TCEQ REGULATORY GUIDANCE
Water Supply Division
RG-478 • Revised February 2026

Establishing and Managing an Effective Cross-Connection Control Program

Contents

1. Introduction

Who Should Read This Guidance?

This guide is intended to help public water system (PWS) managers, operators, and program administrators implement their cross-connection control programs. The audience for this guide is Texas PWSs—for example, a water district, a water-supply corporation, or a city-owned or investor-owned PWS.

Members of the public—customers of water systems—will also find answers in this guide to many questions they may have about cross-connection control programs. This guide provides information on what backflow is, how it can be prevented, and how backflow regulations apply to them. For more information, PWSs and their customers can also contact TCEQ at 512-239-0028 to request the brochure A Consumer's Guide to Backflow Prevention in Texas (TCEQ publication GI-411).[1]

In the text of this document, "you" refers to the PWS and its staff members; "program" is short for 'cross-connection control program'; and "we" refers to TCEQ or its staff.

This publication is for general guidance only and is not a substitute for the rules or regulations governing cross-connection control and backflow prevention.

Texas Rules

Title 30 of the Texas Administrative Code (30 TAC), Chapter 290[2], prohibits PWSs from connecting to an actual or potential contamination hazard without first protecting the potable-water supply. The TCEQ rules require PWSs to:

- adopt plumbing ordinances, regulations, or service agreements
- require customer-service inspections
- require backflow protection using appropriate backflow prevention assemblies
- require those assemblies to be tested to ensure that they are working correctly

This guidance document references the Texas Administrative Code (rules henceforth) in the applicable sections throughout. Implementing these rules constitutes a cross-connection control program.

TCEQ rules place the responsibility for recognizing and evaluating hazards within the PWS's distribution system on the PWS. When a hazard is identified, you must ensure that your consumers are protected from contamination by that hazard. The PWS may terminate water service to any connection where an unprotected health hazard is found and only restore service when the health hazard no longer exists or after it has been properly isolated using a backflow prevention assembly.

Any hazard must be isolated from the drinking-water supply regardless of when the hazard was first created, or the site was built. Because the effects of a backflow event

[1] www.tceq.texas.gov/publications/gi/gi-411.html
[2] www.tceq.texas.gov/drinkingwater/pdw_rules.html

can be so significant, there are no grandfather clauses that apply to cross-connection control and backflow prevention in the TCEQ rules on backflow and backsiphonage.

A backflow incident qualifies as an accident that has a negative impact on the delivery of safe and adequate drinking water and must be reported to TCEQ in accordance with 30 TAC 290.46(w)(5). TCEQ maintains a 24-hour toll-free number for reporting backflow incidents and other emergencies: 888-777-3186. Additionally, you should submit a detailed summary of any backflow incident the Cross-Connection Control Program email to cross-con@tceq.texas.gov or by mail to:

Cross-Connection Control Program
Texas Optimization Program and Response Team, MC 151
Texas Commission on Environmental Quality
PO Box 13087
Austin, TX 78711-3087

A Brief History

Backflow events have been recognized as far back as the early 1900's. One of those early documented cases happened at the 1933 World's Fair in Chicago, where two hotels had a cross-connection with the city sewer system, resulting in nearly 100 deaths and over 1,700 documented cases of dysentery. These are only cases that we know of—unreported incidences of illness, unlinked deaths, and poor communication point to the possibility this may have only been a fraction of the impact.

In response, regulations and research into backflow and backflow prevention amplified. The University of Southern California Foundation for Cross-Connection Control and Hydraulic Research (USC FCCCHR) was established in 1944 to investigate and set backflow standards. In the 1940's, the Texas State Department of Health published regulations regarding the preparation, submission, and approval of plans for water supply systems. In these rules, physical connections between public drinking water and potentially unsanitary water were banned. Backflow prevention was required on sprinkling, condensing, cooling, plumbing, and other systems to protect against backflow into drinking water.

TCEQ regulates backflow prevention in Texas because backflow continues to be a cause for concern. As large backflow events appear in news media, people are more aware of the potential hazards associated with these events.

Definitions

The definitions below are from the USC Foundation for Cross-Connection Control and Hydraulic Research. USC provides testing standards and educational curriculum designed to aid utilities, agencies, the public, and all those involved in cross-connection control efforts. TCEQ uses USC expertise to help shape regulations and test procedures to support programs across the state.

- Backflow – The undesirable reversal of flow of water or mixtures of water and other liquids, gases, or other substances into the distribution pipes of a potable supply of water from any source or sources.
- Backsiphonage – A form of backflow due to a reduction in system pressure, which causes a subatmospheric pressure in the water system.

- Backpressure – Any elevation of pressure in the downstream piping system (by pump, elevation of piping, steam pressure, air pressure, etc.) above the supply pressure at the point of consideration, which would cause or tend to cause a reversal of the normal direction of flow.
- Cross-Connection – Any actual or potential connection or structural arrangement between a public or a consumer's potable water system and any other source or system through which it is possible to introduce into any part of the potable system any used water, industrial fluid, gas, or substance other than the intended potable water with which the system is supplied.
- Direct cross-connection – A cross-connection which is subject to both backsiphonage and backpressure.
- Indirect cross-connection – A cross-connection which is subject to backsiphonage only.

Hydraulics

We expect water to move straight from the water plant, down distribution lines, and into homes. Instead, water flows from high pressure to low pressure. Therefore, water is free to travel in almost any direction.

Depending on the forces that act upon water pressure in water supply lines, water will try to flow from areas of high pressure to low. Turning on a sink faucet, for example, moves water from the high-pressure environment of your pipes to a low-pressure environment in the sink. Conditions can change between distribution pipes and taps creating backflow. A neighbor down the street filling a pool, firefighters using a fire hydrant across town, or a water main break can all cause water to move to those lower pressures, pulling water from all parts of the distribution pipes.

Backflow refers to the undesirable reversal of flow of water and other substances into the potable water supply. An interruption like a ruptured water main can impact the hydraulics of the water supply system. In a case like this, the water will move towards the rupture from both directions in the line. Water from end use points and equipment, or *cross-connections,* such as irrigation systems, car wash equipment, or medical facilities can also be pulled in the direction of the rupture, where a sub-atmospheric (vacuum) pressure is. This *backsiphonage* can suck whatever substances are connected to the water supply with it – bacteria in an irrigation system, soaps from a car wash, or medical waste from a hospital. Some cross-connections, such as *an indirect cross-connection* from a hose sitting in a bucket of car wash soap or chemical contaminants can be easily remedied.

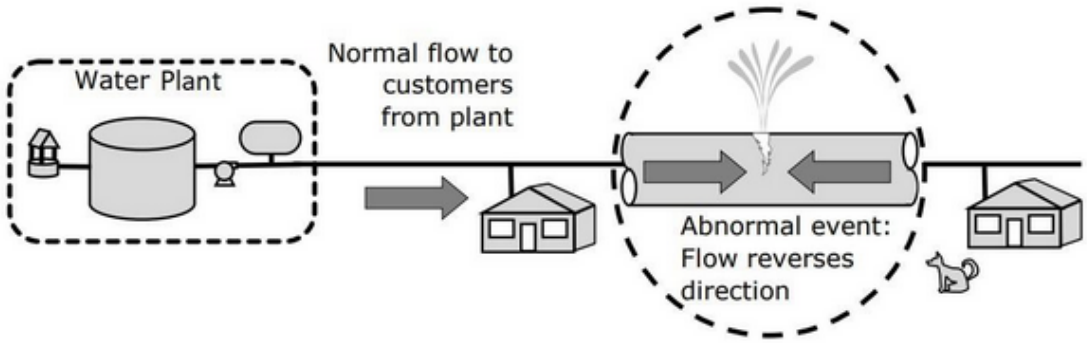

Figure 1. Normal and Abnormal Flow Direction.

Some forces, like pumps or pressurized systems, can instead push water against its normal direction of flow. *Backpressure* results when downstream pressure overcomes the supply pressure. A well pump may be drawing untreated groundwater but can also then push that untreated water into the distribution system if the pump is sufficiently strong. Often a *direct cross-connection* is directly piped in, without a break to the atmosphere, and more difficult to remedy.

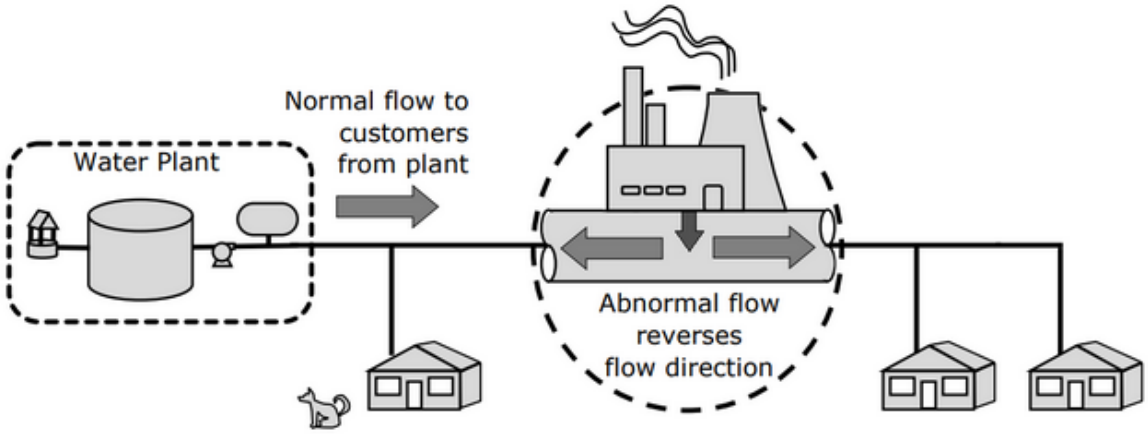

Figure 2. Normal and Abnormal Flow Illustrating Backpressure.

Backflow remains a constant threat and TCEQ stays informed to respond and improve regulations to help guide PWSs in protecting public health.

2. Authority: Plumbing Ordinance, Regulations, or Service Agreements [30 TAC 290.46(i)]

Every PWS is required to adopt:

- a plumbing ordinance,
- plumbing regulations, and/or
- service agreements

These give the local public water supplier the authority to implement a cross-connection control program. Whichever is adopted, it must have critical elements for proper enforcement in order to effectively prohibit cross-connections and other unacceptable plumbing practices.

The ownership type of a system determines which of these to use. For example, requirements for an RV park differ from those for a water supply corporation. In many cases, it is okay to use more than one of these authority documents. A municipality may have both plumbing regulations and service agreements for customers, with special rules for industrial sites.

PWSs serve a wide variety of customers throughout Texas. The potential cross-connections found in a rural area can be very different from those found in an urban setting. Each PWS should carefully consider the types of hazards that may be present in its distribution system before adopting plumbing ordinances, regulations, or service agreements. This will allow the PWS to tailor the adopted rules to better protect the potable-water supply against a category of specific potential hazards in the PWS's local area.

Critical Elements of an Authority Document

The critical elements of an authority document include:

- **Right of entry:** The agreement must give your personnel, particularly customer service inspectors, the authority to enter facilities in order to evaluate cross-connections, backflow risks, plumbing materials, and internal backflow prevention programs (where present). Without a right of entry, it is difficult to get personnel to conduct inspections and testing.
- **Lead ban:** The agreement must have provisions for prohibiting lead that exceeds the federal standards in plumbing materials, as demonstrated by an EPA-recognized lead test or the labeling of plumbing materials.
- **Enforcement:** The agreement must give you the authority to enforce the requirements for cross-connection control and backflow prevention. Without enforcement, regulations are merely words without an impact. Fees, due dates, backflow preventer installation, or discontinuing water service are a few examples of enforcement.

Stringency

Generally, the adopted ordinance, regulations, and/or service agreements must be at least as stringent as the TCEQ regulations, but they may be more stringent. Thus, periodic inspections may be clearly established in local regulations.

For example, if you supply water to residential customers who have irrigation systems and have animals on their lot, run a business from their house, or have an auxiliary water supply—which increases the contamination hazard—you may require more frequent testing of the backflow preventers for those customers.

Similarly, a program may add a requirement in their ordinance for periodic CSIs of facilities with constantly changing internal processes, like petroleum refineries or animal processing facilities. While TCEQ rules address the hazards posed to the potable water supply, specific requirements adopted in the local ordinance, regulations, or service agreement will strengthen your enforcement of these requirements—increasing awareness of the rules and reducing the number of questions.

Note that an investor-owned utility (IOU) has limited authority to adopt more stringent requirements than the TCEQ rules [30 TAC 291.93(5)]. IOUs are privately-owned water systems that are operated for profit, unlike most PWSs which are non-profit. IOUs need approval from TCEQ to be more stringent and must self-fund any stricter requirements.

Service Agreements

Most public water systems do not have the regulatory or governmental structure to adopt ordinances or regulations. These systems must use customer-service agreements, which are agreements between the public water systems and their customers, that have provisions for protection against backflow, and cross-connections, and provide for enforcement. A sample service agreement appears in Appendix B.

If the service agreement used by your PWS has been in existence for a long time, it is likely outdated. We recommend that you review and update it to include current requirements such as the lead levels allowable by the EPA.

You may use the sample service agreement in TCEQ's rules or create your own. If you wish to develop your own, it must include all of the required critical elements listed above.

Plumbing Ordinance or Regulations

An ordinance is a formal enactment by a local government, adopted by the governing body of that government (for example, a city council). Typically, a plumbing ordinance will contain the requirements for cross-connection control and backflow prevention that comply with state regulations and meet the local, specific needs for protecting the potable-water distribution system. A sample plumbing ordinance appears in Appendix H of this guide.

Depending on the local municipality, plumbing regulations that contain requirements for cross-connection control and backflow prevention could be contained within a plumbing ordinance that encompasses the cross-connection control program and all its specific requirements.

Plumbing Codes

The Plumbing License Law in Title 8, Texas Occupations Code, Chapter 1301.551, requires all municipalities with a population of 5,000 or greater to adopt a plumbing code; smaller municipalities and other types of PWSs may voluntarily adopt a plumbing code.

The two plumbing codes that are authorized to be adopted in the state of Texas by the Texas State Board of Plumbing Examiners are the International Plumbing Code and the Uniform Plumbing Code. These codes are revised every three years. Depending on the code and year of revision, the requirements related to cross-connection control and backflow prevention in the code may differ from TCEQ rules. When a difference is identified, the more stringent of the requirements will apply.

Example: City of Cleanwater Plumbing Code Authority

The administrator of a cross-connection control program for a large city noted a backflow test result for the installation of a new backflow preventer on an irrigation system. An inspector noted the irrigation system only sprayed water, with no injection of any pesticides or fertilizers. According to TCEQ regulations, the nonhealth nature of the hazard meant the backflow preventer only needed to be tested upon installation. Satisfied with the result, they file the backflow test result away and leave for lunch.

Over lunch, the administrator thumbs through their newly adopted plumbing code, 2021 Uniform Plumbing Code, and sees a relevant passage:

> **603.4.2 Testing.** The premise owner or responsible person shall have the backflow prevention assembly tested by a certified backflow assembly tester at the time of installation, repair, or relocation and not less than on an annual schedule thereafter, or more often where required by the Authority Having Jurisdiction. (…)

Though TCEQ requires that nonhealth-hazard systems be tested upon installation, UPC 2021 requires that all backflow preventers be tested upon installation and on an annual basis. The administrator puts their sandwich down and calls their Permits Department to relay this annual testing information. The Permits Department revises their permit applications to notify annual testing requirements and begins to follow up with newly installed assemblies.

