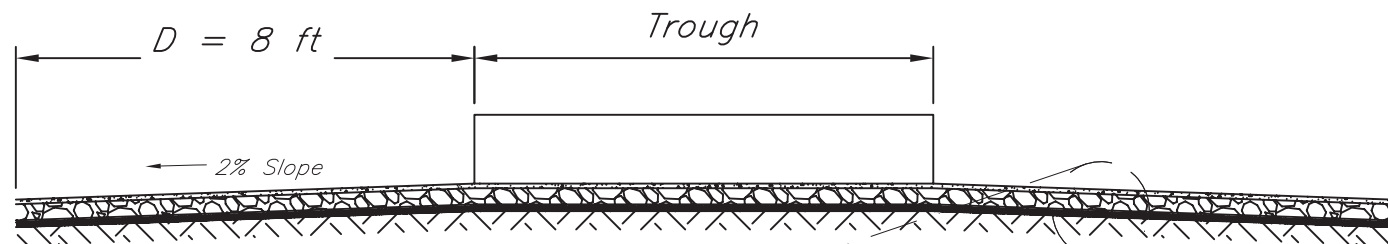
GRADE DRAIN TO DAYLIGHT IN A PROTECTED AREA THAT WILL NOT CAUSE SOIL EROSION. LOCATE DRAIN IN THE SAME DRAINAGE AS THE WATER SOURCE WOULD NATURALLY FLOW. IF THE DRAIN CAN NOT BE DAYLIGHT DRAIN AS SHOWN ABOVE.

Date	08/18/18
Designed	JBK, STP
Drawn	JBK, STP
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Approved	
Title	

**TRENCH, BACKFILL & DRAIN**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

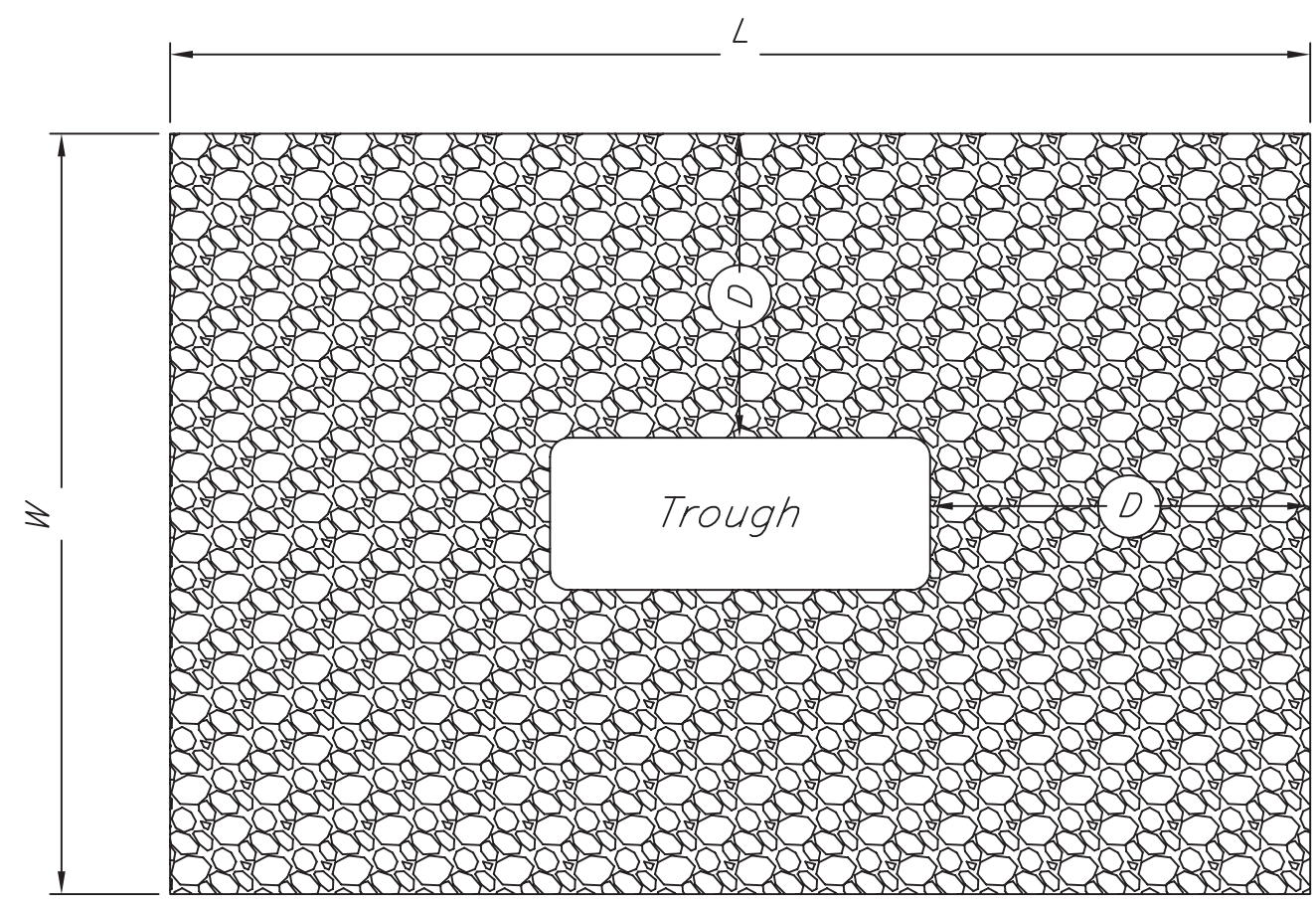
United States Department of Agriculture  
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File Name	RuthBowman
Drawing No.	
Sheet	11 of 22

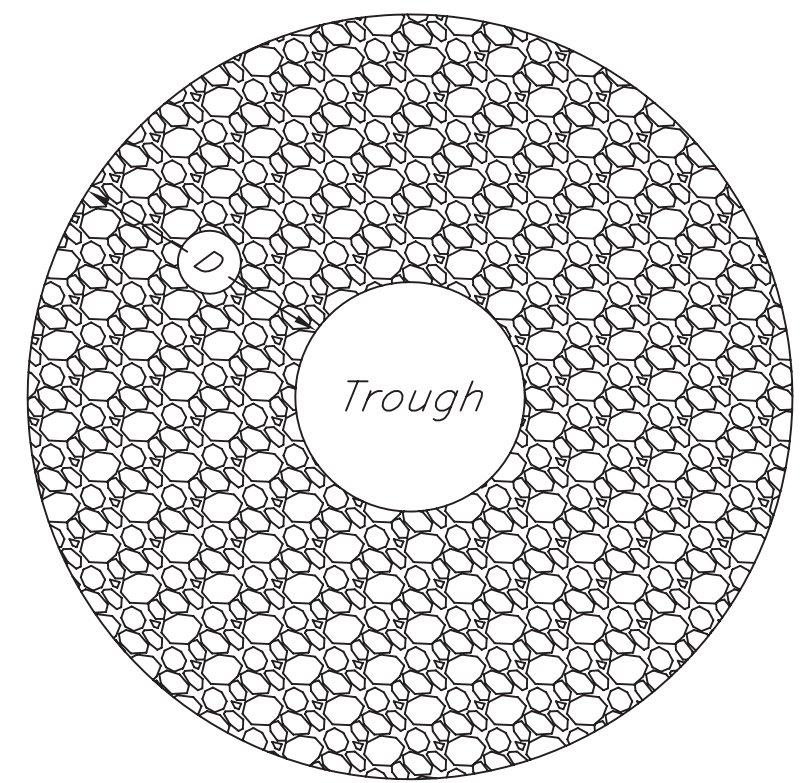


HEAVY USE AND PROTECTION AREA NOTES:

1. Construction of heavy use area shall be completed during suitable weather conditions, or additional rock may be required. All mud and soft subgrade must be removed if constructed during wet weather.
2. Grade heavy use protection area at approximately 2% slope to gravity drain stormwater runoff away from site.
3. Contractor to shape (excavate/fill) existing ground and compact the soil to 3 passes with vibratory compactor in 3 inch lifts. Soil shall be free of all organic and deleterious material such as roots and sod. NRCS Engineer must observe final subgrade prior to placing geotextile.
4. Place the Class 1 Non-woven geotextile according to the manufacturer's recommendations.
5. Place the base rock in 3 layers (lifts), compacting between each layer. The base rock shall be 3" minus crushed rock. The base rock total thickness shall be 6".
6. Place a wearing surface on top of the finished base layer. The wearing surface shall consist of 3/4" minus crushed aggregate for a minimal layer thickness 2".
7. Crushed aggregate shall be compacted to 95% of standard proctor density as determined by ASTM D-698.



RECTANGULAR TROUGH



CIRCULAR TROUGH

PAD DIMENSIONS

$L = \underline{\quad 26 \quad} \text{ ft}$   
 $W = \underline{\quad 20 \quad} \text{ ft}$   
 $D = \underline{\quad 8 \quad} \text{ ft}$

Designed	JBK, STP	Date	08/18/18
Drawn	JBK, STP	Checked	JIC
Approved		Title	

**HEAVY USE AREA DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

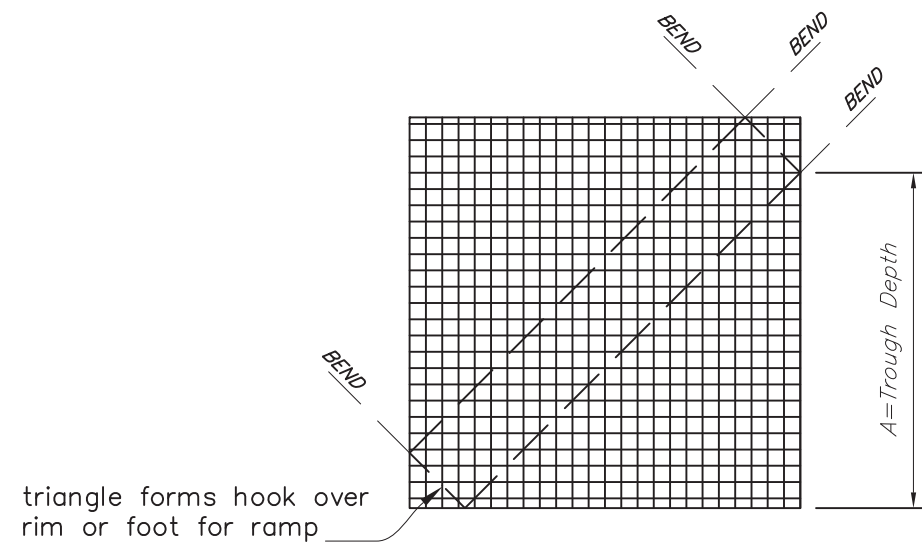
United States  
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 Natural Resources  
 Conservation Service

File Name  
RuthBowman

Drawing No.



