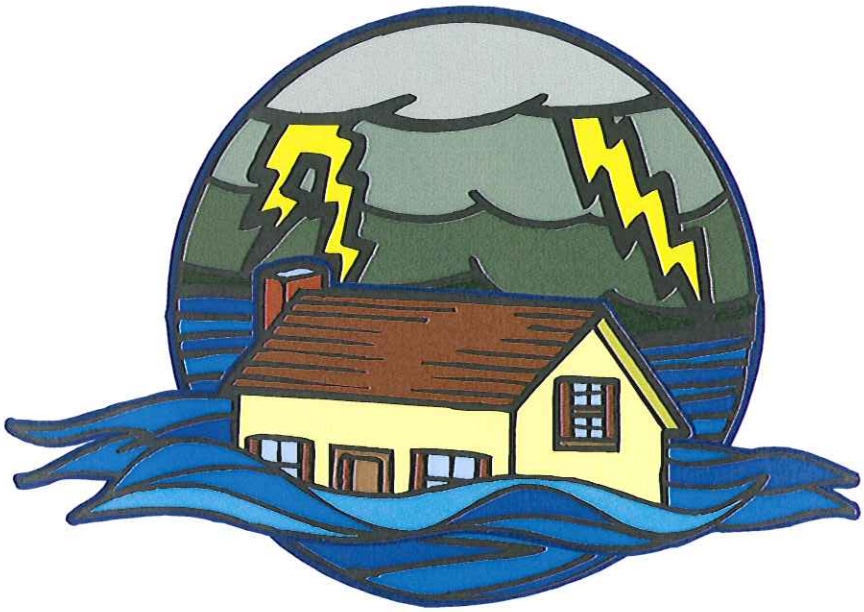


MITIGATING WET OR FLOODED BASEMENTS

CITY OF
LORAIN
ENGINEERING
DEPARTMENT

WHY IS THERE WATER IN MY BASEMENT?

There are two major sources of water in a basement as the result of a heavy rainfall.

1. Sanitary Sewer Back-up
2. Storm Water Infiltration

In order to safe guard your home against flooding you should understand the basic plumbing of your home and the preventative techniques discussed in this brochure. Basement flooding can result in serious property damage. Be mindful of your health and safety when cleaning up your flooded basement. Floodwater may carry waterborne diseases, corrosive agents, irritants, and sharp objects. Electrical accidents are possible because of contact between appliances and water. Dress appropriately; wear overalls, gloves, protective eyewear, protective boots and a mask. Open windows and stay away from electrical equipment and outlets or shut off the electrical power.

CITY SEWER SYSTEMS

The City maintains two separate sewer systems. The sanitary sewer system carries wastewater from homes, commercial buildings, and industry to the City's wastewater treatment plants. After treatment, the water is returned to Lake Erie. The storm sewer system carries rainfall and other surface run-off from parking lots, roads, and private properties directly to the creeks and ditches. This water is not treated before it enters the creeks and ditches.

WHY DO WE HAVE TWO SEPARATE SEWER SYSTEMS?

Some storms tend to drop large amounts of rain over short periods of time. If sanitary sewage and storm water were collected in the same system, the large volume of water from a rain storm would fill the sewers very quickly.

With two separate sewer systems, storm water that doesn't need treatment does not have to go through the expensive sewage treatment process. Sanitary sewage, which would contaminate the storm water, is handled by a separate system. This reduces the cost of sewage treatment for everyone.

PROPER HOUSE PLUMBING

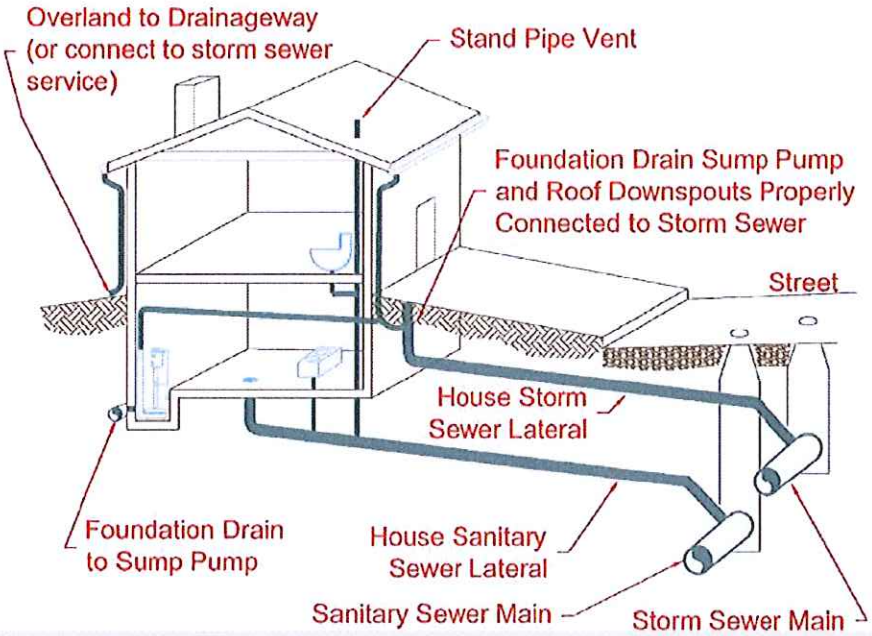
The following items should be connected to the storm sewer:

