5.6 Replacement of On-Farm Irrigation Ditches with Pipelines

Applicability

This BMP is applicable to irrigated farms that use an open ditch to convey irrigation water and as an alternative to lining the ditch. In general, pipelines are used to replace on-farm ditches with less than 2,000 gpm (4.5 cubic feet per second) capacity.

Description

This practice is the replacement of on-farm irrigation ditches with buried pipeline and appurtenances to convey water from the source (well, irrigation turnout, farm reservoir) to an irrigated field. On-farm pipelines can be used to replace most types of farm ditches. In general, on-farm pipelines are 24 inch in diameter or less, with 8 inch through 15 inch pipelines being common. Most farm pipelines use either PVC Plastic Irrigation Pipe ("PIP") or Iron Pipe Size ("IPS") PVC pipe. PIP is available in diameters from 6 inch to 27 inch with pressure ratings from 80 psi to 200 psi. IPS PVC pipe is available in diameters from 6 inch to 12 inch with pressure rates from 63 psi to 200 psi.

Implementation

Installation of any pipeline requires design and field engineering. The pipeline location must be surveyed and the size, installation procedures, pipe type, bedding and compaction details, and other engineering considerations should be addressed in engineering drawings and a design report. Planning considerations include working pressure, friction losses, flow velocities, and flow capacity. Systems shall be designed with appurtenances to deliver water from the pipe system to the irrigated field, check valves to manage backflow, and pressure relief stands to manage air entrapment and pressure issues.

Schedule

The time required to replace an open ditch with a buried PVC pipeline depends on the site conditions, depth of the pipeline trench, size of the pipeline, and number of outlets or connections in the pipeline, and the type of equipment used. Typical installation times range from 100 feet per day to more than 500 feet per day for a 6 inch to 12 inch diameter pipeline installed in a sandy loam soil with few or no rocks, using a four person crew with mechanical excavation of the pipe trench to a depth less than 4 feet, minimal site preparation, and mechanical backfill. Most on-farm pipeline projects are constructed during a time when no irrigation water is required for crops and are typically designed and installed during the winter or early spring.

Scope

The two primary limitations for replacement of a farm ditch with pipelines are cost and capacity. Construction of an unlined farm ditch can typically be done using farm equipment common to farming and at minimal cost. Installation of pipeline usually requires the farm to rent trenching or excavating equipment or contract for the installation of the pipeline at

significant costs. In general, a farm ditch has the capacity to carry significantly more irrigation water than a farm pipeline. The decision to line a farm ditch or replace the ditch using a pipeline is often made based on how much water is conveyed in the ditch. The smaller the capacity of the ditch, the more likely it is a candidate for replacement using a pipeline.

Documentation

To document this BMP, the agricultural water user shall gather and maintain the following documentation:

1. Copies of equipment invoices or other evidence of equipment purchase and installation;
2. Any USDA Farm Service Agency or other governmental agency evaluation and assistance reports that may relate to the project.
3. Water measurement records from both the period before and after conversion to the water efficient irrigation system.

Determination of Water Savings

The seepage rate of ditch can be estimated by conducting one or more ponding tests with a typical section of the ditch prior to the ditch being lined. A ponding test measures the rate at which the level of water ponded behind an earthen dam placed in the ditch drops over two to twenty-four hours. The amount of the ditch that is wetted by the pond behind the dam must be measured. The seepage rate can be calculated as acre-feet per mile of ditch per day. The total quantity of water lost to seepage from the ditch is estimated by multiplying the seepage rate times the number of days per year the ditch is used to convey water. For example a small farm ditch with a wetted perimeter of 5 feet and a length of ½ mile is found to have a seepage rate of 1.0 acre-feet per mile per day. The ditch is used to carry irrigation water 40 days per year. The total seepage from the ditch is 20 acre-feet per year (1/2 x 1.0 x 40). Replacement of the ditch with a buried PVC pipeline would result in minimal or no seepage.

Cost-Effectiveness Considerations

The cost for low pressure PVC PIP or IPS pipe is dependant on the pipe diameter and the distance between the pipe factory and the installation site. PIP 80 psi PVC pipe with a 15 inch diameter costs approximately $5.00 delivered to most parts of Texas. The cost for pipeline design, site preparation, trenching, bedding materials, backfill, compaction, and finish work are is site and project specific.

References for Additional Information

1. *Conservation Practice Standard, Irrigation Water Conveyance, Low Pressure, Underground, Plastic Pipeline*, 5 p. Natural Resources Conservation Service, December 1988.