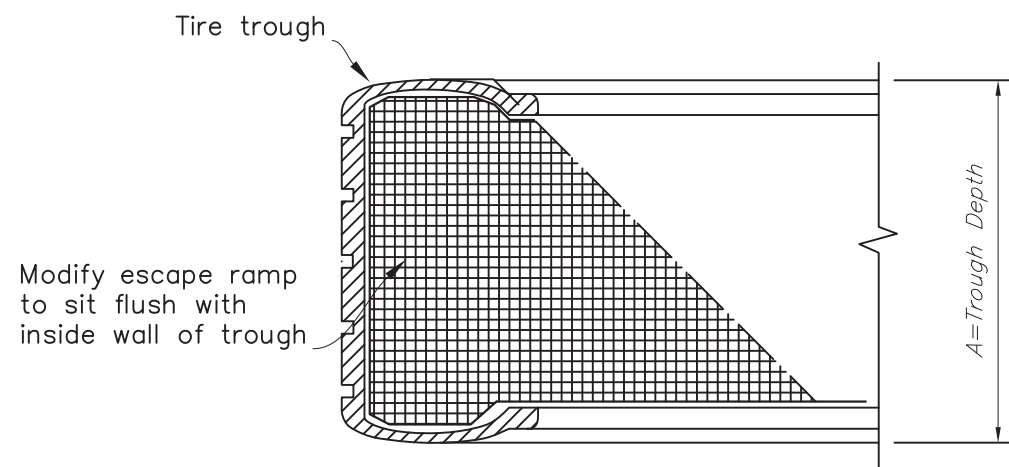
EXAMPLE ANIMAL ESCAPE RAMP



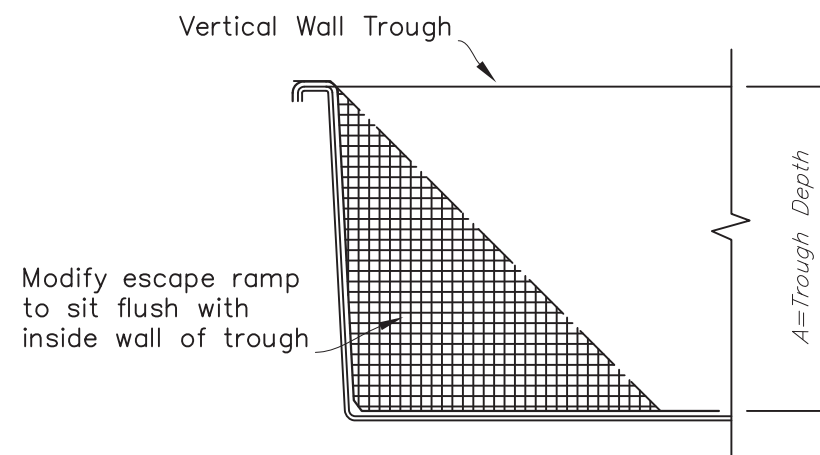
CUTTING AND BENDING DIAGRAM

### EXPANDED METAL RAMP REQUIREMENTS

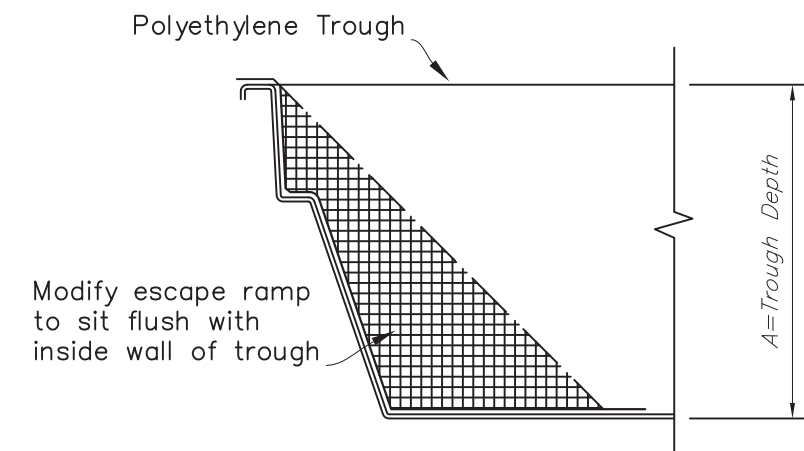
1. Expanded metal ramps shall be fabricated of 11 or 13 gauge steel with 1/2 inch grating. Use cutting diagram, as shown on this steel, with the length (A) matching the depth of the trough.
2. Ramp to be modified as needed to set flush with edge of trough, as shown below.
3. Once all cutting, bending and modifications on ramp are complete, finish ramp with a rust inhibiting paint or coating.
4. Bend the top corner of the ramp over the rim of the trough and attach with screws or bolts.



SECTION VIEW OF TYPICAL TIRE TROUGH



SECTION VIEW OF VERTICAL TROUGH WALL



SECTION VIEW OF IRREGULAR SHAPED TROUGH WALL

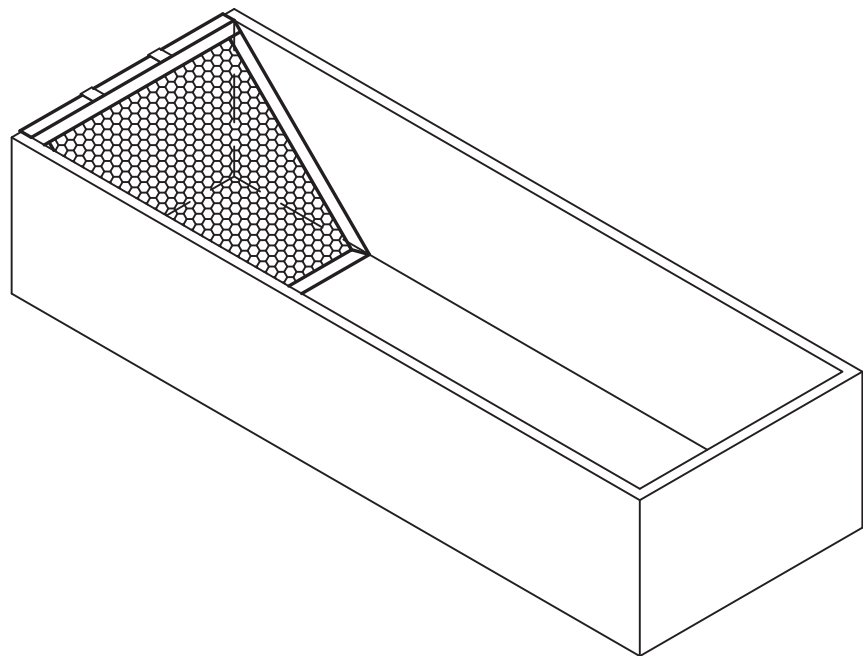
Designed	JBK, STP	Date	08/18/18
Drawn	JBK, STP		08/18/18
Checked	JIC		08/18/18
Approved			
Title			

**BIRD ESCAPE RAMP DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

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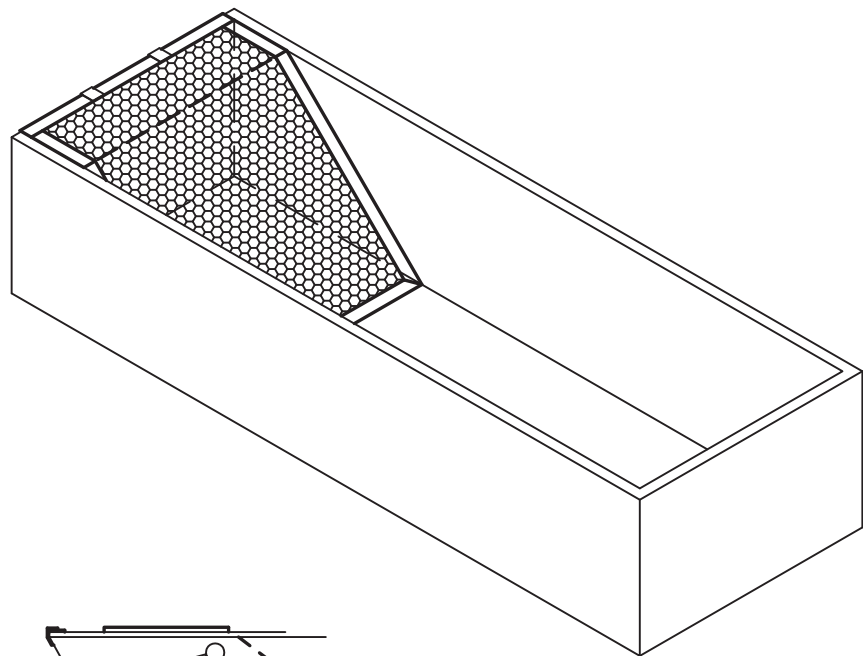
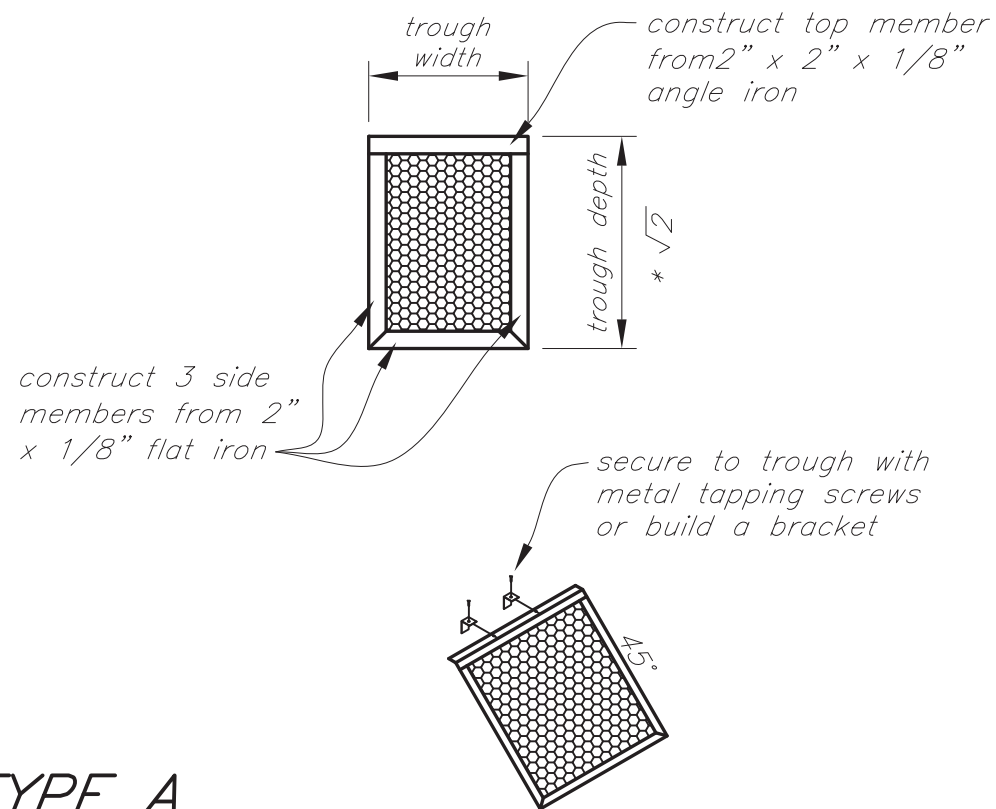
File Name  
 RuthBowman

Drawing No.



A good escape ramp for a rectangular trough is simply an appropriately sized panel of expanded-metal grating that spans the width of the trough at one end and slants from the top of the rim to the bottom.