1. Foundation drain – Perforated pipe along the foundation designed to keep water out of the basement
2. Sump Pump – The foundation drain of some homes is connected to the sump pump, which pumps water from the foundation to the higher elevation of the storm connection to provide drainage for the basement.
3. Downspout Leader – A shallow pipe that is plumbed around the exterior of the house, in which all the downspouts are connected to as well as the sump pump.
4. Storm Connection – The pipe that is plumbed from the house to the storm main that collects the downspout leader and miscellaneous yard drains.

The following items should be connected to the sanitary sewer:

1. Sinks
2. Washing Machine
3. Showers
4. Toilets
5. Floor drains in basement and/or garage (in older homes this may not be the case)
6. Grinder Pumps – Waste water facilities in the basement that are pumped up to a shallow sanitary sewer.

The following diagram shows typical exterior house plumbing for a house with a sump pump. Houses without sump pumps on gravity connections are similar but have a deeper storm lateral which can drain the foundation by gravity. See the detail in the Appendix as well, which shows the downspout leader in detail.

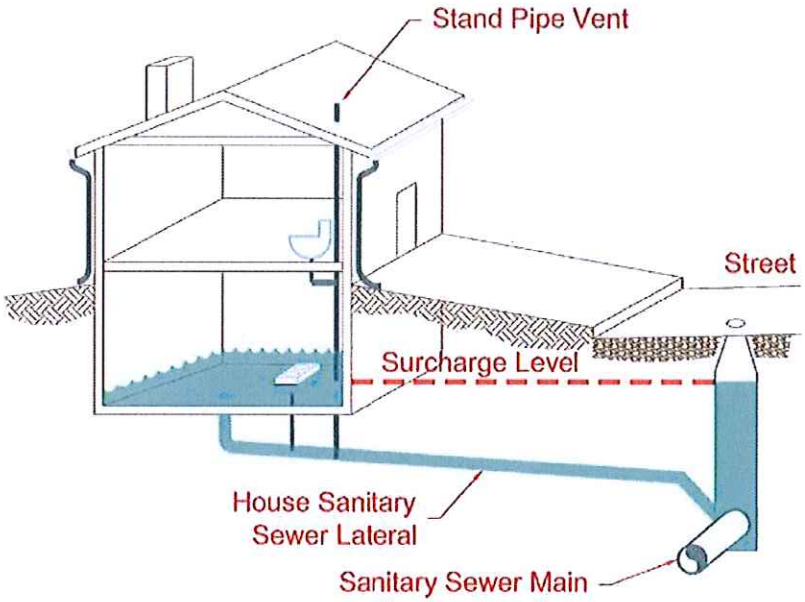


SANITARY SEWER BACK-UP

A. What Causes Sanitary Sewer Back-up?

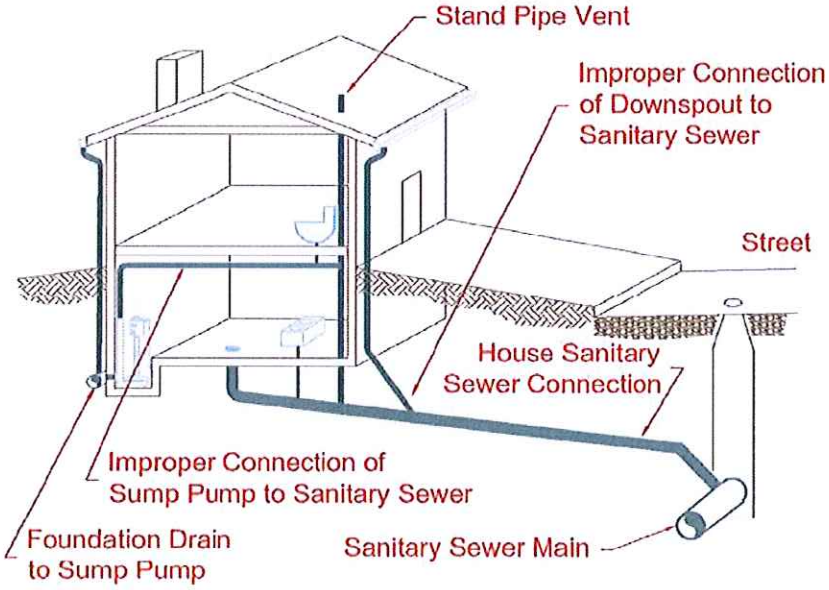
The storm sewer system has a much higher capacity than the sanitary sewer system in order to handle the large volumes of water that can be produced by major storms. Problems arise when water that should be directed to the storm sewer system makes its way into the sanitary system. If too much storm water enters the sanitary system, the sanitary sewer may backup (surcharge) and overflow. When this occurs residences at lower elevations, especially those without adequate backflow protection, are most at risk of experiencing sewer backup.

