Prevalence of Cross-Connections in Household Plumbing Systems

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UNIVERSITY OF SOUTHERN CALIFORNIA

Foundation for Cross-Connection Control and Hydraulic Research

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Introduction

Cross-connection control is the effort to control interconnections between drinking water supplies and non-potable substances or sources. Cross-connection control programs have been a part of water and health agency programs for decades. A concern of many agencies has been household cross-connections. Although many haven't considered the hazards in households to be a major area of concern, it has, for the most part, remained an unknown factor in the cross-connection control field.

The US Environmental Protection Agency (EPA) had funded an epidemiology study (the Water Evaluation Trial, or WET Study) to determine the health effects of a home water treatment unit on the residents of approximately 400 homes in four contiguous urban/suburban communities in the US Mid West. All of the WET study participants lived in single-family homes. One of the concerns, which arose, was the possibility that the water could have been pure water when delivered to the residence, but could have become contaminated through cross-connections on the premises. This question, in turn, led to the funding of this study, wherein approximately 200 of the above mentioned homes were surveyed to determine whether the potential for cross-connections in the home existed and to assess whether cross-connections in the home could result in exposure to contaminants that would cause diarrhea or gastrointestinal illness, with the health effects being measured in the WET Study.

Aside from providing valuable information for the Epidemiology study, this study provided a wealth of data regarding the type and prevalence of cross-connections in household plumbing systems. This report encompasses only the findings of the household cross-connections study.

The Research Team

The Foundation for Cross-Connection Control and Hydraulic Research at the University of Southern California was chosen to conduct this study. The Foundation was founded to work on the problem of cross-connections in 1944. Since that time, the Foundation has developed a standard for backflow prevention assemblies and has an approval program for backflow prevention assemblies, which is widely accepted across the nation. The Foundation also publishes the Manual of Cross-Connection Control, and several training tools. The Foundation has offered the *Course for the Training of Backflow Prevention Assembly Testers* since 1969, and has been offering the *Course for the Training of Cross-Connection Control Program Specialists* since 1987. More information on the Foundation can be found at http://www.usc.edu/fccchr/

The USC Research Team included Prof. J. J. Lee, Ph.D., P.E as the Principal Investigator. Prof. Lee holds a Ph.D. in Civil Engineering from the California Institute of Technology and is a registered Professional Engineer in the State of California. He is a Professor in Civil and Environmental Engineering at the University of Southern California and has been the Director of the Foundation for Cross-Connection Control and Hydraulic Research since 1985. Mr. Patrick Sylvester was the Project Manager. Mr. Sylvester holds a BS in Mechanical Engineering and a Masters in Business Administration from the University of Southern California. He has been with the Foundation for over fifteen years working in the laboratory originally and more recently involved in administrative activities. Mr. Paul Schwartz was the Quality Assurance Manager for the project. Mr. Schwartz holds a BS in Mechanical Engineering from the University of Southern California and is a registered Professional Engineer in the State of California. He is currently the Foundation's Chief Engineer

and has worked with the Foundation for over twenty-five years. The Field Operations Manager was Mr. Mark Witt. Mr. Witt is a licensed plumber in the State of Iowa and was contracted by the Foundation for this project. He has successfully completed the Foundation's *Course for the Training of Cross-Connection Control Program Specialists* and is the owner of Backflow Prevention Services of Iowa. Research Team Member Mr. Henry Chang holds a BS in Mechanical Engineering and a Masters in Materials Engineering from the University of Southern California. He has been with the Foundation for over seventeen years.

Methods and Materials

Recruiting Participants

The participants in the WET study were informed about the study on household cross-connections via a letter from the WET Research Team as soon as EPA granted Institutional Review Board (IRB) approval. The letter briefly outlined the study and asked the interested participants to contact USC at a toll free number or return a postage-paid postcard to USC. The letter also mentioned that the participants would receive $50.00 for their part in the project.

In order for participants to be eligible to participate in this study, it was important to obtain informed consent. The participates were informed of the study, what was involved, what their part would be and what the compensation entailed. The participants were also made aware of any negative impact the study could have on them, such as the need to replace or modify certain components of the household plumbing system and the were informed of the benefits that could be gained by the survey of their plumbing system. They would be made aware of any potential hazards to their drinking water system and they would be informed as to how to go about making needed corrections. The complete letter may be found in Appendix A.

The WET participants who contacted USC were given an explanation of the study over the phone and those who were interested were sent a personalized letter, a fact sheet about the study, and the Informed Consent Form. They were asked to respond within three weeks to confirm their participation in the study.

As the participants responded, the USC Research Team e-mailed this information to the WET Research Team. The WET Research Team provided the dates these participants were to have their Point of Use (POU) water treatment devices removed. The WET Research Team also provided an ID number so that identifying information could be eliminated from the data supplied back to the WET Research Team. This was necessary to maintain the blind analysis required in the WET Study. The original goal was to conduct a site survey of the residential plumbing system shortly after the POU device was removed from service. The USC team sent out a letter to the participants notifying them of their acceptance into the project. They were given the name of the contractor and informed that the contractor would contact them directly, to schedule the specific appointment to conduct the survey of the household water uses. Contact information was forwarded to the contractor to facilitate scheduling of the site surveys.

Training of the Contractor (Field Operations Manager)

The USC Research Team contracted with a plumbing contractor for the position of Field Operations Manager (FOM). The required qualifications included cross-connection control experience, training to conduct the water use surveys, and maintaining a state-issued contractor's license. The contractor had been trained at the *Course for the Training of Cross-Connection Control Program Specialists* offered by USC, and taught by members of the USC Research Team for this project. This ensured

that the contractor was already aware of the USC Research Team's methods and understanding of cross-connections and degrees of hazard

This Field Operations Manager (FOM) performing the actual survey received additional training and instruction from the USC Research Team to ensure proper protocol was followed

Scope of the survey— The survey was to identify actual and potential cross-connections within and around the household. This was to involve examining plumbing fixtures such as: toilet tanks, irrigation systems, sump pumps, boilers, water heaters, spas, swimming pools, etc.

Data Collection—The contractor was instructed on the use of the site survey form (developed for this project) detailing each item on the form, including additional comments, which should be added to the form. The security and chain of custody of the data as covered in the project protocol was conveyed to the contractor. The Quality Assurance Manager (QAM) from the USC Research Team accompanied the FOM on the first several surveys. This clarified the method in which specific information would be transferred to the survey form and it ensured that the FOM understood exactly what information the USC Research Team needed for the project. Midway through the surveys the QAM again accompanied the FOM on several surveys to verify methods and techniques of data collection. All data forms were sent to the USC Research Team via FAX each Monday morning, and the originals were sent to the USC Team via a traceable shipping service. The contractor did not keep a copy of the survey form. All recommendations made to the customer where documented on the survey form.

Interacting with the participants—The contractor was instructed on how to communicate with the participant and those in the household. A professional, courteous demeanor was to be maintained at all times. The contractor was to follow all guidelines required by the Institutional Review Board and those spelled-out in the protocol. The customer was to be informed of the findings of the survey. The contractor was instructed to give some brief advice or recommendations and explain the benefits of correcting any problems discovered. The contractor was not permitted to offer his own services to make any plumbing changes. The contractor was not permitted, in any way, to accept any business from the participants as a result of this research project, nor was the contractor to inform anyone other than USC of the results of the survey, unless authorized to do so by USC. If it were to be necessary to make changes to the plumbing system, the contractor informed the customer. If a cross-connection were to be discovered, which was considered a serious threat to the quality of the water, the contractor was to notify the customer and the USC team immediately.

The Survey Form

The USC Research Team developed a survey form for the FOM to use during the surveys. The form would help the USC Research Team ascertain the following:

- The number of unprotected water uses (i.e., cross-connections) as compared to the total water uses on the premises.
- The degree of hazard of the cross-connections discovered
- If the cross-connections were direct or indirect cross-connections

The Survey Form was designed in such a way as to facilitate the gathering of all the necessary information during the site survey. It was also necessary that the data would be collected and recorded consistently, and could be transferred to a spreadsheet which would provide the best information for the USC Research Team as well as the WET Study Research Team. The survey form was divided in to several categories. In each category it was determined if there was a cross-connection, and if so, whether it was direct or indirect. It was also determined if the cross-connection was with a fluid that could present a health hazard or whether it should be classified as a non-health hazard. The connection was ascertained to be either temporary or permanent, and it was determined whether the cross-connection was protected and if the protection was acceptable. The categories included on the survey form were: Auxiliary Water Supplies, Fire Sprinkler Systems, Irrigation Systems, Heating/Cooling Equipment, Kitchen Facilities, Laundry Facilities, Sewage Systems Swimming Pools/Spas, Tanks, Vats, other Vessels, and hose bibs. There was also a section for additional connections not specifically mentioned on the form. Additionally, there was a section to note any chemicals, which were observed on the premises. The survey forms also indicated the contractor's time-in and time-out. After the initial set of surveys were in the QAM accompanied the FOM on the surveys, the Survey Form was modified slightly in order to clarify findings and ensure what was discovered on the surveys would be understood by the Research Team analyzing the surveys. The finalized Survey Form is shown in Appendix A. Accompanying the survey form was a separate form for recommendations. This was a triplicate form. The recommendations for corrections where included on this form. The participant was given one copy and the other two copies were forwarded to the USC Research Team. Additionally, the information was communicated to the local administrative authority(s), in those few cases where the seriousness of the cross-connection warranted. This form is shown in Appendix B. The FOM was not permitted to offer his own services to make any plumbing changes. The FOM could, in no way, accept any business from the participants as a result of this research project, nor was the FOM to recommend other contractors. When there were corrections to be made to the plumbing system, because of a serious threat to the water supply, the FOM informed the customer that the administrative authority would be notified. The FOM provided the participant with contact information for the local plumbing authority and the water supplier, should they desire more information on how to go about correcting any of the plumbing problems. If no unprotected cross-connections were discovered, the FOM informed the participant of this. The FOM, at that point, answered any of the participant's questions.

The Surveys

Once the participants confirmed their willingness to participate and their agreement to the information provided on the Informed Consent Form, the FOM made specific appointments directly with the participants via telephone. The FOM confirmed the appointments the day before the actual survey and confirmed that an adult would be present in the home at the time of the survey.

The FOM arrived at the site at the pre-scheduled time and date. After a brief review with the participant, the FOM began the water use survey using the survey form provided by the USC Research Team. The various water uses were examined as outlined on the survey form. One adult was asked to spend approximately 30-60 minutes accompanying the FOM as he performed the survey.

To protect participants in the study from unsolicited calls from plumbing contractors, the USC Field Operations Manager agreed not to provide any information on the survey or the names of participants to anyone except USC.

At the conclusion of the survey, the FOM delivered a check in the amount of $50.00 from USC made out to the participant. The FOM also delivered a brochure explaining common household cross-connections and explaining what the resident could do to abate cross-connections in the home. This brochure is shown in Appendix C.

The Data

The Survey Forms were faxed to the USC Research Team each Monday morning following the site surveys. The originals were sent at the same time via UPS, in order to be traceable. The FOM did not keep a copy of the survey form or provide information on individual surveys to anyone except USC.

