

# PIPELINE

(Feet)  
Code 516

Natural Resources Conservation Service  
Conservation Practice Standard

## I. Definition

Pipeline having an inside diameter of 8 inches or less.

## II. Purpose

This practice may be applied as part of a resource management system to achieve one or more of the following purposes:

- Convey water from a source of supply to points of use for livestock, wildlife, or recreation.
- Reduce energy use.
- Develop renewable energy systems (i.e., in-pipe hydropower).

## III. Conditions Where Practice Applies

Where it is desirable or necessary to convey water in a closed conduit from one point to another.

## IV. Federal, Tribal, State, and Local Laws

Users of this standard should be aware of potentially applicable federal, tribal, state and local laws, rules, regulations or permit requirements governing pipelines. This standard does not contain the text of federal, tribal, state or local laws.

## V. Criteria

### A. The following criteria apply to all purposes.

#### 1. Capacity

The installation shall have a capacity to provide seasonal high daily water requirements for the number and species of animals to be supplied. Livestock water requirements can be obtained from Table 1.

The rate at which livestock drink and their watering habits must be assessed in order to

provide adequate pipeline capacity. A combination of tank sizing and pipeline capacity can be used to satisfy the water demand.

For recreation areas, the water capacity shall be adequate for all planned uses. Typical examples are drinking water, fire protection, showers, flush toilets, and irrigation of landscaped areas.

Minimum capacity for household use shall be 10 gallons per minute and 35-50 gallons per day per person.

Additional water capacity will be provided for wildlife when applicable.

**Table 1**  
**Minimum Daily Livestock Water Requirements**

Livestock	Drinking Water Quantity <sup>1</sup> (gals/head)	
	Continuous / Low Management Grazing System	Prescribed / Managed Grazing System
Beef Cow	20	15
Cow & Small Calf	20	15
Horses & Mules	20	15
Sheep & Goats	4	2
Dairy Cow	25	20
Hog	2	

<sup>1</sup>Daily water consumption for livestock classes not listed may be calculated at one gallon per day per 100 pounds of body weight.

## 2. Sanitary Protection

If water from the pipeline is to be used for human consumption, applicable state codes and local regulations shall be met.

When a pipeline serving livestock is supplied from a source that provides water for human consumption, an approved method for eliminating backflow will be installed.

## 3. Pipe

All pipe must withstand the pressure it will be subjected to, including hydraulic transients, internal pressures and external pressures. As a safety factor against surge or water hammer, the highest working pressure should not exceed 72% of the pressure rating of the pipe and the design flow velocity at system capacity should not exceed 5 feet/second. If either of these limits is exceeded, special consideration must be given to flow conditions and measures must be taken to adequately protect the pipeline against surge.

Plastic pipe, fittings, and solvents shall conform to the requirements of the ASTM specifications in Table 2.

Steel pipe shall meet the requirements of AWWA Specification C-200.

Rubber gaskets for pipe joints shall conform to the requirements of ASTM F477, Elastomeric Seals (Gaskets) for Joining Plastic Pipe.

## 4. Drainage

Valves or unions shall be installed at low points in the pipeline so that the line can be drained as needed. Check valves shall be installed as needed to protect groundwater quality or maintain a full pipeline.

Drainage by gravity or compressed air systems shall be provided on above-ground installations.

## 5. Vents

Design shall provide for entry and removal of air along the pipeline, as needed, to prevent air locking or pipe collapse. If parts of the line are above the hydraulic gradient, periodic use of an air pump may be required. Provisions shall be made for pressure relief, air relief and vacuum relief as needed to protect the pipeline.

## 6. Joints

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 they are made of material susceptible to corrosion, provisions must be made to protect them.

## 7. Protection

All pipes shall be protected from hazards presented by traffic, farm operations, freezing temperatures, fire, thermal expansion, and contraction. Reasonable measures should be taken to protect the pipe from potential vandalism.

Install shutoff valves in various locations along the pipeline to allow easy repair of the broken appurtenances and damaged pipe.

Water shall not be allowed to freeze in pipelines or appurtenances. Protection from freezing may be achieved by draining or using compressed air to evacuate the pipe and fittings during freezing conditions, insulating, burying below frost depth, or heating.

If cold weather operation is planned, the pipe shall be buried below frost depth or provisions made to evacuate the pipe after each use. Freeze-resistant pipe is manufactured to allow expansion of the pipe during periods of cold weather. However, parts of the pipeline, such as float valves, connectors, etc., may not be freeze resistant.

Frost depth may be obtained from the NRCS National Engineering Handbook (NEH) Part 651, Agricultural Waste Management Field Handbook, Chapter 10 Wisconsin Supplement or local information.

Polyethylene pipe used in above-ground systems will be made of materials with 2 percent carbon black and be designated with code letter "C" in the material cell classification as defined in ASTM D 3350 to provide ultraviolet resistance. It shall be resistant to ultraviolet light throughout the intended life of the pipe. Pipe of this type is suitable for seasonal use. Protect the pipe by placing it under perimeter and/or cross fences. Where pipelines cross heavy traffic areas or dissect a pasture, they shall be buried to a depth of 8-12 inches. Winterizing of these pipeline systems shall be done prior to freezing temperatures. This can be done by blowing out the system to remove any water within the pipeline or equivalent method.

Other plastic pipe installed above ground shall be resistant to ultraviolet light throughout the intended life of the pipe.

When steel pipe is used, interior protective coatings shall be provided if the pH of the water to be conveyed is 6.5 or lower. If a coal-tar enamel protective coating is needed for corrosion protection, the coating shall meet the requirements of AWWA Specification C203.