When the sanitary main is surcharged, water backs up through the sanitary connection and flows out of the floor drain within the basement or other sanitary facilities. Water always seeks an elevation, so the depth of water in the basement will equal the height of the surcharge within the sanitary main. See diagram below (storm sewer not shown for simplicity):



B. **Sources of Storm Water in Sanitary Main**

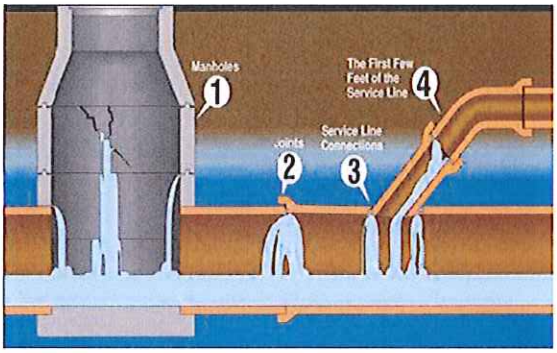
1. **Cross Connection** – Is a connection that permits extraneous storm-related water (water from sources other than sanitary fixtures) to enter the sanitary sewer system. Extraneous storm-related water is water that should either be going to the storm sewer or allowed to soak into the ground without entering the sanitary sewer. Some examples of this are when the following are connected to the sanitary connection; downspouts, sump pumps, Foundation drain, window well drains and driveway drains. The diagram below shows some examples (storm sewer not shown for simplicity):



Removal of cross connections will significantly reduce the flow of extraneous storm-related water to the sanitary sewer system. As a result, the possibilities of basement flooding due to surcharged sanitary sewers are reduced and the sewer system can reduce its costs, which will keep everyone's rates lower. If a cross-connection exists it must corrected in accordance with Fairview Park Codified Ordinance 911.02 Clear Water Connections.

2. **Inflow and Infiltration-** These are caused by extraneous storm related water migrating into the sanitary connections or mains through open joints and or cracks within the pipes.

Sanitary connection with infiltration



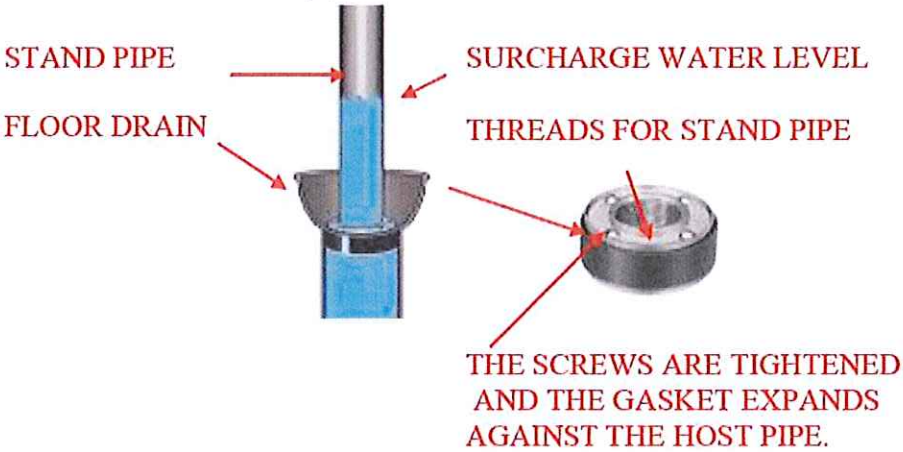
C. **Protecting a House from Sanitary Sewer Back-up**

There are two techniques used in protecting the home. The first is to allow the water to back-up through the connection and contain the water as it seeks the surcharge elevation without covering the entire basement floor. A standpipe accomplishes this task. The key to this protection is elevation not volume. So it is not necessary to have the volume of water flooded in the basement equal the contained volume. It is NOT a good idea to plug the floor drain when the sewer surcharges. If the drain is plugged, pressure in the piping under the floor may build up sufficiently to break the pipe and heave the basement floor. Also since the floor drain is blocked, any water in the basement from a pipe break will not drain out. The modification to the drain will need to be temporarily removed to drain this nuisance water.

The second approach is to block the path of water at the sanitary connection with a backwater valve installed in the front yard.

1. **Standpipe** – Standpipes are lengths of pipe open at the top and screwed into an expandable rubber gasketed escutcheon within the floor drain. The height of the standpipe should be higher than the deepest flooding elevation experienced within the basement. It will hold the sanitary surcharge until it recedes.