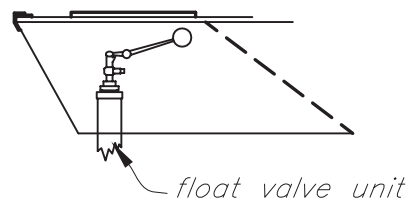
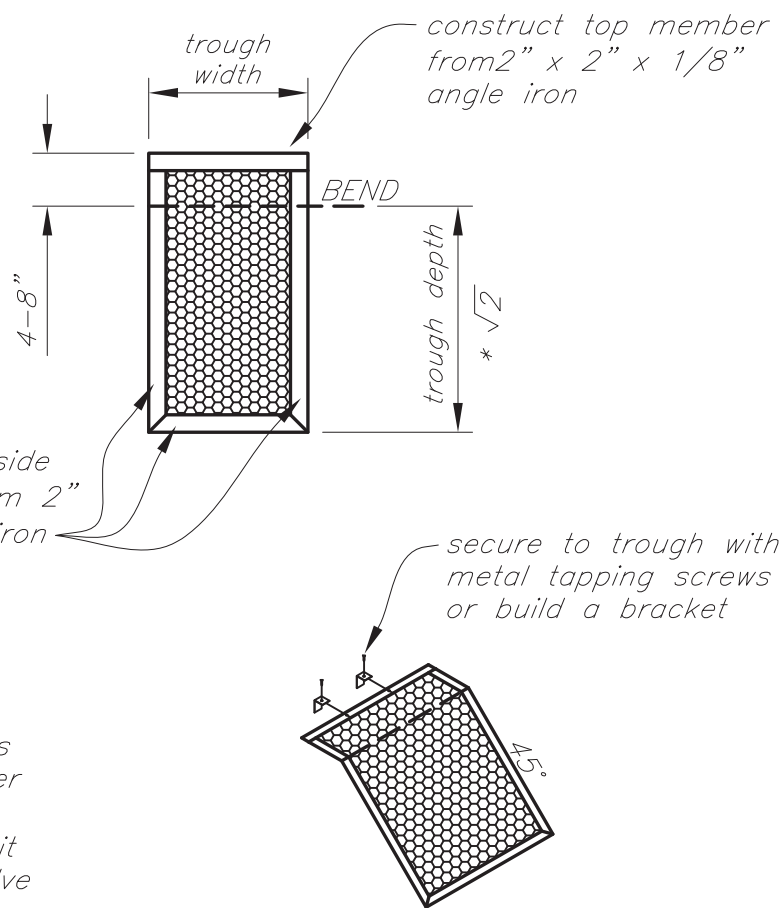
**TYPE A**



construct 3 side members from 2" x 1/8" flat iron

It can be reinforced with steel bars along the edges. By using a larger piece of grating and bending it to provide a flat "cover" at the top, it can be used to protect a float valve or other plumbing.

**TYPE B**



**SIDE VIEW**

**GUIDELINES**

Escape structure shall extend down into the water and meet the inside wall of the trough so animals swimming along the perimeter will find the structure, rather than becoming trapped behind or beneath it or missing it entirely.

Escape structure shall reach to the bottom of the trough, so as to be effective even if the water level drops sharply.

Escape structures shall have a slope no steeper than 45 degrees, on all sides, to allow animals to climb out without slipping back into the water.

Escape structure shall be firmly secured to the trough rim so it will not be knocked loose by livestock or other animals.

Escape structure shall be built of grippable, long lasting materials, such as painted or coated metal grating, concrete, rock and mortar or high-strength plastic composites.

Expandable metal escape structures shall be 13 or 11-gauge with 1/2 inch mesh and shall be finished with a rust-inhibiting paint or coating.

Escape structures must be firmly attached to the trough rim. A metal-tapping screw and washer is simple and effective, or a bracket with a bolt and wing nut can be made or purchased to allow easier removal for trough maintenance. Secure attachment keeps the ramp from being knocked loose by stock or freezing water. The structure can be reinforced by welding a steel strap to the bottom of the mesh at the attachment point where it folds of the trough rim. The strap should be the same width as the ramp and extend at least 6 inches down the slope.

Concrete escape structures are built in much the same way, using concrete mixed on-site and poured into a plywood mold to produce a concrete block that slopes from the rim to bottom. Rebar is needed to strengthen the concrete in larger ramps.

**REFERENCES:**

Water for Wildlife, a Handbook for Ranchers and Range Managers, Bat Conservation International

Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations, Idaho BLM Technical bulletin

Drawing not to scale.

Date	08/18/18
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Drawn	JBK, STP
Checked	JIC
Approved	
Title	

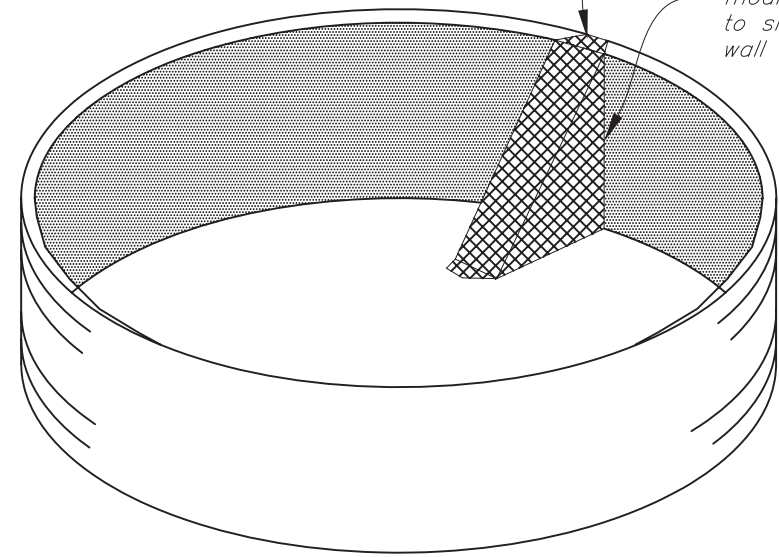
**BIRD ESCAPE RAMP DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

United States Department of Agriculture  
 Natural Resources Conservation Service

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 RuthBowman

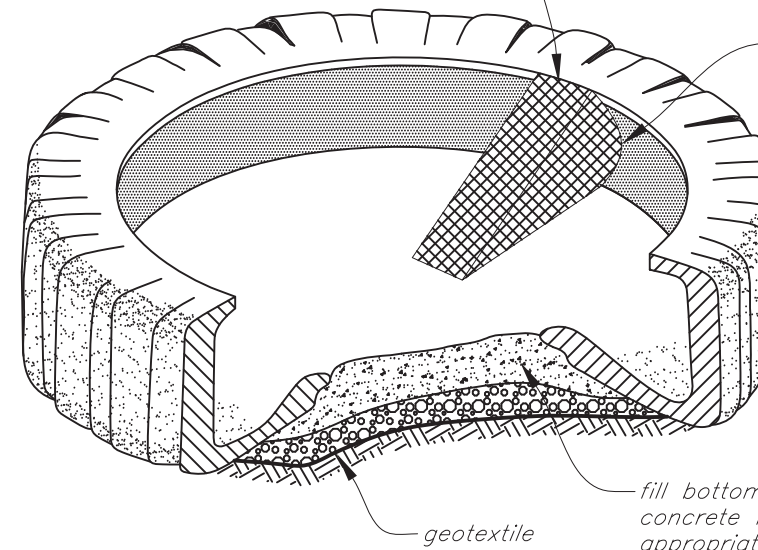
Drawing No.

attach escape ramp securely to side of trough to prevent unintended movement



TYPICAL METAL CIRCULAR TROUGH

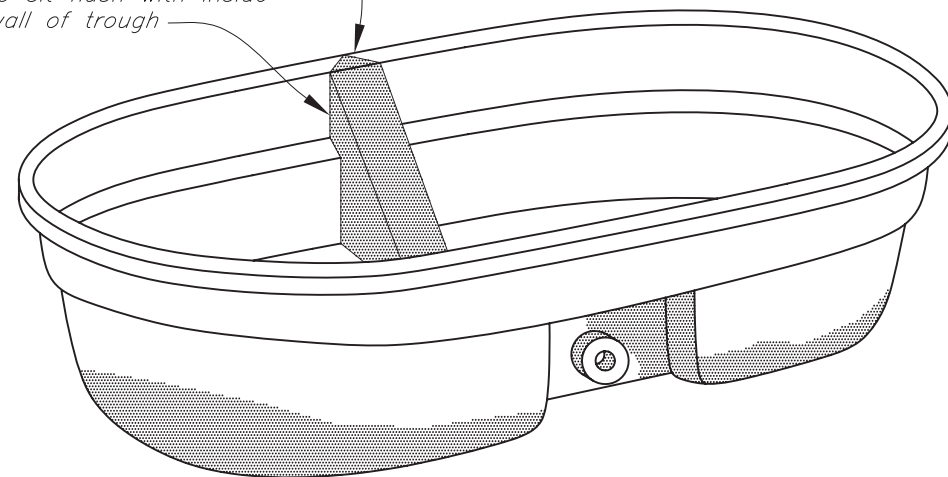
attach escape ramp securely to side of trough to prevent unintended movement



TYPICAL TIRE TROUGH

attach escape ramp securely to side of trough to prevent unintended movement

modify escape ramp to sit flush with inside wall of trough



TYPICAL POLYETHYLENE/FLEXIBLE RUBBER TROUGH

### REQUIREMENTS

1. Escape ramps shall extend to bottom of trough and be flush with inside wall of the trough to provide safe and easy egress at low water levels.
2. Escape ramps shall be sloped no steeper than 45 degrees, to allow animals to climb out without slipping back into the water.
3. Escape ramps shall be built of tractive, long lasting materials, such as painted or coated metal grating, or high-strength plastic composites (e.g., Rainmaker Products polyethylene ramps or approved equal). Expanded metal escape ramps shall be 11 or 13 gauge with 1/2 inch mesh and shall be finished with a rust-inhibiting paint or coating. Refer to Expanded Metal Escape Ramp Fabrication drawing for construction details of expanded metal escape ramps.
4. Escape ramps shall be securely attached to the trough rim. Recommend attaching ramp with metal-tapping screw and washer, or a bracket with a bolt and wing nut for easy removal during trough maintenance. Secured attachment shall keep ramp from being moved loose by livestock, animals or freezing water.

#### REFERENCE:

"Water for Wildlife: a Handbook for Ranchers and Range Managers," Bat Conservation International, 2007

"Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations," Idaho BLM Technical Bulletin 89-4, May 1989

Designed	JBK, STP	Date	08/18/18
Drawn	JBK, STP		08/18/18
Checked	JIC		08/18/18
Approved			
Title			