This very important area of cross-connection control and backflow prevention can become confusing. TCEQ regulations require that a public water supplier adopt a plumbing ordinance, regulation, or service agreement as described in this section. The Texas Occupations Code requires the adoption of a plumbing code by municipalities with a population over 5,000; however, adopting a plumbing code does **not** mean that a PWS is compliant with TCEQ's plumbing-ordinance regulation.

While plumbing codes contain some very important cross-connection control and backflow prevention requirements, they do not address the authority of a cross-connection control program. Plumbing codes provide design, installation, and technical plumbing regulations, but are not supported by specific enforcement nor implementation measures. A plumbing ordinance regulation allows the public water supplier to adopt requirements for cross-connection control and backflow prevention specific to its distribution system and gives authority to the cross-connection control program.

3. Customer-Service Inspections

Customer-service inspections (CSIs) are the foundation of a successful cross-connection control program. After you have established an authority, conducting CSIs is the next step in implementing a program.

A CSI is required in the following situations:

- all new construction,
- existing service connections where the PWS has reason to believe that cross-connections or other potential contamination hazards exist, or
- existing service connections where a material improvement, correction, or addition has been made to the private water-distribution facilities [30 TAC 290.46(j)].

Sometimes, there is some confusion regarding the need for backflow prevention at a site and a CSI can clear up the confusion.

Example: Big Tooth Dentistry

A new dentist's office is being built in the city of Cleanwater. Appendix F lists dental clinics as posing a health hazard requiring a reduced pressure principal backflow prevention assembly (RPBA) or an air gap at the meter. As such, a backflow program manager schedules a CSI to document hazards.

The inspector reviews a brand-new dental chair and does not note any connection to the water supply. They also fail to find a darkroom for patient X-rays. Upon further research, they learned dental chairs can be self-contained, with their own water source, and not connected to the potable-water supply. Also, taking x-rays digitally can eliminate the need for potable water to develop them. Reporting this information to the water supplier, the inspector records that this modernized dental clinic may not pose a health hazard.

If it can be documented in a CSI that the use of potable water in a dental clinic does not constitute a health hazard then, even though these clinics are named in Appendix F, backflow prevention may not be required.

When necessary, the person performing CSIs has the option of using more than one CSI certificate to document the inspection results. For example, if the CSI is at a site that is very large and has several different structures, then more than one certificate should be issued to document the locations that were inspected, hazards encountered at each site, and the need for backflow prevention at each site.

The results of the CSI will identify any cross-connections or actual or potential contamination hazards and determine if backflow prevention is required at the site.

More detailed information concerning CSIs appears in the TCEQ publication Customer-Service Inspections: A Guide for Public Water Systems (RG-206).[3]

Who Can Perform a CSI

A CSI can be conducted by a TCEQ-licensed customer-service inspector, a plumbing inspector, or a licensed plumber with a "water supply protection specialist" endorsement. The last two are licensed by the Texas State Board of Plumbing Examiners. A licensed customer-service inspector (also CSI) is trained and licensed to examine private water-distribution facilities in order to determine the presence of cross-connections, potential contamination hazards, and illegal materials containing lead and copper, but is **not** permitted to perform plumbing inspections.

Information on acquiring a CSI license may be obtained by contacting the TCEQ Occupational Licensing Section.[4]

[3] www.tceq.texas.gov/downloads/drinking-water/plan-technical-review/prevention/rg-206.pdf
[4] www.tceq.texas.gov/licensing/licenses/csilic

Fees and Payment for the CSI

A PWS that requires a customer-service inspection by its own employees, or provides this service as part of its business, should either:

- charge a fee established by the PWS and approved by its governing body or established by the Public Utility Commission (PUC) in the case of an investor-owned utility, or
- provide the service at no initial cost and then recoup the expenses through rates.

A PWS that requires a customer to arrange for a CSI must:

- ensure that the CSI is conducted by a qualified professional
- ensure that it obtains the original or a copy of the CSI certificate

Payment for the CSI is directly between the customer and the customer-service inspector. TCEQ does not regulate nor set prices on CSIs.

4. Backflow Prevention Assemblies

An effective cross-connection control program must include requirements for appropriate means to prevent backflow. This is typically accomplished by requiring installation of backflow prevention assemblies at connections with potential cross-connections. Whenever possible, the backflow preventer should be located at the point closest to the actual or potential contamination hazard. This will limit the amount of water exposed to backflow, should it occur, and will also make it less likely for someone to tap the water-supply line downstream of the backflow prevention assembly, which would make the downstream connection vulnerable to the contamination hazard.

Selection of Assemblies

TCEQ rules distinguish between health and nonhealth hazards:

- A *health hazard (or contaminant)* involves any substance that can cause death, illness, the spread of disease, or which has a high probability of causing such effects. For example, a potable-water connection to a heating system that uses a toxic corrosion-control fluid.
- *A nonhealth hazard (or pollutant)* involves any substance that constitutes a nuisance or would be aesthetically objectionable if introduced into the distribution system. For example, a potable-water connection to fermentation tanks at a winery. Such hazards can appear in residential, commercial, industrial, and other types of connections.

For protection from a health hazard, the following types of backflow prevention assemblies may be used, provided they are installed per the manufacturers and plumbing code requirements:

- Reduced pressure principle backflow prevention assembly (RP or RPBA): will function under both back pressure and backsiphonage.

- Pressure-vacuum breaker (PVB): will function under backsiphonage only; it is allowable to have a control valve downstream.
- Spill-resistant vacuum breaker (SVB): will function under backsiphonage only; it is allowable to have a control valve downstream.
- Atmospheric vacuum breaker (AVB): non-testable, will function under backsiphonage only, and cannot have a control or shutoff valve downstream.
- Air gap (AG): if this method is used, it must meet the definition of an air gap:
- The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet conveying water to a tank, fixture, receptor, sink, or other assembly and the flood level rim of the receptacle. The vertical, physical separation must be at least twice the diameter of the water supply outlet, but never less than 1.0 inch. [30 TAC 290.38(2)]

Example: Selection of Assemblies at Gas Station

The administrator of a cross-connection control program noted a new soda machine at their local gas station. Peeking behind the machine, the administrator saw a dual check valve with a vent installed on the water line feeding the machine. The dual check valve looks similar to the backflow prevention assemblies they are familiar with. A significant difference from RPBAs is that there are no test cocks, and the device is untestable. This is enough to satisfy plumbing code requirements, but the administrator decides to do additional research.

Reviewing soda machine requirements, the administrator notes that drink dispensers and vending machines require an RPBA or a PVB. They note that soda machines use a post mix carbonator to create carbonic acid and backpressure. The carbonator can create backpressure, while carbonic acid could dissolve any lead or copper it's exposed to. With the potential for negative health effects and continuous pressure, the administrator requires the installation of an RPBA

Note that, at a customer connection, once the water flows through an air gap, you no longer retain sanitary control of the water, and the supply pressure is lost. In addition, both you and the customer must consider that the air gap exposes the water and the container to the environment, allowing for the direct entry of pathogens, debris, or insects.

Testing Versus Inspection

RPs, PVBs, and SVBs are testable assemblies, whereas AVBs are just inspectable. Thus, RPs, PVBs, and SVBs are the most suitable assemblies for preventing backflow from a health hazard and are preferable to AVBs in almost every situation. If AVBs and air gaps are installed to protect against health hazards, then the authority having jurisdiction should ensure that they are annually inspected for proper installation and operation with a periodic CSI, and to confirm that the device has not been compromised.

The adequacy of an AG or AVB can be determined by inspecting it, rather than testing it. An air gap or AVB can be inspected by:

- determining if it is installed correctly, in accordance with the recommendations from the manufacturer and requirements in the plumbing code;
- checking any moving parts for free movement;
- assessing the parts corrosion; and
- looking for any evidence of modification.

Check Valves

Single-check valves are not recognized by TCEQ as backflow prevention assemblies. They cannot be tested or inspected to ensure they are working correctly and are not constructed with a back-up check valve or fail-safe design. The valve seats may become degraded or fouled, which can allow contaminants to backflow through them.

Double-check valves are acceptable in some situations if they are testable. For protection from a nonhealth hazard, any of the previously mentioned assemblies may be used, as well as a testable double-check-valve backflow prevention assembly (**DCVA**), which will function under back pressure or backsiphonage.

Location of Backflow Prevention Assemblies

TCEQ **does not recommend** the installation of backflow-prevention assemblies at **all** service connections. A typical residential building that has no special water-using equipment or processes **does not need** containment backflow prevention. The installation of backflow prevention assemblies at all connections, regardless of hazard presence, may result in pressure loss and impact service across the distribution system.

However, backflow prevention assemblies are required or recommended at residences and other buildings or facilities that:

- Use an auxiliary water supply,
- Have a contamination hazard on site, and;
- Have a potential contamination hazard.

Auxiliary Water Supply

Buildings that use an auxiliary water supply, such as a private well, a rainwater-harvesting system, or a recycled/reclaimed water system, must install an RP at the meter connection or provide an air gap at the meter.

If it can be documented in a CSI that the auxiliary water supply and the potable water supply are physically separated and not cross-connected, then the separation distance *may* serve as part of an adequate internal cross-connection control program. Periodic CSIs must be required to make sure that the two separate systems have not been cross-connected, and the final determination if this hydraulic separation is adequate rests with the water supplier.

See Section 5 for more information on internal cross-connection control programs.

Potential Hazards

Connections can feature hazards that are not directly connected to the water supply. Irrigation systems fed exclusively by private wells, above ground pools filled by hoses, or at-home salon stations fall into potential hazards that may be indirectly cross-connected into the system. TCEQ recommends that the hazards be assessed in place to verify if they pose a hazard to the water supply. The PWS should use customer service inspections, adopted plumbing codes, and best judgement to determine the follow up and appropriate backflow prevention.

On-Site Hazard

Buildings that have an actual contamination hazard on-site must use an appropriate backflow prevention assembly. Appendix E has a partial list of facilities where health hazards are commonly found [30 TAC 290.47(f)].

Typical Residences

Typical residences only require minimal internal backflow prevention such as vacuum breakers on the hose bibbs, an air gap for their water-softener drain line, and a backflow prevention assembly on their irrigation system. Even this minimal backflow prevention is critical because, if backflow occurs, the contaminant will first enter the residential plumbing and those people living there will be the first exposed.

Purchase and Installation of Backflow Prevention Assemblies

A PWS with qualified personnel may install the backflow prevention assembly, charge for its installation, and charge a test fee established by the PWS and approved by its governing body.

A PWS may instead require the customer to purchase the backflow-prevention assembly and have it installed. If so, the PWS must ensure that the correct assembly is installed, and a qualified individual installed it.

Regardless of who installs a backflow prevention assembly, it *must* be tested upon installation. Experience has shown that a brand-new assembly often will fail the test right out of the box and will need modification, repair, or cleaning.

The regulations of the Texas State Board of Plumbing Examiners determine which qualified individuals can install such assemblies. Licensed plumbers can install backflow prevention assemblies, but exemptions in the Plumbing License Law allow other individuals to install assemblies in specific cases. For example, a homeowner who has obtained the appropriate permit (if required) may install a backflow prevention assembly on an irrigation system or a water operator may install an assembly on his own distribution system.

The flowchart in Appendix A can help you determine who is authorized to install backflow prevention assemblies under certain conditions.

5. Containment Programs and Internal Cross-Connection Control Programs

A **containment program**, also called "premises isolation," has backflow prevention at the main water connection to the facility (at the meter). For example, one backflow prevention assembly could be installed at the main water-supply line to a manufacturing facility so that all actual or potential hazards located at that site are contained within that facility without danger of backflowing into the public water supply. One benefit is that the public water supply is protected with only one backflow prevention assembly. However, the people within the facility remain vulnerable to backflow. **Protection from internal cross-connections of health hazards is critically important, as they can be found in many facilities with relatively large populations — hospitals, schools, large business facilities, manufacturing facilities, etc.**

When requiring containment backflow prevention, the PWS should alert the site to the hazards of thermal expansion and the need to turn the water off to the entire site in order to test the backflow preventer. Some sites, such as hospitals, with containment backflow prevention will install two backflow preventers in parallel, so that water service will not be interrupted. While one backflow preventer is being tested, the other can continue to supply water to the site. If, in a parallel installation, water flows through only one backflow preventer and the second is only there to be used during testing, then the second should at least be pressurized to close the relief valve and prevent entry of any contaminants.

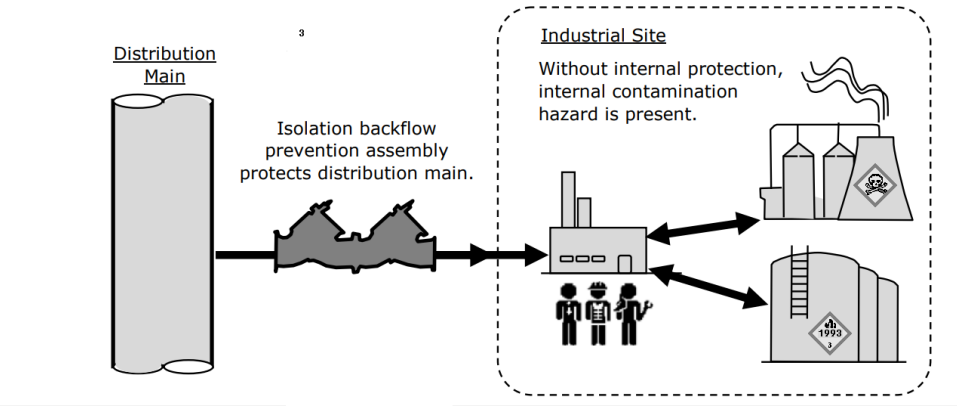

Figure 3. A Simplified Containment Program.

An **internal cross-connection control program** is a program that is located within a facility that has actual or potential contamination hazards connected to the internal potable-water distribution system. This should not be confused with the cross-connection control program administered by the PWS. These internal hazards and cross-connections are identified when the customer-service inspection is conducted. An internal cross-connection control program consists of backflow prevention at specific locations within a facility where hazards are located. For example, backflow prevention assemblies could be installed on the water supply lines to water-using equipment in a manufacturing facility.

An internal cross-connection control program benefits the PWS and the individuals within the facility from backflow. A challenge is the possible need to install more than one backflow prevention assembly at each potentially hazardous point of use.

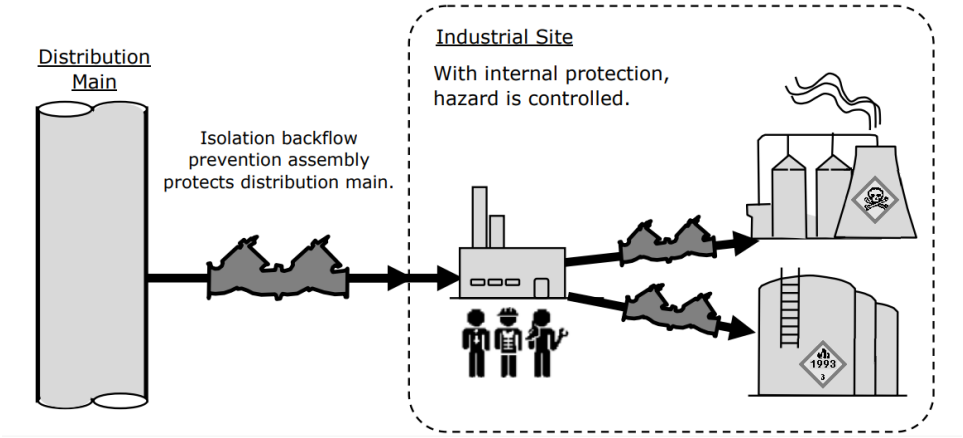

Figure 4. An Internal Program with Containment.