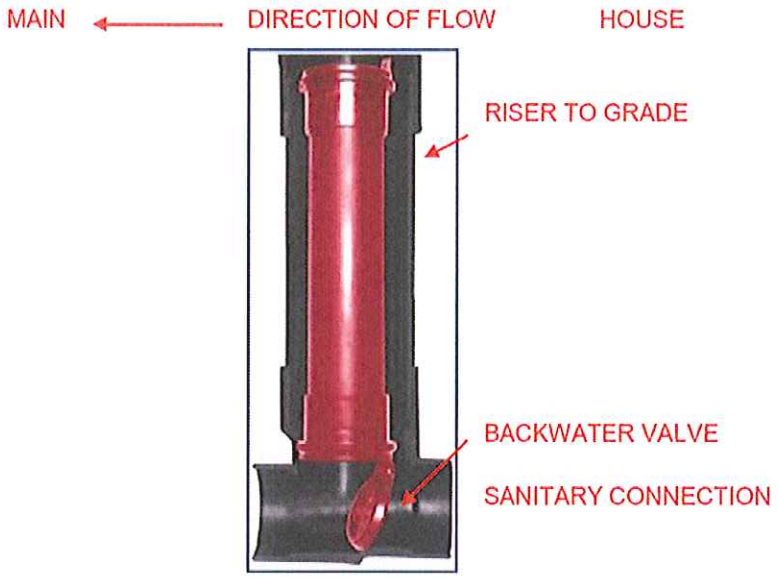
Standpipes are generally inexpensive, easy to install and help relieve pressure caused by back ups. However, using standpipes very tall or capping a standpipe may rupture sewer pipe joints under the basement floor. Also, the protruding pipes may be a trip hazard and basement floor drains cannot be used until standpipes are removed. Special fittings may need to be used to connect a condensate drain to a standpipe. See the Flood Guard brand below.



2. **Back Water Valve** – A backwater valve is a device that prevents sewage from backing up into your basement. A valve will automatically prevent water from the sanitary sewer from coming back into your home's plumbing system. A properly installed backwater valve must be placed so that sewage backup will be stopped and not come out through plumbing fixtures or the floor drain in your basement. A licensed plumber can look at your system and recommend the appropriate installation. Two such valves are the Clean Check Expandable Back Water Valve and the Canplas Extendable Adapt-A-Valve Backwater Valve. If you are going to install a backwater valve, a licensed plumbing contractor must install it properly and a City of Fairview Park plumbing permit is required. These valves also require periodic inspection and maintenance to remove debris and reduce the risk of failure. Valves installed in sewer lines sometimes become clogged with debris and fail to close completely. When this happens, the valve will slow down the flow of sewage but will not stop it completely. Ask a licensed plumbing contractor how to properly inspect and maintain the backwater valve that is installed for your home.

It is important to note that a backwater valve is designed to be closed during sewer surcharge conditions to keep water from the sanitary sewer system from flowing into your home. When the backwater valve closes, water from the inside of your home will not drain out. **When there is a risk of sewer surcharge, such as during a heavy rain storm, you should avoid using the toilet, sink, shower, washer, dishwasher or any other appliance that releases water to the sanitary sewer system.** The water will not be able to get past your backflow prevention device(s) and will have nowhere to go except back into your home. This is referred to as "self-flooding" as the basement will be flooded with wastewater that originated within your home.

Regardless of whether or not you install a backwater valve, if storm water from you property still enters the sanitary sewer system you are increasing the risk that your property and the properties around you may flood. If you redirect drainage from your property to the storm sewer system, you will reduce the risk of flooding for yourself and for your neighbors.



CLEAN CHECK INC.

STORM WATER INFILTRATION

Basement flooding as a result of storm water occurs from three situations.

1. Excessive Water at Foundation/Slab
2. Compromised Waterproofing/Backfill
3. Compromised Storm Connection

Excessive Water at Foundation/Slab

When this situation exists the foundation drain becomes overwhelmed and water eventually migrates into the basement since water is not being drawn away from the house and follows the path of least resistance.

The following are the main reasons for this event

A. Compromised Foundation Drain

If the foundation drain is blocked or the perforations or open joints become full of silt, water is not drawn away from the house. The solution to this would be to clean the pipe or full replacement

B. Sump Pump Failure

If the foundation drain is connected to the sump pump, which is not operating due to mechanical failure or power outage, the house could flood since the foundation drain becomes overwhelmed. Also, the sump pump may not be large enough to pump the required capacity based on the size of the home.

In most applications the City recommends a back-up sump pump to protect against power failure, primary pump failure, or to prevent the primary pump from being overwhelmed by a heavy storm. Different types of back-up sump pumps are available; Standard Electric Pumps which have a high capacity, Battery Back-up Pumps which operate on a rechargeable battery and Hydro Pumps which operate from the pressure of the domestic water supply.

The back-up pump, regardless of type, shall be plumbed to discharge to the yard. By doing so, the secondary pump will work more efficiently in case the lateral is full or blocked. This also allows homeowners to see that the secondary pump is running which shows that the primary pump may have failed or there is a problem with the storm lateral or discharge line. See photo below:

Two discharge lines in crock Discharge line plumbed to yard

Some homes may be too large for a single pump and require a second electric sump pump. If this is recommended at your house then this pump shall be installed at a higher float elevation and discharged to grade as well.

