820
Irrigation

General

Irrigation provides additional moisture to plants during establishment (3-5 years), during long dry periods, or in special cases, on a continuing basis. Irrigation is a high maintenance and high cost item; use only when absolutely necessary.

References

Backflow Prevention Assemblies Approved for Installation in Washington State. Washington State Department of Health.

Cross Connection Control Manual: Accepted Procedure and Practice. Pacific Northwest Section - American Water Works Association.

Design Manual M 22-01, WSDOT

Standard Specifications for Road, Bridge and Municipal Construction M 41-10, American Public Works Association and WSDOT

Resources

Regional or HQ Design Office Landscape Architects

Regional or HQ Utilities Section

Regional or HQ Maintenance Offices

Definitions[1]

approved Refers to an approval in writing by the health authority or other agency having jurisdiction.

atmospheric vacuum breaker(AVB) A device that contains a float check (poppet), a check seat and an air inlet vent. When water pressure is reduced to a gauge pressure of zero or below, the float check drops. This allows air to enter the device to prevent backsiphonage. It is designed to protect against backsiphonage only.

backflow Refers to the flow of water or other liquids, gases, or solids from any source back into the customer's plumbing system or the serving utility's water distribution system.

backflow prevention assembly Refers to a backflow preventer that is designed to be in-line tested and repaired, and to meet the head loss

[1] *Cross Connection Control Manual: Accepted Procedure and Practice*

and flow requirements of the recognized approval authority. The assembly consists of the backflow prevention unit, two resilient seated shutoff valves, and test cock(s).

backpressure Refers to water pressure that exceeds the operating pressure of the purveyor's potable water supply.

backsiphonage Backflow due to a negative or reduced pressure within the purveyor's potable water supply.

check valve A generic term used for a variety of valves that specifically allow flow in only one direction.

conduit A pipe containing electrical wiring.

contamination An impairment of the quality of potable water (by sewage, industrial fluids, or waste) that creates an actual hazard to the public health through poisoning or the spread of disease.

cross connection Any actual or potential physical connection between a potable water line and any pipe, vessel, or machine containing a nonpotable fluid, or having the possibility of containing a nonpotable fluid, such that it is possible for the non-potable fluid to enter the water system by backflow.

double check valve assembly (DCVA) An approved assembly consisting of two independently operating check valves, loaded to the closed position by springs or weights, and having suitable connections for testing. It is installed as a unit with and between two resilient seated shutoff valves

potable water Water that is safe for human consumption and free from harmful or objectionable materials as described by the jurisdictional health authority.

pressure vacuum breaker assembly An approved assembly consisting of a spring loaded check valve loaded to the closed position, an independently operating air inlet valve loaded to the open position, and suitable connections for testing. It is installed as a unit with and between two resilient seated shutoff valves. It is designed to protect against backsiphonage only.

reduced pressure backflow assembly An approved assembly consisting of two independently operating check valves, spring loaded to the closed position, separated by a spring loaded differential pressure relief valve loaded to the open position, and having four suitable test cocks for checking the water tightness of the check valves and the operation of the relief valve. It is installed as a unit with and between two resilient seated shutoff valves.

service connection The piping connection by means of which water is conveyed from the serving utility's distribution main to a customer's premises.

sleeve A pipe containing other irrigation pipe. Also called *casing pipe.* (See Figure 820.1)

Planning

Source of Water

Sources of water for irrigation include municipal water systems and water pumped from a well, pond, stream, or irrigation district. When selecting a source of water, consider what permits and agreements might be needed as well as the cost and feasibility of bringing water from the source to the site. Show the location and water source on the irrigation plan. In some jurisdictions it might be necessary to calculate water use for the years of plant establishment. Calculate that cost and include it in the estimate.

Municipal Water

Document in the project file:

- Location for the service meter. Define by contacting the serving utility.
- Location and depth of the municipal water main .
- Available liters per minute and the static water pressure in megapascals (or pounds per square inch [psi]) at the proposed meter location. Include this information on the plan sheet.
- Preliminary cost estimate for water meter and connection fee, monthly fees, and cost of water. An example of an irrigation system water cost estimate is found in the Appendix.
- Cost savings that might be realized on landscape rehabilitation jobs where there have been prior meters. Check for existing meters, their age, condition, and connections to the main.
- Water service agreement from the water supplier and an electrical service agreement with the electrical supplier. Work with the Utilities Section to obtain utility agreements.
- Cost for connections in the cost estimate.

Well, Pond, Stream, or Irrigation District

Document in the project file:

- Desired location of pump (for pond, stream or irrigation canal only).
- Location and type of power source.
- Length of suction line required.
- Height of suction lift.
- Type of suction intake.
- Need for screening of contaminants.
- Provide pump data in accordance with the *Hydraulics Manual*.

Obtain the needed permit(s) from the jurisdictional authority for water withdrawal.

Check with the serving utility about pipe and backflow details required.

Design

System Controls

- In appropriate locations, use electric (110 volts), battery, wind, or solar operated automatic controllers.