## BIRD ESCAPE RAMP DETAILS

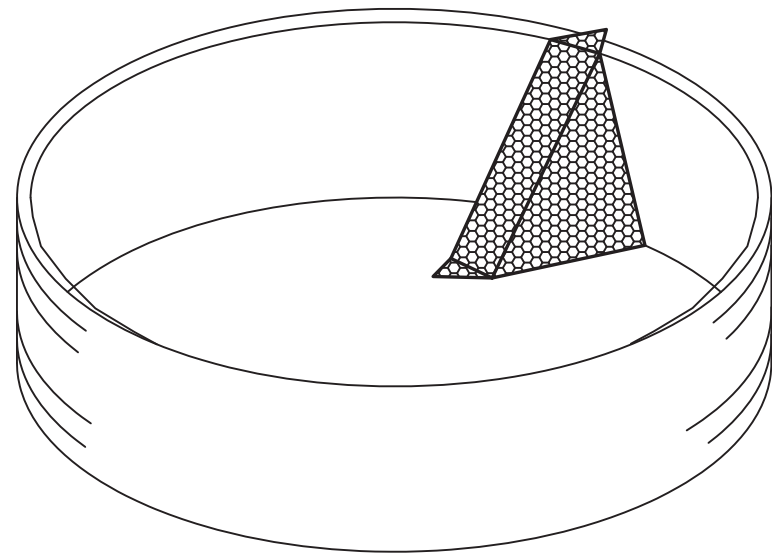
RUTH BOWMAN LIVESTOCK

JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574

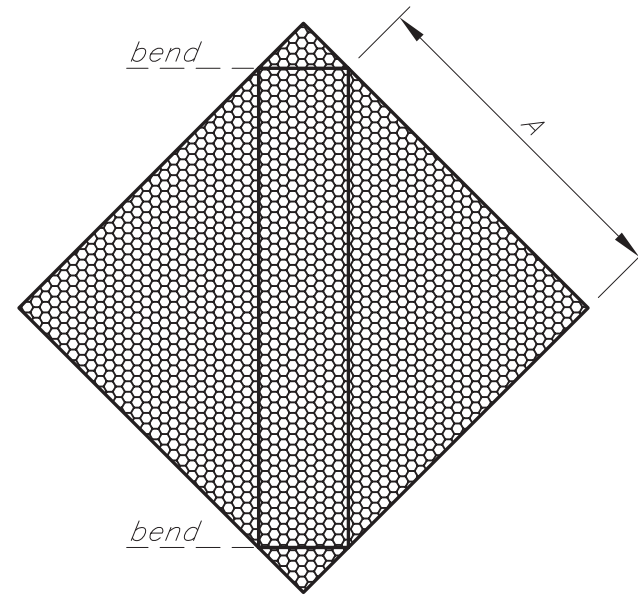
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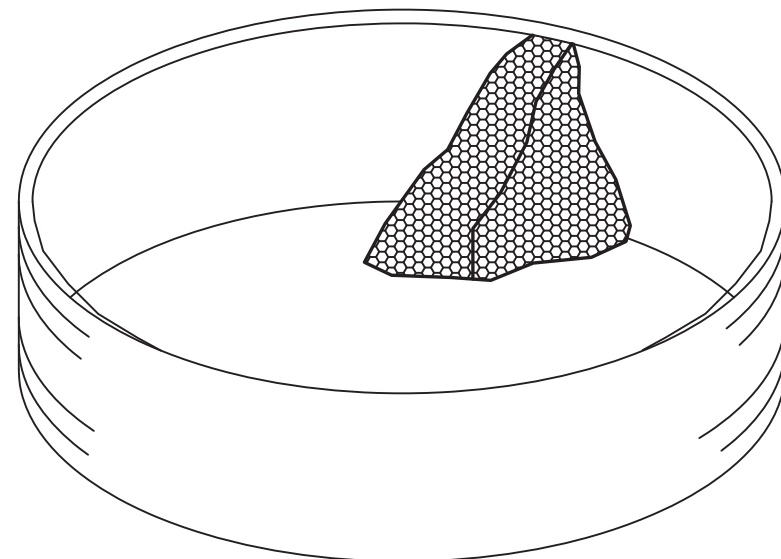
Drawing No.



Expanded metal grating (with 1/2 mesh) is an effective wildlife escape structure. Use cutting diagram, as shown on this sheet, with the length (A) matching the depth of the trough. The top corner bends over the rim of the trough and is attached with screws or bolts.



CUTTING AND BENDING DIAGRAM



Rough-surfaced stones firmly set in mortar to form a slanting, top-to-bottom ramp flush with the side of the trough produce a durable escape structure. Concrete poured into plywood forms results in a similar structure.

## GUIDELINES

Escape structure shall extend down into the water and meet the inside wall of the trough so animals swimming along the perimeter will find the structure, rather than becoming trapped behind or beneath it or missing it entirely.

Escape structure shall reach to the bottom of the trough, so as to be effective even if the water level drops sharply.

Escape structures shall have a slope no steeper than 45 degrees, on all sides, to allow animals to climb out without slipping back into the water.

Escape structure shall be firmly secured to the trough rim so it will not be knocked loose by livestock or other animals.

Escape structure shall be built of grippable, long lasting materials, such as painted or coated metal grating, concrete, rock and mortar or high-strength plastic composites.

Expandable metal escape structures shall be 13 or 11-gauge with 1/2 inch mesh and shall be finished with a rust-inhibiting paint or coating.

Escape structures must be firmly attached to the trough rim. A metal-tapping screw and washer is simple and effective, or a bracket with a bolt and wing nut can be made or purchased to allow easier removal for trough maintenance. Secure attachment keeps the ramp from being knocked loose by stock or freezing water. The structure can be reinforced by welding a steel strap to the bottom of the mesh at the attachment point where it folds of the trough rim. The strap should be the same width as the ramp and extend at least 6 inches down the slope.

Concrete escape structures are built in much the same way, using concrete mixed on-site and poured into a plywood mold to produce a concrete block that slopes from the rim to bottom. Rebar is needed to strengthen the concrete in larger ramps.

### REFERENCES:

*Water for Wildlife, a Handbook for Ranchers and Range Managers, Bat Conservation International*

*Wildlife Watering and Escape Ramps on Livestock Water Developments: Suggestions and Recommendations, Idaho BLM Technical bulletin*

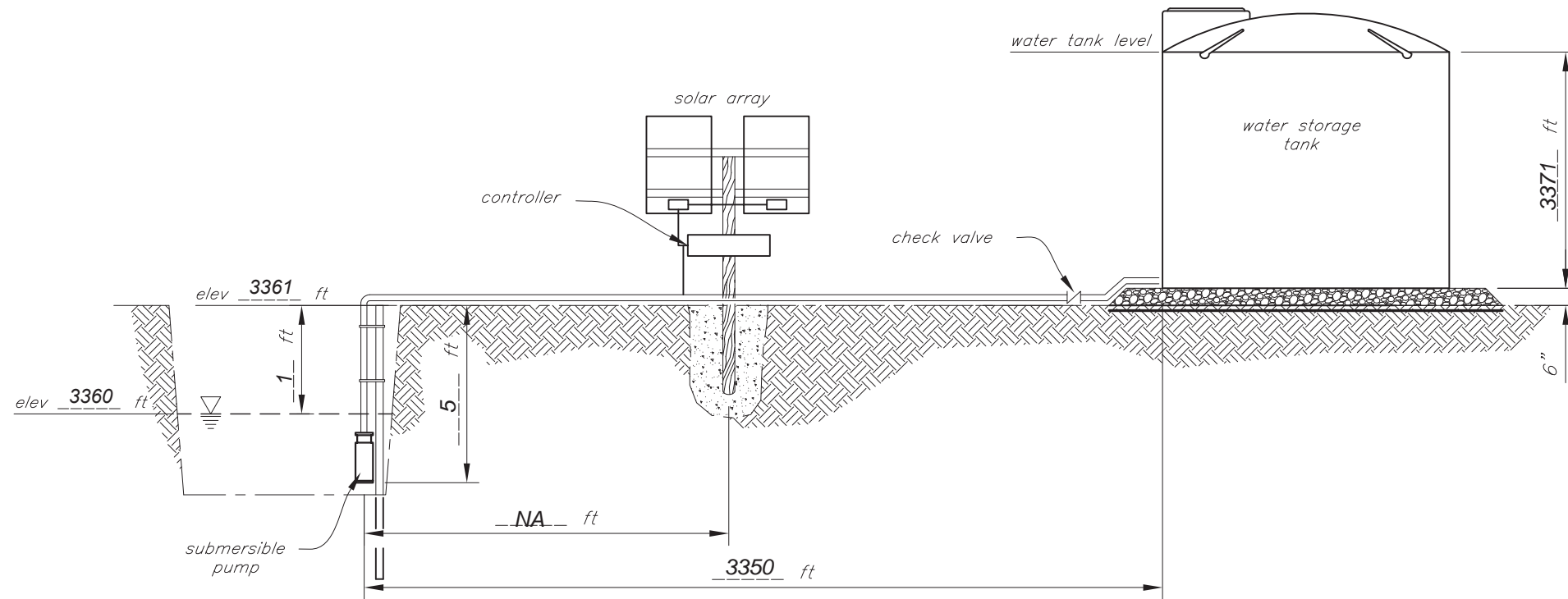
Date	08/18/18
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Title	

**BIRD ESCAPE RAMP DETAILS**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

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File Name	RuthBowman
Drawing No.	
Sheet	16 of 22

Drawing not to scale.



PUMP <sup>1</sup>	_____ watts	<u>6.7</u> design gpm
	_____ amps	_____ manufacturer (or approved equal)
	_____ volts	
PANEL ARRAY	<u>705</u> minimum watts needed (pump size*1.25)	
	<u>30</u> summer tilt angle	_____ amps
	<u>60</u> winter tilt angle	_____ volts
PANEL CONFIGURATION <sup>2</sup>	<input type="checkbox"/> series	<input type="checkbox"/> parallel
TANK VOLUME	<u>3000</u> gallons	
FLOAT SWITCH	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no
WATER TROUGHS	<u>4</u> # of troughs	
	<u>800 gal</u> size of trough	
FLOAT	<u>Y</u> #1	<u>Y</u> #3
	<u>Y</u> #2	min. pressure head to open valves
FISH SCREEN REQUIRED <sup>3</sup> (at intake)	<input type="checkbox"/> yes	<input checked="" type="checkbox"/> no

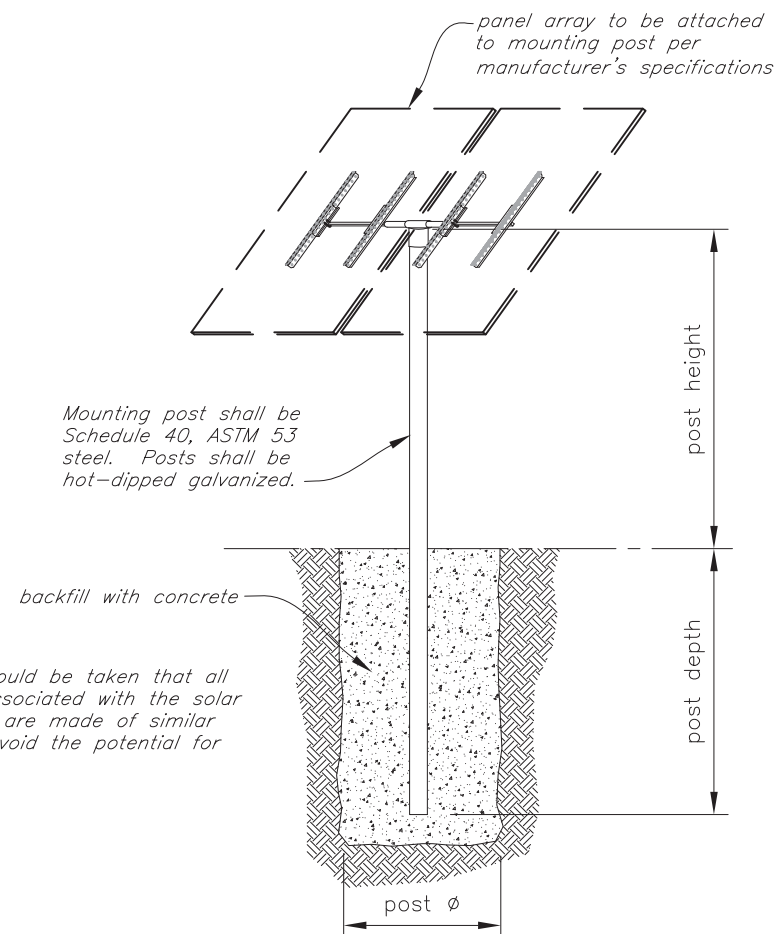
- <sup>1</sup> Pump controller, valves, switch box to be specified by manufacturer's recommendation
- <sup>2</sup> Contractor to provide landowner/NRCS as-builts to include panel array configuration and wiring details
- <sup>3</sup> See Oregon Department of Fish and Wildlife Screening Criteria