C. Gravity Tie

This exists at a house which has no sump pump and the foundation drain is connected to the storm connection by gravity. During a large rain event the storm main or creek could surcharge and cause water to back up through the storm connection and overwhelm the foundation drain which could cause water to flood into the basement. Some older homes have floor drains connected to the storm so water could surcharge out of those as well.

The solution to this plumbing scenario is to install an exterior sump pump and break the gravity connection. This will prevent the water from backing up to the foundation drain and/or floor drain.

D. Compromised Downspout Leader

If the downspout leader is blocked, crushed and/or broken water will leave the pipe and travel through the house backfill and could overwhelm the foundation drain and/or sump pump. This problem can occur even if the downspouts are connected, because water could back-up through the storm connection if the storm main is surcharged, which may cause the downspout leader to be pressurized. Then water will leave the compromised downspout and be introduced along the foundation.

The solution to this is to televise the suspected pipe and locate the compromised section of pipe for repair.

Dye water from a compromised downspout leader flowing into sump pump crock

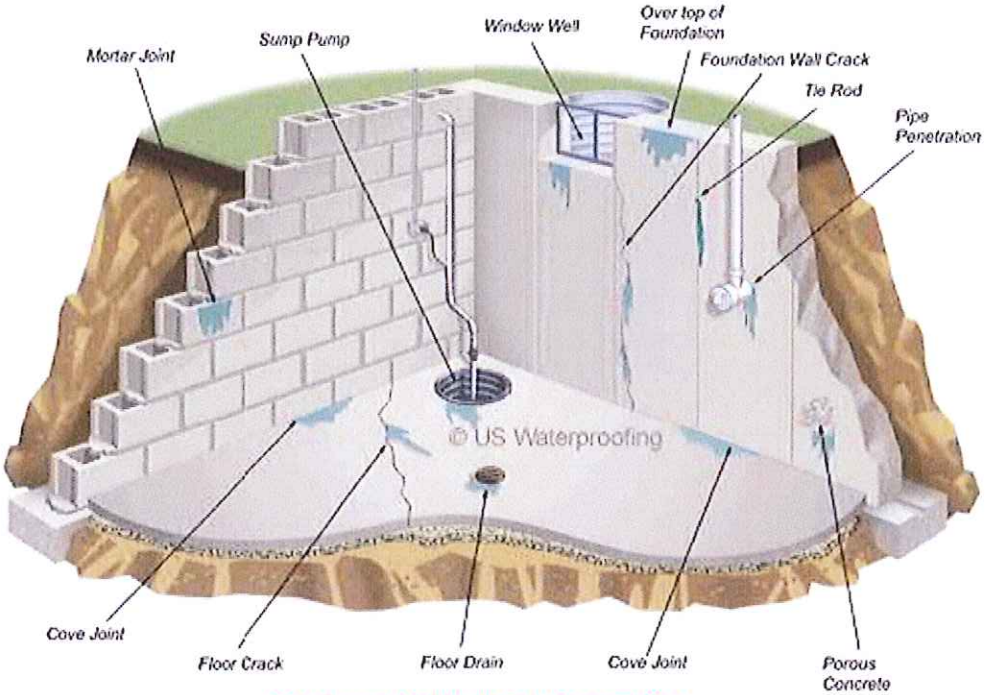
E. Poor Grade around Foundation and House Exposure

New home construction may have the foundation backfilled with stone to within 12" of grade. During summer months the soil on the surface shrinks and creates a void along the foundation, which exposes the porous stone backfill. During a large rain event water bypasses the gutter and falls along the foundation. Also a large home has a large exposure to the rain that will direct a large volume of water to the foundation from the face of the house. If the porous backfill is exposed the foundation drain could be overwhelmed from all this additional water. This may occur to older homes as well, dependent on, the type of backfill, so all homeowners should be aware of this. Some downspouts are splash blocked, which cause additional water to drain into the backfill of the house. Poor grade around the house could promote surface runoff to drain towards the foundation as well.

The solution to this problem is to have positive drainage graded away from the house. To protect the porous backfill of the house, use non-shrinking soils in the landscaping beds along the house. Also flashing could be placed at the base of the house to seal the voids created by the shrinking soils. See detail in appendix.

COMPROMISED WATERPROOFING

Along the exterior of the basement wall a protective coating is placed on the wall to prevent water from migrating through the wall and into the basement. As a house ages this coating may be compromised and requires replacement. Water seepage into the basement may be the result of this. See diagram of various paths of seepage.