System Components

Select products with proven desirable performance records. Consult with maintenance personnel to determine desirable products. When a system is designed using a certain product, include a note to the contractor stating that the system has been designed with that product; but the contractor may use other manufacturers' products that are approved by the Engineer as equal or better.

- A proprietary item request might be appropriate so that all components (for example, the same valve) in a maintenance area are the same. This allows for ease of maintenance and inventory control.
- Select durable, readily available, easy to operate, and vandal resistant irrigation components. Plastic rather than brass heads may be selected to discourage vandalism.
- Determine the size of service meter needed once the demand (gallons per minute) is known.

- Meter water use for type of consumption where appropriate, especially at safety rest areas to determine irrigation versus restroom water use.

Layout

Perform a site analysis prior to layout design.

- Consider current and potential locations of power source, signs, guardrails, maintenance areas, planting areas, and so forth, when locating irrigation lines.
- Consider prevailing wind direction and velocity and its effect on spray patterns.
- Where practical, set sprinkler heads at least 0.6 m from trails and sidewalks, or use pop-up spray heads in order to minimize vandalism.
- Space sprinkler heads at a distance of 50 to 60% of their diameter of throw for groundcover and shrub areas. For turf areas, space them at a maximum of 50% of their diameter of throw.
- Install irrigation lines along slope contours rather than running downhill.
- Minimize the use of partial pattern heads and strip spray heads.
- Match precipitation rates for uniform coverage of the planting area.
- Balance head distribution evenly for each valve zone. Consider pressure change due to elevation and pressure loss from friction.
- For drip irrigation systems, install emitters in multiples at shrubs, and trees, to ensure a wider and more uniform distribution of water over the entire plant root area.
- Install drip emitters up-slope of trees and shrubs.
- When using a subsurface dripline irrigation system, a self-cleaning pressure-compensating system is preferred to keep the dripline from plugging with soil particles. A dripline system that incorporates root intrusion treated components or chemical release water delivery is also a preferred system.
- When possible, mount automatic controllers inside a building, for security, in a location that is easily accessible to maintenance personnel. If it is not feasible to locate the controller inside a building, then locate it away from sprinklers and preferably at a location from which the irrigation system can be viewed in operation.

- Consider the need for winterization of irrigation systems to avoid freeze damage to system components. An air compressor fitting may be needed to blow out the lines for winter.

Piping

Irrigation systems typically use PVC pipe. Refer to the *Standard Specifications for Road, Bridge and Municipal Construction* for irrigation pipe and installation specifications.

Minimize the number of pipe sizes in order to reduce the number of contract Bid Items, and the construction cost. Where practical, eliminate small quantities of one size of pipe by increasing the size to the next size used on the project.

Include pipe design calculations (Pressure Loss Calculations) in the project file. An example of irrigation system pressure loss calculations can be found in the Appendix.

See *Design Manual* for additional design documentation requirements.

Sleeves

When irrigation lines are to be installed under pavement, provide sleeves for pipes and wiring. Install sleeves prior to paving per *Standard Specifications for Road, Bridge and Municipal Construction*.

- Sleeves must have smooth interior walls (not corrugated) and may be Class 200 PVC pipe, “Drain Pipe ___Diam.” or other pipe material that meets the specific load requirements.
- Size the sleeve so that the inside diameter (ID) is at least 2.5 times the combined outside diameters (OD) of the pipe(s) that are to be in it.
- Place metal locator strip above sleeve as noted in the drawing on the following page.

See the following Figure for an example of piping inside a sleeve.