Internal cross-connection control programs are supported by the following:

- **30 TAC 290.44(h)(1)(B)** At any residence or establishment where an actual or potential contamination hazard exists and an adequate internal cross-connection control program is in effect, backflow protection at the water service entrance or meter is not required.
  - **(i)** An adequate internal cross-connection control program shall include an annual inspection and testing by a licensed backflow prevention assembly tester on all backflow prevention assemblies used for health hazard protection.
  - **(ii)** Copies of all such inspection and test reports must be obtained and kept on file by the water purveyor.
  - **(iii)** It will be the responsibility of the water purveyor to ensure that these requirements are met.
- **30 TAC 290.44(h)(5)** The use of a backflow prevention assembly at the service connection shall be considered as additional backflow protection and shall not negate the use of backflow protection on internal hazards as outlined and enforced by local plumbing codes.

These programs pose a challenge because, being internal, they can be compromised without your knowledge. Annual customer service inspections and annual backflow assembly testing are tools that take periodic “snapshots” of how protected a connection is.

As stated above, internal cross-connection control programs are required to be “adequate” in order for the PWS to **not** require a backflow preventer at the meter as well. When a PWS is relying **solely** on an internal cross-connection control program, then adequacy of the internal program must be determined by requiring CSIs to verify that end-point water uses, and cross-connections are secured. TCEQ recommends requiring periodic CSIs within local regulations for facilities with an internal cross-connection control program and no backflow prevention at the meter. This will ensure that any new or altered cross-connections created between CSIs have the appropriate

backflow prevention and existing ones are still in place. The PWS must retain the original or copies of the inspection reports.

As specified in 30 TAC 290.46(j), whenever a PWS "has reason to believe that cross-connections or other potential contaminant hazards exist," the PWS can conduct or require a customer-service inspection. The fact that internal cross-connection control programs can change without the PWS being aware and the potential of internal cross-connection controls at sites with large populations supports the periodic inspections of internal cross-connection control programs. Periodic CSIs for internal cross-connection control programs should also be reflected in the local ordinance or other local authority.

Example: Nuts 'R' Us

A pecan processing manufacturing facility had several cross-connections on-site. It did not have a containment program but instead had an internal program in which a backflow preventer was installed at each cross-connection. During the routine testing of the backflow preventer, the licensed backflow prevention assembly tester (BPAT) noticed that the backflow preventer was the same type as the one he had tested several weeks ago. This seemed suspicious, so he compared the serial number, as well as the make and model, with test reports from previous tests.

He was able to confirm that the manufacturer was removing the backflow preventer, reforming the cross-connection by replacing it with a pipe, and reinstalling the same backflow preventer at the next cross-connection which was due to have its backflow preventer tested. He had been testing the same backflow preventer at different locations! He immediately informed the PWS, which used this as a reason to believe that cross-connections or other potential contaminant hazards existed and conducted a customer service inspection. After the CSI showed the unprotected cross-connections, the manufacturer installed individual backflow preventers at each one.

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6. Teamwork: Building a Successful Cross Connection-Control Program

A successful backflow prevention and cross-connection control program will include three important elements: communication, coordination, and cooperation, internally and externally with involved stakeholders. Some of the people to include in a cross-connection control program may be:

- city, utility, or district management in charge of implementing a program
- a plumbing inspector who can conduct CSIs and is knowledgeable about plumbing
- a building official familiar with local plumbing requirements
- regulations employees in environmental services that may deal with hazardous materials
- permitting department staff dealing with potential hazards
- the fire marshal's office in charge of fire suppression systems and required backflows
- industry professionals (irrigators, plumbers, testers, inspectors) who work with and are regulated by the PWS

For private or smaller entities, consider including:

- Plumbers
- Engineers familiar with plumbing and changes
- Water-department management and personnel regulated by TCEQ
- Administrative staff who receive customer feedback and review forms
- Other industrial and district stakeholders

When a PWS supplies water to customers inside incorporated areas where a plumbing code has been adopted, PWSs must frequently coordinate cross-connection control with a building or plumbing-inspection department. The cross-connection control program should be organized between the water utility and the building or plumbing-inspection departments and include staff from both. The building or plumbing-inspection department administers the plumbing code, which has its own requirements for backflow prevention and cross-connection control; the PWS administers the TCEQ requirements for backflow prevention and cross-connection control, so their responsibilities naturally overlap.

One challenge faced by PWSs is how to protect the people within a site when the system's authority ends at the meter. A common misconception is that a PWS that requires backflow prevention at the metered connection does not have to require backflow protection within the site. However, backflow prevention extends beyond the meter and into the connection. One key benefit of a cross-connection control program is that it allows for the protection of both the potable-water supply to the main distribution system and within a site. The point where the PWS's authority generally

ends, at the meter, is where the authority of other jurisdictions like a plumbing department take over.

Installing a meter at a connection alone does not necessarily satisfy all backflow requirements:

> "The use of a backflow prevention assembly at the service connection shall be considered as additional backflow protection and shall not negate the use of backflow protection on internal hazards as outlined and enforced by local plumbing codes" [30 TAC 290.44(h)(5)].

Therefore, backflow protection at the meter is "considered as additional backflow protection." In other words, in addition to backflow prevention required by other authorities—such as plumbing codes or the fire marshal's office—backflow protection may also be required at the meter, allowing for protection of customers from backflow within the site. The ultimate determination rests with the water purveyor. Because of the shared responsibility for cross-connection control, it is important that everyone involved develop written protocols for sharing information, storing records, and delineating where one department's jurisdiction ends, and another department's jurisdiction begins. Open lines of communication and good working relationships are essential.

Example: Communication and Coordination With Other Departments

The administrator of a cross-connection control program was having trouble getting a local backflow prevention assembly tester to submit the original test forms in a reasonable amount of time. Often, this tester would wait months before turning in the test reports. This delay made it difficult for the program administrator to track where new assemblies had been installed and when they were due for testing.

The program administrator coordinated with the building- and plumbing-inspection staff so that approval of the plumbing installation and issuance of a certificate of occupancy for those locations where a test was conducted depended on all necessary documentation—such as the Backflow Prevention Assembly Test and Maintenance Report—to first be submitted to the city.

This coordination and cooperation between the administrator and department solved the problem. Relevant to this example is the landscape-irrigation regulation [30 TAC 344.52(c), Appendix H], which requires submission of a test report to the water purveyor within 10 business days of testing. Another option for the administrator was to inform the tester that only those registered with the city could test, and those registered testers must submit timely reports.

PWS personnel do not always have the support of a plumbing or inspection department. In those cases, the PWS does not have the benefit of plumbing-code rules, thus the responsibility for the cross-connection control program rests solely on the PWS. It then becomes essential that the PWS ensures that its service agreement meets

TCEQ standards, that each customer signs the service agreement, and that the PWS can follow up on hazards identified through periodic CSIs or the required backflow prevention assembly testing.

7. Testing, Inspection, Certification

Assemblies used for protection from health hazards, whether installed at the meter or part of an internal program, must be tested upon installation and at least once a year thereafter by a licensed backflow prevention assembly tester (BPAT). Test records must be retained by the PWS for at least three years.

Testing Backflow Prevention Assemblies

Like all mechanical devices, backflow prevention assemblies are subject to failure over time and must be tested to ensure that they are operating properly. As noted above, TCEQ rules require that all backflow prevention assemblies be tested upon installation, and that assemblies installed to protect against health hazards must be tested at least annually [30 TAC 290.44(h)(4)]. Some PWSs may require more frequent testing if codified in their plumbing ordinance, regulations, customer service agreement, or adopted plumbing code.

In addition to recording the test results, the Test and Maintenance Report (T&M) form in Appendix C requires that the licensed BPAT certify whether the installation of the assembly complies with manufacturer recommendations and local codes. The BPAT then forwards the **signed original** to the PWS, which the PWS retains for at least three years. If the BPAT submits a form to the PWS indicating an improper installation of a backflow prevention assembly, even though it passed the test, the PWS *must* arrange for the reinstallation of the assembly in accordance with manufacturer recommendations and local codes.

If, during a routine test of a backflow prevention assembly, the BPAT determines that the assembly will fail a test but needs repair, then the assembly must be repaired and retested. Otherwise, it cannot be said that the backflow prevention assembly passed the test. This is documented by the BPAT in the official T&M form located in Appendix C of this guide and on the TCEQ website.

Even if the assembly failed or needed repair, the water supplier should be aware of the issue, and the failed form should be submitted to the water supplier for recordkeeping purposes. This can help the PWS determine what is failing, when it's failing, and inform more backflow decisions on a local level.

Tester Duties and Restrictions

Licensed BPATs are qualified to test and repair assemblies on any domestic, commercial, industrial, or irrigation service.

There is an additional requirement for BPATs who test and repair assemblies on fire-suppression systems or fire lines. BPATs may test an assembly on fire systems **only** if they are permanently employed by an approved fire-line contractor due to alerting apparatus and wiring on the backflow prevention assembly. Additionally, there are extra insurance requirements in place to protect backflows devices on fire lines. It is

critical that the BPAT be properly trained to leave the assembly in proper functioning order after the test. A mistake could risk lives and property.

Under Texas Insurance Code Section 6003.002 (Fire Sprinkler Rules) there are certain authorities and individuals to which the rules do not apply, like owners or lessees. If the Fire Sprinkler Rules do not apply, then permanent employment of the BPAT by a fire-line contractor may not be necessary; however, the requirement to obtain a backflow prevention assembly license will remain. More information on backflow prevention on fire suppression systems appears in Backflow Protection on Water-Based Fire Protection Systems (TCEQ publication RG-345).[5]

Specific requirements regarding the Texas Insurance Code and the Texas State Fire Marshall's office can be found at:

www.tdi.texas.gov/fire/

To promote consistency in training, TCEQ requires training providers to teach the testing procedures that appear in the latest edition of the *Manual of Cross-Connection Control* from the University of Southern California (USC). This manual may be obtained from the USC website[6]. Variations from the most recent USC *Manual of Cross-Connection Control* testing procedures are not permitted.

For maximal protection of public health, these procedures are designed to fail an assembly **before** it will allow backflow and contaminate the potable-water supply. An individual who wishes to obtain a BPAT license must pass a written and practical test based on the USC field-test procedures approved by TCEQ.

The TCEQ Occupational Licensing Section has information available regarding the BPAT license. You can contact the section at 512-239-6133 or visit the Licensing web page[7].

Inspection

Equipment and Notification

The gauges that BPATs use to test backflow prevention assemblies are very sensitive and accurate in measuring pressure differentials. If these gauges are not working properly, there is a risk that a backflow prevention assembly could pass a test but not be functioning correctly. Therefore, licensed BPATs must have their test gauges verified for accuracy upon purchase and at least once per year in accordance with 30 TAC 290.44(h)(4)(B). Information on testing gauges may be found in Accuracy Testing of Gauges Used for Testing Backflow-Prevention Assemblies[8] (RG-493).

PWSs should notify customers when backflow prevention assembly is due for testing. This letter should notify the customer that the water will have to be temporarily turned off, allowing the customer to make any necessary accommodations. Additionally, it should also reference the potential enforcement actions if the assembly remains untested and out of compliance.

[5] www.tceq.texas.gov/downloads/drinking-water/plan-technical-review/prevention/rg-345.pdf
[6] fccchr.usc.edu/tools.html
[7] https://www.tceq.texas.gov/licensing/licenses/bpatlic
[8] www.tceq.texas.gov/downloads/drinking-water/plan-technical-review/prevention/rg-493.pdf

For convenience, these notifications may include a list of local licensed BPATs that the customer can choose from. The PWS should be aware of any restrictions for recommending private companies before providing a list, such as a potential conflict of interest. Depending on the type of ownership, it may be necessary for you to include a disclaimer establishing that the list of BPATs does not constitute an endorsement by the PWS. Another option is to generate a list of BPATs by conducting a search of the TCEQ online operator-licensing database[9].

Some PWSs require BPATs testing assemblies in their service area to register with them and submit their gauge and license information, either for free or a small fee. This gives the PWS an advantage because it allows the system to determine that the BPAT's license is current, that the BPAT's test gauge has been tested for accuracy within the last year, and that the testers are using the correct test report or their TCEQ-approved alternate form.

Fees and Payment for Backflow Prevention Assembly Testing

Payment for testing a backflow prevention assembly usually takes one of three routes:

- A PWS with one or more BPATs on staff may test backflow prevention assemblies in its service area and charge the customer a fee.
- A PWS may require its customers to have the backflow prevention assembly tested. The PWS maintains a list of locally approved BPATs or refers customers to the TCEQ website list.
- A PWS may give its customers the option of using a private company or the PWS to conduct testing.

A PWS requiring customers to arrange for their own testing must ensure that a TCEQ-licensed BPAT conducts the test and the test results are recorded on the correct form (TCEQ-20700, Backflow Prevention Assembly Test and Maintenance Report)[10].

Certification and Approval of Backflow Prevention Assemblies

The TCEQ rules (30 TAC 290) do not currently require certification or approval of backflow-prevention assemblies, nor does TCEQ perform any testing or certification on assemblies. If a PWS would like to adopt a requirement or restriction identifying the specific backflow-prevention assemblies that can be installed in its service area, it should clearly state the requirement or restriction in its ordinance, regulations, and/or service agreement.

Some plumbing codes require backflow prevention assemblies to be approved by third-party professional organizations. Stringent field testing of backflow prevention assemblies is a crucial aspect of the approval process. Several U.S. organizations maintain standards for field testing and evaluating of backflow prevention assemblies, including:

[9] www.tceq.texas.gov/goto/lic_reg_search
[10] www.tceq.texas.gov/downloads/drinking-water/plan-technical-review/prevention/tceq-20700.pdf

- the USC Foundation for Cross-Connection Control and Hydraulic Research
- the American Society of Sanitary Engineers (ASSE)
- the International Association of Plumbing and Mechanical Officials (IAPMO)

Updated lists of test assemblies are often available on the organization's website.

Code of Ethics

TCEQ encourages BPATs and PWS programs to follow the *TCEQ Licensed BPAT's Code of Ethics* created by the Cross-Connection Control Subcommittee in 2013.

1. BPAT's shall abide by the Code of Ethics and substantially follow the BPAT Standards of Practice.
2. The BPAT shall not engage in any practices that could be damaging to the public or bring discredit to the Backflow Prevention Cross-Connection control inspection industry.
3. The BPAT shall be fair, honest, impartial, and act in good faith in dealing with the public.
4. The BPAT shall not discriminate in any business activities on the basis of race, color, religion, sex, national origin, familial status, sexual orientation or handicap, and shall comply with all federal, state and local laws concerning discrimination.
5. The BPAT shall be truthful regarding his/her services and qualifications.
6. The BPAT shall have no undisclosed conflict of interest with the client.
7. BPAT shall not communicate any information about a test to anyone except the client without the prior written consent of the client, except where it may affect the safety of others or violates a law or statute.
8. The BPAT shall always act in the interests of the client, unless doing so violates a law, statute or this Code of Ethics.

The BPAT shall comply with all government rules and licensing requirements of the jurisdiction where they conduct business.

8. Records and Record Retention

The goal of good record keeping is to maintain accurate, well-documented records and to be able to supply records to appropriate people when needed. This goal can only be accomplished by records management through the creation, use, maintenance, retention, preservation, and disposal of records. An effective records-management program should allow for the systematic control of records throughout their life cycle.

Backflow Prevention Assembly Test and Maintenance Reports (T&M Forms)

T&M forms are primarily used to record the results of testing a backflow prevention assembly, along with other pertinent information. A sample T&M form appears in Appendix C. A PWS may wish to capture other information from the assembly testing that is not listed in the official T&M Form, such as line pressure or customer account

information. In such cases TCEQ allows for alternate forms to be developed and used; however, those alternate forms must receive approval from TCEQ before being used. TCEQ requires that the PWS retain signed, hard-copy original T&M Forms for at least three years.