Three members of the USC Research Team scored each survey independently of one another and placed the data on a spreadsheet. The QAM compared the individual scores and, when necessary, discussed specific scores, going back to the original survey forms in order to gain a consensus for the scoring. Once a consensus was reached, the data was entered into a master spreadsheet. Once a member of the Research Team entered the data, another member confirmed the entries to ensure accuracy in data entry. The spreadsheet included the number of protected cross-connections as compared with the number of total water uses within each category. For example 3/4 in the kitchen facility would indicate that there were four water uses and three of them were protected. The degree of hazard, and type of cross-connection (direct or indirect) was also indicated for the residence as a whole, with worst-case scenario being indicated. For example if there were both non-health hazards and health hazards, the degree of hazard indicated would be health hazard. Likewise, if there were direct and indirect cross-connections the form would indicate a direct cross-connection for the residence.

The final number of surveys completed was 188. Once the data was analyzed and the data input in the spreadsheet, the spreadsheet was sent to the WET Study Research Team at the University of California, Berkeley for inclusion in the WET Study.

Quality Control

Quality Objectives and Criteria

A major objective was to obtain consistent and accurate information regarding the water uses within the participating homes. After extensive training and discussions with the USC Research Team, the FOM conducted the surveys in accordance with the training. The QAM accompanied the FOM on the first several surveys to ensure consistency in the survey and in the completion of the survey report and in the understanding of various household cross-connections. After approximately one half of the surveys were conducted the QAM accompanied the FOM on several more surveys to ensure consistency.

When the data forms were returned to USC, three members of the USC research team analyzed the data forms independently to determine the degree of hazard present on the premises, if any. The

Research Team followed procedures based on the USC training course, *Course for the Training of Cross-Connection Control Program Specialist*, of which the members of the USC Research Team are instructors. Specifically, the type of cross-connection (direct or indirect) and the degree of hazard were determined.

Special Training

The FOM was required to have successfully completed the five-day training course, *Course for the Training of Cross-Connection Control Program Specialists* conducted by the University of Southern California. Since the FOM was a contractor working within Iowa, this training was necessary to ensure that the FOM had full understanding of the Research Teams methods and concepts of cross-connection control. The FOM was also required to maintain a contractor's license in the State of Iowa.

Documents and Records

The FOM sent all field survey forms via FAX to the USC Research Team each Monday morning following the completion of the survey. The original survey forms were shipped via UPS each week. The FOM did not maintain copies of the survey forms or provide information on individual surveys to anyone except USC.

The survey form was modified slightly to clarify information regarding the household bathrooms as recommended by the QAM following initial field testing of the survey form. In the original form, bathrooms 1, 2, and 3 were listed under Toilets/Bidets. In the modified form bathrooms 1, 2, and 3 were listed with bathtub/shower and toilet/bidet listed as subcategories under each bathroom. This clarified what was discovered at each location. The change was made to make the data recording easier and more consistent. On the first several survey forms, the data was recorded, but written explanations were needed in some cases to clarify which toilets were reflected in the data.

The QAM distributed the forms to three members of the USC Research Team for independent assessment. The members of the USC Research Team assessed each survey form recording the number of water uses and number of protected water uses at each residence. These were subdivided into the categories listed on the survey form. The degree of hazard for each category was assessed and a determination was made as to whether the cross-connection hazard was a direct (subject to backsiphonage and/or backpressure) or an indirect (subject to backsiphonage only) cross-connection. Each assessor summarized his findings on a spreadsheet, which was submitted to the Quality Assurance Manager for review. When the research team members arrived at conflicting assessments, the QAM discussed the issues in question to bring about a consensus. There were a relatively small number of instances that required the QAM to clarify situations in order to bring consensus. These situations, typically, required clarification of specific plumbing fixtures and how they were engineered. Once this information was brought to the attention of the Research Team members, consensus was forthcoming. Once a consensus was reached the data was entered into an Excel spreadsheet by one of the research team members. Once the data was entered, another member of the research team checked the data entry point by point with each of the research team members signing off on the data as it was entered for each household.

The data was e-mailed to the UCB Project Manager for use in the WET Study as it became available.

Electronically stored records were automatically backed up on a mirrored hard drive. Additionally, the mirrored hard drive was backed up to tape weekly.

Data Collection Method

The FOM arrived at the participant's home at a prescheduled time. After a brief explanation of what he would be doing, he, accompanied by an adult member of the household, proceeded to survey the water uses. He looked at sinks, toilets, irrigation systems, water heaters, boilers, water softeners, and any other water using equipment to determine if there were protected and/or unprotected cross-connections present. The surveyor indicated on the survey form what was discovered. The survey form may be found in Appendix B. Although the form is fairly exhaustive, there is a section on the survey form for other water uses that the surveyor may have discovered. These too were recorded on the survey form. The FOM determined if the cross-connection(s) were subject to backpressure or backsiphonage. The FOM also indicated what type of substance could have backflowed through the cross-connection(s). The FOM indicated what type of backflow protection was present, if any, and if the installation was correct. This information, as well as other observations, which may affect the hydraulic conditions of the household, such as number of stories, elevation relative to surrounding areas, etc., was recorded on the survey form. A separate triplicate form (Appendix B) was used to advise the resident of any recommendations to correct cross-connections, which were discovered. A copy was given to the customer, and the remaining copies were forwarded to USC with the original survey forms. In situations where a serious cross-connection hazard existed, which could have threatened the public water supply, a copy was forwarded to the Iowa American Water Company. In seventeen cases a direct cross-connection with a health hazard was discovered. Fourteen of these were direction connections to the sewer via improperly plumbed, or unacceptable toilet fixtures. Two were direct connections to the drain via improperly installed water softeners and the remaining cross-connection was a direct connection to an on-site well. The last three of these instances were determined to be severe enough to contact the water supplier, the Iowa American Water Company.

Data Chain of Custody

The FOM sent all field survey forms via FAX to the USC Research Team each Monday of the week following the completion of the survey. The original survey forms were shipped via UPS. The FOM did not maintain copies of these forms.

The data was detailed in an Excel file and e-mailed to the UCB Project Manager for use in the WET Study. Identifying information was not included with the data other than a specific ID number. The WET Study had been a triple blind study, and to ensure the WET Study team did not receive identifying information, the ID numbers were used.

Analytical methods

According to the *Manual of Cross-Connection Control*, Ninth Edition, a cross-connection is defined as "any unprotected 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." If the cross-connection is subject to backsiphonage only, it is considered an indirect cross-connection. A connection, which is subject to backsiphonage and backpressure, is considered a direct cross connection. The FOM described the type of cross-connection discovered and determined if there is adequate protection,

such as a vacuum breaker on the connection. The FOM followed conventions for types of cross-connections discussed in the USC *Course for the Training of Cross-Connection Control Program Specialists* and conventions discussed specifically with the USC Research team. These conventions were verified and confirmed in the first few surveys where the FOM was accompanied by the QAM to ensure consistency. In the initial surveys the FOM and QAM surveyed the property together, but completed the survey form separately. Afterward the forms were compared to determine if there were any discrepancies and discuss the reasons for such discrepancies. There were some discrepancies in recording the data, which were eliminated after the first few surveys. The discrepancies were minor and would not actually have made a difference in the data reporting. Midway through the project the QAM accompanied the FOM on several more surveys to confirm quality assurance guidelines were being followed and to ensure consistency in the data collection method. During these surveys there were no discrepancies.

Hazards were designated as a health hazard, a non-health hazard, or a non-hazard. A health hazard cross-connection is a cross-connection between the potable water supply and a substance that may cause illness or death if ingested. Sewage would be considered a health hazard as well as chemical additives used in boilers, and other systems. A cross-connection to a well would normally be considered a health hazard, unless the well was accepted by the local health authority as an acceptable drinking water supply. An unprotected hose bibb is normally considered to be a cross-connection with a health hazard, since the end of the hose can be easily dropped into a number of unknown substances such as ponds, fertilizer, pesticides, etc. A non-health hazard cross-connection is a connection between the potable water supply and an aesthetically objectionable materiel, which would not cause illness or death if ingested. This could be a substance that may change the color, smell or taste of the water without compromising the quality from a health perspective.

The FOM will define the cross-connections and what substance is subject to backflow (e.g., toilet water, spa water, etc.). Three members of the USC Research Team analyzed the survey forms independently to make an assessment of the degree of hazard. Discrepancies were eliminated by the QAM bringing clarity to the forms, mostly by defining specific plumbing fixtures such as toilet fixtures. Once the data was analyzed and the types of cross-connections and degrees of hazard determined, the data was compiled and is summarized in the Results and Conclusions section of this report. The data was also forwarded to the UCB Research Team for incorporation into the Wet Study.

Instrument testing, inspection and maintenance

The only instrument used in this study is the survey form, which has gone through several reviews by those involved in the WET Study and those involved in this study. After the initial surveys with the QAM and the FOM, some minor adjustments, were necessary to ensure clarity, accuracy and consistency in the reporting of data.

Inspection/ acceptance criteria

The data from the survey forms was accepted for use in the study unless there was unclear data. The QA Manager reviewed the data for clarity upon receipt. When there were unclear points, the QA Manager contacted the FOM requesting clarification. There was no need to eliminate any data as clarity was obtained in each case.

Assessments and Response Actions

On several occasions, the USC Research Team conducted a conference call with the UCB Research Team and the EPA Project Officer, as well as other stakeholders in the WET Study, to review the data submitted during the previous month(s). The USC Project Manager was in contact with the WET Study Project Manager on a regular basis as the need arose to ensure the delivery of data in a form useful to the WET Study Team and to discuss specific issues as they arose.

Reports to Management

Quarterly progress reports were made to the Environmental Protection Agency via the EPA Project Officer for this study. Project status, performance evaluation, periodic data quality assessments, any QA problems were addressed in regular telephone conversations, quarterly status reports and email.

Reconciliation with User Requirements

The USC Research Team worked closely with the UCB Research Team during the initial design of the study and throughout the data collection process to ensure that the cross-connection survey data met the needs of the UCB WET Study. The development of the survey form was coordinated between the USC, and UCB Research Teams. The summary spreadsheets were modified after the first group of surveys to serve the needs of the WET Study team. The cross-connections found in the bathrooms were divided into bathroom cross-connections and toilet cross-connections. The USC Research Team met with the Wet Study Project Manager after the initial surveys. At this meeting it was determined that cross-connections involving the toilets would be more pertinent to the WET Study. The data was contained in the original survey forms, but had not been separated on the initial spreadsheets forwarded to the WET Study Team. At this point, using the original data, the summary spreadsheet was modified to distinguish between toilet cross-connections and other bathroom cross-connections.

Results and Discussion

Surveys of household plumbing systems were conducted on 188 homes of those involved in the WET Study from May of 2002 to January of 2003. Homes found to have direct cross-connections to a health hazard constituted 9.6% of the homes. On average 73% of water uses were unprotected, constituting cross-connections. Only 4.3% of the homes had either no unprotected cross-connections or unprotected cross-connections to a non-hazardous substance. Homes with a cross-connection (either direct or indirect) to a health hazard constituted 95.7% of the homes. Although this is a large percentage, the greatest concern was with the 9.6% of the homes having a direct cross-connection to a health hazard. In most cases these cross-connections were due to improperly plumbed toilet fixtures, or specific toilet fixtures which could create a backpressure situation and force hazardous water from the toilet tank into the drinking water supply. 91% of the homes contained unprotected hose bibs, which are considered an indirect cross-connection to a health hazard, due to the potential for connecting hose bibs to any substance within reach of a hose. 61%

of the homes contained unprotected cross-connections involving the toilets with 8.8% of these being direct cross-connections. Cross-Connections to tanks, vats or water softeners were found in 5.9% of the homes. Of these, 18.2% were direct cross-connections to health hazards. Unprotected cross-connections to health hazards within the heating/cooling system were discovered in 43.6% of the homes. Only one home had an unprotected irrigation system of the five that had an irrigation system. The detailed spreadsheet covering each cross-connection for each residence is exhibited in Appendix D.