### MOUNTING POST SELECTION TABLE

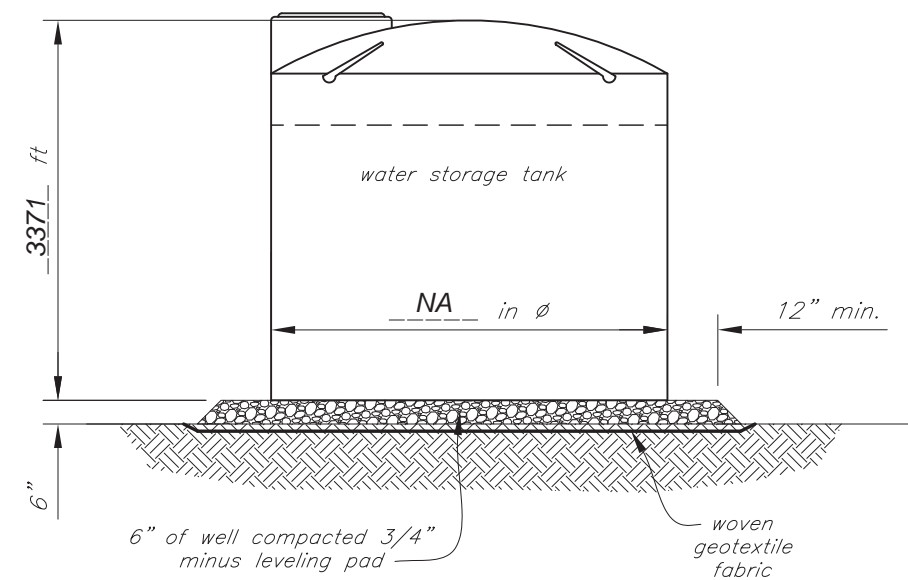
(Producer shall install mounting configuration circled below)

POST HEIGHT (FT)	PANELS	MIN. POST DIA. (IN)	POST HOLE DIA. (IN)	MIN. EMBEDMENT DEPTH (IN)	CONCRETE VOLUME (CY)
4 FT	Single Panel (A = 13.9 ft <sup>2</sup> )	4	24	38	0.46
	Double Panel (A = 27.8 ft <sup>2</sup> )	4	24	48	0.55
	Triple Panel (A = 41.7 ft <sup>2</sup> )	4	30	54	0.96
	Quad Panel (A = 55.6 ft <sup>2</sup> )	4	36	56	1.42
6 FT	Single Panel (A = 13.9 ft <sup>2</sup> )	4	24	36	0.44
	Double Panel (A = 27.8 ft <sup>2</sup> )	4	30	50	0.90
	Triple Panel (A = 41.7 ft <sup>2</sup> )	4	36	54	1.38
	Quad Panel (A = 55.6 ft <sup>2</sup> )	6	36	60	1.49
8 FT	Single Panel (A = 13.9 ft <sup>2</sup> )	4	30	38	0.72
	Double Panel (A = 27.8 ft <sup>2</sup> )	4	30	50	0.90
	Triple Panel (A = 41.7 ft <sup>2</sup> )	6	36	54	1.36
	Quad Panel (A = 55.6 ft <sup>2</sup> )	6	36	60	1.49
10 FT	Single Panel (A = 13.9 ft <sup>2</sup> )	4	24	44	0.51
	Double Panel (A = 27.8 ft <sup>2</sup> )	6	30	52	0.91
	Triple Panel (A = 41.7 ft <sup>2</sup> )	6	36	58	1.45
	Quad Panel (A = 55.6 ft <sup>2</sup> )	8	36	64	1.58

NOTE: Minimum post diameter, post hole diameter and post depth values have been designed for a wind speed of 95 mph and a 1 inch thick ice load. Sites where wind and ice loads exceed these values will need to be examined by a qualified engineer.



Note: Care should be taken that all connections associated with the solar power system are made of similar materials to avoid the potential for corrosion



### COMPACTED FILL:

$$\text{cubic yardage} = \left[ \frac{\pi}{4} (D + 2')^2 (0.5' \text{ gravel}) \right] \frac{1}{27} = \text{NA} \text{ cu yd}$$

Date  
08/18/18  
Designed: JBK, STP  
08/18/18  
Drawn: JBK, STP  
08/18/18  
Checked: JIC  
08/18/18  
Approved: \_\_\_\_\_  
Title: \_\_\_\_\_

**SOLAR POWERED SUBMERSIBLE PUMP**  
**RUTH BOWMAN LIVESTOCK**  
JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

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RuthBowman

Drawing No.

Sheet 17 of 22

### WATER QUALITY AT SOURCE

- Very Good Water contains no abrasive particles, and/or TDS < 50 ppm
  - Good Water may contain small amounts of silt, and/or TDS < 100 ppm
  - Fair Water may contain small amounts of silt, sand, or rust and/or TDS < 200 ppm
  - Poor Water may contain moderate amounts of silt, sand, or rust and/or TDS = 200-800 ppm
  - Very Poor Water regularly contains silt, sand, or rust and/or TDS > 800 ppm
- Comments: \_\_\_\_\_

### WATER STORAGE DATA

Volume Required = Maximum Daily Requirement 1200 (gal/day) x 3 days = 3600 gallons.

	Open Tank	Pres. Tank	In Line	Other	Total
Volume Available (gal):	<u>3000</u>	_____	_____	<u>1600</u>	<u>4600</u>
New or Existing:	<u>New</u>	_____	_____	<u>New</u>	_____

### WATER PUMPING DATA

- Static Water Depth: 0 ft. (Distance from ground to water surface when not pumping).
- Drawdown Level: NA ft. at \_\_\_\_\_ GPM. (Depth water drops when pumping).
- Discharge Head: 370 ft. (Dist. from ground surface to highest water surface in discharge line). (Use either Discharge Level or Pressure Head, but not both).
- Pressure Head: NA ft. (Tank pressure in psi. x 2.31).
- Losses: NA ft. (Minor and friction losses in discharge line from pump to tank).
- Total Dynamic Head: 370 ft. (Sum of values above).

### WATER SOLAR POWER DATA

#### SOLAR ISOLATION VALUES

Solar Station	Average kwh/m <sup>2</sup> /day or full sun hours	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Month
<u>45</u>		<u>3.1</u>	<u>3.2</u>	<u>4.3</u>	<u>5.5</u>	<u>6.3</u>	<u>6.8</u>	<u>7.4</u>	<u>6.9</u>	<u>6.1</u>	<u>4.8</u>	<u>2.6</u>	<u>2</u>	Hours
Latitude														

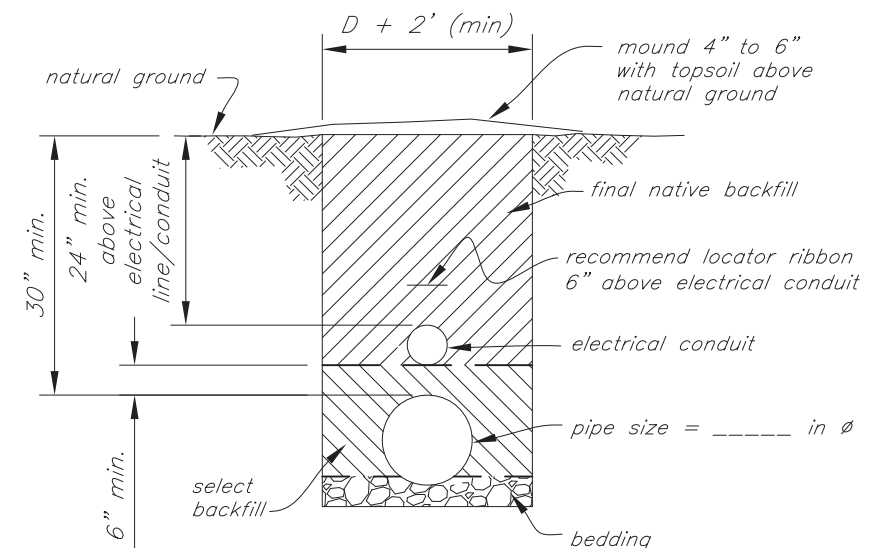
Design Solar Radiation Hours = 3 hours  
 Design Flow Rate (gpm) = 3600 gals (Volume Required) / 3 Solar Radiation Hours (1 hour/60 minutes)

### WATER SOURCE INFORMATION

SUBSURFACE		SURFACE			
WELL	SPRING	STREAM	CANAL	POND	
Depth (ft)	Yield (gpm)	Flow Rate (gpm)			<u>6.7</u>
Max. Yield (gpm)	COLLECTION BOX DATA	Seasonal or Perennial			<u>P</u>
Casing I.D. (in)	Depth (ft)	Min. Water Elev. (ft)			<u>3360</u>
Well Test (Y or N)	Volume (gal)				
Date of Test	Covered (Y or N)				

### WATER USE INFORMATION

Type of Use	Seasonal Water Requirement (gal/day)				Comments (# or type of animals, type or irrigation, etc.)
	Summer	Fall	Winter	Spring	
Livestock	<u>1200</u>				
Wildlife					
Irrigation					
Domestic/Potable					
Other					
Total Requirement	<u>1200</u>	<u>0</u>	<u>0</u>	<u>0</u>	

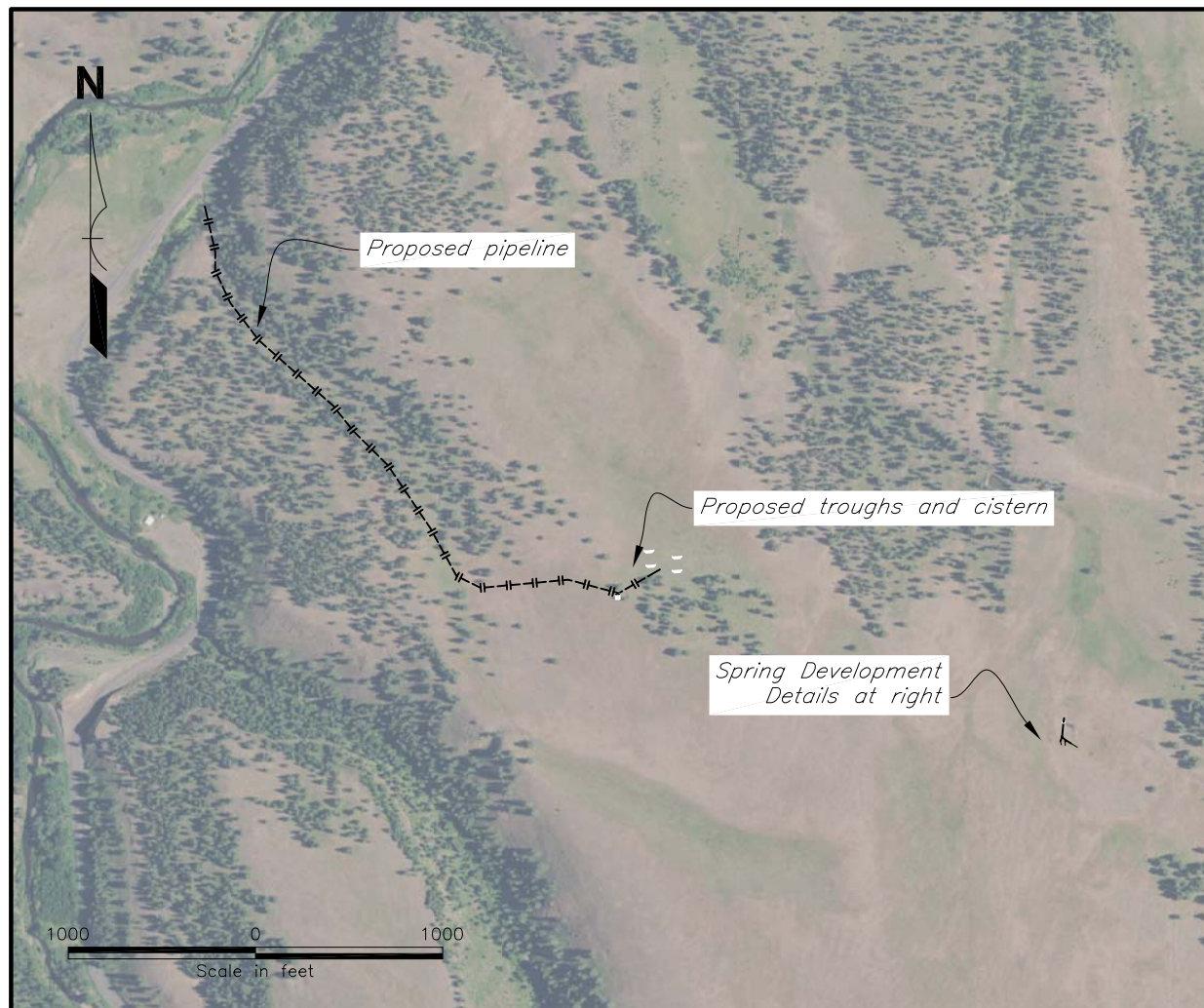


TYPICAL TRENCH DETAIL

Date	08/18/18
Designed	JBK, STP
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Title	