Steel pipe installed above ground shall be galvanized or shall be protected with a suitable protective paint coating, including a primer coat and two or more final coats.

#### 8. Low Pressure Systems

These systems are gravity flow or pumping systems where operating pressure does not exceed 15 psi and length of the pipe is less than 1,500 feet. The minimum pipe size shall be  $\frac{3}{4}$  inch diameter.

NRCS National Engineering Handbook (NEH) Part 650, Engineering Field Handbook (EFH), Chapter 12 may be used for design of these systems. Low pressure pumping

systems such as nose pumps, solar pumps, etc., shall be considered if operating pressure does not exceed 15 psi.

#### 9. Vegetation

Disturbed areas shall be established with vegetation or otherwise stabilized as soon as practical after construction. Seedbed preparation, seeding, fertilizing, and mulching shall conform to NRCS Field Office Technical Guide (FOTG), Section IV, Standard 342, Critical Area Planting.

#### 10. Visual Resources

The visual design of pipelines and appurtenances in areas of high public visibility shall be carefully considered.

### **B. Additional Criteria Applicable to Reduce Energy Use**

Provide analysis to demonstrate reduction of energy use from practice implementation.

Reduction of energy use is calculated as average annual or seasonal energy reduction compared to previous operating conditions.

### **C. Additional Criteria Applicable to Develop Renewable Energy Systems**

Renewable energy systems shall meet applicable design criteria in NRCS and/or industry standards, and shall be in accordance with manufacturer's recommendations. Hydropower systems shall be designed, operated, and maintained in accordance with the Microhydropower Handbook, Sections 4 and 5, as appropriate.

## **VI. Considerations**

Considerations include additional design recommendations that are not required criteria, but may be used to enhance or avoid problems with the design and function of this practice.

- A. Potential effects of installation and operation of the pipeline on cultural, historical, archaeological, or scientific resources at or near the site need to be considered in planning.
- B. Vegetation should be allowed to grow over the pipe to shade it from the sun. Where fire is to be used as a management tool, specific provisions must be made to protect the pipe from fire.
- C. The impact of water available at remote sites is a factor in keeping livestock out of streams and lakes with the resulting reduction in bank erosion, sediment yield, and the direct deposit of manure in water courses.

## **VII. Plans and Specifications**

Plans and specifications for installing pipelines shall be in keeping with this standard and shall describe the requirements for applying the practice to achieve its intended purpose. If the pipeline is a component of a system that includes additional conservation practices, the information necessary to construct these additional practices will also be conveyed on the plans.

The NEH Part 650, EFH, Chapter 5, may be used as a guide for the development of construction plans.

## **VIII. Operation and Maintenance**

An Operation and Maintenance Plan specific to the type of installed pipeline shall be provided to the landowner. The plan shall include, but not be limited to, the following provisions:

- Opening/closing valves to prevent excessive water hammer;
- Filling at the specified rate requirements;
- Inspecting and testing valves, pressure regulators, pumps, switches and other appurtenances;
- Maintaining erosion protection at outlets;
- Checking for debris, minerals, algae and other materials which may restrict system flow; and
- Draining and/or providing for cold weather operation of the system.

## **IX. References**

USDA, NRCS, Wisconsin Field Office Technical Guide, Section IV, Conservation Practice Standards and Specifications.

USDA, NRCS, National Engineering Handbook, Part 650, Engineering Field Handbook.

USDA, NRCS, National Engineering Handbook, Part 651, Agricultural Waste Management Field Handbook.

Table 2

## Plastic Pipe Materials, Fittings, and Solvents for Pipeline Installation

<b>Pipe Materials</b> (ASTM Specifications unless otherwise noted)	D 1527 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe, Schedules 40 and 80
	D 1785 Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
	*D 2104 Polyethylene (PE) Plastic Pipe, Schedule 40
	*D 2239 Polyethylene (PE) Plastic Pipe (SIDR-PR) Based on Controlled Inside Diameter
	D 2241 Poly(Vinyl Chloride) (PVC), Pressure-Rated Pipe (SDR)
	D 2282 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe (SDR-PR)
	*D 2447 Polyethylene (PE) Plastic Pipe, Schedules 40 and 80, Based on Outside Diameter
	D 2513 Thermoplastic Gas Pressure Pipe, Tubing and Fittings
	*D 2737 Polyethylene (PE) Plastic Tubing
	D 2672 Joints for IPS PVC Using Solvent Cement
	*D 3035 Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Controlled Outside Diameter
	AWWA C900 Polyvinyl Chloride (PVC) Pressure Pipe, 4 inches through 12 inches
	*AWWA C901 Polyethylene (PE) Pressure Pipe and Tubing, ½ inch through 3 inches
<b>Pressure Fittings</b> (ASTM Specifications)	D 2464 Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
	D 2466 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40
	D 2467 Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80
	D 2468 Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe Fittings, Schedule 40
	D 2609 Plastic Insert Fittings for Polyethylene (PE) Plastic Pipe
	D 2683 Socket-Type Polyethylene Fittings for Outside Diameter-Controlled Polyethylene Pipe and Tubing
	D 3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
	D 3261 Butt Heat Fusion Polyethylene (PE) Plastic Fittings for Polyethylene (PE) Plastic Pipe and Tubing
<b>Solvents</b> (ASTM Specifications)	D 2235 Solvent Cement for Acrylonitrile-Butadiene-Styrene (ABS) Plastic Pipe and Fittings
	D 2564 Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings
	D 2855 Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings

\*Must contain the code letter "C" in the material cell classification for above-ground use. (ASTM D 3350 states that code letter C pipe contains 2% carbon black.)