Summary of Results Table

Percentage of Homes	Condition Determined
9.6%	Direct cross-connection to a health hazard
73%	of all water uses unprotected
4.3%	All cross-connections protected or, if unprotected, was a non-health hazard
95.7%	Direct or indirect cross-connection to a health hazard
91%	Unprotected hose bibs at the residence
61%	Unprotected cross-connections involving toilets (8.8% of these were direct.)
5.9%	Of homes had cross-connections to tanks, vats, or water softeners
18.2%	Of the cross-connections to tanks, vats or water softeners were direct connections
43.6%	Of homes had heating/cooling system cross-connections

Conclusions and Recommendations

The results indicate that there are a large number of unprotected cross-connections in the home. Many of these cross-connections can be corrected by simple measures, such as a hose bib vacuum breaker or the change in a toilet fixture. Other problems which may occur, such as a direct cross-connection to the sewer via a water softener would require some additional plumbing work to alleviate. The fact that 73% of all water uses were through unprotected cross-connections indicates that there is a significant chance for backflow to occur should the hydraulic conditions change. Events that are not uncommon such as a water main break or fire hydrant use (for firefighting or flushing) would drop the pressure at the incident to atmospheric pressure. Pressure in the piping system elevated above the main break could drop to sub-atmospheric levels. In such cases backflow would occur through these unprotected cross-connections. A problem within the home could also occur should the water supply to the home be shut-off for any maintenance reason. If a tap at a lower elevation were opened, backflow would occur through an unprotected cross-connection.

This study indicates, first of all, that further study is needed in other areas of the nation. This project included homes in one water system in Iowa. There were only five irrigation systems, no pools, or spas, and no fire sprinkler systems. Additionally, the homes were, in general, older homes and they were all single-family dwellings. Irrigations systems which are common in some parts of the country, could easily contribute to the potential for backflow occurrences in residences. Pools and Spas are also potential sources of contamination, depending upon the design of the system for filling and/or make-up water.

Although data on the age of the home was only obtainable of 83 of the homes the average home age was almost fifty years old. Studies of newer homes may show homes are better protected.

Another recommendation would be for water agencies to increase their efforts in the area of public education. While almost every home had a cross-connection with a health hazard present few of the residents had any idea of the potential hazards. Most of the cross-connections discovered could be abated with a few dollars and a few minutes, but residents where unaware of the hazards existing in their own plumbing system.

Appendix A

The Initial Letter from USC

24 January 2002

Thank you for expressing interest in the study, "Prevalence of Cross-Connections in Household Plumbing," conducted by the University of Southern California. The research project is being conducted in coordination with the Iowa-American Water Company and the University of California, Berkeley WET (Water Evaluation Trial) Study, in which you have participated.

The purpose of this study will be to survey your household plumbing system to determine if there are any cross-connections in your home. A cross-connection is a connection between the drinking water plumbing system and any other source, which may contribute to the degradation of the quality of the drinking water. A brochure entitled *Working Together for Safe Water* is enclosed to help you understand what cross-connections are. A professional cross-connection control specialist will survey your plumbing system and determine if there exist any unprotected cross-connections in the system. One adult from your household will be asked to spend about 30-60 minutes accompanying the specialist as the survey is performed.

The information obtained will be valuable to the WET Study, the water distribution industry and to you. You will be informed of any connections in your plumbing system, which may permit other substances to enter your plumbing system and, thus, degrade the quality of your drinking water. You will be informed as to how to make the corrections necessary to protect your drinking water from these interconnections. These corrections may be as simple as replacing a part in your toilet tank, or installing a hose bib vacuum breaker. Once such corrections are made, or if no problems are discovered, you can be sure that you've done your part in protecting you, your family, neighbors and the water distribution system as a whole. ***At the end of the survey, the specialist will present you with a check for $50.00 for your participation in this study.***

Although it is likely that no unprotected cross-connections will be discovered in your home, your participation will allow you to gain greater insight in understanding your household water system.

We thank you for your interest in this study and look forward to your participation. I'm sure you will find the information obtained useful and interesting. To confirm your decision to participate in this study, you will need to read and agree to the enclosed Informed Consent Form and contact our office by calling toll-free 866-545-6340. Contacting our office signifies you agree to the enclosed Informed Consent Form. Please contact our office **within three weeks.**

Thank you again for your participation and if you have any questions, please contact our office at the phone number above or e-mail fccchr@usc.edu.

Sincerely,

J. J. Lee, Ph.D., P.E.
Director

Appendix B

The Survey Form

USC
UNIVERSITY OF SOUTHERN CALIFORNIA
Foundation for Cross-Connection Control and Hydraulic Research

Prevalence of Cross-Connections in Household Plumbing

Survey Form

USC ID # _____

Survey Location

Name Mr. Mrs. Miss _____

Street Address _____

City _____ *State* _____ *Zip* _____

Phone (_____)_____ FAX (_____) _____

Contact person upon arrival Mr. Mrs. Miss _____

Arrival Time _____ am/pm Departure Time _____ am/pm

Service Connection(s) & Number — Water Meter Size

- ☐ Domestic _____ — ☐ 5/8″ ☐ _″ ☐ 1″ ☐ other _____
- ☒ **Irrigation** _____ — ☒ **5/8″** ☒ **_″** ☒ **1″** ☒ **other** _____
- ☐ Fire _____ — ☐ 5/8″ ☐ _″ ☐ 1″ ☐ other _____

Building Height - Number of Stories: ☐ One ☐ Two ☐ Three
Basement: ☐ Yes ☐ No

Water Usage		Cross-Connection? *No* / *Yes - **Dir**ect or **Ind**irect*			Protection ***AG**, **A**VB, **P**VB, **S**VB **RP**, **DC**, **Du**Ch,**DCAP** (1)*	Installation Acceptable (2)		Permanent or Temporary (3)	
		No	**Dir**	**Ind**		**Yes**	**No**	**Perm**	**Temp**
☐	Auxiliary water supply								
	☐ Water well- pressure tank	☐	☐	☐		☐	☐	☐	☐
	☐ Storage tank	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	**Fire Sprinkler System**								
	☐ Anti-freeze	☐	☐	☐		☐	☐	☐	☐
	☐ Storage tank	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	Irrigation System	☐	☐	☐		☐	☐	☐	☐
	☐ Chemical Injection	☐	☐	☐		☐	☐	☐	☐
	☐ Booster Pumps	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									

Water Usage		Cross-Conn			Type of Protection	Proper		Perm	Temp
		No	Dir	Ind		Yes	No		
☐	Heating/Cooling Equipment								
	☐ Water Heater T& P Valve ☐Yes ☐No	☐	☐	☐		☐	☐	☐	☐
	☐ Boiler	☐	☐	☐		☐	☐	☐	☐
	☐ Geo-thermal heating	☐	☐	☐		☐	☐	☐	☐
	☐ Heat Exchanger	☐	☐	☐		☐	☐	☐	☐
	☐ Humidifier	☐	☐	☐		☐	☐	☐	☐
	☐ Hydronic Heat	☐	☐	☐		☐	☐	☐	☐
	☐ Snow Melt System	☐	☐	☐		☐	☐	☐	☐
	☐ Solar Heating	☐	☐	☐		☐	☐	☐	☐
	☐ Water cooled equip	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	Kitchen Facilities								
	☐ Faucet	☐	☐	☐		☐	☐	☐	☐
	☐ Pull out spray head	☐	☐	☐		☐	☐	☐	☐
	☐ Dishwasher - Inlet	☐	☐	☐		☐	☐	☐	☐
	Outlet	☐	☐	☐		☐	☐	☐	☐
	☐ Icemaker	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	**Laundry**								
	☐ Washing machine	☐	☐	☐		☐	☐	☐	☐
	☐ Wash Sink	☐	☐	☐		☐	☐	☐	☐
	☐ Portable Equipment	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	Sewage System								
	☐ Sewage Ejectors	☐	☐	☐		☐	☐	☐	☐
	☐ RV Flushing Facilities	☐	☐	☐		☐	☐	☐	☐
	☐ Bathroom #1 - Sink	☐	☐	☐		☐	☐	☐	☐
	☐ Bathtub/Shower	☐	☐	☐		☐	☐	☐	☐
	☐ Toilet/Bidet	☐	☐	☐		☐	☐	☐	☐
	☐ Bathroom #2 - Sink	☐	☐	☐		☐	☐	☐	☐
	☐ Bathtub/Shower	☐	☐	☐		☐	☐	☐	☐
	☐ Toilet/Bidet	☐	☐	☐		☐	☐	☐	☐
	☐ Bathroom #3 - Sink	☐	☐	☐		☐	☐	☐	☐
	☐ Bathtub/Shower	☐	☐	☐		☐	☐	☐	☐
	☐ Toilet/Bidet	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									

Water Usage		Cross-Conn			Type of Protection	Proper		Perm	Temp
		No	Dir	Ind		Yes	No		
☐	Swimming Pool/Spa								
	☐ Fill Line	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	Tanks, Vats, other Vessels								
	☐ Water Softener - Inlet	☐	☐	☐		☐	☐	☐	☐
	Outlet	☐	☐	☐		☐	☐	☐	☐
	☐ Other _____	☐	☐	☐		☐	☐	☐	☐
Comments:									
☐	**Outdoor Hose bibbs**								
	☐ #1 -	☐	☐	☐		☐	☐	☐	☐
	☐ #2 -	☐	☐	☐		☐	☐	☐	☐
	☐ #3 -	☐	☐	☐		☐	☐	☐	☐
	☐ #4 -	☐	☐	☐		☐	☐	☐	☐
	☐ **Other** _____	☐	☐	☐		☐	☐	☐	☐
Comments:									

Other Actual or Potential Cross-Connections :

_____

_____

Type of Chemicals observed on-site:

_____

_____

All internal cross-connections protected? ☐ Yes ☐ No	Surveyor _____ Signature _____ **Date of Survey** _____

USC Research Team Transferred to Data Base

Type of Cross-Conn _____ Hazard Date:

Attachment #1

Detailing for Survey Form

(1) Protection - Type of Backflow Protection Present

AG - Air gap

Break *- Air break*

AVB- Atmospheric Vacuum Breaker

PVB - Pressure Vacuum Breaker
SVB - Spill-Resistant Pressure Vacuum Breaker
RP - Reduced Pressure Principle Assembly
DC - Double Check Valve Assembly
DuCh - Dual Check
DCAP - Dual Check with Atmospheric Port

(2) Installation Acceptable -

Yes *- General compliance with installation criteria (ref - Iowa Plumbing Code)*

Proper Elevation for AVB, PVB, SVB
Proper Clearances
Accessibility for testing/maintenance

No - Non-compliance with installation criteria

(3) Permanent or Temporary Connection

Perm - Permanently or rigidly affixed with piping/tubing

Temp *- Temporary connection*

Appendix C

The Recommendation Form

Prevalence of Cross-Connections in Household Plumbing

Recommended Corrections

Thank you for participation in this important study. During the water use survey of your residence, the surveyor has identified actual or potential cross connections. Below are suggested recommendations to correct these cross connections.