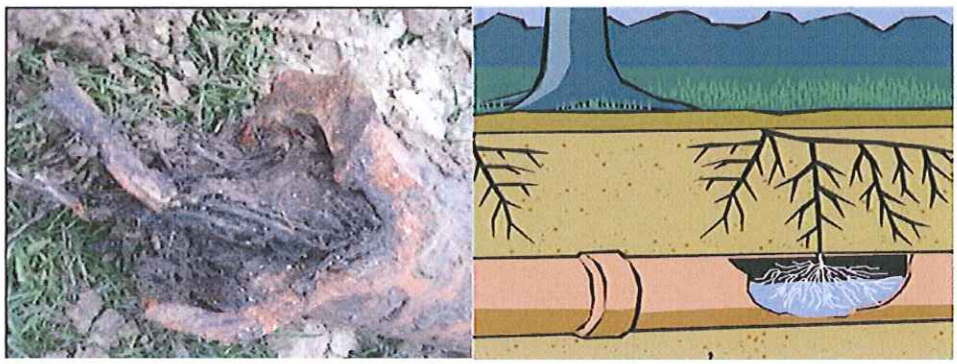


Detail provided by U.S. Waterproofing

COMPROMISED STORM CONNECTION

If the storm connection is blocked and/or crushed storm water can't be drained away from the property and the foundation drain will eventually become overwhelmed and the basement will flood.

Large trees on a property contribute to this problem by having their roots migrate into the pipe which creates a blockage. Once roots find this source of moisture they continue to grow and the blockage becomes more secure.



The solution to this problem is to have the connection cleaned and/or televised. If cleaning does not remove the blockage a point repair will have to be performed. Older homes with clay pipe have this problem due to poor joints between the pipes. The following could be done to prevent a blockage:

A. Sewer Cleaning
In many cases, periodic cleaning is all that is needed to control root growth and reduce the likelihood of blockage.

B. Copper Sulfate Treatment
Many homeowners have had good results by flushing a small quantity of copper sulfate crystals down the sewer at regular intervals. The copper sulfate reduces the rate of growth without harming the trees. Although this treatment may not eliminate root growth, it often increases the interval between cleanings.

CONCLUSION

This brochure was intended to provide a basic understanding of how basement flooding can occur and the possible solutions to prevent it. Since every home is different it would not be practical to discuss all the various types of scenarios in depth. A professional consultation would be recommended prior to any major work associated with basement flooding.

APPENDIX

The following appendix has some additional useful information:

Interior Sump Pump Detail with Gravity Tie Disconnect

Exterior Sump Pump Detail with Gravity Tie Disconnect

Exterior House Plumbing

Clean Check Backwater Valve

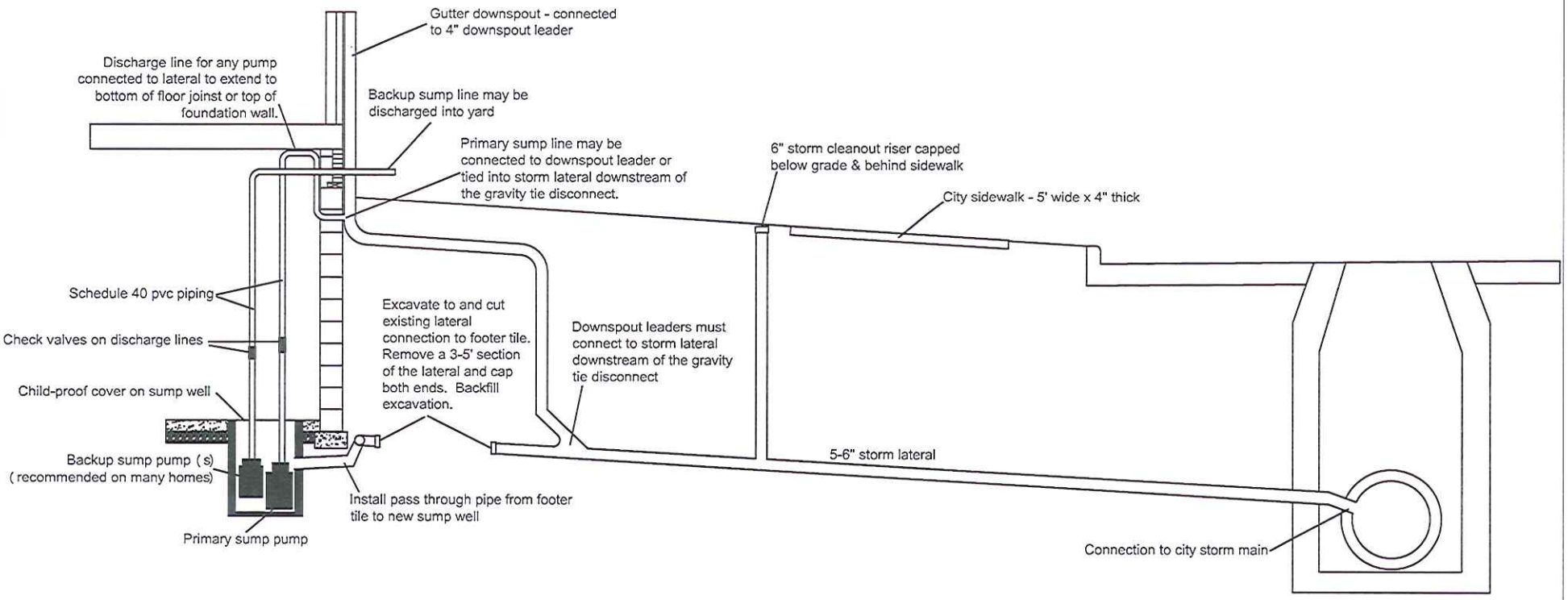
Canplas Backwater Valve

Backwater Installation Valve Detail

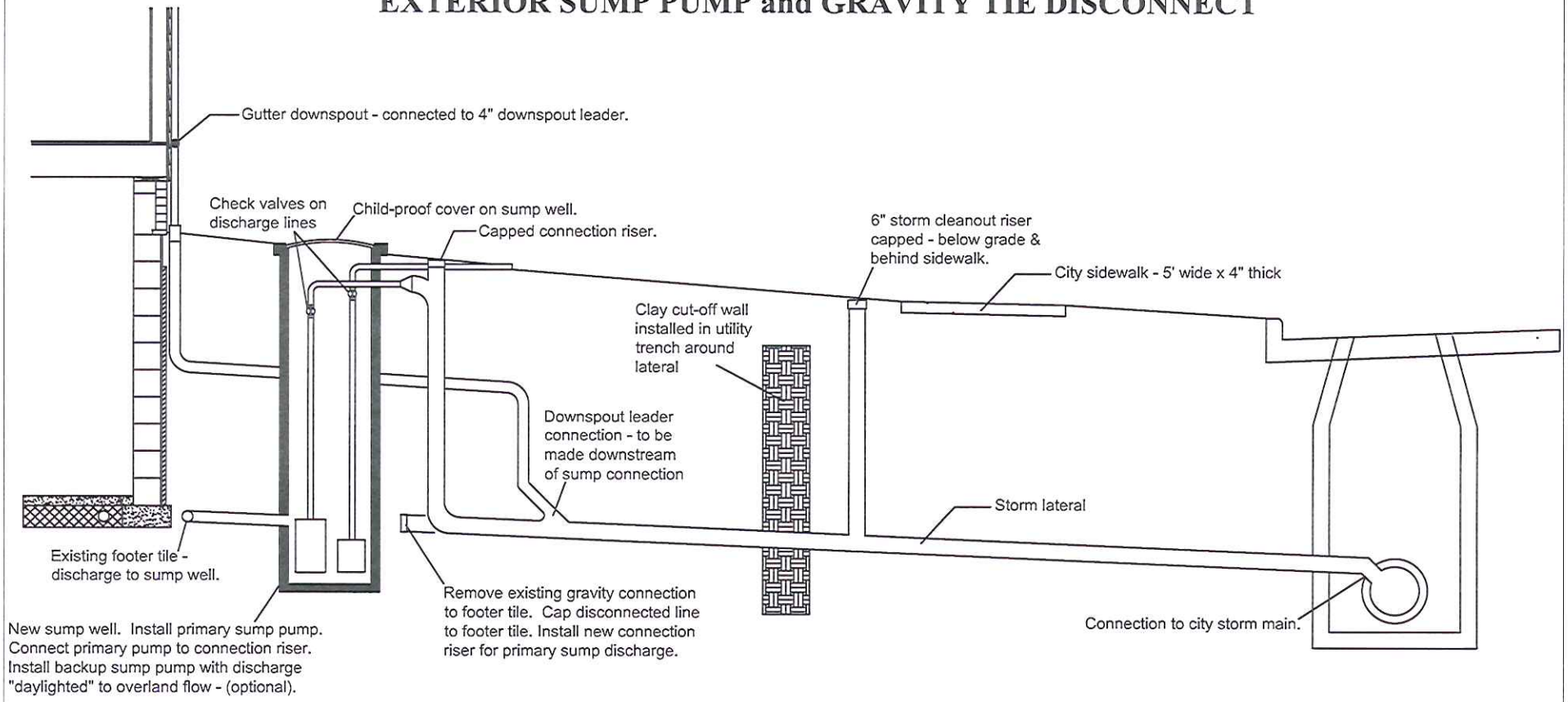
Foundation Detail with Flashing

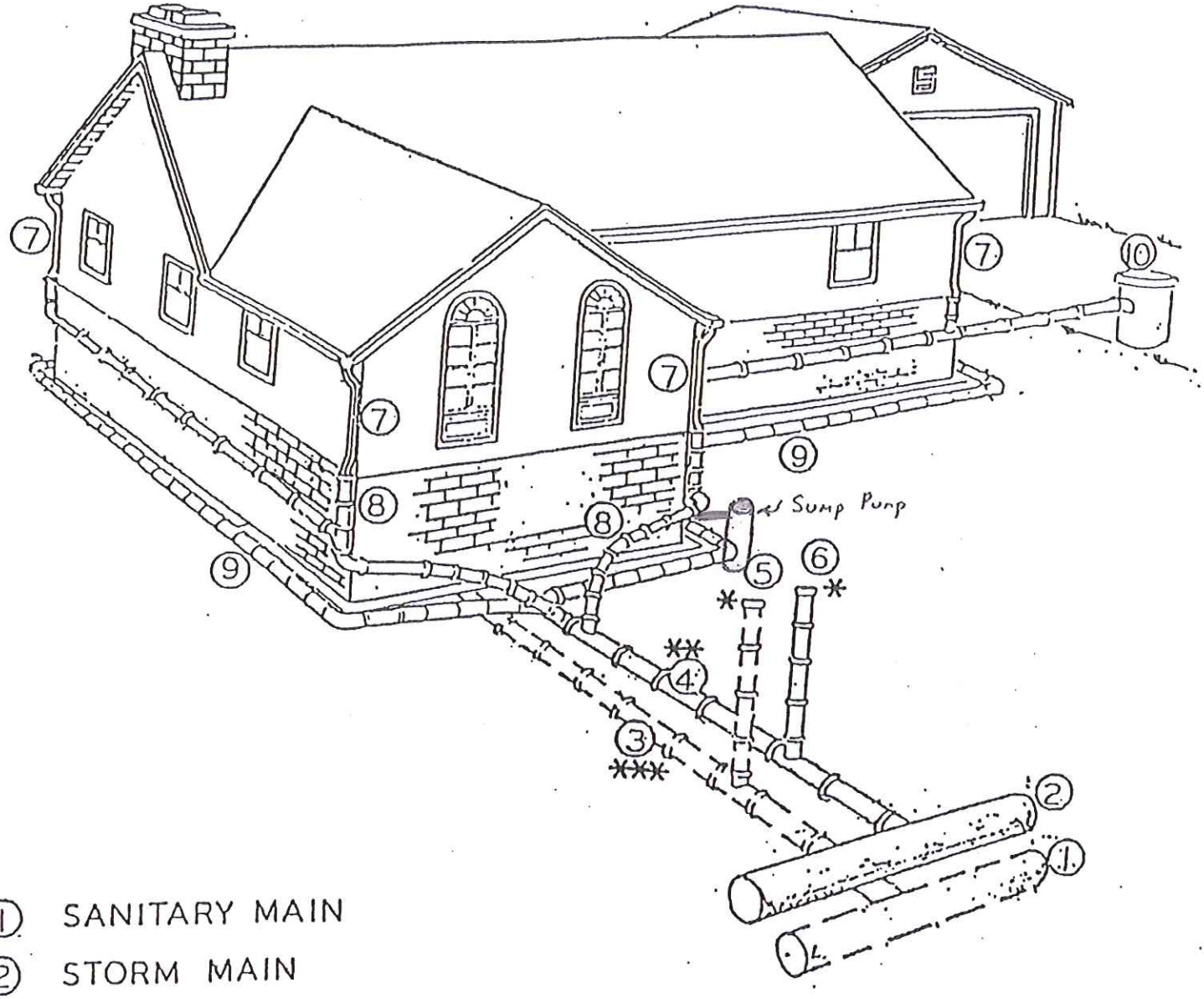
This information was provided courtesy of the
City of Westlake Engineering Department

INTERIOR SUMP PUMP and GRAVITY TIE DISCONNECT



EXTERIOR SUMP PUMP and GRAVITY TIE DISCONNECT





① SANITARY MAIN

② STORM MAIN

③ SANITARY HOUSE CONNECTION

④ STORM HOUSE CONNECTION

⑤ SANITARY TEST TEE

⑥ STORM TEST TEE

