6.2 Replacement of Irrigation District Canals and Lateral Canals with Pipelines

Applicability

This BMP is applicable to Water Districts that use open canals and lateral canals to convey irrigation water and as an alternative to lining the canals or lateral canals. In general, pipelines are used to replace district canals or lateral canals with less than 44,900 gpm (100 cubic feet per second) capacity.

Description

This practice is the replacement of district irrigation canals or lateral canals with buried pipeline and appurtenances to convey water from the source (well, river, reservoir) to a farm or irrigation turnout. District irrigation pipelines can be used to replace most types of small canals or lateral canals. In general, district irrigation pipelines are 72 inch in diameter or less, with 12 inch through 48 inch diameter pipes being common. Most district irrigation pipelines use either PVC Plastic Irrigation Pipe ("PIP") or Reinforced Concrete Pipe ("RCP") with gasketed joints. PIP is available in diameters from 6 inch to 27 inch with pressure ratings from 80 psi to 200 psi. RCP is typically available in diameters between 24 inch and 72 inch. It is common practice in the irrigation districts in the Lower Rio Grande Valley to use PIP for 24 inch or less diameter pipe and RCP for pipe diameters greater than 24 inch. On a limited basis, 36 inch and 42 inch diameter PVC pressurized sewer pipe is being used to replace open canals.

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 will be designed with appurtenances to deliver water from the pipe system to the farmer and open pipe stands to allow for air release and surge (water hammer) protection.

Schedule

The time required to replace an open canal with a buried PVC or RCP pipeline depends on the site conditions, depth of the pipeline trench, size of the pipeline, number of outlets or connections in the pipeline, and the type of equipment used. Most district pipeline projects are constructed during a time when no irrigation water is required for crops, which is typically during the winter or early spring.

Scope

The two primary limitations for replacement of canals with pipelines are cost and capacity. In many cases the length and engineering of existing canal systems will require a number of years to replace with pipeline. In such cases, a program for progressively replacing canals and lateral canals should be developed with a focus on replacing those canals and lateral canals with larger potential for water conservation. The decision to line a canal or replace the canal using a pipeline is often made based on how much water is conveyed in the canal. The smaller the capacity of the canal, the more likely it is a candidate for replacement using a pipeline.

Documentation

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

1) Copies of equipment invoices or other evidence of equipment purchase and installation;
2) Any USDA, NRCS or other governmental agency evaluation and assistance reports that may relate to the project.
3) Water measurement records from both the period before and the period after the installation of the pipeline.

Determination of Water Savings

The seepage rate of a canal can be estimated by conducting a ponding test within a typical section of the canal or lateral canal prior to the canal and lateral canal being lined. A ponding test measures the rate at which the level of water ponded behind an earthen dam in a canal drops over two to twenty-four hours. The amount of the canal that is wetted by the pond behind the dam must be measured. The seepage rate can be calculated as acre-feet per mile of canal per day. The total quantity of water lost to seepage from the canal is estimated by multiplying the seepage rate times the number of days per year the canal is used to convey water. For example, a canal with a wetted perimeter of 50 feet and a length of 1 mile is found to have a seepage rate of 1.0 acre-foot per mile per day. The canal and lateral canal are used to carry irrigation water 270 days per year. The total seepage from the canal is 270 acre-feet per year per mile (1.0 x 1.0 x 270). Replacement of the canal with a buried PVC pipeline would result in minimal or no seepage.

Cost-Effectiveness Considerations

The cost for low-pressure PVC PIP pipe is based on the pipe diameter and the distance between the pipe factory and the installation site. PIP 80 psi PVC pipe with a 24 inch diameter costs between $15 and $21 delivered to most parts of Texas. Because of the heavy weight and associated transportation costs, reinforced concrete pipe is usually manufactured in the area in which the pipe is being installed. The cost for pipeline design, site preparation, trenching, bedding materials, backfill, compaction, and finish work are all site and project specific. The cost per acre-foot can be estimated by dividing the estimated quantity of water conserved (acre-feet per acre) by the cost per acre of the system ($ per acre-foot).

References for Additional Information

1. Natural Resources Conservation Service, December 1988, “Conservation Practice Standard, Irrigation Water Conveyance, Low Pressure, Underground, Plastic Pipeline”, 5 p. Code 430EE.