Water Usage	Location	Cross connection	Recommended Correction *

* 1. Install approved/listed hose bib vacuum breaker
2. Install approved/listed antisiphon ballcock
3. Install approved/listed reduced pressure principle backflow prevention assembly

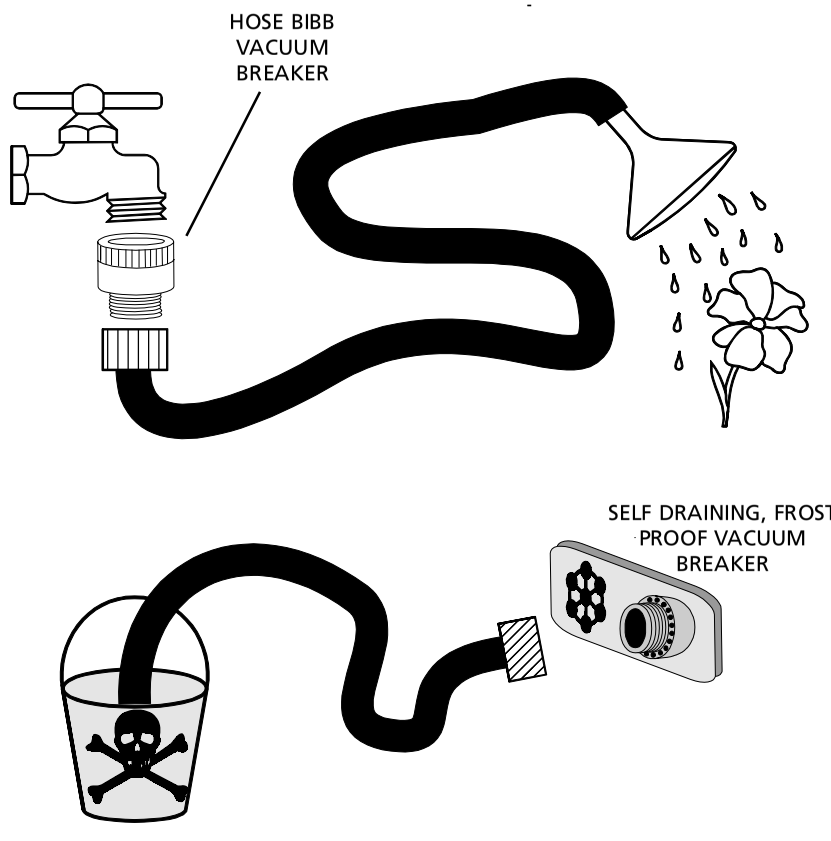
Distribution:
Original – USC

Appendix D

The Household Cross-Connections Brochure

Hose bibbs

Hose bibbs are part of our everyday life. They allow us to hook up a garden hose to water the plants, wash the car, clean out the gutters, fill the swimming pool, etc. However, every time you connect a garden hose to a hose bibb, you are extending the end of the water line. To make sure that no harmful materials are drawn back into the garden hose, a vacuum breaker should be installed on each hose bibb. When the hose bibb is exposed to freezing conditions, make sure to use a self-draining, frost-proof vacuum breaker.

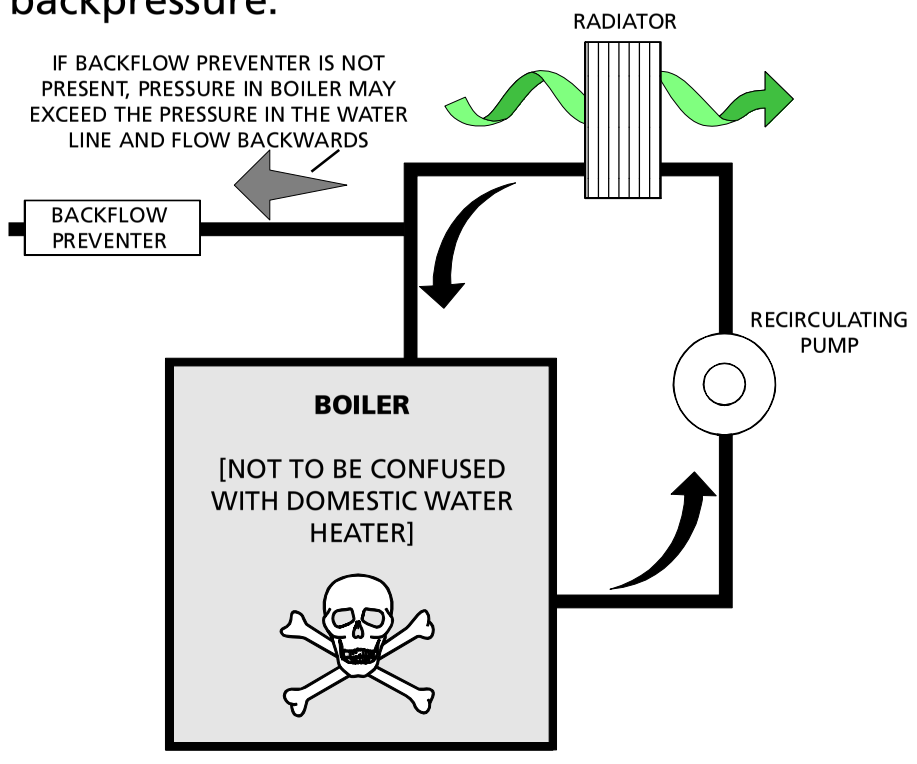


NOTE

Make sure to use only listed or approved products. Should you have any questions regarding the selection or installation of proper backflow protection, check with your local city building and safety department.

Boilers

Due to the pressure that may build up inside of a boiler, the pressure of the boiler water may exceed that of the water feeding the boiler. The boiler water (which may be chemically treated with poisonous anti-corrosion compounds, etc.) may be pushed, or *backpressured*, into the make-up water line. This chemically contaminated water may be forced back into your home's potable water system, unless there is an appropriate backflow preventer that is designed for backpressure.



LOCAL CONTACTS

Iowa-American Water Company
Mr. Brock Earnhardt
(563) 324-3264

City of Davenport - Mr. Bill Miller
(563) 326-7745

City of Bettendorf - Mr. Joe Creek
(563) 344-4074

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USC
UNIVERSITY OF SOUTHERN CALIFORNIA
Foundation for Cross-Connection Control and Hydraulic Research

Prevalence of Cross-Connections in Household Plumbing

We would like to thank you for participating in this water-use survey. The purpose of the study is to conduct a water-use survey to determine if there are any unprotected *cross-connections* present in the household plumbing system. A *cross-connection* is a connection between the drinking water plumbing system and any other source, which may contribute to the degradation of the quality of the drinking water.

Your local water company, health, and building and safety departments work hard to provide the safest water possible to your home. However, once this water enters your property, there are common problems that may arise due to improper changes in, or misuse of, your plumbing system.

During the review of the various uses of water within your household, some of the following may have been found. This brochure is intended to provide some additional information to answer your questions.

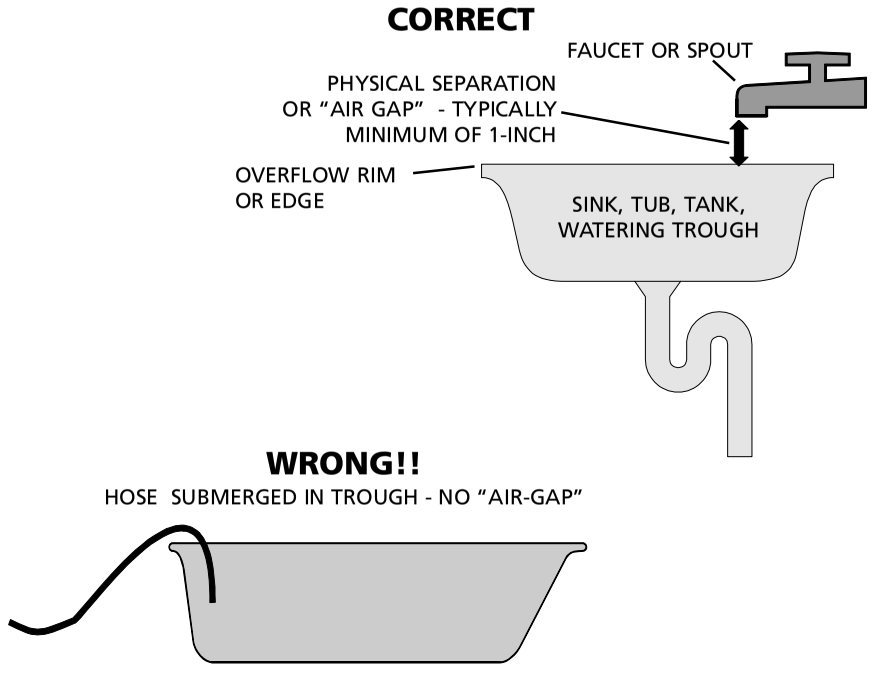
Our Homes...

Have you ever considered all of the places that you use water in your home? You may be surprised how many different ways that water can be used, and possibly misused.

This brochure discusses a few of the uses of water that you might want to pay more attention to in order to protect the purity of the water you drink, cook with, or bath in. Let's look at a few examples.