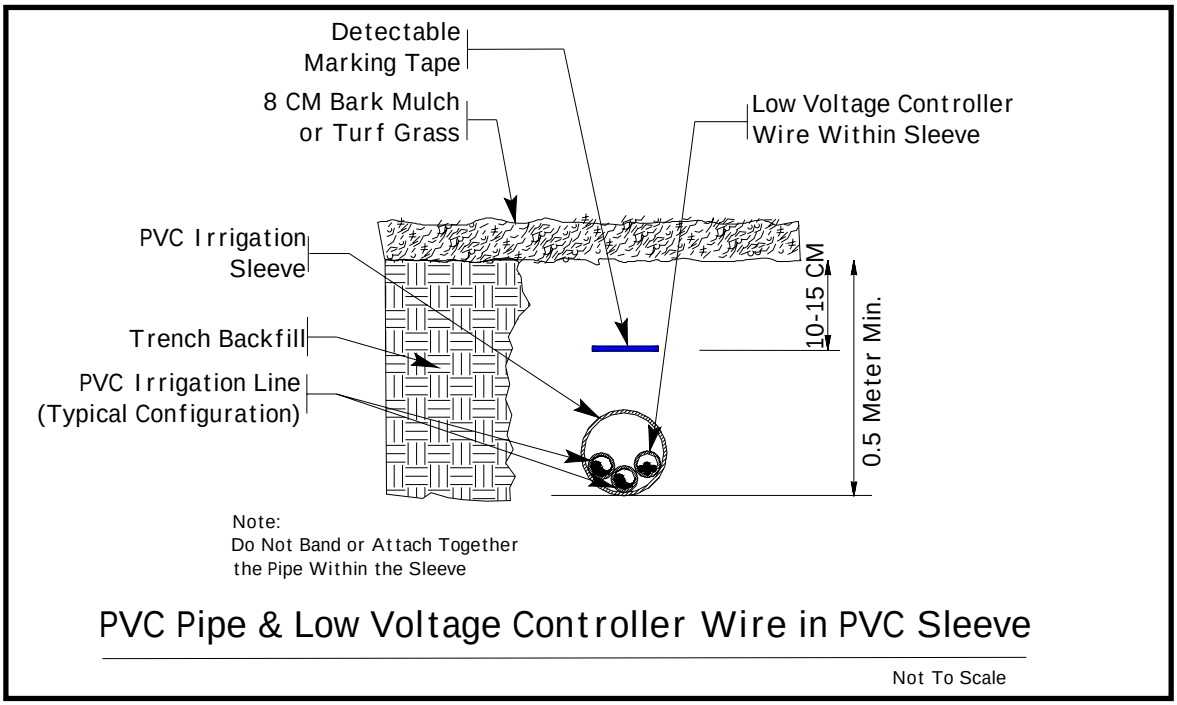

Figure 820.1 Irrigation Sleeve

Valves

Master Remote Control Valve

Master remote control valves are recommended for use in main lines, especially where a break in the main line is likely to produce significant erosion or hazard. The valves are installed just down flow from the meter so the mainline is pressurized.

For added protection from breaks in irrigation lines a flow sensor may be used to shut off the water. See the HQ Design Office Roadside & Site Development Unit or the HQ Maintenance & Operations Program Landscape Architect for more information.

Station Control Valves

Group valves in valve boxes for efficient maintenance access. Consider maintenance vehicle access when choosing locations.

Wiring

- See *Standard Specifications for Road, Bridge, and Municipal Construction* for wiring specifications.
- Provide additional wire runs (one spare wire to each valve) for backup power source.
- Low voltage controller wire may be placed in the sleeve along with irrigation piping.

- The main electrical supply lines (110 volts) must be installed in a separate conduit.
- Use wire splices as specified in Section 9-15 of the *Standard Specifications for Road, Bridge, and Municipal Construction*. Check with the HQ Design Office Roadside & Site Development Office if additional information is needed.

Cross Connection Control Devices

The protection of public potable water supplies is accomplished by eliminating or controlling actual and potential cross connections (backflow). Cross connections might allow contamination to reverse flow into a potable water system or aquifer. Do not allow water to flow through the backflow device until the device has been tested by the serving utility. When a facility such as a safety rest area has no serving utility, backflow devices on wells are tested by an inspector with certification through Washington State Department of Health. Contact the HQ Maintenance Office for information.

Types of mechanical backflow devices are:

- Reduced pressure backflow assembly (RPBA).
- Double check valve assembly (DCVA).
- Pressure vacuum breaker assembly (PVBA).
- Atmospheric vacuum breaker (AVB).

All four types of mechanical devices provide adequate protection against a **low degree** of hazard contamination if installed correctly. Therefore, when selecting the type of device to be used against a low degree of hazard contamination, consider initial cost, serving utility requirements, and maintenance.

Of these four mechanical devices, the RPBA affords the greatest protection against backflow. The RPBA is the **only** mechanical device to be used where a backflow would produce a **high degree** of contamination hazard. The local serving utility is the ultimate approval authority for backflow prevention within their jurisdiction. It is therefore necessary to contact the local serving utility to ascertain what type of device they will require as a minimum.

Once the appropriate type of device has been determined, the device is selected from the current list in *Backflow Prevention Assemblies Approved for Installation in Washington State*, published and periodically updated by the Department of Health. Consult the HQ Design Office Roadside & Site Development Unit if you have questions.

A bore-sighted drain (sloped downward) to daylight must be

provided to ensure positive drainage whenever there is an underground vault installation of an acceptable backflow device. The vault drain must be sized in accordance with the requirements of the *Cross Connection Control Manual: Accepted Procedure and Practice*.

Construction

As a minimum, all mechanical backflow devices are installed in accordance with the most current copy of the *Cross Connection Control Manual: Accepted Procedure and Practice*, published by the Pacific Northwest Section - American Water Works Association. In addition, they must be installed in accordance with the *Standard Specifications for Road, Bridge, and Municipal Construction,* and their manufacturer's recommendations.

Maintenance

Irrigation systems require regular maintenance to function properly.

- Backflow prevention devices are to be tested annually by an inspector with certification through the Washington State Department of Health. Contact HQ Maintenance & Operations Program for information.
- Winterize irrigation lines by draining or blowing out the lines prior to the first winter freeze.
- Check system as part of Spring start-up and throughout the season.
- Repair irrigation system promptly to avoid water loss and to prevent erosion from broken water lines.