At a minimum, before accepting a test report, a PWS should verify that:

- The form is completed in full.
- The assembly passed the test.
- The assembly was installed correctly.
- The gauges used were tested for accuracy.
- The type of test gauge was used correctly on a potable or non-potable line.
- The date when the assembly was tested is within a year of the date when the test gauge was tested for accuracy.
- The tester's license is current.
- The assembly is not a new installation needing to be added to a tracking program.

PWSs should develop a procedure to address cases in which they receive a report indicating a failed test. Some possible considerations would be to determine the risk posed by that connection, the cause of the failure, the time needed to correct the failing backflow preventer, the date for a follow-up test, and the best way to monitor the status of the backflow preventer. In addition, the reason for failure may help determine the appropriate follow-up. For example, if a test failed because the assembly was installed in the wrong orientation, the PWS can review the remarks and the "installed correctly" box to determine an appropriate follow up and communicate with the customer.

An incomplete form fails to communicate everything needed to track a backflow test. A missing test date, unverified gauge, or an unknown location makes tracking backflow preventers and determining compliance difficult. An incomplete form should be rejected and returned to the tester for follow-up, such as a retest of the BPA.

The Customer Service Inspection Certificate

The CSI Certificate is used to record the results of the CSI. As with the T&M Form, PWSs must use the TCEQ official CSI Certificate. A sample of that form appears in Appendix D. However, a PWS may develop its own form or make changes to the official form, as long as the alternate form has received TCEQ approval. CSI certificates must be retained for at least 10 years or kept as a permanent record of the PWS.

Experience has shown that distributing records in the following order has proven beneficial to PWSs:

9. The PWS retains the original.
10. The customer receives a copy.
11. The BPAT or CSI inspector keeps a copy.

Quality Control

Both the CSI certificate and T&M forms contain valuable information that helps the PWS protect public health. Hazard types, backflow prevention assemblies, and their locations show what poses a danger to the water system.

Staff reviewing CSI certificates and BPAT forms should understand their meaning. For example, a failing result on a T&M form may indicate that more action needs to be taken, or submittal of incomplete or incorrectly completed forms may indicate that the BPAT did not accomplish the testing job completely or correctly. Filing away forms without review defeats their purpose of providing comprehensive compliance information to the PWS. Licensed testers and inspectors are the eyes and ears of your backflow program. The remarks box and repairs/materials-used box shed valuable light on what is out in the field.

One quality control test is to tag out a backflow preventer prior to its annual test date. As a requirement in local regulations, the tester may be required to submit the tag as part of their test results to confirm they were out on site. If the tag was not turned in, this could be an indication that the backflow preventer was not tested. A PWS requiring backflow testers register with them locally can maintain tester information, as well as weed out potential bad actors not certifying their gauges, not having a valid license, or performing poorly (see section 7 on Testing, Inspection, and Certification).

Electronic Recordkeeping

With changes in technology, PWSs are often generating, using, and maintaining electronic forms and records. TCEQ requires the PWS to retain signed hard-copy original records, or copies in the case of a CSI certificate. For this reason, an electronic form is considered an alternate form and must receive approval. Case by case, a PWS may receive approval to use the internet or another technological medium to comply with the TCEQ record-keeping requirements. TCEQ acknowledges the use of unique usernames and passwords generally serves the same purpose as signing a hard-copy original.

Some of the key questions which should be answered when requesting approval are:

12. What are the deviations from the official TCEQ forms?
13. What precautions have you taken to prevent data loss?
14. What precautions have you taken to ensure data integrity (fraud prevention, consistency with USC test procedures)?
15. How will the software comply with record-retention requirements (BPAT retention: three years; CSI retention: 10 years or indefinitely)?
16. Will the PWS be able to produce a hard copy of the records when requested during a comprehensive compliance inspection by the TCEQ regional investigators?
17. Will training be available to the PWS to ensure that its staff knows enough to be able to supply required information during a comprehensive compliance inspection?

18. Will the software identify when values that are out of acceptable parameters are entered?
19. Will the software alert the tester that a backflow preventer has failed a test?
20. Will the software record that a backflow preventer failed a test, was repaired, and passed the test after repair?
21. What precautions are taken when the tester has successfully tested a backflow preventer and, for some reason, the software is not available (malfunction, user error, etc.)?
22. Where an unscrupulous person is misusing the software, can it confirm that the tester went on-site to conduct the test?

Keeping track of the locations and test due dates of all the backflow prevention assemblies installed within a PWS's service area can be complicated. Software that has been created specifically to help PWS personnel with this task is available for purchase. An online search for this software will give you an idea of the options available. An alternative is for you to develop your own electronic tracking system.

Electronic programs have their limits. For example, a tester's username and password acts as their signature—administrative staff cannot enter results with one master username and password for all testers. TCEQ does not broadly approve of recordkeeping companies nor software programs, thus approval must be requested on a per-system basis.

Alternate forms provide the opportunity to track not only backflow testing information, but also other information such as account numbers, failure rates, and tester information. Both hardcopy and electronic forms must meet the minimum information laid out in TCEQ form 20700. To have an alternate form reviewed for approval, send a letter of request and a copy of the form to the Cross-Connection Control program online to CrossCon@tceq.texas.gov, or by mail to:

The Cross-Connection Control Program, MC-151
TCEQ
P.O. Box 13087
Austin, TX 78711-3087

9. Landscape Irrigation

Rules for landscape irrigation in 30 TAC 344 may have an impact on a PWS's cross-connection control program because they have requirements for backflow prevention as well as detailed installation requirements. Typically, irrigation systems are a direct cross-connection to the potable-water supply, which requires backflow prevention. Some typical hazards posed by an irrigation system are:

- Connection of alternative water sources (creeks, rainwater harvesting systems, lakes, private wells, stock tanks, etc.).
- Organisms (parasites, insect larvae, pathogens) living in the water of the irrigation system.
- Exposure of the sprinkler heads to fertilizers, herbicides, or pesticides in the yard.

- Exposure of the sprinkler heads to fecal material from animals living on the site (dogs, cats, rodents, farm animals).
- Direct connection of chemical additives to the irrigation system.
- The backflow requirements for irrigation systems make it logical that the landscape-irrigation rules and the rules on cross-connection control and backflow prevention are interrelated. PWSs that have not considered the impact of these rules may need to take action to learn about them and implement additional protective measures within their cross-connection control program.

To assist public water suppliers, TCEQ has published Landscape Irrigator's Rule Compilation (RG-470)[11]. You can contact the TCEQ Landscape Irrigation Program at 512-239-5296 or by visiting their web page[12].

To conserve water, many irrigation systems are supplied with reclaimed water. RG-470 addresses the use of reclaimed water for irrigation systems. It describes requirements for backflow prevention, color coding, and necessary signs. "Reclaimed water" is defined in 30 TAC 210. It refers to wastewater that is discharged under a TCEQ 210 Permit for beneficial use. If the beneficial use involves likely human contact, the water is considered Type 1 reclaimed water; if not, the water is called Type 2 reclaimed water. Regardless of type, reclaimed water poses a health hazard to the water system, requiring backflow prevention.

Many irrigation systems are installed on sites that have an on-site sewage facility (OSSF) such as a septic tank and laterals. The existence of the OSSF elevates the classification of the irrigation system to a health hazard requiring the installation of an RPBA and annual testing requirements. Irrigation systems that were installed prior to a rule change in 2009 may not have RPBAs installed and should be evaluated for compliance.

Licensed irrigators may install backflow prevention assemblies on irrigation systems. The irrigator must use the correct type of assembly considering:

- the hydraulic conditions (back pressure)
- hazard analysis
- testing requirements
- installation requirements

Though a licensed irrigator may install the backflow prevention assembly, it must be tested by a licensed BPAT upon installation.

10. Education and Training

Education and training are important to every aspect of a program. Training gives an individual the critical information needed to carry out specific tasks and interpret information. Backflow, what a cross-connection is, and how contaminated water from a customer's premises can get into the potable water supply, are important concepts **all** personnel need to comprehend. Staff not directly involved in water, such as managers, front desk staff, cashiers, or other positions can be primed to recognize potential

[11] www.tceq.texas.gov/downloads/publications/rg/landscape-irrigators-rule-compilation-rg-470.pdf
[12] www.tceq.texas.gov/goto/lawn

backflow issues. Contamination involving backflow is usually discovered through water quality complaints and understanding cross-connection control measures is a necessity. The following are two examples emphasizing the importance of trained staff:

Example 1. Internal Program Change

Personnel at a particular PWS receive basic training on some concepts of cross-connection control. The meter readers, repair personnel, and anyone having a field job are requested to inform the program coordinator of any potential hazards they notice—such as auxiliary water sources or extensive plumbing work.

A meter reader observes that large pieces of equipment are being brought into a facility. The coordinator makes inquiries and determines that the facility has totally changed the type of work it conducts and will now be using water using equipment that has contaminants under pressure for various processes. It will now need an RP installed at the meter. Without the knowledge and actions of the field personnel, the potable-water supply would have been vulnerable to the new contamination hazards at that facility.

Example 2. Bubble Complaint

A complaint coordinator receives a complaint of tiny bubbles in the water at a restaurant. Upon investigating, the coordinator finds what appears to be air in the water and tells the restaurant personnel to flush their internal piping system and the PWS will open the fire hydrants to flush any air out of the water main. This does not solve the problem, and the tiny bubbles persist.

Many times, what appears to be air in the water at restaurants is carbon dioxide associated with the carbonated beverage dispensing unit. These dispensers have CO2 canisters that have from 150 to 400 psi of pressure and can backflow the CO2 gas into the potable water system if the backflow preventer fails. When the CO2-water mixture comes in contact with copper, it leaches out copper due to the acidity of the mixture. The leached copper then ends up in drinks, making people sick. The coordinator missed the problem because they did not understand cross-connection control and the restaurant's hazardous conditions.

Customer Education

Customer education is also a critical public relations tool. Educating customers about the hazards of cross-connections and backflow will help them recognize their responsibility and the benefits of helping to protect their potable water supply. Opportunities like community events, an active website, or social media group can serve as a first line of information. Numerous educational videos are posted to

YouTube by various groups like AWWA and ABPA that explain backflow concepts in plain language. Customers become invested when they realize the first people affected by a backflow event in their backyard will be their families. Customers who understand cross-connection control can become allies in preventing further cross-connections and advocates for educating other customers. Small systems such as RV parks or a factory can help protect against cross connections by providing information to residence or workers.

11. Where to Find More Information

Licensing for Backflow Prevention Assembly Testers and Customer-Service Inspectors

Personnel from the TCEQ Occupational Licensing Section can answer routine inquiries about BPAT and CSI licenses. You can contact them by phone at 512-239-6133—press *1* for new BPAT or CSI applications or exams. You can reach the Occupational Licensing Section by e-mail at licenses@tceq.texas.gov. The mailing address is:

Backflow Prevention Assembly Tester Licensing Program, MC 178
or
Customer Service Inspection Licensing Program, MC 178
TCEQ
PO Box 13087
Austin, TX 78711-3087

Landscape Irrigation Systems

The Landscape Irrigation program answers common technical questions to landscape irrigation systems. The Landscape Irrigation program also responds to landscape irrigator complaints and hosts the quarterly Irrigation Advisory Council. You can reach the Landscape irrigation program at 512-239-5296) or by email at install@tceq.texas.gov. The mailing address is:

Landscape Irrigation Program, MC-174
TCEQ
P.O. Box 13087
Austin, TX 78711-3087

The Cross-Connection Control Program

The TCEQ Emergency Preparedness & Response Section has personnel available to answer questions about establishing a program or interpreting state rules and regulations. Contact the Cross-Connection Control Program and ask to speak to someone about backflow prevention at 512-239-1075 or by email at CrossCon@tceq.texas.gov. The mailing address is:

Emergency Preparedness & Response Section, MC 151
or
Cross-Connection Control Program, MC 151
TCEQ
PO Box 13087
Austin, TX 78711-3087

Information about the TCEQ Cross-Connection Control Program is available at www.tceq.texas.gov/drinkingwater/cross-connection. Information regarding quarterly meetings of the Cross-Connection Control Subcommittee is available at www.tceq.texas.gov/drinkingwater/cross-connection/cccgroup.html.

Texas State Board of Plumbing Examiners

The Texas State Board of Plumbing Examiners can be reached by phone at 512-936-5200, by email at info@tsbpe.texas.gov, or on the web at www.tsbpe.texas.gov.

Purchase a Copy of a State-Approved Plumbing Code

International Plumbing Code

International Code Council Store
11711 West 85th Street
Lenexa KS 66214
www.iccsafe.org

Uniform Plumbing Code

IAPMO Order Desk
5001 East Philadelphia Street
Ontario CA 91761
www.iapmomembership.org/store

Other Sources of Information about Cross-Connection Control

American Society of Sanitary Engineering

ASSE International Office
901 Canterbury, Suite A
Westlake OH 44145
www.asse-plumbing.org

American Water Works Association

6666 West Quincy Ave.
Denver CO 80235-3098
www.awwa.org

Foundation for Cross-Connection Control and Hydraulic Research

University of Southern California
KAP-200 University Park MC-2531
Los Angeles CA 90089-2531
fccchr.usc.edu

American Backflow Prevention Association
The American Backflow Prevention Association
6672 South 1570 West
West Jordan, UT 84084
www.abpa.org

Appendix A: Can I Install a Backflow-Prevention Assembly?

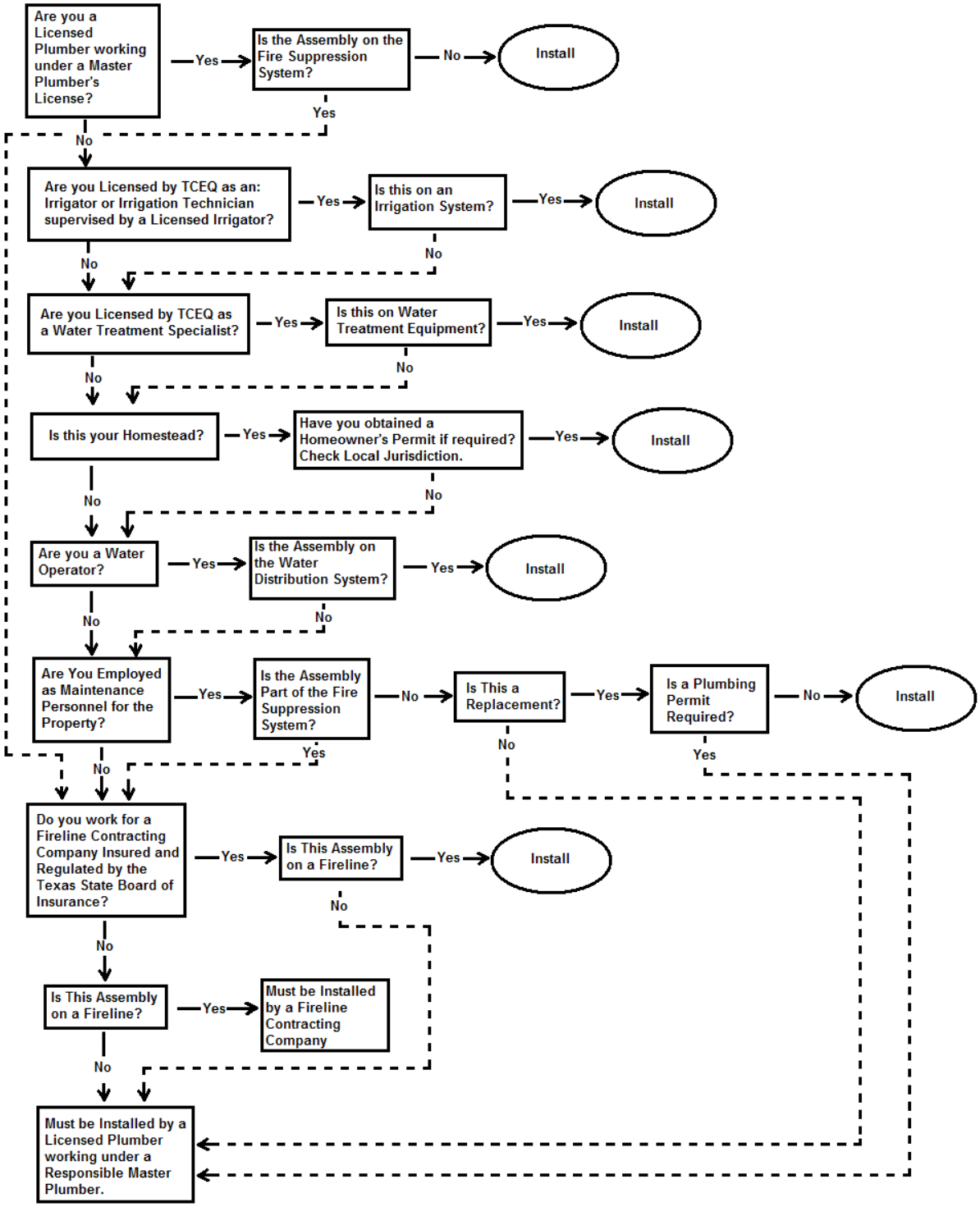

Figure 5. Backflow Prevention Assembly Installation.