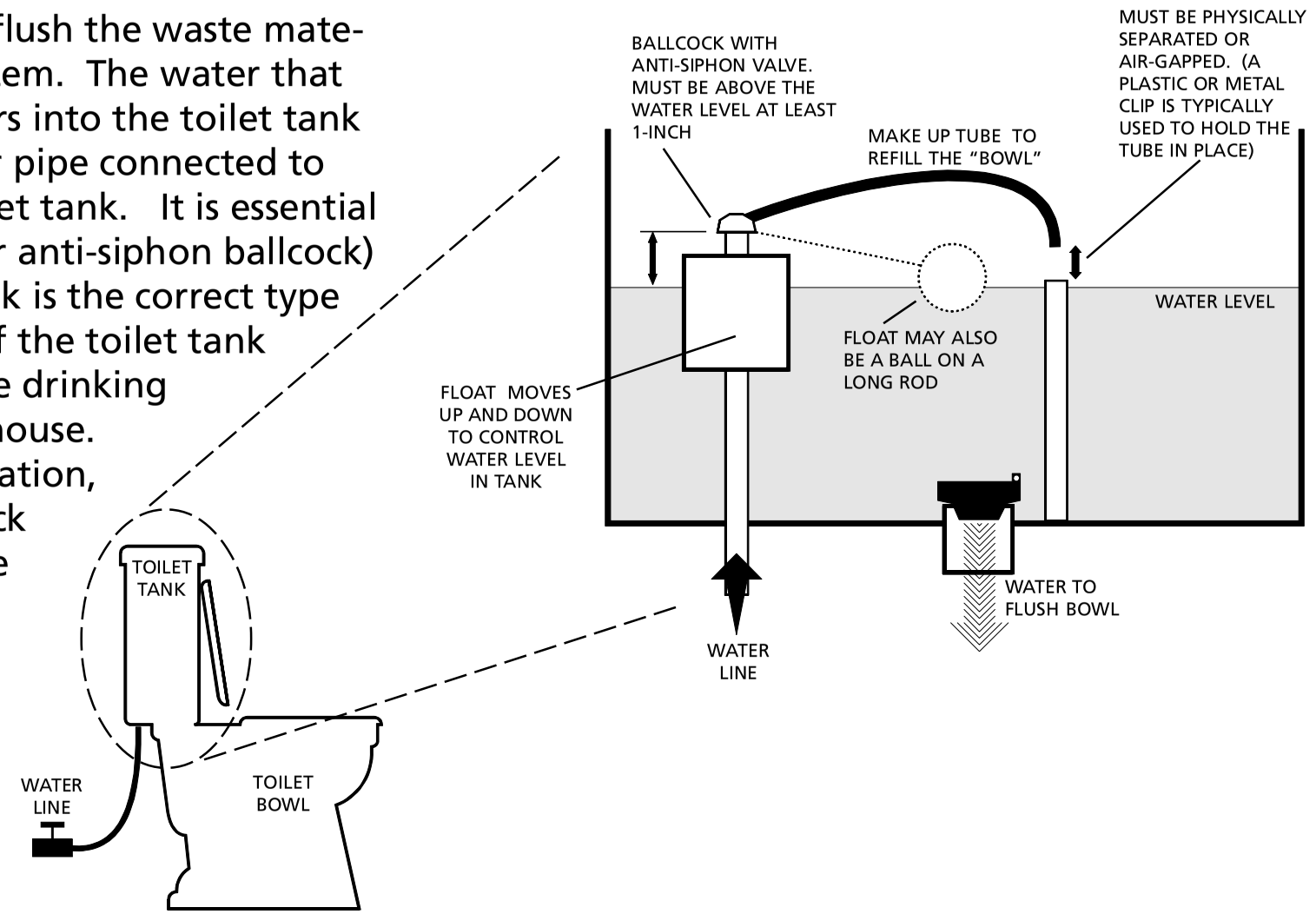
Sinks, Tubs, Tanks

The faucets in your bathroom or kitchen must be located so that the end of the faucet is above the overflow level of the sink or tub. Fill lines to water troughs or tanks must also be physically separated or "air-gapped." If there is no air-gap, then the contents of the sink, tub, or tank may be sucked or "backsiphoned" into the water line during a loss of water pressure.



Toilets

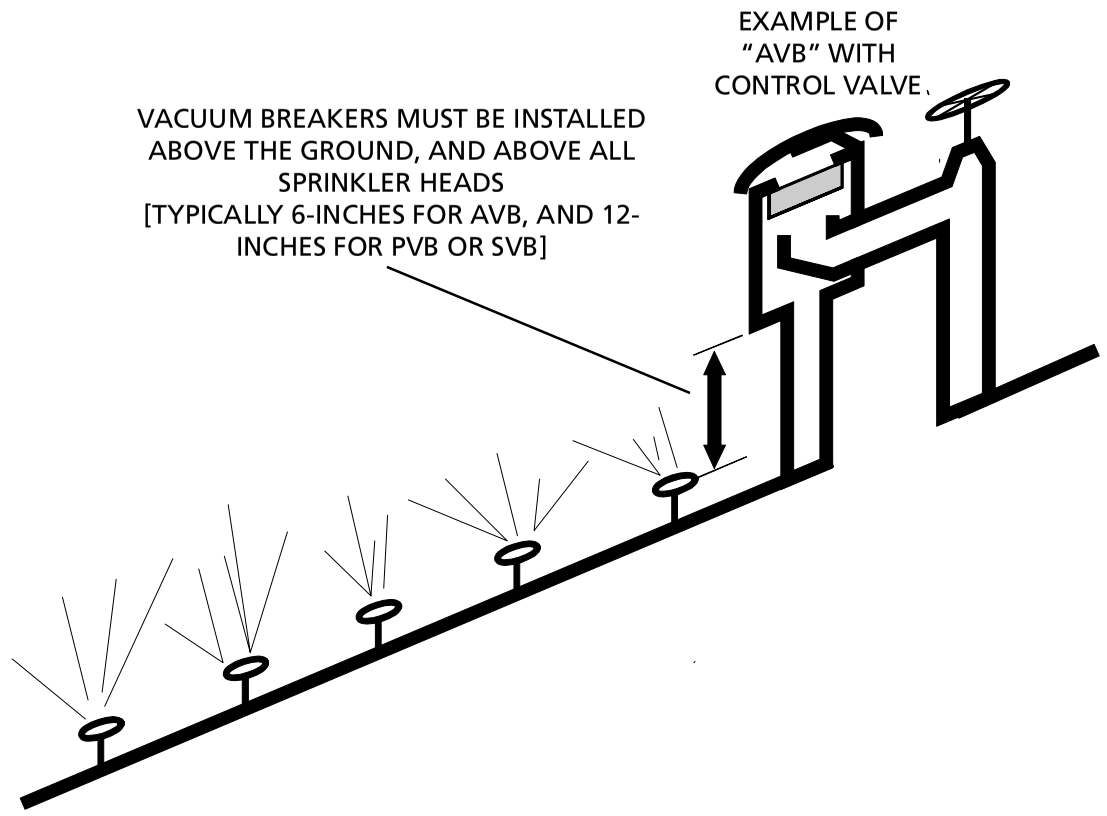
Toilets need water to flush the waste material into the sewer system. The water that flushes the toilet enters into the toilet tank from the small hose or pipe connected to the bottom of the toilet tank. It is essential that the float-valve (or anti-siphon ballcock) inside of the toilet tank is the correct type so that the contents of the toilet tank don't get back into the drinking water system in your house. As shown in the illustration, the anti-siphon ballcock and refill tube must be above the water level in the tank.



Irrigation

Irrigation systems make watering of your lawn or garden much easier, but if not properly constructed, contaminants may backflow into your drinking water. Backflow protection may be provided with vacuum breakers (atmospheric (AVB) or pressure (PVB or SVB)) or reduced pressure principle assemblies (RP).

Water pooling around sprinkler heads may be contaminated by chemicals, fertilizers, or animal waste.