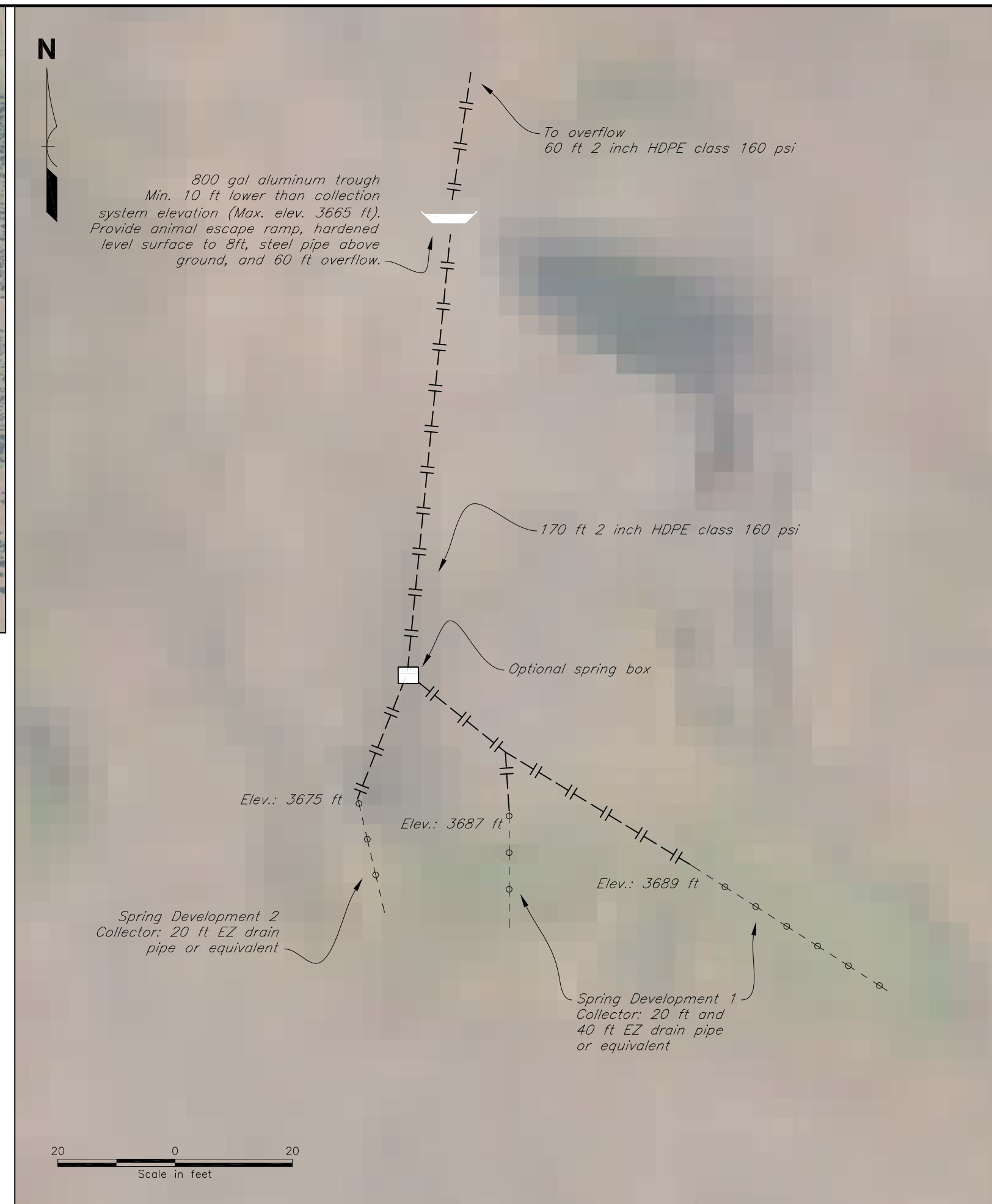
**WATERING SYSTEM GENERAL INFORMATION**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

United States Department of Agriculture  
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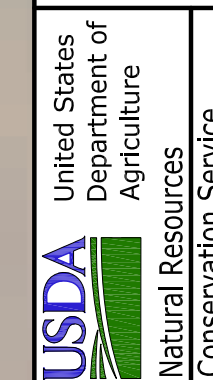
**Construction Notes:**

1. Minimum 18 inch depth of cover over pipe, see Trench Detail, Sheet 11.
2. Trough must overflow 60 ft away. See Overflow Details, Sheet 11.
3. Trough must have animal escape ramp. See Details, Sheets 13 – 16.
4. Trough must have hardened level surface to 8 ft. See Heavy Use Area Details, Sheet 12.
5. Trough must have steel pipe above ground, and trough must be properly secured. See Trough Details, Sheets 7–9.
6. Use 4" EZ drain pipe or equivalent for spring developments. See Spring Development Detail Sheets 20–21.
7. An optional spring box/settling basin may be installed. See Spring Box Detail, Sheet 22.

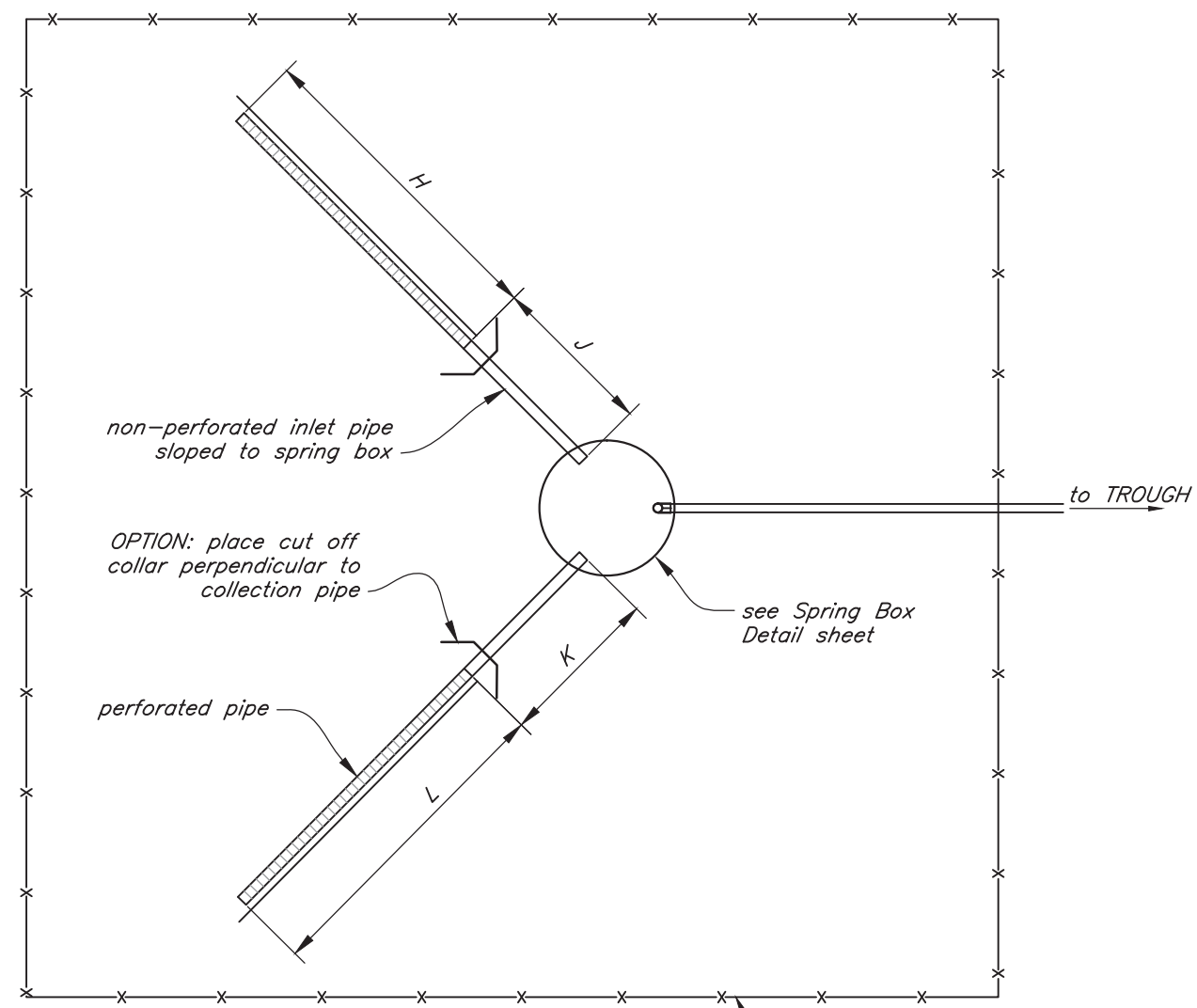


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Designed	JBK_STP
Drawn	JBK_STP
Checked	JIC
Approved	
Title	

