NATURAL RESOURCES CONSERVATION SERVICE

CONSERVATION PRACTICE STANDARD

ABOVE GROUND, MULTI-OUTLET PIPELINE

(Ft.)

CODE 431

DEFINITION

A water distribution tubing consisting of aluminum, PVC, or lay-flat polyethylene pipeline with closely spaced orifices or gates.

PURPOSE

- To increase water use efficiency on irrigated land.
- To reduce irrigation induced soil erosion.
- To reduce excessive runoff, flooding, or ponding associated with inefficient irrigation water use.
- To improve the productivity, health and vigor of the crop.
- To increase the quantity and quality of feed and forage for domestic animals.

CONDITIONS WHERE PRACTICE APPLIES

The practice applies to irrigable land suited to surface application methods. This practice shall not be used in lieu of buried pipelines for conveyance systems. However, reaches of un-gated pipe may be used:

- to obtain necessary working pressure for the system,
- to convey water to various points within a field,
- for splitting irrigation runs as in surge irrigation, or
- where rock precludes the installation of buried pipelines.

Water supplies and rates of irrigation delivery for the area served by the multi-outlet pipeline shall be sufficient to make irrigation practical for the crop to be grown and for the method of application.

CRITERIA

General Criteria Applicable To All Purposes

Working pressure. The maximum working pressure for rigid pipe shall be 10 pounds per square inch or 23 feet of head. Excess working pressure shall be reduced to acceptable levels by installing an appropriate head control appurtenance.

For lay-flat polyethylene pipe, the manufacturer's recommendations for maximum allowable working pressure shall be followed. If the manufacturer's recommendations are not available, the hoop stress formula in National Engineering Handbook (NEH) Part 636 Chapter 52 shall be used to determine maximum working pressure, using a safety factor of 1.5.

Friction losses. For design purposes, friction head losses shall be no less than those computed by either the Hazen-Williams equation, using roughness coefficients of C=130 for aluminum pipe and C=150 for plastic or lay-flat polyethylene pipe, or by Manning's equation using a roughness coefficient of n = 0.012 for plastic or aluminum pipe . The use of approved computer software methods, or a multiple outlet factor in manual computations shall be used in computing losses when appropriate. Refer to National Engineering Handbook (NEH), Part 650, EFH Chapter 15: Irrigation for guidance.

Flow velocity. Velocity in the pipeline when operating at system capacity shall not exceed 7 feet per second.

Capacity. The design capacity of the pipeline shall be sufficient to deliver an adequate

irrigation stream to the design area for the planned irrigation method.

Outlet gates. Individual outlet gates shall have the capacity at design working pressure to deliver the required flow to a point at least 0.3 feet above the field surface.

Head requirement. The working head shall not be less than 0.5 feet above outlet gates, and the pipe shall be installed on a uniform grade when the working head is less than 1.0 feet above the outlet gates.

Where either the design working head exceeds 5 feet or where stream flows are erosive, an effective method of energy dissipation shall be installed on each gate, or permanent vegetation shall be planted along the pipeline to provide erosion control.

Outlet Appurtenances. A suitable outlet shall be installed at the end of the pipeline for flushing the line free of sediment or other foreign material. Some provisions for removing trapped air or excess flow shall be provided at the end of the pipeline in order to protect the pipeline during initial filling.

Materials. Rigid pipe shall be aluminum or plastic material certified by the manufacturer for above ground use.

For durability and transportability, rigid pipes shall be a minimum of 6 inches in diameter and not greater than 12 inches in diameter.

All pipe appurtenances shall be compatible with the size and brand of gated pipe being used.

All fittings and couplers shall equal or exceed the pressure rating of the pipe with which they will be used. They shall be made of material that is recommended by the manufacturer for use with the pipe

Rigid pipe and appurtenances shall be furnished with a coupling system that is interchangeable with the selected pipe material.