Appendix E

The Data Spreadsheet

USC ID #	Survey No.	Aux Water # of CC	Aux Water Hazard	Fire Sprinkler # of CC	Fire Sprinkler Hazard	Irrigation # of CC	Irrigation Hazard	Heating / Cooling # of CC	Heating / Cooling Hazard	Kitchen # of CC	Kitchen Hazard	Laundry # of CC	Laundry Hazard	Bathrooms # of CC	Bathrooms Hazard	Toilets # of CC	Toilets # of CC	Pool/Spa # of CC	Pool/Spa Hazard	Tanks, Vats # of CC	Tanks, Vats Hazard	Hosebibbs # of CC	Hosebibbs Hazard	Overall Assessment Type of CC	Overall Assessment Degree of Hazard	Protected connections	Total Water Connections	% protected Connections	Year Home Built (approx.)	Survey Date	Reviewer #1 (PAS) CC	Reviewer #1 (PAS) DOH	Reviewer #2 (HWC) CC	Reviewer #2 (HWC) DOH	Reviewer #3 (LLC) CC	Reviewer #3 (LLC) DOH	Final Determination Type of CC	Final Determination Degree of Hazard
		1/2 convention indicates one protected cross-connection of two discovered																																				
9048	1							2/2	H	1/1	H	2/2	H	3/3	H	0/2	H					0/2	H	D	H	8	12	67	1922	5/20/02	D	H	D	H	D	H	D	H
9030	2							1/1	H	1/1	H	1/1	H	3/3	H	1/1	H					0/2	H	I	H	7	9	78		5/20/02	I	H	I	H	I	H	I	H
9029	3							1/1	H	2/2	H	1/1	H	2/2	H	0/1	H					0/3	H	I	H	6	10	60	1900	5/20/02	I	H	I	H	I	H	I	H
9047	4							1/1	H	3/3	H	1/1	H	3/3	H	1/2	H			0/1	H	0/2	H	I	H	9	13	69	1974	5/20/02	I	H	I	H	I	H	I	H
9097	5							1/2	H	1/1	H	1/2	H	2/2	H	0/1	H					0/2	H	I	H	5	10	50	1989	5/20/02	I	H	I	H	I	H	I	H
9016	6							1/2	H	5/5	H	2/2	H	7/7	H	3/3	H					0/2	H	I	H	18	21	86	1998	5/21/02	I	H	I	H	I	H	I	H
9014	7							1/2	H	5/5	H	1/1	H	9/10	H	0/3	H					2/2	H	I	H	18	23	78	1991	5/21/02	I	H	I	H	I	H	I	H
9053	8							1/1	H	3/3	H	1/1	H	3/3	H	1/2	H					0/2	H	I	H	9	12	75	1964	5/21/02	I	H	I	H	I	H	I	H
9028	9							1/1	H	3/3	H	1/1	H	5/5	H	2/3	H					1/2	H	I	H	13	15	87		5/21/02	I	H	I	H	I	H	I	H
9019	10							1/2	NH	2/2	H	2/2	H	2/2	H	0/1	H					0/2	H	I	H	7	11	64	1900	5/21/02	I	H	I	H	I	H	I	H
9003	11							1/1	H	3/3	H	1/1	H	3/3	H	0/2	H					0/2	H	I	H	8	12	67		5/21/02	I	H	I	H	I	H	I	H
9045	12							1/1	H	3/3	H	1/1	H	4/4	H	0/2	H					0/2	H	I	H	9	13	69	1973	5/21/02	I	H	I	H	I	H	I	H
9009	13							2/2	H	3/3	H	1/1	H	5/5	H	2/3	H					2/3	H	I	H	15	17	88	1996	5/21/02	I	H	I	H	I	H	I	H
9034	14							1/1	H	3/3	H	1/1	H	3/3	H	2/2	H					0/1	H	I	H	10	11	91	1972	5/21/02	I	H	I	H	I	H	I	H
9035	15					0/1	H	2/2	H	2/2	H	1/1	H	4/4	H	2/2	H					0/3	H	I	H	11	15	73	1919	5/22/02	I	H	I	H	I	H	I	H
9013	16							1/1	H	4/4	H	2/2	H	4/4	H	1/2	H					2/2	H	I	H	14	15	93	1936	5/22/02	I	H	I	H	I	H	I	H
9036	17							2/2	H	4/4	H	1/2	H	5/5	H	2/3	H			1/2	H	1/2	H	D	H	16	20	80	1971	5/22/02	D	H	D	H	D	H	D	H
9115	18							1/2	H	4/4	H	1/1	H	5/5	H	3/3	H					2/2	H	I	H	16	17	94	1999	9/27/02	I	H	I	H	I	H	I	H
9066	19							1/1	H	3/3	H	1/2	H	5/5	H	2/3	H			1/1	H	0/2	H	I	H	13	17	76		9/25/02	I	H	I	H	I	H	I	H
9142	20							1/1	H	3/3	H	1/2	H	3/3	H	2/2	H					0/1	H	I	H	10	12	83		9/25/02	I	H	I	H	I	H	I	H
9109	21							1/2	H	2/2	H	2/2	H	2/3	H	1/1	H					0/1	H	I	H	8	11	73		9/26/02	I	H	I	H	I	H	I	H
9127	22							1/2	H	4/4	H	1/1	H	4/4	H	0/2	H					0/4	H	I	H	10	17	59		9/26/02	I	H	I	H	I	H	I	H
9098	23					1/1	H	1/4	H	4/4	H	2/2	H	5/5	H	0/2	H					0/3	H	I	H	13	21	62	1968	9/26/02	I	H	I	H	I	H	I	H
9161	24							1/2	H	2/2	H	1/1	H	3/3	H	2/2	H			0/1	H	0/2	H	I	H	9	13	69		9/26/02	I	H	I	H	I	H	I	H
9138	25							1/1	H	4/4	H	1/1	H	6/6	H	0/3	H					1/4	H	I	H	13	19	68		9/26/02	I	H	I	H	I	H	I	H
9112	26							1/1	H	1/1	H	1/1	H	3/3	H	1/1	H					0/1	H	I	H	7	8	88	1936	9/26/02	I	H	I	H	I	H	I	H
9178	27							1/1	H	1/1	H	1/1	H	4/4	H	0/2	H					0/3	H	I	H	7	12	58	1916	9/26/02	I	H	I	H	I	H	I	H
9183	28							2/2	H	3/3	H	1/1	H	7/7	H	4/4	H					0/2	H	I	H	17	19	89		9/26/02	I	H	I	H	I	H	I	H
9111	29							1/1	H	3/3	H	1/1	H	2/2	H	1/1	H					1/2	H	I	H	10	11	91		9/26/02	I	H	I	H	I	H	I	H
9116	30							1/1	H	3/3	H	1/2	H	5/5	H	1/3	H					0/2	H	I	H	11	16	69		9/26/02	I	H	I	H	I	H	I	H
9046	31					1/1	H	1/2	H	4/4	H	1/2	H	5/5	H	3/3	H					2/2	H	I	H	17	19	89		9/26/02	I	H	I	H	I	H	I	H
9175	32							1/1	H	4/4	H	1/1	H	2/2	H	0/1	H					0/2	H	I	H	8	11	73		9/27/02	I	H	I	H	I	H	I	H
9128	33							1/2	H	3/3	H	3/3	H	1/1	H	1/1	H					0/2	H	I	H	9	12	75		9/27/02	I	H	I	H	I	H	I	H
9186	34							1/1	H	3/3	H	1/2	H	7/7	H	2/3	H					0/2	H	I	H	14	18	78		9/27/02	I	H	I	H	I	H	I	H
9162	35							1/2	H	3/3	H	1/1	H	4/4	H	1/2	H					0/2	H	I	H	10	14	71		9/27/02	I	H	I	H	I	H	I	H
9146	36							1/2	H	2/2	H	1/1	H	4/4	H	1/2	H			0/1	H	0/1	H	I	H	9	13	69		9/27/02	I	H	I	H	I	H	I	H
9131	37							1/2	H	3/3	H	1/1	H	2/2	H	1/1	H					0/1	H	I	H	8	9	89	1920's	9/27/02	I	H	I	H	I	H	I	H
9119	38							1/1	H	3/4	H	1/2	H	2/2	H	2/2	H			0/1	H	0/2	H	I	H	9	14	64		9/27/02	I	H	I	H	I	H	I	H
9055	39							1/1	H	1/1	H	1/1	H	2/2	H	0/1	H			0/1	H	0/2	H	I	H	5	9	56	1999	9/27/02	I	H	I	H	I	H	I	H
9157	40							1/1	H	3/3	H	1/1	H	5/5	H	2/2	H					2/2	H	None	None	14	14	100		9/27/02	None	None	None	None	None	None	None	None
9213	41							1/2	H	2/2	H	2/2	H	3/3	H	1/1	H					0/2	H	I	H	9	12	75		10/24/02	I	H	I	H	I	H	I	H
9156	42							1/1	H	2/2	H	1/1	H	4/4	H	2/2	H			1/2	H	1/2	H	I	H	12	14	86		10/24/02	I	H	I	H	I	H	I	H
9087	43							1/1	H	1/1	H	1/1	H	0/2	H	1/1	H					1/2	H	I	H	5	8	63		10/24/02	I	H	I	H	I	H	I	H
9326	44							1/1	H	4/4	H	1/1	H	5/5	H	1/3	H					0/2	H	I	H	12	16	75		10/24/02	I	H	I	H	I	H	I	H
9032	45							1/2	H	4/4	H	1/2	H	4/4	H	1/2	H					0/2	H	I	H	11	16	69		10/24/02	I	H	I	H	I	H	I	H
9106	46							1/2	H	4/4	H	1/1	H	4/4	H	2/2	H					0/2	H	I	H	12	15	80		10/24/02	I	H	I	H	I	H	I	H
9185	47							1/2	H	2/2	H	1/2	H	2/3	H	1/1	H					0/1	H	I	H	7	11	64		10/24/02	I	H	I	H	I	H	I	H
9302	48							0/1	H	3/3	H	0/1	H	1/2	H	0/1	H							I	H	4	8	50		10/24/02	I	H	I	H	I	H	I	H
9107	49							1/2	H	2/2	H	1/1	H	3/4	H	0/2	H					0/4	H	I	H	7	15	47		10/24/02	I	H	I	H	I	H	I	H
9284	50							1/2	H	3/3	H	1/2	H	3/3	H	1/2	H			1/1	H	0/2	H	I	H	10	15	67		10/24/02	I	H	I	H	I	H	I	H
9078	51							1/2	H	3/3	H	1/1	H	5/5	H	0/3	H					0/2	H	I	H	10	16	63		10/25/02	I	H	I	H	I	H	I	H
9134	52							1/2	H	3/3	H	1/1	H	3/5	H	1/2	H			1/1	H	0/4	H	I	H	10	18	56		10/25/02	I	H	I	H	I	H	I	H
9081	53							1/1	H	3/4	H	3/3	H	3/3	H	0/2	H			1/1	H	0/2	H	D	H	11	16	69		10/24/02	D	H	D	H	D	H	D	H
9151	54							1/2	H	4/4	H	1/1	H	4/5	H	1/3	H					0/2	H	I	H	11	17	65		10/24/02	I	H	I	H	I	H	I	H
9153	55							1/1	H	4/4	H	1/1	H	1/3	H	2/2	H					0/2	H	I	H	9	13	69		10/25/02	I	H	I	H	I	H	I	H
9379	56							1/3	H	3/3	H	2/2	H	6/6	H	3/3	H					0/3	H	I	H	15	20	75		10/25/02	I	H	I	H	I	H	I	H
9344	57							1/1	H	2/2	H	1/1	H	4/4	H	1/1	H					0/1	H	I	H	9	10	90		10/25/02	I	H	I	H	I	H	I	H
9015	58							1/2	H	3/3	H	1/1	H	4/5	H	3/3	H			0/1	H	2/4	H	I	H	14	19	74		10/25/02	I	H	I	H	I	H	I	H
9266	59							1/2	H	3/3	H	1/1	H	4/4	H	1/2	H					0/2	H	I	H	10	14	71		10/25/02	I	H	I	H	I	H	I	H
9235	60							1/2	H	4/4	H	1/2	H	2/3	H	1/2	H					0/2	H	I	H	9	15	60		10/25/02	I	H	I	H	I	H	I	H
9174	61							1/1	H	4/4	H	1/1	H	2/2	H	1/2	H					0/2	H	I	H	9	12	75		10/25/02	I	H	I	H	I	H	I	H
9313	62							1/2	H	2/2	H	1/2	H	3/5	H	0/2	H					0/2	H	I	H	7	15	47		10/25/02	I	H	I	H	I	H	I	H
9010	63							1/1	H	4/4	H	1/1	H	2/2	H	0/1	H					0/2	H	I	H	8	11	73		10/25/02	I	H	I	H	I	H	I	H
9312	64	0/1	H					1/2	H	3/3	H	1/1	H	2/2	H	1/1	H			1/1	H	0/1	H	D	H	9	11	82		10/25/02	D	H	D	H	D	H	D	H
9105	65							1/1	H	2/2	H	1/1	H	2/2	H	1/1	H					0/2	H	I	H	7	9	78		10/25/02	I	H	I	H	I	H	I	H
9264	66							1/2	H	3/3	H	1/1	H	3/3	H	0/2	H			1/1	H	0/2	H	I	H	9	14	64		10/30/02	I	H	I	H	I	H	I	H