Note: All backflow prevention assemblies must be tested by a licensed BPAT upon installation

Appendix B: Sample Service Agreement [30 TAC 290.47(b)]

I. PURPOSE. The NAME OF WATER SYSTEM is responsible for protecting the drinking water supply from contamination or pollution which could result from improper system construction or configuration on the retail connection owner's side of the meter. The purpose of this service agreement is to notify each customer of the restrictions which are in place to provide this protection. The public water system enforces these restrictions to ensure the public health and welfare. Each retail customer must sign this agreement before the NAME OF WATER SYSTEM will begin service. In addition, when service to an existing retail connection has been suspended or terminated, the water system will not re-establish service unless it has a signed copy of this agreement.

II. RESTRICTIONS. The following unacceptable practices are prohibited by State regulations.

A. No direct connection between the public drinking water supply and a potential source of contamination is permitted. Potential sources of contamination shall be isolated from the public water system by an air-gap or an appropriate backflow prevention device.

B. No cross-connection between the public drinking water supply and a private water system is permitted. These potential threats to the public drinking water supply shall be eliminated at the service connection by the installation of an air-gap or a reduced pressure-zone backflow prevention device.

C. No connection which allows water to be returned to the public drinking water supply is permitted.

D. No pipe or pipe fitting which contains more than 0.25% lead may be used for the installation or repair of plumbing at any connection which provides water for human use.

E. No solder or flux which contains more than 0.2% lead can be used for the installation or repair of plumbing at any connection which provides water for human use.

III. SERVICE AGREEMENT. The following are the terms of the service agreement between the NAME OF WATER SYSTEM (the Water System) and NAME OF CUSTOMER (the Customer).

A. The Water System will maintain a copy of this agreement as long as the Customer and/or the premises is connected to the Water System.

B. The Customer shall allow his property to be inspected for possible cross-connections and other potential contamination hazards. These inspections shall be conducted by the Water System or its designated agent prior to initiating new water service; when there is reason to believe that cross-connections or other potential contamination hazards exist; or after any major changes to the private water distribution facilities. The inspections shall be conducted during the Water System's normal business hours.

C. The Water System shall notify the Customer in writing of any cross-connection or other potential contamination hazard which has been identified during the initial inspection or the periodic reinspection.

D. The Customer shall immediately remove or adequately isolate any potential cross-connections or other potential contamination hazards on his premises.

E. The Customer shall, at his expense, properly install, test, and maintain any backflow prevention device required by the Water System. Copies of all testing and maintenance records shall be provided to the Water System.

IV. ENFORCEMENT. If the Customer fails to comply with the terms of the Service Agreement, the Water System shall, at its option, either terminate service or properly install, test, and maintain an appropriate backflow prevention device at the service connection. Any expenses associated with the enforcement of this agreement shall be billed to the Customer.

CUSTOMER'S SIGNATURE: _____

DATE: _____

Appendix C: Backflow Prevention Assembly Test and Maintenance Report (TCEQ Form-20700)

This form is periodically updated – below is a sample only. For the most recent form, please go to [www.tceq.texas.gov/drinkingwater/cross-connection.](www.tceq.texas.gov/drinkingwater/cross-connection)

Texas Commission on Environmental Quality

BACKFLOW PREVENTION ASSEMBLY TEST AND MAINTENANCE REPORT

The following form must be completed for each assembly tested. A signed and dated original must be submitted to the public water supplier for recordkeeping *purposes:

NAME OF PWS:	
PWS ID#:	
PWS MAILING ADDRESS:	
PWS CONTACT PERSON:	
ADDRESS OF SERVICE:	

The backflow prevention assembly detailed below has been tested and maintained as required by commission regulations and is certified to be operating within acceptable parameters.

TYPE OF BACKFLOW PREVENTION ASSEMBLY (BPA):				
☐	Reduced Pressure Principle (RPBA)	☐	Reduced Pressure Principle-Detector (RPBA-D)	Type II ☐
☐	Double Check Valve (DCVA)	☐	Double Check-Detector (DCVA-D)	Type II ☐
☐	Pressure Vacuum Breaker (PVB)	☐	Spill-Resistant Pressure Vacuum Breaker (SVB)	

Manufacturer:	Main:	Bypass:	Size:	Main:	Bypass:
Model Number:	Main:	Bypass:	BPA Location:		
Serial Number:	Main:	Bypass:	BPA Serves:		

Reason for test:	New ☐	Existing ☐	Replacement ☐	Old Model/Serial #		
Is the assembly installed in accordance with manufacturer recommendations and/or local codes?					☐ Yes	☐ No
Is the assembly installed on a non-potable water supply (auxiliary)?					☐ Yes	☐ No

TEST RESULT PASS ☐ FAIL ☐	Reduced Pressure Principle Assembly (RPBA)			Type II Assembly	PVB & SVB	
	DCVA		Relief Valve	Bypass Check	Air Inlet	Check Valve
	1st Check	2nd Check***				
Initial Test Date: Time:	Held at ____ psid Closed Tight ☐ Leaked ☐	Held at ____ psid Closed Tight ☐ Leaked ☐	Opened at ____ psid Did not open ☐	Held at ____ psid Closed Tight ☐ Leaked ☐	Opened at ____ psid Did not open ☐ Did it fully open (Yes ☐ /No ☐)	Held at ____ psid Leaked ☐
Repairs and Materials Used**	Main: Bypass:					
Test After Repair Date: Time:	Held at ____ psid Closed Tight ☐	Held at ____ psid Closed Tight ☐	Opened at ____ psid	Held at ____ psid Closed Tight ☐	Opened at ____ psid	Held at ____ psid

*** 2nd check: numeric reading required for DCVA only

Differential pressure gauge used:		Potable: ☐		Non-Potable: ☐	
Make/Model:		SN:		Date tested for accuracy :	

Remarks:

Company Name:		Licensed Tester Name (Print/Type):	
Company Address:		Licensed Tester Name (Signature):	
Company Phone #:		BPAT License #	
		License Expiration Date:	

The above is certified to be true at the time of testing.

* TEST RECORDS MUST BE KEPT FOR AT LEAST THREE YEARS [30 TAC §290.46(B)]

** USE ONLY MANUFACTURER'S REPLACEMENT PARTS

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Appendix D: Customer Service Inspection Certificate (TCEQ Form-20699)

This form is periodically updated – below is a sample only. For the most recent form, please go to [www.tceq.texas.gov/drinkingwater/cross-connection.](www.tceq.texas.gov/drinkingwater/cross-connection)

Texas Commission on Environmental Quality

Customer Service Inspection Certificate

Name of PWS:	
PWS ID #:	
Location of Service:	

Reason for Inspection:	
New construction	☐
Existing service where contaminant hazards are suspected	☐
Material improvement, correction or expansion of distribution facilities	☐

I _____, upon inspection of the private water distribution facilities connected to the aforementioned public water supply do hereby certify that, to the best of my knowledge

Compliance	Non-Compliance		
☐	☐	(1)	No direct or indirect connection between the public drinking water supply and a potential source of contamination exists. Potential sources of contamination are isolated from the public water system by an air gap or an appropriate backflow prevention assembly in accordance with Commission regulations.
☐	☐	(2)	No cross-connection between the public drinking water supply and a private water system exists. Where an actual air gap is not maintained between the public water supply and a private water supply, an approved reduced pressure principle backflow prevention assembly is properly installed.
☐	☐	(3)	No connection exists which would allow the return of water used for condensing, cooling or industrial processes back to the public water supply.
☐	☐	(4)	No pipe or pipe fitting which contains more than 8.0% lead exists in private water distribution facilities installed on or after July 1, 1988 and prior to January 4, 2014.
☐	☐	(5)	Plumbing installed on or after January 4, 2014 bears the expected labeling indicating ≤0.25% lead content. If not properly labeled, please provide written comment.
☐	☐	(6)	No solder or flux which contains more than 0.2% lead exists in private water distribution facilities installed on or after July 1, 1988.

I further certify that the following materials were used in the installation of the private water distribution facilities:

Service lines:	Lead ☐	Copper ☐	PVC ☐	Other ☐
Solder:	Lead ☐	Lead Free ☐	Solvent Weld ☐	Other ☐

Remarks:	

I recognize that this document shall be retained by the aforementioned Public Water System for a minimum of ten years and that I am legally responsible for the validity of the information I have provided.

Signature of Inspector:		License Type:	
Inspector Name(Print/Type):		License Number:	
Title of Inspector:		Date / Time of Insp.:	/

A Customer Service Inspection Certificate should be on file for each connection in a public water system to document compliance with 30 TAC § 290.44(h)/290.46(j).

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Appendix E: Rules Related to Cross-Connection Control and Backflow Prevention

The following rules have been extracted from the Title 30, Texas Administrative Code, Chapter 290 and reformatted for ease of use. In the case of any discrepancy between this guide and the rules published at the Texas Secretary of State's website www.sos.state.tx.us, the SOS site shall apply.

§ 290.38. Definitions

The following words and terms, when used in this chapter shall have the following meanings, unless the context clearly indicates otherwise. If a word or term used in this chapter is not contained in the following list, its definition shall be as shown in Title 40 Code of Federal Regulations (CFR) Section 141.2. Other technical terms used shall have the meanings or definitions listed in the latest edition of The Drinking Water Dictionary, prepared by the American Water Works Association.

§290.38(2) Air gap—The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet conveying water to a tank, fixture, receptor, sink, or other assembly and the flood level rim of the receptacle. The vertical, physical separation must be at least twice the diameter of the water supply outlet, but never less than 1.0 inch.

§290.38(16) Contamination—The presence of any foreign substance (organic, inorganic, radiological or biological) in water which tends to degrade its quality so as to constitute a health hazard or impair the usefulness of the water.

§290.38(17) Cross-connection—A physical connection between a public water system and either another supply of unknown or questionable quality, any source which may contain contaminating or polluting substances, or any source of water treated to a lesser degree in the treatment process.

§290.38(20) Disinfection—A process which inactivates pathogenic organisms in the water by chemical oxidants or equivalent agents.

§290.38(21) Distribution system—A system of pipes that conveys potable water from a treatment plant to the consumers. The term includes pump stations, ground and elevated storage tanks, potable water mains, and potable water service lines and all associated valves, fittings, and meters, but excludes potable water customer service lines.

§290.38(22) Drinking water—All water distributed by any agency or individual, public or private, for the purpose of human consumption or which may be used in the preparation of foods or beverages or for the cleaning of any utensil or article used in the course of preparation or consumption of food or beverages for human beings. The term "Drinking Water" shall also include all water supplied for human consumption or used by any institution catering to the public.

§290.38(23) Drinking water standards—The commission rules covering drinking water standards in Subchapter F of this chapter (relating to Drinking Water Standards Governing Drinking Water Quality and Reporting Requirements for Public Water Systems).

§290.38(31) Health hazard—A cross-connection, potential contamination hazard, or other situation involving any substance that can cause death, illness, spread of disease, or has a high probability of causing such effects if introduced into the potable drinking water supply.

§290.38(32) Human consumption—Uses by humans in which water can be ingested into or absorbed by the human body. Examples of these uses include, but are not limited to drinking, cooking, brushing teeth, bathing, washing hands, washing dishes, and preparing foods.

§290.38(53) Nonhealth hazard—A cross-connection, potential contamination hazard, or other situation involving any substance that generally will not be a health hazard, but will constitute a nuisance, or be aesthetically objectionable, if introduced into the public water supply.

§290.38(57) Plumbing inspector—Any person employed by a political subdivision for the purpose of inspecting plumbing work and installations in connection with health and safety laws and ordinances, who has no financial or advisory interest in any plumbing company, and who has successfully fulfilled the examinations and requirements of the Texas State Board of Plumbing Examiners.

§290.38(58) Plumbing ordinance—A set of rules governing plumbing practices which is at least as stringent and comprehensive as one of the following nationally recognized codes:

§290.38(58)(A) the International Plumbing Code; or

§290.38(58)(B) the Uniform Plumbing Code.

§290.38(59) Potable water customer service line—The sections of potable water pipe between the customer's meter and the customer's point of use.

§290.38(60) Potable water service line—The section of pipe between the potable water main to the customer's side of the water meter. In cases where no customer water meter exists, it is the section of pipe that is under the ownership and control of the public water system.

§290.38(61) Potable water main—A pipe or enclosed constructed conveyance operated by a public water system which is used for the transmission or distribution of drinking water to a potable water service line.

§290.38(62) Potential contamination hazard—A condition which, by its location, piping or configuration, has a reasonable probability of being used incorrectly, through carelessness, ignorance, or negligence, to create or cause to be created a backflow condition by which contamination can be introduced into the water supply. Examples of potential contamination hazards are:

§290.38(62)(A) bypass arrangements;

§290.38(62)(B) jumper connections;

§290.38(62)(C) removable sections or spools; and

§290.38(62)(D) swivel or changeover assemblies.

§290.38(73) Service line - A pipe connecting the utility service provider’s main and the water meter, or for wastewater, connecting the main and the point at which the customer’s service line is connected, generally at the customer’s property line.

§ 290.42. Water Treatment

§290.42(d)(2) All plant piping shall be constructed so as to be thoroughly tight against leakage. No cross-connection or interconnection shall be permitted to exist in a filtration plant between a conduit carrying filtered or post-chlorinated water and another conduit carrying raw water or water in any prior stage of treatment.

§290.42(d)(2)(A) Vacuum breakers must be provided on each hose bibb within the plant facility.

§290.42(d)(2)(B) No conduit or basin containing raw water or any water in a prior stage of treatment shall be located directly above, or be permitted to have a single common partition wall with another conduit or basin containing finished water.

§290.42(d)(2)(C) Make-up water supply lines to chemical feeder solution mixing chambers shall be provided with an air gap or other acceptable backflow prevention device.