Rubber gaskets shall be according to the manufacturer's standard design dimensions and tolerances for the pipe material selected. They shall be of such size and shape as to provide an adequate compressive force against the spigot and socket after assembly to effect a positive seal. The gasket shall be the sole element depended upon to make the joint flexible and watertight. The gasket shall be a continuous elastomeric ring.

Minimum wall thickness for aluminum gated pipe shall be 0.050 inches for 6 through 10 inches in diameter and 0.058 inches for 12 inch diameter pipe.

Corrosion protection shall be provided for aluminum pipe when:

- conveying water with a copper content exceeding 0.02 ppm,
- in contact with soil having a resistivity of less than 500 ohm-cm
- in contact with soil having a pH less than 4 or greater than 9

Minimum wall thickness of rigid PVC pipe shall be 0.120 inches. The pressure rating of the pipe shall be 22 p.s.i. or greater, prior to gate installation.

Minimum wall thickness of lay-flat polyethylene pipe shall be 6 mil (.006 inch).

Related structures. An open ditch supply shall include a permanent water control structure as the inlet to multi-outlet pipe.

Screens or other devices to remove debris should be installed upstream of the gated pipe when the water supply may contain debris that could plug the gates.

When the water supply for lay-flat polyethylene pipe is greater than 0.5 feet above ground, a rigid pipe shall be used to convey water between the outlet and the coupling of lay-flat polyethylene pipe.

CONSIDERATIONS

Consider provisions for thrust control at locations subject to pipe movement.

Consider applicability of future surge or automation alternatives in preparing the design.

Consider the water source and potential trash types and amounts when evaluating screen types and sizes and in the design of an inlet screen.

Consider effects on the water budget, including water quality, volume of runoff, and rates of runoff, in any downstream drainage.

Consider effects on wetlands and water related wildlife.

Consider effects on water flows and aquifers and the effects on other water uses and users.

Consider disposal of lay-flat polyethylene pipe and potential of recycling.

Consider anchoring lay-flat polyethylene tubing when winds may cause it to move.

Consider including a water measuring device to assist in irrigation water management.

PLANS AND SPECIFICATIONS

Plans and specifications shall be prepared to show site specific details. The drawings and specifications shall show:

- pipe location(s),
- pipe size(s);
- construction details for the inlet structure and screen as applicable;
- sizes and construction details for head control facilities; and
- gate spacing and erosion control details as appropriate.

If lay-flat polyethylene pipe is included in the plan, and the manufacturer's recommendations for working pressure are not available, an appropriate formula or table for determining maximum working pressure shall be included in the practice specification.

Plans should also included gate openings or orifice sizes necessary to deliver the design flows as determined by appropriate surface irrigation design procedures.

OPERATION AND MAINTENANCE

The operation and maintenance plan for the system shall include:

- requirements to avoid damaging the pipe during filling operations,
- requirements for flushing pipe,
- requirements for cleaning and repairing of screens and structures,
- requirements for inspecting and replacing individual gates and gaskets,
- requirements for off-season collection, storage and handling of pipe,
- requirements for anchoring pipe where wind conditions require, and
- recommendation for recycling lay-flat polyethylene pipe, where recycling is available.

If the source of water supply is from a water well, the operation and maintenance plan shall note that the presence of sand in the pipeline may indicate problems with the water well.

REFERENCES

NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 3, Hydraulics. USDA Natural Resources Conservation Service. Washington, D.C.

NRCS. National Engineering Handbook, Part 650, Engineering Field Handbook, Chapter 15, Irrigation. USDA Natural Resources Conservation Service. Washington, D.C.

NRCS. National Engineering Handbook, Part 623, Chapter 5, Furrow Irrigation. USDA Natural Resources Conservation Service. Washington, D.C.

NRCS. National Engineering Handbook, Part 652, National Irrigation Guide. USDA Natural Resources Conservation Service. Washington, D.C.

NRCS. Colorado Irrigation Guide. USDA Natural Resources Conservation Service. Lakewood, CO.