1/2 convention indicates one protected cross-connection of two discovered

USC ID #	Survey No.	Aux Water		Fire Sprinkler		Irrigation		Heating / Cooling		Kitchen		Laundry		Bathrooms		Toilets		Pool/Spa		Tanks, Vats		Hosebibbs		Overall Assessment		Protected connections	Total Water Connections	% protected Connections	Year Home Built (approx.)	Survey Date	Reviewer #1 (PAS)		Reviewer #2 (HWC)		Reviewer #3 (LLC)		Final Determination	
		# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	# of CC	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	Type of CC	Degree of Hazard						CC	DOH	CC	DOH	CC	DOH	Type of CC	Degree of Hazard
9252	67							1/1	H	2/2	H	2/2	H	2/2	H	0/1	H					0/1	H	I	H	7	9	78		10/30/02	I	H	I	H	I	H	I	H
9137	68							1/1	H	4/4	H	1/1	H	4/5	H	3/3	H					0/3	H	I	H	13	17	76		10/30/02	I	H	I	H	I	H	I	H
9351	69							1/1	H	2/2	H	1/1	H	1/2	H	0/1	H					1/1	H	I	H	5	7	71		10/30/02	I	H	I	H	I	H	I	H
9165	70							1/1	H	2/2	H	1/1	H	3/3	H	1/2	H					0/2	H	I	H	8	11	73		10/30/02	I	H	I	H	I	H	I	H
9336	71							1/1	H	4/4	H	1/1	H	5/6	H	1/3	H			2/2	H	0/2	H	I	H	14	19	74		10/30/02	I	H	I	H	I	H	I	H
9287	72							1/2	H	2/2	H	1/1	H	4/4	H	0/2	H					0/2	H	I	H	8	13	62		10/30/02	I	H	I	H	I	H	I	H
9022	73							1/2	H	3/3	H	1/1	H	4/4	H	0/2	H					0/4	H	I	H	9	16	56	1960	10/30/02	I	H	I	H	I	H	I	H
9386	74							1/1	H	2/2	H	2/2	H	3/4	H	0/1	H					0/1	H	I	H	8	11	73		10/30/02	I	H	I	H	I	H	I	H
9307	75							1/1	H	3/3	H	1/1	H	2/2	H	0/1	H					0/2	H	I	H	7	10	70		10/30/02	I	H	I	H	I	H	I	H
9372	76							1/2	H	3/3	H	1/1	H	3/4	H	1/2	H			1/1	H	0/2	H	I	H	10	15	67	1920	10/30/02	I	H	I	H	I	H	I	H
9317	77							1/1	H	4/4	H	2/2	H	5/5	H	1/3	H			1/1	H	0/2	H	I	H	14	18	78		10/31/02	I	H	I	H	I	H	I	H
9099	78							1/1	H	3/3	H	2/2	H	6/7	H	2/4	H					0/2	H	I	H	15	20	75		10/31/02	I	H	I	H	I	H	I	H
9230	79							1/1	H	3/3	H	3/3	H	6/6	H	3/3	H			1/1	H	0/4	H	I	H	17	21	81		10/31/02	I	H	I	H	I	H	I	H
9316	80							1/1	H	2/2	H	1/1	H	3/3	H	1/2	H					0/2	H	I	H	8	11	73		10/31/02	I	H	I	H	I	H	I	H
9132	81							1/2	H	2/2	H	1/2	H	3/5	H	1/3	H					0/2	H	I	H	8	16	50	1869	10/31/02	I	H	I	H	I	H	I	H
9092	82							1/2	H	2/2	H	1/1	H	2/3	H	2/2	H					0/1	H	I	H	8	11	73		10/31/02	I	H	I	H	I	H	I	H
9188	83							1/2	H	3/3	H	1/3	H	5/6	H	1/3	H					1/2	H	I	H	12	19	63		10/31/02	I	H	I	H	I	H	I	H
9082	84							1/1	H	1/1	H			1/2	H	0/1	H			1/1	H	0/3	H	I	H	4	9	44		10/31/02	I	H	I	H	I	H	I	H
9032	85							1/1	H	3/3	H	1/2	H	1/2	H	1/1	H					0/2	H	I	H	7	11	64		10/31/02	I	H	I	H	I	H	I	H
9070	86							1/1	H	1/1	H	1/1	H	4/4	H	0/2	H					0/1	H	I	H	7	10	70		10/31/02	I	H	I	H	I	H	I	H
9039	87							1/2	H	1/1	H	1/2	H	3/3	H	2/2	H					0/2	H	I	H	8	12	67		11/7/02	I	H	I	H	I	H	I	H
9236	88							1/1	H	4/4	H	1/2	H	3/5	H	0/3	H					0/2	H	D	H	9	17	53	1950's	11/7/02	D	H	D	H	D	H	D	H
9108	89							1/2	H	4/4	H	1/2	H	3/5	H	0/3	H					0/3	H	I	H	9	19	47		11/7/02	I	H	I	H	I	H	I	H
9277	90							1/1	H	1/1	H	1/1	H	2/2	H	1/1	H					0/1	H	I	H	6	7	86		11/7/02	I	H	I	H	I	H	I	H
9234	91							1/2	H	4/4	H	1/1	H	6/6	H	3/3	H					0/3	H	I	H	15	19	79		11/7/02	I	H	I	H	I	H	I	H
9122	92							1/1	H	3/3	H	1/1	H	4/4	H	1/2	H					0/2	H	I	H	10	13	77		11/7/02	I	H	I	H	I	H	I	H
9091	93							1/2	H	4/4	H	3/3	H	4/4	H	2/2	H					0/2	H	I	H	14	17	82		11/7/02	I	H	I	H	I	H	I	H
9225	94							1/1	H	1/1	H	1/1	H	1/2	H	0/1	H					0/1	H	I	H	4	7	57		11/7/02	I	H	I	H	I	H	I	H
9160	95							1/2	H	3/3	H	1/2	H	3/3	H	0/1	H					0/4	H	I	H	8	15	53		11/8/02	I	H	I	H	I	H	I	H
9291	96							2/3	H	3/3	H	1/1	H	6/6	H	3/3	H					0/2	H	I	H	15	18	83		11/8/02	I	H	I	H	I	H	I	H
9314	97							1/1	H	3/3	H	1/2	H	4/4	H	2/3	H					0/1	H	I	H	11	14	79		11/8/02	I	H	I	H	I	H	I	H
9200	98							1/2	H	3/3	H	1/2	H	4/5	H	2/3	H			0/1	H	0/2	H	D	H	11	18	61		11/8/02	D	H	D	H	D	H	D	H
9332	99							1/2	H	3/3	H	1/1	H	8/8	H	0/4	H					1/3	H	I	H	14	21	67		11/8/02	I	H	I	H	I	H	I	H
9254	100							1/1	H	4/4	H	1/2	H	1/2	H	1/1	H					0/1	H	I	H	8	11	73		11/8/02	I	H	I	H	I	H	I	H
9339	101							1/1	H	2/2	H	1/1	H	4/4	H	1/2	H					0/1	H	I	H	9	11	82		11/21/02	I	H	I	H	I	H	I	H
9126	102							1/1	H	2/2	H	1/1	H	1/2	H	1/1	H					2/2	H	I	H	8	9	89		11/21/02	I	H	I	H	I	H	I	H
9123	103							1/2	H	4/4	H	1/2	H	5/5	H	1/3	H					2/2	H	I	H	14	18	78		11/21/02	I	H	I	H	I	H	I	H
9064	104							2/2	H	6/6	H	1/1	H	7/9	H	3/4	H					0/5	H	I	H	17	25	68		11/21/02	I	H	I	H	I	H	I	H
9073	105							1/1	H	3/3	H	1/1	H	1/2	H	0/1	H					0/1	H	I	H	6	9	67	1880	11/21/02	I	H	I	H	I	H	I	H
9061	106					1/1	H	1/2	H	3/3	H	2/2	H	5/5	H	2/3	H					3/3	H	I	H	17	19	89		11/21/02	I	H	I	H	I	H	I	H
9361	107							1/2	H	4/4	H	2/2	H	2/3	H	0/2	H					0/3	H	I	H	9	16	56		11/21/02	I	H	I	H	I	H	I	H
9371	108							1/2	H	3/3	H	1/1	H	4/4	H	2/2	H					0/2	H	I	H	11	14	79		11/21/02	I	H	I	H	I	H	I	H
9244	109							1/2	H	4/4	H	1/1	H	3/4	H	0/2	H					0/2	H	I	H	9	15	60		11/21/02	I	H	I	H	I	H	I	H
9214	110							1/1	H	2/2	H	1/2	H	4/4	H	1/1	H					2/2	H	I	H	11	12	92		11/21/02	I	H	I	H	I	H	I	H
9219	111							1/2	H	3/3	H	1/1	H	3/3	H	2/2	H			0/1	H	0/1	H	I	H	10	13	77		11/22/02	I	H	I	H	I	H	I	H
9263	112							1/2	H	3/3	H	1/1	H	4/4	H	1/2	H					1/2	H	I	H	11	14	79		11/22/02	I	H	I	H	I	H	I	H
9171	113							1/1	H	4/4	H	1/1	H	3/3	H	1/2	H					0/2	H	I	H	10	13	77		11/22/02	I	H	I	H	I	H	I	H
9272	114							1/1	H	1/1	H	1/1	H	2/2	H							0/1	H	I	H	5	6	83		11/22/02	I	H	I	H	I	H	I	H
9355	115							1/1	H	4/4	H	1/1	H	8/8	H	2/4	H					0/2	H	I	H	16	20	80		11/22/02	I	H	I	H	I	H	I	H
9117	116							1/2	H	1/1	H	2/2	H	4/4	H	1/2	H					0/1	H	I	H	9	12	75		11/22/02	I	H	I	H	I	H	I	H
9002	117							1/2	H	2/2	H	1/1	H	3/3	H	0/2	H					0/2	H	I	H	7	12	58		11/22/02	I	H	I	H	I	H	I	H
9267	118							1/2	H	3/3	H	2/2	H	4/4	H	3/3	H					0/2	H	I	H	13	16	81		11/22/02	I	H	I	H	I	H	I	H
9145	119							1/2	H	2/2	H	1/2	H	2/2	H	0/1	H					0/1	H	I	H	6	10	60	1888	11/22/02	I	H	I	H	I	H	I	H
9375	120							1/1	H	3/3	H	1/1	H	1/2	H	0/1	H					0/1	H	I	H	6	9	67		11/22/02	I	H	I	H	I	H	I	H
9176	121							1/2	H	4/4	H	1/2	H	5/5	H	3/3	H					0/2	H	I	H	14	18	78		11/23/02	I	H	I	H	I	H	I	H
9202	122							1/1	H	3/3	H	1/1	H	2/4	H	2/2	H					0/2	H	I	H	9	13	69		11/29/02	I	H	I	H	I	H	I	H
9065	123							1/1	H	4/4	H	1/1	H	3/4	H	0/2	H					0/1	H	I	H	9	13	69		11/29/02	I	H	I	H	I	H	I	H
9296	124							1/1	H	2/2	H	0/1	H	2/2	H	0/1	H					0/1	H	I	H	5	8	63		11/29/02	I	H	I	H	I	H	I	H
9240	125							1/1	H	2/2	H	1/1	H	2/2	H	1/1	H					0/2	H	I	H	7	9	78		11/29/02	I	H	I	H	I	H	I	H
9305	126							1/2	H	2/2	H	1/2	H	4/4	H	1/3	H					0/2	H	I	H	9	15	60		11/29/02	I	H	I	H	I	H	I	H
9322	127							1/1	H	3/3	H	2/2	H	4/4	H	2/2	H					0/2	H	I	H	12	14	86		11/29/02	I	H	I	H	I	H	I	H
9222	128							1/1	H	2/2	H	1/1	H	4/4	H	0/2	H					0/2	H	I	H	8	12	67		11/29/02	I	H	I	H	I	H	I	H
9308	129							1/1	H	4/4	H	1/1	H	3/4	H	2/2	H					0/2	H	I	H	11	14	79		11/29/02	I	H	I	H	I	H	I	H
9018	130							1/1	H	2/2	H	1/1	H	1/2	H	0/1	H					0/2	H	I	H	5	9	56		11/30/02	I	H	I	H	I	H	I	H
9269	131							1/1	H	2/2	H	1/1	H	1/2	H	1/1	H							I	H	6	7	86		11/30/02	I	H	I	H	I	H	I	H
9228	132							1/1	H	3/3	H	1/2	H	4/4	H	2/2	H					0/2	H	I	H	11	14	79	1970	12/5/02	I	H	I	H	I	H	I	H