§290.42(d)(2)(D) Filters shall be located so that common walls will not exist between them and aerators, mixing and sedimentation basins or clearwells. This rule is not strictly applicable, however, to partitions open to view and readily accessible for inspection and repair.

§290.42(d)(2)(E) Filter-to-waste connections, if included, shall be provided with an air gap connection to waste.

§290.42(d)(2)(F) Air release devices on treated waterlines shall be installed in such a manner as to preclude the possibility of submergence or possible entrance of contaminants. In this respect, all openings to the atmosphere shall be covered with 16-mesh or finer corrosion-resistant screening material or an equivalent acceptable to the executive director.

§290.42(d)(11)(F)(vi) When used, surface filter wash systems shall be installed with an atmospheric vacuum breaker or a reduced pressure principle backflow assembly in the supply line. If an atmospheric vacuum breaker is used it shall be installed in a section of the supply line through which all the water passes and which is located above the overflow level of the filter.

§290.42(d)(13)(A) A plant that is built or repainted after October 1, 2000 must use the following color code. The color code to be used in labeling pipes is as follows:

Letters	**Color of Pipe**
Potable Water	Light Blue
Compressed Air	Light Green
Instrument Air	Light Green with Dark Green Bands
Chlorine (gas, liquid, or vent)	Yellow
Chlorine (solution)	Yellow with Red Bands
Liquid Alum	Yellow with Orange Bands
Alum (solution)	Yellow with Green Bands
Ammonia	Yellow with Brown Bands
Chlorine Dioxide (solution)	Yellow with Blue Bands
Ferric chloride	Brown with Red Bands
Ferric sulfate	Brown with Yellow Bands
Polymers	White with Green Bands
Liquid caustic	White with Red Bands
Caustic (solution)	White with Orange Bands
Fluoride	White with Yellow Bands
Ozone	Stainless Steel with White Bands
Settled Water	Green
Filter Effluent	Light Blue
Backwash Supply	Light Blue

Backwash Waste	Dark Gray
Drain	Dark Gray
Raw Water	Tan

§290.42(d)(13)(B) A plant that was repainted before October 1, 2000 may use an alternate color code. The alternate color code must provide clear visual distinction between process streams.

§290.42(d)(13)(C) The system must maintain clear, current documentation of its color code in a location easily accessed by all personnel.

§ 290.43. Water Storage

§290.43(c)(7) Each clearwell or potable water storage tank shall be provided with a means of removing accumulated silt and deposits at all low points in the bottom of the tank. Drains shall not be connected to any waste or sewage disposal system and shall be constructed so that they are not a potential agent in the contamination of the stored water. Each clearwell or potable water storage tank must be designed to drain the tank.

§290.43(c)(9) No tanks or containers shall be used to store potable water that have previously been used for any nonpotable purpose. Where a used tank is proposed for use, a letter from the previous owner or owners must be submitted to the executive director which states the use of the tank.

§ 290.44. Water Distribution

§290.44(b) Lead ban. The following provisions apply to the use of lead in plumbing.

§290.44(b)(1) The use of pipes and pipe fittings that contain more than 0.25% lead or solders and flux that contains more than 0.2% lead is prohibited in the following circumstances:

§290.44(b)(1)(A) for installation or repair of any public water supply; and

§290.44(b)(1)(B) for installation or repair of any plumbing in a residential or nonresidential facility providing water for human consumption and connected to a public drinking water supply system.

§290.44(b)(2) This requirement will be waived for lead joints that are necessary for repairs to cast iron pipe.

§290.44(h) Backflow, siphonage.

§290.44(h)(1) No water connection from any public drinking water supply system shall be allowed to any residence or establishment where an actual or potential contamination hazard exists unless the public water facilities are protected from contamination.

§290.44(h)(1)(A) At any residence or establishment where an actual or potential contamination hazard exists, additional protection shall be required at the meter in the form of an air gap or backflow prevention assembly. The type of backflow prevention assembly required shall be determined by the specific potential hazard identified in §290.47(f) of this title (relating to Appendices).

§290.44(h)(1)(B) At any residence or establishment where an actual or potential contamination hazard exists and an adequate internal cross-connection control program is in effect, backflow protection at the water service entrance or meter is not required.

§290.44(h)(1)(B)(i) An adequate internal cross-connection control program shall include an annual inspection and testing by a certified backflow prevention assembly tester on all backflow prevention assemblies used for health hazard protection.

§290.44(h)(1)(B)(ii) Copies of all such inspection and test reports must be obtained and kept on file by the water purveyor.

§290.44(h)(1)(B)(iii) It will be the responsibility of the water purveyor to ensure that these requirements are met.

§290.44(h)(2) No water connection from any public drinking water supply system shall be connected to any condensing, cooling, or industrial process or any other system of nonpotable usage over which the public water supply system officials do not have sanitary control, unless the said connection is made in accordance with the requirements of paragraph (1) of this subsection. Water from such systems cannot be returned to the potable water supply.

§290.44(h)(3) Overhead bulk water dispensing stations must be provided with an air gap between the filling outlet hose and the receiving tank to protect against back siphonage and cross-contamination.

§290.44(h)(4) All backflow prevention assemblies that are required according to this section and associated table located in §290.47(f) of this title shall be tested upon installation by a recognized backflow prevention assembly tester and certified to be operating within specifications. Backflow prevention assemblies which are installed to provide protection against health hazards

must also be tested and certified to be operating within specifications at least annually by a recognized backflow prevention assembly tester.

§290.44(h)(4)(A) Recognized backflow prevention assembly testers shall have completed an executive director approved course on cross-connection control and backflow prevention assembly testing, pass an examination administered by the executive director, and hold a current license as a backflow prevention assembly tester.

§290.44(h)(4)(A)(i) Backflow prevention assembly testers are qualified to test and repair assemblies on any domestic, commercial, industrial, or irrigation service.

§290.44(h)(4)(A)(ii) Backflow prevention assembly testers may test and repair assemblies on firelines only if they are permanently employed by an Approved Fireline Contractor. The State Fire Marshal's office requires that any person performing maintenance on firelines must be employed by an Approved Fireline Contractor.

§290.44(h)(4)(B) Gauges used in the testing of backflow prevention assemblies shall be tested for accuracy annually in accordance with the University of Southern California's Manual of Cross-Connection Control or the American Water Works Association Recommended Practice for Backflow Prevention and Cross-Connection Control (Manual M14). Public water systems shall require testers to include test gauge serial numbers on "Test and Maintenance" report forms and ensure testers have gauges tested for accuracy.

§290.44(h)(4)(C) A test report must be completed by the recognized backflow prevention assembly tester for each assembly tested. The signed and dated original must be submitted to the public water supplier for recordkeeping purposes. Any form which varies from the format specified in commission Form No. 20700 must be approved by the executive director prior to being placed in use.

§290.44(h)(5) The use of a backflow prevention assembly at the service connection shall be considered as additional backflow protection and shall not negate the use of backflow protection on internal hazards as outlined and enforced by local plumbing codes.

§290.44(h)(6) At any residence or establishment where there is no actual or potential contamination hazard, a backflow prevention assembly is not required.

§290.44(i) Water hauling. When drinking water is distributed by tank truck or trailer, it must be accomplished in the following manner.

§290.44(i)(2)(E) Connections for filling and emptying the tank shall be properly protected to prevent the possible entrance of contamination. These openings must be provided with caps and keeper chains.

§290.44(j) If a structure is connected to a public water supply system and has a rainwater harvesting system, the structure must have appropriate cross-connection safeguards in accordance with subsection (h)(1) of this section.

§290.44(j)(1) A privately owned rainwater harvesting system with a capacity of more than 500 gallons that is connected to a public water system for a back-up supply shall have a backflow prevention assembly or an air gap installed at the storage facility for the harvested rainwater to ensure physical separation between the rainwater harvesting system and the public water system.

§290.44(j)(2) At each residence or facility where water from a rainwater harvesting system is used for potable purposes and there is a connection to a public water system, the public water system shall ensure that the rainwater harvesting system is installed and maintained by a master plumber or journeyman plumber licensed by the Texas State Board of Plumbing Examiners and who holds an endorsement issued by the Texas State Board of Plumbing Examiners as a Water Supply Protection Specialist.

§290.44(j)(3) A person who intends to connect a rainwater harvesting system to a public water system must give written notice of that intention to the municipality or the owner or operator of the public water system in which the rainwater harvesting system is located.

§290.44(j)(4) The public water system used as a back-up supply for the rainwater harvesting system may be connected only to the water storage tank and may not be connected to the plumbing of a structure.

§ 290.46. Minimum Acceptable Operating Practices for Public Drinking Water Systems

§290.46(f)(3) All public water systems shall maintain a record of operations.

§290.46(f)(3)(B) The following records shall be retained for at least three years:

§290.46(f)(3)(B)(v) the records of backflow prevention device programs

§290.46(f)(3)(E) The following records shall be retained for at least ten years:

§290.46(f)(3)(E)(iv) copies of the Customer Service Inspection reports required by subsection (j) of this section;

[CSI Certificate retention: The CSI Certificate requires that it be retained permanently, whereas the rule references 10 years; therefore, a discrepancy exists. The TCEQ recommends that CSI Reports be retained permanently, as long as the inspected facility is in existence.]

§290.46(i) Plumbing ordinance. Public water systems must adopt an adequate plumbing ordinance, regulations, or service agreement with provisions for proper enforcement to insure that neither cross-connections nor other unacceptable plumbing practices are permitted (See §290.47(b) of this title (relating to Appendices)). Should sanitary control of the distribution system not reside with the purveyor, the entity retaining sanitary control shall be responsible for establishing and enforcing adequate regulations in this regard. The use of pipes and pipe fittings that contain more than 0.25% lead or solders and flux that contain more than 0.2% lead is prohibited for installation or repair of any public water supply and for installation or repair of any plumbing in a residential or nonresidential facility providing water for human consumption and connected to a public drinking water supply system. This requirement may be waived for lead joints that are necessary for repairs to cast iron pipe.

§290.46(j) Customer service inspections. A customer service inspection certificate shall be completed prior to providing continuous water service to new construction, on any existing service either when the water purveyor has reason to believe that cross-connections or other potential contaminant hazards exist, or after any material improvement, correction, or addition to the private water distribution facilities. Any customer service inspection certificate form which varies from the format found in commission Form No. 20699 must be approved by the executive director prior to being placed in use.

§290.46(j)(1) Individuals with the following credentials shall be recognized as capable of conducting a customer service inspection certification.

§290.46(j)(1)(A) Plumbing Inspectors and Water Supply Protection Specialists licensed by the Texas State Board of Plumbing Examiners (TSBPE).

§290.46(j)(1)(B) Customer service inspectors who have completed a commission-approved course, passed an examination administered by the executive director, and hold current professional license as a customer service inspector.

§290.46(j)(2) As potential contaminant hazards are discovered, they shall be promptly eliminated to prevent possible contamination of the water supplied by the public water system. The existence of a health hazard, as identified in §290.47(f) of this title, shall be considered sufficient grounds for immediate termination of water service. Service can be restored only when the health

hazard no longer exists, or until the health hazard has been isolated from the public water system in accordance with §290.44(h) of this title (relating to Water Distribution).

§290.46(j)(3) These customer service inspection requirements are not considered acceptable substitutes for and shall not apply to the sanitary control requirements stated in §290.102(a)(5) of this title (relating to General Applicability).

§290.46(j)(4) A customer service inspection is an examination of the private water distribution facilities for the purpose of providing or denying water service. This inspection is limited to the identification and prevention of cross-connections, potential contaminant hazards, and illegal lead materials. The customer service inspector has no authority or obligation beyond the scope of the commission's regulations. A customer service inspection is not a plumbing inspection as defined and regulated by the TSBPE. A customer service inspector is not permitted to perform plumbing inspections. State statutes and TSBPE adopted rules require that TSBPE licensed plumbing inspectors perform plumbing inspections of all new plumbing and alterations or additions to existing plumbing within the municipal limits of all cities, towns, and villages which have passed an ordinance adopting one of the plumbing codes recognized by TSBPE. Such entities may stipulate that the customer service inspection be performed by the plumbing inspector as a part of the more comprehensive plumbing inspection. Where such entities permit customer service inspectors to perform customer service inspections, the customer service inspector shall report any violations immediately to the local entity's plumbing inspection department.

§290.46(k) Interconnection. No physical connection between the distribution system of a public drinking water supply and that of any other water supply shall be permitted unless the other water supply is of a safe, sanitary quality and the interconnection is approved by the executive director.

Appendix F: Assessment of Hazard and Selection of Assemblies [30 TAC 290.47(f)]

The following table lists many common hazards. It is not an all-inclusive list of the hazards that may be found connected to public water systems.

Premises Isolation: Description of Premises	**Assessment of Hazard**	**Required Assembly**
Aircraft and missile plants	Health	RPBA or AG
Animal feedlots	Health	RPBA or AG
Automotive plants	Health	RPBA or AG
Breweries	Health	RPBA or AG
Canneries, packing houses and rendering plants	Health	RPBA or AG
Commercial car wash facilities	Health	RPBA or AG
Commercial laundries	Health	RPBA or AG
Cold storage facilities	Health	RPBA or AG
Connection to sewer pipe	Health	AG
Dairies	Health	RPBA or AG
Docks and dockside facilities	Health	RPBA or AG
Dye works	Health	RPBA or AG
Food and beverage processing plants	Health	RPBA or AG
Hospitals, morgues, mortuaries, medical clinics, dental clinics, veterinary clinics, autopsy facilities, sanitariums, and medical labs	Health	RPBA or AG
Metal manufacturing, cleaning, processing, and fabrication plants	Health	RPBA or AG
Microchip fabrication facilities	Health	RPBA or AG
Paper and paper products plants	Health	RPBA or AG
Petroleum processing or storage facilities	Health	RPBA or AG
Photo and film processing labs	Health	RPBA or AG
Plants using radioactive material	Health	RPBA or AG
Plating or chemical plants	Health	RPBA or AG
Pleasure-boat marinas	Health	RPBA or AG
Private/Individual/Unmonitored Wells	Health	RPBA or AG
Reclaimed water systems	Health	RPBA or AG
Restricted, classified or other closed facilities	Health	RPBA or AG
Rubber plants	Health	RPBA or AG
Sewage lift stations	Health	RPBA or AG
Sewage treatment plants	Health	RPBA or AG
Slaughter houses	Health	RPBA or AG
Steam plants	Health	RPBA or AG
Tall buildings or elevation differences where the highest outlet is 80 feet or more above the meter	Nonhealth	DCVA

NOTE: AG = air gap; AVB = atmospheric vacuum breaker; DCVA = double check valve backflow prevention assembly; PVB = pressure vacuum breaker; RPBA = reduced-pressure principle backflow prevention assembly

Internal Protection: Description of Cross-Connection	**Assessment of Hazard**	**Required Assembly**
Aspirators	Nonhealth†	AVB
Aspirator (medical)	Health	AVB or PVB
Autoclaves	Health	RPBA
Autopsy and mortuary equipment	Health	AVB or PVB
Bedpan washers	Health	AVB or PVB
Connection to industrial fluid systems	Health	RPBA
Connection to plating tanks	Health	RPBA
Connection to salt-water cooling systems	Health	RPBA
Connection to sewer pipe	Health	AG
Cooling towers with chemical additives	Health	AG
Cuspidors	Health	AVB or PVB
Degreasing equipment	Nonhealth†	DCVA
Domestic space-heating boiler	Nonhealth†	RPBA
Dye vats or machines	Health	RPBA
Fire-fighting system (toxic liquid foam concentrates)	Health	RPBA
Flexible shower heads	Nonhealth†	AVB or PVB
Heating equipment		
Commercial	Nonhealth†	RPBA
Domestic	Nonhealth†	DCVA
Hose bibbs	Nonhealth†	AVB
Irrigation systems		
with chemical additives	Health	RPBA
without chemical additives	Nonhealth†	DCVA, AVB,or PVB
Kitchen equipment—Commercial	Nonhealth†	AVB
Lab bench equipment	Health or Nonhealth†	AVB or PVB
Ornamental fountains	Health	AVB or PVB
Swimming pools		
Private	Nonhealth†	PVB or AG
Public	Nonhealth†	RPBA or AG
Sewage pump	Health	AG
Sewage ejectors	Health	AG
Shampoo basins	Nonhealth†	AVB
Specimen tanks	Health	AVB or PVB
Steam generators	Nonhealth†	RPBA
Steam tables	Nonhealth†	AVB
Sterilizers	Health	RPBA
Tank vats or other vessels containing toxic substances	Health	RPBA
Trap primers	Health	AG
Vending machines	Nonhealth†	RPBA or PVB
Watering troughs	Health	AG or PVB

NOTE: AG = air gap; AVB = atmospheric vacuum breaker; DCVA = double check valve backflow prevention assembly; PVB = pressure vacuum breaker; RPBA = reduced-pressure principle backflow prevention assembly

AVBs and PVBs may be used to isolate health hazards under certain conditions, that is, back-siphonage situations. Additional area of premises isolation may be required.