**SPRING DEVELOPMENT**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

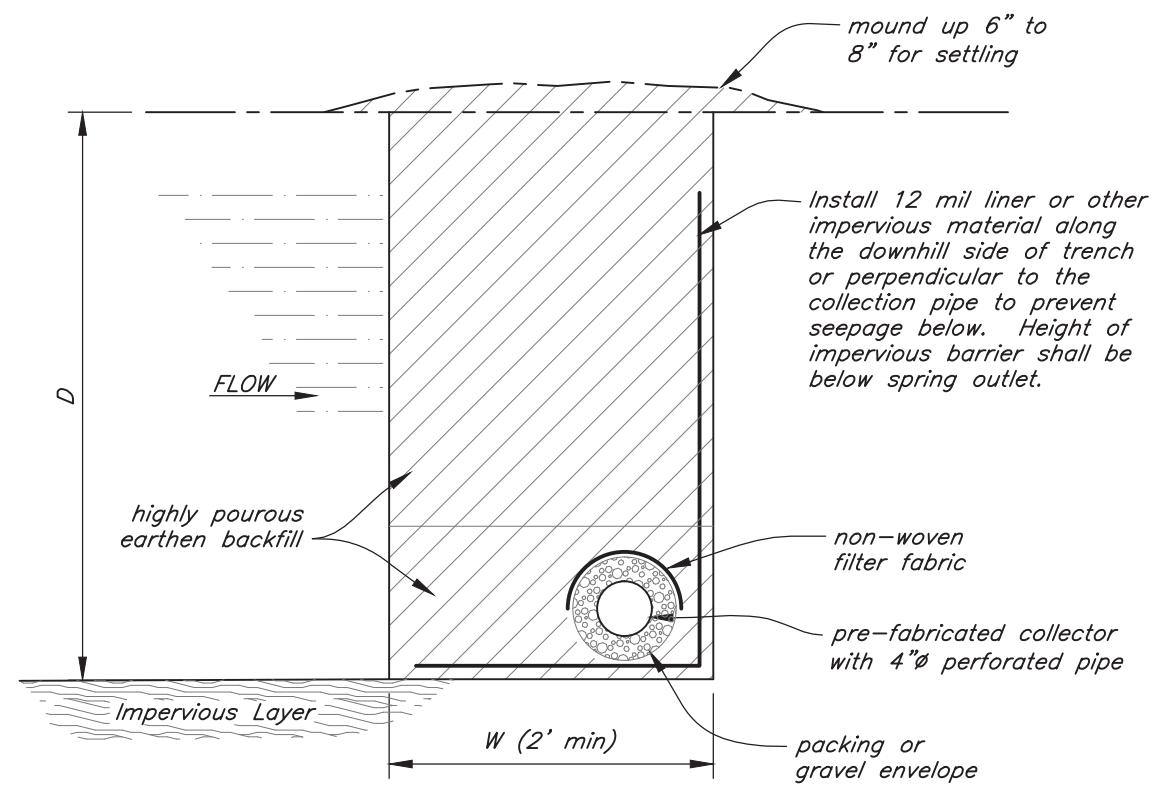


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Drawing No.	
Sheet	19 of 22

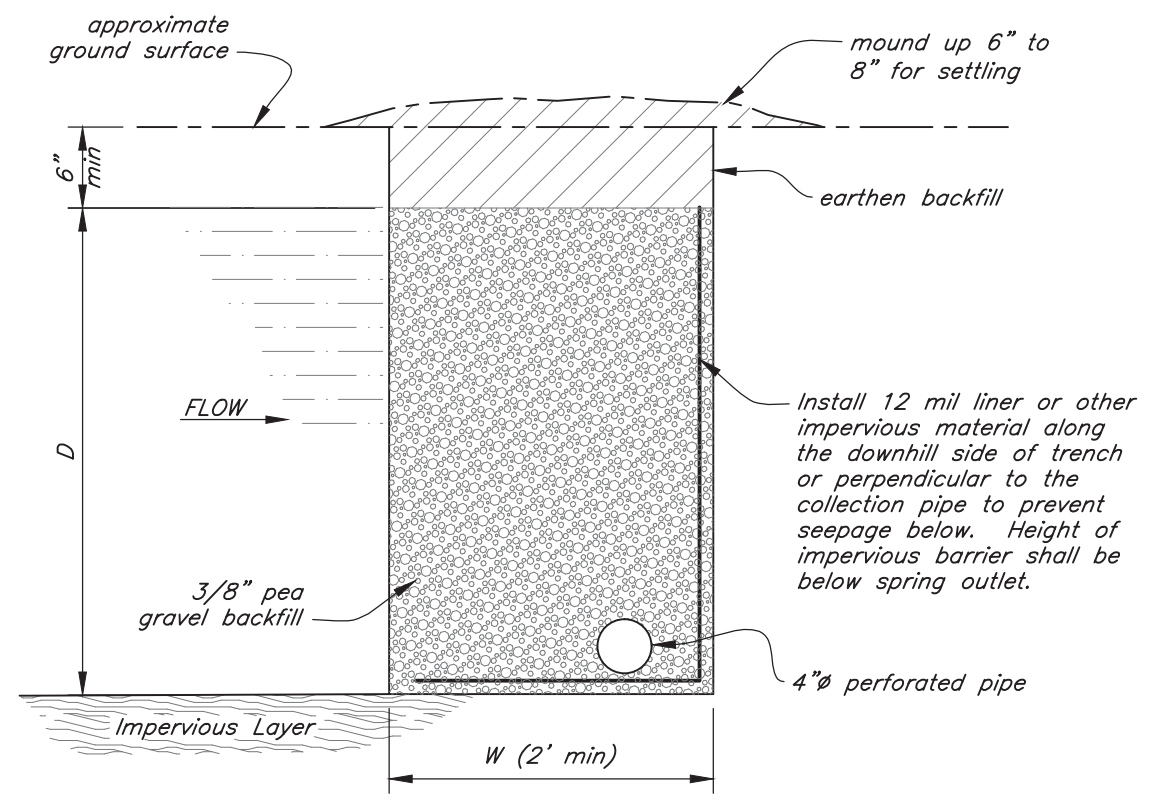


**PLAN VIEW**

standard 5-wire cattle fence and brace as specified in NRCS Construction Specification CS-092, Field Fence, and Range Technical Note No. 20, Fence Designs



**OPTION A**  
ROCKLESS DRAINAGE PANEL WITH 4"Ø PERFORATED PIPE



**OPTION B**  
4"Ø PERFORATED PIPE WITH PEA GRAVEL BACKFILL

**NOTES:**

1. Install collector pipe upstream of the visible green surface area just as it exits the subsurface confining layer.
2. Install the collector pipe on a confining surface for water flow. Minimum depth is 2.5 ft.
3. Cover the collector pipe from 9 o'clock to 3 o'clock with a 100 sieve non woven filter fabric
4. Sand / gravel backfill shall be clean and well graded.

TRENCHED COLLECTION SYSTEM		
OPTION (X choose)	DESCRIPTION	
✓	OPTION A	Rockless drainage panel with 4"Ø perforated pipe
	OPTION B	Perforated 4"Ø pipe with pea gravel backfill

DIMENSIONS					
TRENCH		INLET PIPE		COLLECTION PIPE	
W	30 in	J	2 in	H	4 in
D	TBD	K	2 in	L	4 in

Date	08/01/18
Designed	JBK
Drawn	JBK
Checked	JJC
Approved	
Title	

SPRING DEVELOPMENT DETAIL - PERFORATED COLLECTOR PIPE  
RUTH BOWMAN LIVESTOCK  
JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY

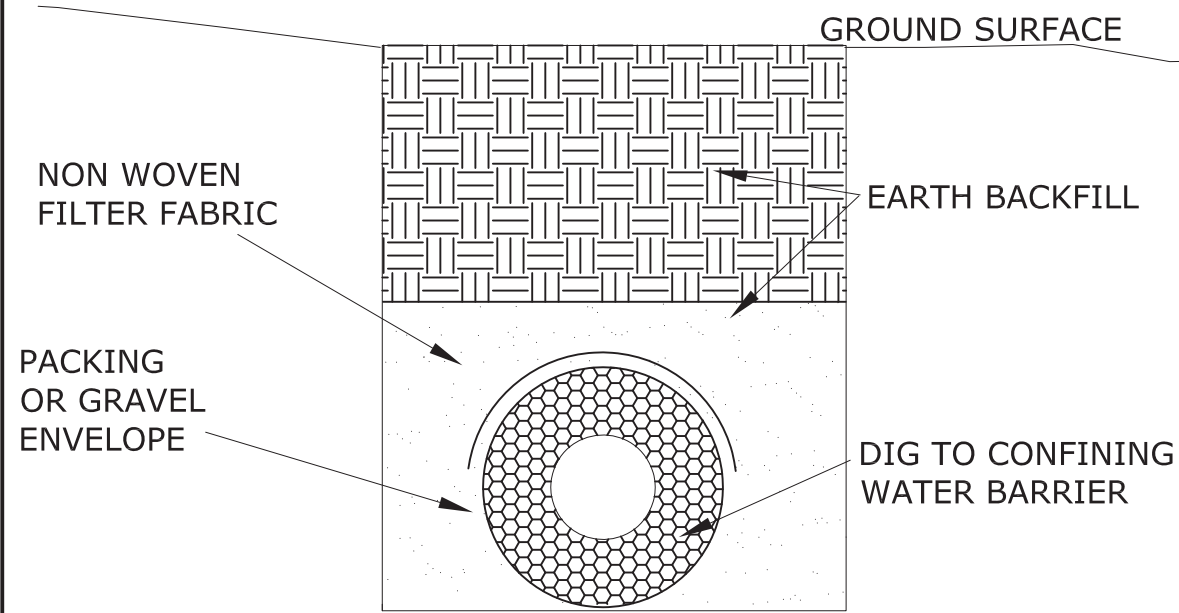


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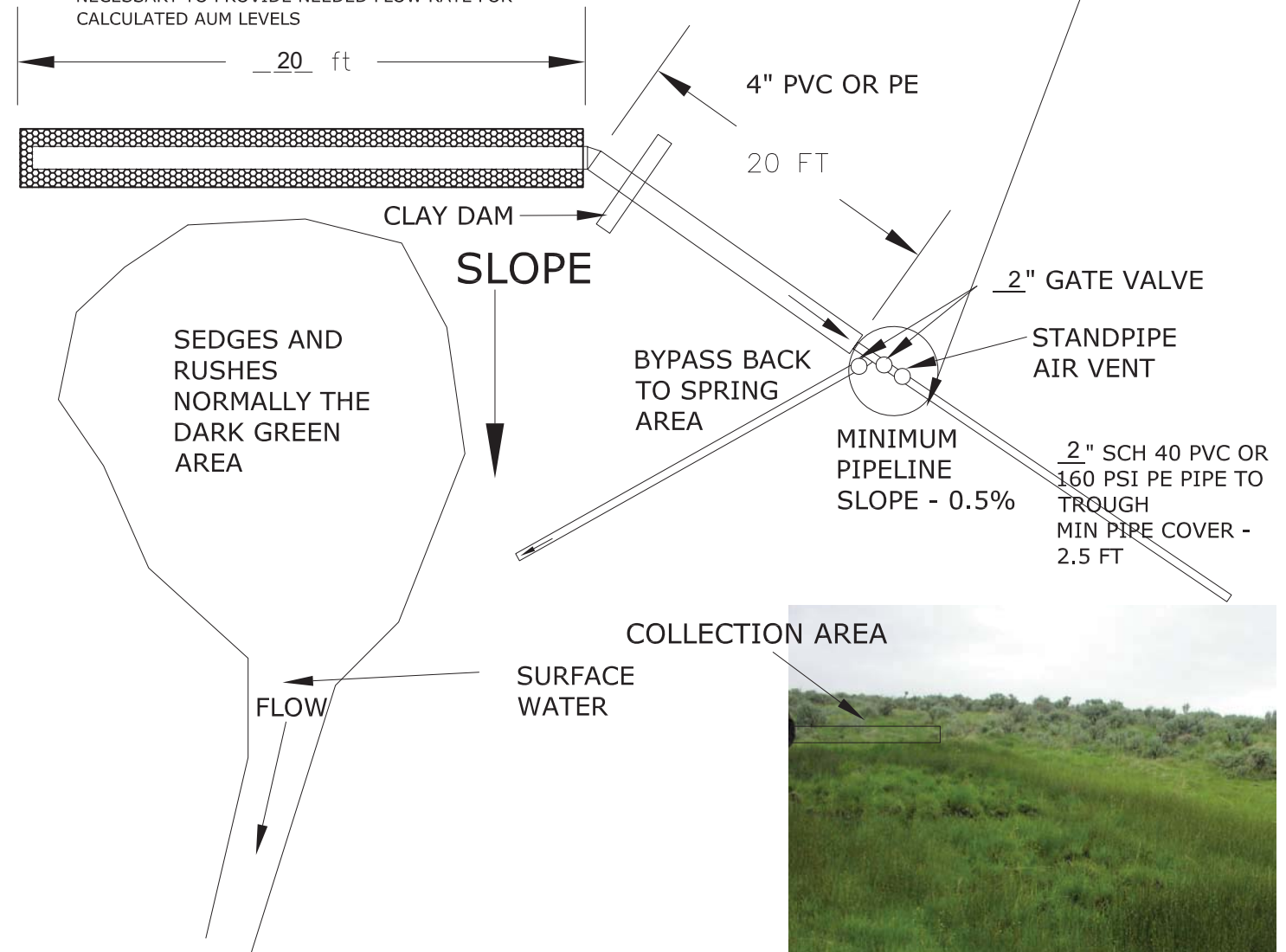