1/2 convention indicates one protected cross-connection of two discovered

USC ID #	Survey No.	Aux Water		Fire Sprinkler		Irrigation		Heating / Cooling		Kitchen		Laundry		Bathrooms		Toilets		Pool/Spa		Tanks, Vats		Hosebibbs		Overall Assessment		Protected connections	Total Water Connections	% protected Connections	Year Home Built (approx.)	Survey Date	Reviewer #1 (PAS)		Reviewer #2 (HWC)		Reviewer #3 (LLC)		Final Determination	
		# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC		# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	Type of CC	Degree of Hazard														
9391	133							0/1	H	1/1	H	1/1	H	2/2	H	0/1	H					0/2	H	D	H	4	8	50	1979	12/5/02	D	H	D	H	D	H	D	H
9398	134							1/1	H	3/3	H	1/1	H	3/5	H	3/3	H					1/3	H	I	H	12	16	75	1900	12/5/02	I	H	I	H	I	H	I	H
9049	135							1/2	H	3/3	H	1/2	H	3/4	H	0/2	H			1/1	H	0/2	H	I	H	9	16	56	1940	12/5/02	I	H	I	H	I	H	I	H
9161	136							1/2	H	4/4	H	1/2	H	5/5	H	2/2	H					1/2	H	I	H	14	17	82	1975	12/5/02	I	H	I	H	I	H	I	H
9035	137							1/1	H	4/4	H	1/3	H	6/6	H	2/3	H					0/2	H	I	H	14	19	74	1999	12/5/02	I	H	I	H	I	H	I	H
9164	138							1/2	H	1/1	H	1/1	H	5/5	H	0/3	H					0/2	H	I	H	8	14	57	1952	12/5/02	I	H	I	H	I	H	I	H
9051	139							1/2	H	4/4	H	1/1	H	8/8	H	2/4	H					1/2	H	D	H	17	20	85	1977	12/5/02	D	H	D	H	D	H	D	H
9110	140							1/2	H	3/3	H	1/1	H	2/3	H	1/1	H					0/2	H	I	H	8	12	67	1925	12/6/02	I	H	I	H	I	H	I	H
9323	141							1/1	H	4/4	H	1/1	H	4/5	H	3/3	H			0/1	H	0/2	H	I	H	13	17	76	1996	12/6/02	I	H	I	H	I	H	I	H
9265	142							1/1	H	3/3	H	1/1	H	4/4	H	2/2	H					2/2	H	N	N	13	13	100	1990	12/6/02	N	N	N	N	N	N	N	N
9155	143							1/2	H	3/3	H	1/2	H	5/5	H	3/3	H					1/2	H	I	H	14	17	82	1970	12/6/02	I	H	I	H	I	H	I	H
9268	144							1/2	H	1/1	H	1/1	H	4/4	H	1/2	H					0/1	H	D	H	8	11	73	1953	12/6/02	D	H	D	H	D	H	D	H
9229	145							1/1	H	2/2	H	1/1	H	3/3	H	0/1	H					0/2	H	I	H	7	10	70	1963	12/6/02	I	H	I	H	I	H	I	H
9090	146							1/2	H	3/3	H	1/1	H	3/3	H	0/2	H					0/1	H	I	H	8	12	67	1967	12/6/02	I	H	I	H	I	H	I	H
9120	147							1/1	H	4/4	H	1/2	H	5/5	H	0/3	H					0/2	H	I	H	11	17	65	1965	12/6/02	I	H	I	H	I	H	I	H
9024	148							1/2	H	3/3	H	1/1	H	4/5	H	0/2	H					0/1	H	I	H	9	14	64	1930	12/6/02	I	H	I	H	I	H	I	H
9329	149							1/2	H	4/4	H	1/1	H	3/3	H	0/2	H					0/1	H	I	H	9	13	69	1920	12/6/02	I	H	I	H	I	H	I	H
9282	150							1/1	H	2/2	H	1/1	H	3/3	H	2/2	H					0/2	H	I	H	9	11	82	1925	12/6/02	I	H	I	H	I	H	I	H
9292	151							1/2	H	4/4	H	1/1	H	2/2	H	0/1	H					0/2	H	D	H	8	12	67	1963	12/7/02	D	H	D	H	D	H	D	H
9242	152							1/2	H	4/4	H	1/2	H	6/6	H	1/4	H					0/2	H	D	H	13	20	65	1981	12/7/02	D	H	D	H	D	H	D	H
9203	153							1/1	H	3/3	H	1/1	H	3/3	H	1/1	H					0/1	H	I	H	9	10	90	1920	12/7/02	I	H	I	H	I	H	I	H
9204	154							1/1	H	2/2	H	1/1	H	2/2	H	1/1	H					0/1	H	I	H	7	9	78	1954	12/7/02	I	H	I	H	I	H	I	H
9274	155							1/1	H	2/2	H			1/3	H	0/1	H					0/1	H	I	H	4	8	50	1900	12/7/02	I	H	I	H	I	H	I	H
9300	156							1/1	H	6/6	H	1/1	H	6/6	H	2/3	H					0/4	H	I	H	16	21	76	1980	12/7/02	I	H	I	H	I	H	I	H
9067	157							1/1	H	4/4	H	1/1	H	5/5	H	3/3	H					0/2	H	I	H	14	16	88	1965	12/13/02	I	H	I	H	I	H	I	H
9298	158							1/1	H	4/4	H	1/1	H	7/7	H	3/3	H					2/2	H	N	N	18	18	100	1990	12/13/02	N	N	N	N	N	N	N	N
9182	159							1/1	H	2/2	H	1/1	H	2/2	H	0/1	H					0/1	H	D	H	6	8	75	1900	12/13/02	D	H	D	H	D	H	D	H
9100	160							1/2	H	4/4	H	1/2	H	5/5	H	2/3	H					0/2	H	I	H	13	18	72	1974	12/13/02	I	H	I	H	I	H	I	H
9376	161							1/1	H	2/2	H	1/1	H	4/4	H	2/2	H					0/2	H	I	H	10	12	83	1959	12/13/02	I	H	I	H	I	H	I	H
9221	162							1/1	H	2/2	H	1/1	H	4/4	H	1/2	H					0/1	H	D	H	9	11	82	1939	12/13/02	D	H	D	H	D	H	D	H
9348	163							1/1	H	3/3	H	1/1	H	3/3	H	1/2	H					0/1	H	I	H	9	11	82	1980	12/13/02	I	H	I	H	I	H	I	H
9006	164							1/1	H	2/2	H	2/2	H	5/5	H	2/3	H					0/2	H	I	H	12	15	80	1950	12/14/02	I	H	I	H	I	H	I	H
9005	165							1/2	H	4/4	H	1/1	H	7/7	H	4/4	H					0/1	H	I	H	17	19	89	1978	12/14/02	I	H	I	H	I	H	I	H
9026	166							1/1	H	1/1	H			2/2	H	1/1	H							N	N	5	5	100	1960	12/14/02	N	N	N	N	N	N	N	N
9220	167							1/2	H	2/2	H	1/1	H	4/4	H	2/2	H					0/2	H	I	H	10	13	77	1965	12/19/02	I	H	I	H	I	H	I	H
9311	168							1/2	H	3/3	H	1/2	H	4/4	H	2/2	H					1/2	H	I	H	12	15	80	1978	12/19/02	I	H	I	H	I	H	I	H
9184	169							1/1	H	2/2	H	2/2	H	4/4	H	1/2	H					2/2	H	I	H	12	13	92	1960	12/19/02	I	H	I	H	I	H	I	H
9276	170							1/1	H	2/2	H	1/1	H	2/2	H	1/1	H					0/1	H	I	H	7	8	88	1925	12/19/02	I	H	I	H	I	H	I	H
9147	171							1/2	H	3/3	H	1/2	H	7/7	H	3/3	H			1/1	H	1/2	H	I	H	17	20	85	1979	12/19/02	I	H	I	H	I	H	I	H
9012	172							1/2	H	3/3	H	1/1	H	7/7	H	1/3	H					1/2	H	I	H	14	18	78	1976	12/19/02	I	H	I	H	I	H	I	H
9366	173							1/1	H	4/4	H	2/2	H	1/2	H	1/2	H					0/2	H	I	H	9	13	69	1971	12/19/02	I	H	I	H	I	H	I	H
9041	174							1/1	H	4/4	H	1/2	H	7/7	H	4/4	H					0/2	H	I	H	17	20	85	1989	12/19/02	I	H	I	H	I	H	I	H
9199	175							1/1	H	1/2	H	1/2	H	2/2	H	0/1	H					0/1	H	D	H	5	9	56	1952	12/19/02	D	H	D	H	D	H	D	H
9217	176							1/1	H	3/3	H	1/2	H	1/2	H	1/1	H			1/1	H	0/1	H	I	H	8	11	73	1940	12/19/02	I	H	I	H	I	H	I	H
9211	177							1/2	H	4/4	H	1/1	H	7/7	H	2/4	H					2/2	H	D	H	17	20	85	1995	12/20/02	D	H	D	H	D	H	D	H
9319	178							1/2	H	4/4	H	1/2	H	7/7	H	3/3	H					3/4	H	I	H	19	22	86	1992	12/20/02	I	H	I	H	I	H	I	H
9113	179							1/1	H	1/1	H	1/1	H	2/2	H	0/1	H					0/1	H	D	H	5	7	71	1975	12/20/02	D	H	D	H	D	H	D	H
9179	180					1/1	H	1/2	H	3/3	H	1/3	H	5/5	H	2/2	H			1/1	H	1/3	H	I	H	15	19	79	1980	12/20/02	I	H	I	H	I	H	I	H
9093	181							1/2	H	4/4	H	1/2	H	4/4	H	2/2	H					0/2	H	I	H	12	16	75	1910	1/9/03	I	H	I	H	I	H	I	H
9069	182							1/1	H	3/3	H	1/1	H	2/2	H	0/1	H					0/2	H	D	H	7	10	70	1975	1/9/03	D	H	D	H	D	H	D	H
9201	183							1/1	H	2/2	H	1/1	H	2/2	H	0/1	H					0/1	H	I	H	6	8	75	1970	1/9/03	I	H	I	H	I	H	I	H
9249	184							1/1	H	4/4	H	2/2	H	4/5	H	1/3	H					0/2	H	D	H	12	17	71	1972	1/9/03	D	H	D	H	D	H	D	H
9271	185							1/1	H	2/2	H	1/1	H	1/2	H	0/1	H					0/3	H	D	H	5	10	50	1972	1/9/03	D	H	D	H	D	H	D	H
9139	186							1/2	H	1/1	H	1/2	H	3/3	H	1/1	H					0/1	H	I	H	7	10	70	1955	1/9/03	I	H	I	H	I	H	I	H
9259	187							1/1	H	1/1	H	1/1	H	2/2	H	1/1	H							N	N	6	6	100	1971	1/9/03	N	N	N	N	N	N	N	N
9071	188							1/1	H	3/3	H	1/2	H	4/4	H	0/2	H					0/2	H	I	H	9	14	64	1978	1/9/03	I	H	I	H	I	H	I	H

Survey No	Comment
1	Toilet fill valve submerged
171	Softener direct to drain/FluidMaster 200A
53	Softener direct to drain/FluidMaster 200A
64	Well
81	Boiler
86	Condo
88	3 Hushflow to Toilet fill valves
98	Boiler with Chemicals

1/2 convention indicates one protected cross-connection of two discovered

USC ID #	Survey No.	Aux Water		Fire Sprinkler		Irrigation		Heating / Cooling		Kitchen		Laundry		Bathrooms		Toilets		Pool/Spa		Tanks, Vats		Hosebibbs		Overall Assessment		Protected connections	Total Water Connections	% protected Connections	Year Home Built (approx.)	Survey Date	Reviewer #1 (PAS)		Reviewer #2 (HWC)		Reviewer #3 (LLC)		Final Determination	
		# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	# of CC	# of CC	# of CC	Hazard	# of CC	Hazard	# of CC	Hazard	Type of CC	Degree of Hazard						CC	DOH	CC	DOH	CC	DOH	Type of CC	Degree of Hazard
	133	Fluidmaster 200																																				
	139	Hushflow																																				
	141	Softner																																				
	144	Boiler, no chemicals																																				
	147	submerged fill line																																				
	151	Fluidmaster 200																																				
	152	Hushflow																																				
	154	Old Well																																				
	156	Old Well																																				
	159	Flushmaster 200																																				
	162	Submerged fill line																																				
	175	Fill valve too low																																				
	177	Fill valve too low																																				
	179	Fill valve too low																																				
	182	Fill valve too low																																				
	184	Hushflow																																				
	185	Fluidmaster 200																																				
	187	Mobile Home																																				