†Where a greater hazard exists (due to toxicity or other potential health impact) additional area protection with RPBAs is required.

Appendix G: Rules for Licensing CSI Inspectors, BPATs, and Landscape Irrigators

The following rules have been extracted from the TAC and reformatted for ease of use. In the case of any discrepancy between this guide and the rules published at the Texas Secretary of State's website www.sos.state.tx.us, the SOS site shall apply.

Licensing Requirements for Backflow Prevention Assembly Testers (from 30 TAC Chapter 30, Subchapter B)

§ 30.51 Purpose and Applicability

§30.51(a) The purpose of this subchapter is to establish qualifications for issuing and renewing licenses to an individual who tests and repairs backflow prevention assemblies.

§30.51(b) An individual who tests and repairs backflow prevention assemblies must meet the qualifications of this subchapter and be licensed according to Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations).

§ 30.57 Definitions

The following word and term, when used in this subchapter, shall have the following meaning, unless the context clearly indicates otherwise.

Backflow prevention assembly tester (BPAT)—An individual who tests and repairs backflow prevention assemblies.

§ 30.60 Qualifications for Initial License

To obtain a license, an individual must have:

§30.60(1) met the requirements in Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations);

§30.60(2) passed an examination;

§30.60(3) received a high school diploma or equivalent certificate;

§30.60(4) completed an approved 40-hour backflow prevention assembly testing training course; and

§30.60(5) worked at least two years in an approved area which includes, but is not limited to:

§30.60(5)(A) operating or maintaining a public drinking water system;

§30.60(5)(B) installing or repairing residential, commercial, or industrial drinking water treatment equipment;

§30.60(5)(C) installing or repairing lawn irrigation systems;

§30.60(5)(D) performing activities requiring a master or journeyman plumbing license;

§30.60(5)(E) installing or servicing fire suppression sprinkler systems and lines;

§30.60(5)(F) operating or maintaining a domestic wastewater treatment facility;

§30.60(5)(G) performing health inspections that requires a registered sanitarian; or

§30.60(5)(H) performing other duties approved by the executive director.

§30.60(6) An individual may substitute one year of the required experience with:

§30.60(6)(A) one year of college credit (32 semester hours); or

§30.60(6)(B) 20 hours of approved training in addition to the required 40-hour backflow prevention assembly testing training course.

§ 30.62 Qualifications for License Renewal

To renew a license, an individual must have:

§30.62(1) met the requirements in Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations); and

§30.62(2) completed 24 hours of approved continuing education which includes eight hours of approved practical skills training.

Licensing Requirements for Customer-Service Inspectors (from 30 TAC Chapter 30, Subchapter C)

§ 30.81 Purpose and Applicability

§30.81(a) The purpose of this subchapter is to establish qualifications for issuing and renewing licenses to individuals who conduct and certify customer service inspections.

§30.81(b) An individual who performs customer service inspections must meet the qualifications of this subchapter and be licensed according to Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations)**§30.81(d)** A licensed customer service inspector shall not perform plumbing inspections required under Plumbing Licensing Law 15(a) (Texas Civil Statutes, Volume 17-1/2, Article 6243-101).

§ 30.87 Definitions

The following words and terms, when used in this subchapter, shall have the following meanings, unless the context clearly indicates otherwise.

§30.87(1) Cross-connection—A physical connection between a public water system and either another supply of unknown or questionable quality, any source which may contain contaminating or polluting substances, or any source of water treated to a lesser degree in the treatment process.

§30.87(2) Customer service inspection—An examination of the private water distribution facility for the purpose of providing or denying water service. The inspection is limited to the identification and prevention of cross-connections, potential contaminant hazards, and illegal lead materials. Customer service inspections are completed before providing continuous water service to new construction, on any existing service where there is reason to believe that cross-connections or other potential contaminant hazards exist, or after any material improvement, correction, or addition to private water distribution facilities (see §290.46(j) of this title (relating to Minimum Acceptable Operating Practices for Public Drinking Water Systems)).

§30.87(3) Customer service inspector—The person who is licensed by the executive director to perform customer service inspections.

§ 30.90 Qualifications for Initial License

§30.90(a) To obtain a license, an individual must have:

§30.90(a)(1) met the requirements in Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations);

§30.90(a)(2) received a high school diploma or equivalent certificate;

§30.90(a)(3) completed an approved customer service inspector training course;

§30.90(a)(4) worked at least two years in an approved area which includes, but is not limited to:

§30.90(a)(4)(A) operation or maintenance of a public drinking water treatment or distribution system;

§30.90(a)(4)(B) performing activities requiring a master or journeyman plumbing license;

§30.90(a)(4)(C) conducting building or construction inspections; or

§30.90(a)(4)(D) performing duties related to this profession approved by the executive director.

§30.90(b) One year of college (32 semester hours) or an additional 20 hours of training credits may be substituted for one year of the experience requirement.

§ 30.92 Qualifications for License Renewal

To renew a license, an individual must have:

§30.92(1) met the requirements in Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations); and

§30.92(2) completed 16 hours of approved continuing education.

§ 30.95 Exemptions

Plumbing inspectors and water supply protection specialists licensed by the State Board of Plumbing Examiners are exempt from these requirements.

Licensing Requirements for Landscape Irrigators, Installers, Irrigation Technicians, and Irrigation Inspectors (from 30 TAC Chapter 30, Subchapter D)

§ 30.111 Purpose and Applicability

§30.111(a) The purpose of this subchapter is to establish qualifications for issuing and renewing licenses to individuals who:

§30.111(a)(1) sell, design, install, maintain, alter, repair, or service an irrigation system;

§30.111(a)(2) provide consulting services relating to an irrigation system;

§30.111(a)(3) connect an irrigation system to any water supply; or

§30.111(a)(4) inspect irrigation systems and perform other enforcement duties as an employee or as a contractor.

§30.111(b) An individual who performs any of the tasks listed in subsection (a) of this section must meet the qualifications of this subchapter and be licensed according to Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations), unless they are exempt under §30.129 of this title (relating to Exemptions); and must comply with the requirements in Chapter 344 of this title (relating to Landscape Irrigation).

§ 30.117 Definitions

The following words and terms, when used in this subchapter, shall have the following meanings, unless the context clearly indicates otherwise.

§30.117(1) Installer—An individual who connects irrigation systems to any water supply.

§30.117(2) Irrigator—An individual who sells, designs, installs, maintains, alters, repairs, or services an irrigation system; provides consulting services relating to an irrigation system; or connects an irrigation system to any water supply.

§ 30.120 Qualifications for Initial License

§30.120(b) To obtain an irrigator license, an individual must:

§30.120(b)(1) meet the requirements in Subchapter A of this chapter (relating to Administration of Occupational Licenses and Registrations);

§30.120(b)(2) complete and pass the basic irrigator training course; and

§30.120(b)(3) pass all sections of the applicable examination.

§30.120(c) To obtain an irrigation technician license, an individual must:

§30.120(c)(1) meet the requirements in Subchapter A of this chapter;

§30.120(c)(2) complete the basic irrigation technician course; and

§30.120(c)(3) pass the applicable examination.

§30.120(d) To obtain an irrigation inspector license, an individual must:

§30.120(d)(1) meet the requirements in Subchapter A of this chapter.

§30.120(d)(2) successfully complete:

§30.120(d)(2)(A) the basic irrigator training course;

§30.120(d)(2)(B) an approved backflow prevention assembly testing training course; and

§30.120(d)(2)(C) an approved water conservation or water audit course; or

§30.120(d)(2)(D) an approved landscape irrigation inspection course.

§30.120(d)(3) pass the applicable examination.

§30.120(e) An individual is ineligible to obtain an irrigation inspector license if the individual engages in or has financial or advisory interest in an entity that:

§30.120(e)(1) sells, designs, installs, maintains, alters, repairs, or services an irrigation system;

§30.120(e)(2) provides consulting services relating to an irrigation system; or

§30.120(e)(3) connects an irrigation system to any water supply.

§ 30.122 Qualifications for License Renewal

§30.122(a) Effective January 1, 2010, the installer license was replaced by an irrigation technician license.

§30.122(b) To renew an irrigator license, an individual must:

§30.122(b)(1) meet the requirements in Subchapter A of this chapter; and

§30.122(b)(2) complete 24 hours of approved training credits.

§30.122(c) To renew an irrigation technician license, an individual must:

§30.122(c)(1) meet the requirements in Subchapter A of this chapter; and

§30.122(c)(2) complete 16 hours of approved training credits.

§30.122(d) To renew an irrigation inspector license, an individual must:

§30.122(d)(1) meet the requirements in Subchapter A of this chapter; and

§30.122(d)(2) complete 24 hours of approved training credits.

§ 30.129 Exemptions

§30.129(a) The licensing requirements of this chapter do not apply to a person who:

§30.129(a)(1) is licensed by a plumbing licensing authority in the state of Texas and is working within the scope provided by the plumbing laws;

§30.129(a)(2) is registered or licensed as a professional engineer or architect or landscape architect if the work is related to the pursuit of the profession;

§30.129(a)(3) is under the direct supervision of a licensed irrigator and assists in the installation, maintenance, alteration, repair, or service of an irrigation system; or

§30.129(a)(4) is an owner of a business that employs a licensed irrigator to supervise the business' sale, design, consultation, installation, maintenance, alteration, repair, and service of irrigation systems. For the purpose of this subchapter, employs means steadily, uniformly, or habitually working in an employer-employee relationship with the intent to earn a livelihood, as opposed to working casually or occasionally.

§30.129(b) The licensing requirements of this chapter do not apply to:

§30.129(b)(1) irrigation or yard sprinkler work that is performed by a property owner in a building or on premises owned or occupied by the owner as the owner's home;

§30.129(b)(2) irrigation or yard sprinkler repair work, other than extension of an existing irrigation or yard sprinkler system or installation of a replacement system that is:

§30.129(b)(2)(A) performed by a maintenance person who does not act as an irrigator or engage in yard sprinkler construction or maintenance for the public; and

§30.129(b)(2)(B) incidental to and on premises owned by the business in which the person is regularly employed or engaged;

§30.129(b)(3) irrigation or yard sprinkler work that is performed:

§30.129(b)(3)(A) by a regular employee of a railroad who does not act as an irrigator or engage in yard sprinkler construction or maintenance for the public; and

§30.129(b)(3)(B) on the premises or equipment of the railroad;

§30.129(b)(4) irrigation and yard sprinkler work that is performed on public property by a person who is regularly employed by a county, city, town, special district, or political subdivision of the state;

§30.129(b)(5) irrigation or yard sprinkler work that is performed by a person using a garden hose, hose sprinkler, hose-end product, including soaker hose, or agricultural irrigation system;

§30.129(b)(6) an activity that includes a commercial agricultural irrigation system;

§30.129(b)(7) irrigation or yard sprinkler work that is performed by an agriculturist, agronomist, horticulturist, forester, gardener, contract gardener, garden or lawn caretaker, nurseryman, or grader or cultivator of land on land owned by the individual performing the work;

§30.129(b)(8) irrigation or yard sprinkler work that is performed by a member of a property owners' association as defined by Property Code, §202.001, on real property owned by the association or in common by the members of the association if the irrigation or yard sprinkler system water real property that is less than 1/2 acre in size and is used for aesthetic or recreational purposes.

§30.129(c) A person who is exempt from the license requirements of this subchapter shall comply with the standards established by Chapter 344 of this title (relating to Landscape Irrigation). The term irrigation system does not include a system used on or by an agricultural operation as defined in Texas Agriculture Code, §251.002.

Appendix H: Landscape Irrigation Program Rules Related to Cross-Connection Control Programs

The following rules have been extracted from the 30 TAC 344, Subchapter A, and reformatted for ease of use. In the case of any discrepancy between this guide and the rules published at the Texas Secretary of State's website www.sos.state.tx.us, the SOS site shall apply.

§Section 344.1. Definitions

The following words and terms, when used in this chapter, have the following meanings, unless the context clearly indicates otherwise.

§344.1(1) Air gap—The unobstructed vertical distance through the free atmosphere between the lowest opening from any pipe or faucet conveying water to a tank, fixture, receptor, sink, or other assembly and the flood level rim of the receptacle. The vertical, physical separation

must be at least twice the diameter of the water supply outlet, but never less than 1.0 inch.

§344.1(3) Backflow prevention—The prevention of the reversal of flow, due to back siphonage or backpressure, of nonpotable water from an irrigation system into the potable water supply.

§344.1(4) Backflow prevention assembly—A mechanical assembly used to prevent backflow into a potable water system. The type of assembly used is based on the degree of hazard (health hazard or nonhealth hazard) and hydraulic conditions

§344.1(5) Completion of irrigation system installation—When the landscape irrigation system has been installed, all minimum standards met, all tests performed, and the irrigator is satisfied that the system is operating correctly.

§344.1(7) Cross-connection—A physical connection between a public water system and either another supply of unknown or questionable quality, any source which may contain contaminating or polluting substances, or any source of water treated to a lesser degree in the treatment process.

§344.1(10) Double Check Valve—An assembly that is composed of two independently acting, check valves, including tightly closing resilient seated shutoff valves attached at each end of the assembly and fitted with properly located resilient seated test cocks. Also known as a Double Check Valve Backflow Prevention Assembly.

§344.1(16) Health hazard—A cross-connection, potential contamination hazard, or other situation involving any substance that can cause death, illness, spread of disease, or has a high probability of causing such effects if introduced into the potable drinking water supply.

§344.1(18) Irrigation inspector—A water district operator, governmental entity, or licensed irrigation inspector who inspects irrigation systems and performs other enforcement duties for a municipality or water district and is required to be licensed under Chapter 30 of this title (relating to Occupational Licenses and Registrations) or a licensed plumbing inspector.

§344.1(30) Major maintenance, alteration, repair, or service—Any activity that involves opening to the atmosphere the irrigation main line at any point prior to the discharge side of any irrigation zone control valve. This includes, but is not limited to, repairing or connecting into a main supply pipe, replacing a zone control valve, or repairing

a zone control valve in a manner that opens the system to the atmosphere.

§344.1(34) Nonhealth hazard—A cross-connection, potential contamination hazard, or other situation involving any substance that generally will not be a health hazard but will constitute a nuisance or be aesthetically objectionable if introduced into the public water supply.