TYPICAL COLLECTOR INSTALLATION



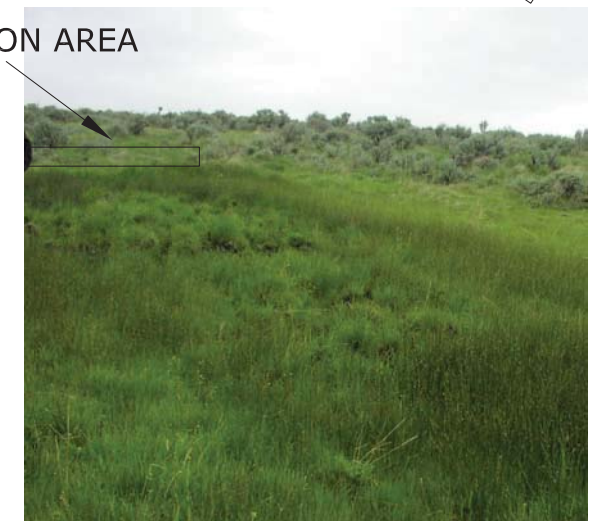
COLLECTOR TRENCH DETAIL

4" COLLECTOR PIPE ENCASED IN GEO-SYNTHETIC AGGREGATE (EZFLOW PIPE OR EQUIVALENT) OR MIN 12" GRAVEL ENVELOPE SURROUNDING 4" PERFORATED COLLECTOR PIPE  
 -ONLY DEVELOP AS MUCH SPRING AREA AS NECESSARY TO PROVIDE NEEDED FLOW RATE FOR CALCULATED AUM LEVELS



PLAN VIEW - TYPICAL SPRING DEVELOPMENT LAYOUT

**NOTE:**  
 -INSTALL COLLECTOR PIPE UPSTREAM OF THE VISIBLE GREEN SURFACE AREA JUST AS IT EXITS THE SUBSURFACE CONFINING LAYER  
 -INSTALL THE COLLECTOR PIPE ON A CONFINING SURFACE FOR WATER FLOW. MINIMUM DEPTH IS 2.5 FT  
 -COVER THE COLLECTOR PIPE FROM 9 O'CLOCK TO 3 O'CLOCK WITH A 100 SIEVE NON WOVEN FILTER FABRIC

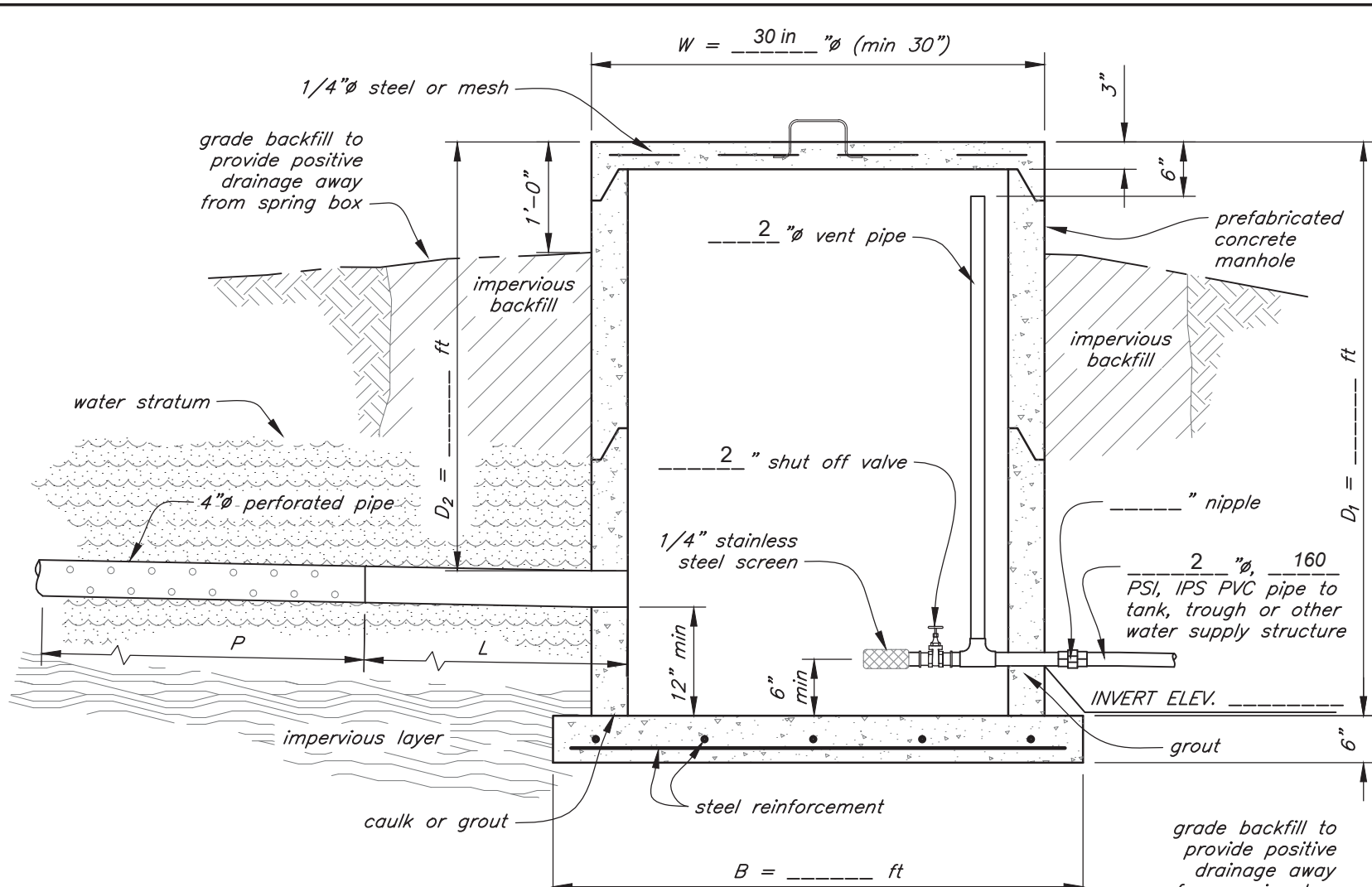


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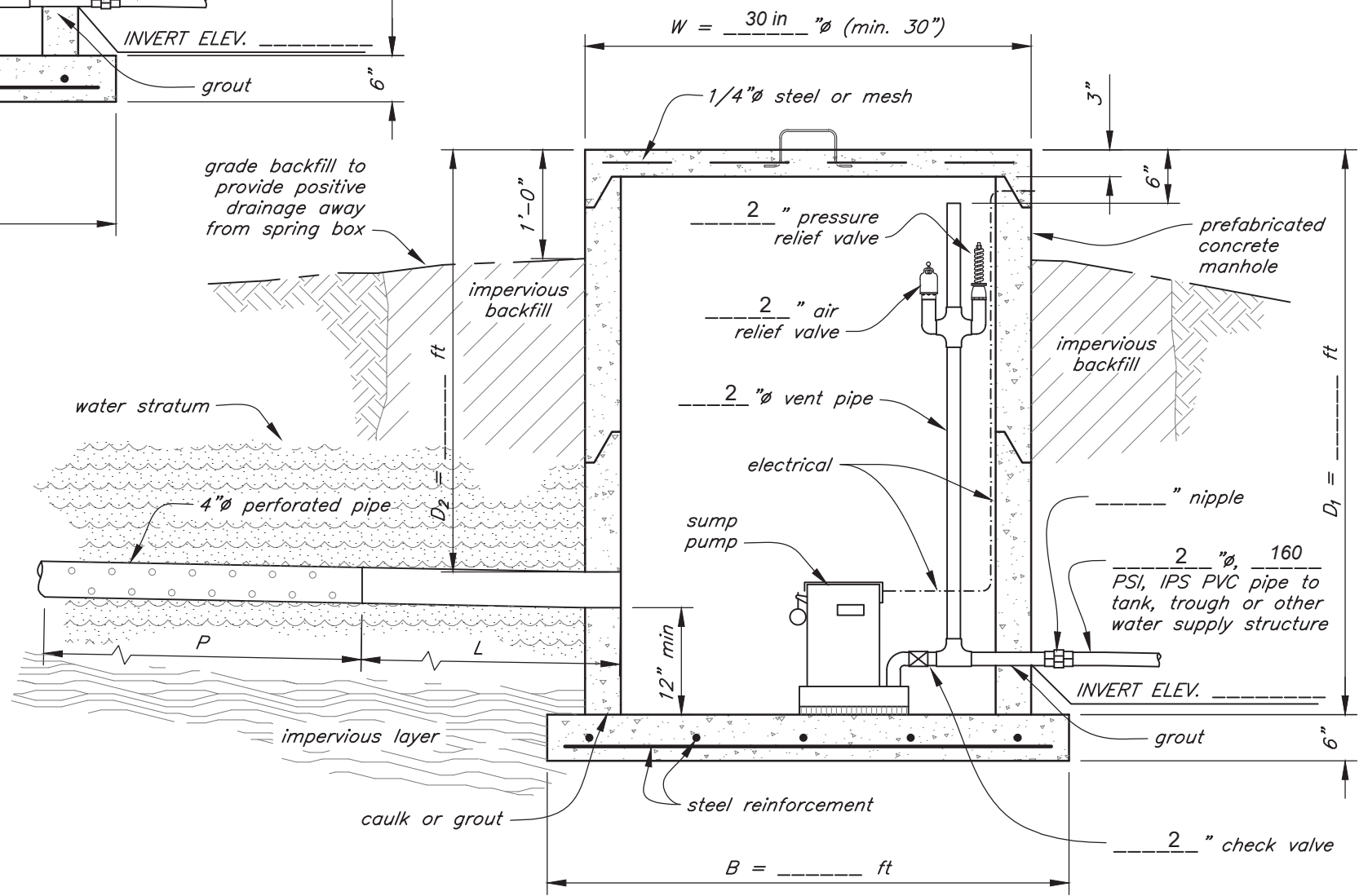
**SPRING DEVELOPMENT DETAILS**  
 RUTH BOWMAN LIVESTOCK  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY



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**SECTION**



**ALTERNATE SECTION**

**GENERAL NOTES**

1. All concrete shall be reinforced with #4 rebar @ 12" c-c, both ways.
2. Place perforated pipe sections in water bearing strata.
3. Connect supply line to tank, trough or other water supply structure.
4. Provide air passage into spring box by placing three 1/2" holes in cover.
5. Corrugated metal pipe or other metal pipe may be used instead of concrete pipe. Use 1/8" galvanized steel lid if collector is corrugated metal.
6. Install collector pipe upstream of the visible green surface area just as it exits the subsurface confining layer.
7. Install the collector pipe on a confining surface for water flow. Minimum depth is 2.5 feet.
8. Cover the collector pipe from 9 o'clock to 3 o'clock with a 100 sieve non woven filter fabric.
9. Spring box shall be founded on impervious material or have a 3/16" galvanized steel plate bottom.

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**CONCRETE SPRING BOX**  
**RUTH BOWMAN LIVESTOCK**  
 JOB CLASS: IV PRACTICE STANDARDS: 533, 516, 614, 587, 574  
 JOHN DAY UMATILLA SNAKE RIVER BASIN UNION COUNTY



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