§344.1(35) Non-potable water—Water that is not suitable for human consumption. Non-potable water sources include, but are not limited to, irrigation systems, lakes, ponds, streams, gray water, water condensate from cooling towers, reclaimed water, and harvested rainwater.

§344.1(37) Potable water—Water that is suitable for human consumption and meets the definition of drinking water in §290.38(23) of this title (relating to Definitions)).

§344.1(38) Pressure Vacuum Breaker—An assembly that contains an independently operating internally loaded check valve and an independently operating loaded air inlet valve located on the discharge side of the check valve. Also known as a Pressure Vacuum Breaker Back-siphonage Prevention Assembly.

§344.1(39) Reclaimed water—Domestic or municipal wastewater which has been treated to a quality suitable for beneficial use, such as landscape irrigation.

§344.1(41) Reduced Pressure Principle Backflow Prevention Assembly—An assembly containing two independently acting approved check valves together with a hydraulically operating mechanically independent pressure differential relief valve located between the two check valves and below the first check valve.

§Section 344.24. Local Regulation and Inspection

§344.24(b) Any city, town, county, water district, other political subdivision of the state, or public water supplier that is not required to adopt rules or ordinances regulating landscape irrigation may adopt a landscape irrigation program by ordinance or rule and may be responsible for inspection of irrigation systems on sites that are connected to its public water supply system. Any rule or ordinance adopted to regulate landscape irrigation shall be at least as stringent as the requirements in this chapter.

§344.24(c) Municipalities with a population of 20,000 or more shall verify that the irrigator that designs and installs an irrigation system holds a valid irrigator's license and has obtained a permit before installing a system within its territorial limits or its extraterritorial jurisdiction. Inspectors must verify that the design and

installation meet the requirements of this chapter and local ordinances or rules that do not conflict with this chapter, or that are more stringent than this chapter.

§Section 344.36. Duties and Responsibilities of Installers and Irrigation Technicians

§344.36(a) A licensed irrigation technician under the supervision of a licensed irrigator, is responsible for:

§344.36(a)(1) connecting an irrigation system to a water supply;

§344.36(a)(2) installing a backflow prevention assembly pursuant to §344.50 of this title (relating to Backflow Prevention Methods);

§344.36(a)(3) conducting irrigation services including maintaining, altering, repairing, servicing, or directing the installation of irrigation systems; and

§344.36(a)(4) conducting the final walk through in compliance with the requirements in §344.63 of this title (relating to Completion of Irrigation System Installation).

§344.36(b) If an irrigation technician connects an irrigation system to a potable water supply, the connection and installation of the backflow prevention assembly must be as indicated on the site irrigation plan or as directed by the licensed irrigator and documented on the site irrigation plan.

§344.36(c) An irrigation technician, under the supervision of a licensed irrigator, is responsible for:

(1) connecting an irrigation system to a water supply; and

(2) providing on-site supervision of the installation, maintenance, alteration, repair, service of an irrigation system including the final walk through with the irrigation system owner or owner's representative to explain the maintenance and operation of the irrigation system.

§344.36(d) An irrigation technician shall not act as an irrigator nor advertise or offer to perform irrigation services.

§Section 344.50. Backflow Prevention Methods.

§344.50(a) All backflow prevention assemblies installed per this chapter shall be installed according to manufacturer's recommendations and provided with sufficient clearance to facilitate testing.

§344.50(b) If conditions that present a health hazard exist, one of the following types of backflow prevention shall be used.

§344.50(b)(1) An air gap may be used if installed per the definition of air gap in §344.1(1) of this title (relating to Definitions).

§344.50(b)(2) Reduced pressure principle backflow prevention assemblies may be used if installed per subsection (a) of this section and:

§344.50(b)(2)(A) the assembly is installed at a minimum of 12 inches above ground in a location that will ensure that the assembly will not be submerged; and

§344.50(b)(2)(B) drainage is provided for any water that may be discharged through the relief valve.

§344.50(b)(3) Pressure vacuum breakers may be used if installed per subsection (a) of this section and:

§344.50(b)(3)(A) there is no actual or potential for a back-pressure condition; and

§344.50(b)(3)(B) the assembly is installed at a minimum of 12 inches above any downstream piping and the highest downstream opening. Pop-up sprinklers are measured from the retracted position from the top of the sprinkler.

§344.50(b)(4) Spill-resistant pressure vacuum breakers may be used if installed per subsection (a) of this section and:

§344.50(b)(4)(A) there is no actual or potential for a back-pressure condition; and

§344.50(b)(4)(B) the assembly is installed at a minimum of 12 inches above any downstream piping and the highest downstream opening. Pop-up sprinklers are measured from the retracted position from the top of the sprinkler.

§344.50(c) If there are no conditions that present a health hazard, double check valve backflow prevention assemblies may be used to prevent backflow if the assembly is tested upon installation and:

§344.50(c)(1) a local regulatory authority does not prohibit the use of a double check valve; and

§344.50(c)(2) test cocks are used for testing only.

§344.50(d) Double check valve assemblies installed below ground shall meet the following installation requirements:

§344.50(d)(1) test cocks shall be plugged, except when the double check valve is being tested;

§344.50(d)(2) test cock plugs shall be threaded, water-tight, and made of non-ferrous material; and

§344.50(d)(3) there shall be a clearance all the way around the assembly to allow space for testing and repair.

§344.50(e) At a minimum, all backflow prevention assemblies shall be tested by a licensed backflow prevention assembly tester upon installation, repair, replacement, or relocation. Those backflow prevention assemblies used in irrigation systems designated as health hazards shall be tested annually.

§Section 344.51. Specific Conditions and Cross-Connection Control

§344.51(a) Before any chemical is added by any method (aspiration, injection, etc.) to an irrigation system which is connected to any potable water supply, the irrigation system shall be connected through a reduced pressure principle backflow prevention assembly or air gap.

§344.51(b) Irrigation system components treated with chemical additives and connected to any potable water supply shall be connected through a reduced pressure principle backflow prevention assembly.

§344.51(c) Connection of more than one water source to an irrigation system presents the potential for contamination of the potable water supply if backflow occurs. Therefore, connection of any additional water source to an irrigation system that is connected to the potable water supply can only be made if the irrigation system is connected to the potable water supply through a reduced-pressure principle backflow prevention assembly or an air gap.

§344.51(d) If an irrigation system is designed or installed on a property that is served by an on-site sewage facility, as defined in Chapter 285 of this title (relating to On-Site Sewage Facilities), then:

§344.51(d)(1) all irrigation piping and valves shall meet the separation distances from the On-Site Sewage Facilities system as required for a private water line in §285.91(10) of this title (relating to Tables), concerning the minimum required separation distances for on-site sewage facilities;

§344.51(d)(2) the irrigation system is designated a health hazard and any connections using a private or public potable water source shall be connected to the water source through a reduced pressure principle backflow prevention assembly as defined in §344.50 of this title (relating to Backflow Prevention Methods); and

§344.51(d)(3) any water from the irrigation system that is applied to the surface of the area utilized by the On-Site Sewage Facility system shall be

controlled on a separate irrigation zone or zones so as to allow complete control of any irrigation to that area so that there will not be excess water that would prevent the On-Site Sewage Facilities system from operating effectively.

§Section 344.52. Installation of Backflow Prevention Device

§344.52(a) If an irrigation system is connected to a potable water supply and requires major maintenance, alteration, repair, or service, the system shall be connected to the potable water supply through an approved, properly installed backflow prevention method as defined in this title before any major maintenance, alteration, repair, or service is performed.

§344.52(b) If an irrigation system is connected to a potable water supply through a double check valve, pressure vacuum breaker, or reduced pressure principle backflow prevention assembly and includes an automatic master valve on the system, the automatic master valve shall be installed on the discharge side of the backflow prevention assembly.

§344.52(c) The irrigator shall ensure the backflow prevention assembly is tested prior to being placed in service and the test results provided to the local water purveyor within ten business days of testing the backflow prevention assembly.

§Section 344.61. Minimum Standards for the Design of the Irrigation Plan

§344.61(c) All irrigation plans used for construction must be drawn to scale. The plan must include, at a minimum, the following information:

> **§344.61(c)(7)** specifications for all irrigation system components to include, but not limited to, location, type, size, manufacturer, model number, operating pressure, flow range, radius of throw;

§Section 344.62. Minimum Design and Installation Requirements

§344.62(k) Isolation valve. All new irrigation systems must include an isolation valve between the water meter and the backflow prevention assembly.

§344.62(n) Water contained within the piping of an irrigation system is deemed to be non-potable.

§Section 344.65. Reclaimed Water

Reclaimed water may be utilized in landscape irrigation systems if:

§344.65(4) the domestic potable water line providing water to the site is connected using an air gap or a reduced pressure principle backflow prevention assembly in accordance with §290.47(f) of this title (relating to Appendices);

§344.65(6) backflow prevention on the reclaimed water supply line shall be in accordance with the regulations of the water purveyor.

Appendix I: Sample Plumbing Ordinance

Please note that this is a **sample** ordinance and should not be modified or adopted without review by the public water system's legal counsel.

This ordinance adds a new section to the City's Code of Ordinances.

ORDINANCE NO. _____

An ordinance of the city council of the City of _____, Texas, amending Chapter ___ of the Code of Ordinances of _____, Texas, by adding a new section _____ to be entitled "Cross-Connection Control Program," providing a repeal clause and a severability clause, establishing penalties for the violation of these restrictions and provisions for their enforcement, and finding and determining that the meeting at which this ordinance is passed is open to the public as required by law.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF _____, TEXAS:

SECTION 1—That Chapter ___ of the Code of Ordinances of the City of _____, Texas, be amended to add a new section _____, such section to read as follows:

Section _____: Cross-Connection Control Program

a. **Definitions**

(1) **Manual M14:** The American Water Works Association's *Recommended Practice for Backflow Prevention and Cross-Connection Control*, current edition.

(2) **TCEQ:** Texas Commission on Environmental Quality.

(3) **290 Rules:** The TCEQ rules and regulations for public water systems, which appear in Title 30, Texas Administrative Code, Chapter 290.

b. **General**

(1) No water-service connection shall be made to any establishment where a potential or actual contamination hazard exists unless the water supply is protected in accordance with the 290 Rules and this ordinance. The water purveyor shall discontinue water service if a required air gap or backflow prevention assembly is not installed, maintained, and tested in accordance with the 290 Rules and this ordinance.

(2) No backflow protection at the water service meter is required where an adequate internal cross-connection control program is in place.

c. **Installation, Testing, and Maintenance of Backflow Prevention Assemblies**

(1) All backflow prevention assemblies must be tested upon installation by a licensed backflow prevention assembly tester and certified to be operating within specifications. Backflow prevention assemblies that are installed to protect against health hazards must also be tested and certified to be operating within specifications at least annually by a recognized backflow prevention assembly tester.

(2) Backflow prevention assemblies installed on fire suppression systems must be tested by a backflow prevention assembly tester permanently employed by an approved fireline contractor.

(3) Gauges used for backflow prevention assembly testing must be tested for

accuracy at least annually in accordance with the AWWA's Manual M14 or the current edition of the University of Southern California's *Manual of Cross-Connection Control*. A copy of the gauge accuracy test report must be submitted to the City of _____ to demonstrate the gauge has been tested for accuracy.

(3) A recognized backflow prevention assembly tester must hold a current license issued from TCEQ.

c. **Customer Service Inspections**

(1) A customer service inspection must be completed before the provision of continuous water service to all new construction, on any existing service when the water purveyor has reason to believe that cross-connections or other contaminant hazards exist, or after any material improvement, correction, or addition to the private water-distribution facilities.

(2) Only individuals with the following credentials shall be recognized as capable of conducting a customer service inspection:

(A) Plumbing inspectors and water-supply-protection specialists that have been licensed by the Texas State Board of Plumbing Examiners.

(B) Customer service inspectors that have been licensed by TCEQ.

(3) The customer service inspection must certify that:

(A) No direct connection between the public drinking water supply and a potential source of contamination exists. Potential sources of contamination must be isolated from the public water system by a properly installed air gap or an appropriate backflow prevention assembly.

(B) No cross-connection between the public water supply and a private water source exists. Where an actual, properly installed air gap is not maintained between the public water supply and a private water supply, an approved reduced-pressure-zone backflow prevention assembly is properly installed, and a service agreement exists for annual inspection and testing by a recognized backflow prevention assembly tester.

(C) No connection exists that allows water to be returned to the public drinking water supply.

(D) No pipe or pipe fitting that contains more than 0.25 percent lead is used for the installation or repair of plumbing at any connection that supplies water for human use.

(E) No solder or flux that contains more than 0.2 percent lead is used for the installation or repair of plumbing at any connection that provides water for human use.

Irrigation Systems

(1) Any irrigation system that is connected to a public or private potable water supply must be connected through a backflow prevention assembly approved by the Texas Commission on Environmental Quality.

(2) Backflow prevention assemblies installed on irrigation systems that are classified as health hazards must be tested at least annually.

SECTION 2—REPEAL

All ordinances that are in conflict with the provisions of this ordinance are hereby repealed, and all other ordinances of the City not in conflict with the provisions of this ordinance shall remain in full force and effect.

SECTION 3—SEVERABILITY

The phrases, clauses, sentences, paragraphs, and sections of this ordinance are severable and, if any phrase, clause, sentence, paragraph, or section of this ordinance shall be declared unconstitutional by the valid judgment or decree of any court of competent jurisdiction, such unconstitutionality shall not affect any of the remaining phrases, clauses, sentences, paragraphs, and sections of this ordinance.

SECTION 4—ENFORCEMENT

A violation of this ordinance is a misdemeanor and, upon conviction, any person who violates this ordinance shall be punished by a fine of not less than _____ and not more than _____. Each day that one or more of the provisions in this ordinance is violated shall constitute a separate offense. If a person is convicted of _____ or more distinct violations of this ordinance, the _____, _____, _____ shall, upon due notice to the customer, be authorized to discontinue water service to the premises where such violations occur. Services discontinued under such circumstances shall be restored only upon payment of a reconnection charge, hereby established at $_____, and any other costs incurred by the City of _____ in discontinuing service. In addition, suitable assurance must be given to the _____, _____, or _____ that the same action shall not be repeated while the ordinance is in effect. Compliance with this ordinance may also be sought through injunctive relief in district court.

Optional Provisions for the Section "Installation, Testing and Maintenance of Backflow Prevention Assemblies":

All backflow prevention assemblies must be installed and tested in accordance with the manufacturer's instructions, Manual M14, or the University of Southern California's *Manual of Cross-Connection Control*.

Assemblies must be repaired, overhauled, or replaced whenever the assemblies are found to be defective. Original forms recording testing, repairs, and overhaul must be kept and submitted to the City of _____ within five working days of the test, repair or overhaul of each backflow prevention assembly.
No backflow prevention assembly or device may be removed from use, or relocated, or other assembly or device substituted for it, without the approval of the City of _____.

Optional Provision for the Section "Irrigation Systems":

Backflow prevention assemblies installed on irrigation systems that are not classified as health hazards must be tested every _____ years or as required by the adopted plumbing code.

Optional Section:

Fire-Hydrant Protection

An approved reduced-pressure principle backflow prevention assembly (RPBA) is the minimum protection for fire-hydrant water meters that are being used for a temporary water supply during any construction or other uses which would pose a potential hazard to the public water supply.

(A) An RPBA must be installed if any solution other than potable water can be introduced into the system.
(B) The RPBA must be tested on each temporary water supply and annually as long as the RPBA is being used.
(C) It is the responsibility of all persons engaging in the use and rental of a fire-hydrant water meter to abide by the conditions of this article. All fire-hydrant meter rentals shall meet the current requirements of the City.