⑦ DOWNSPOUT

⑧ DOWNSPOUT DRAIN

⑨ FOOTER DRAIN TILE

⑩ DRIVEWAY CATCH BASIN

* - DIVISION BETWEEN CITY RESPONSIBILITY & PROPERTY OWNER'S RESPONSIBILITY

** ALL OUTSIDE DRAINS SHOULD BE CONNECTED

*** ALL INSIDE DRAINS SHOULD BE CONNECTED

BACKWATER VALVE-OPTION 1

Clean Check®
Stops Sewage Backups

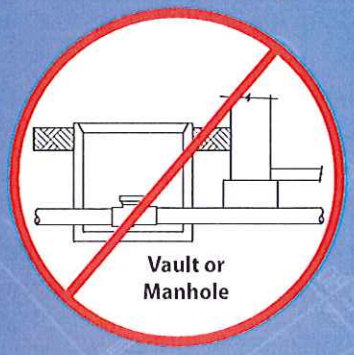
Clean Check® is a simple but revolutionary extendable backwater valve that eliminates the need for expensive and unsightly manholes regardless of the burial depth.

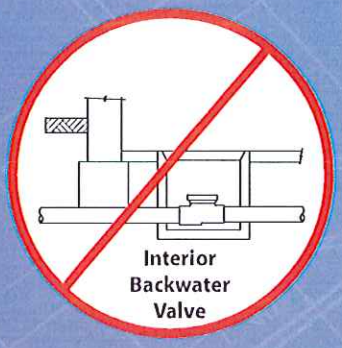
- Easy to perform maintenance & inspection from ground level
- "Hands-off" cleaning
- Meets all model construction and plumbing codes

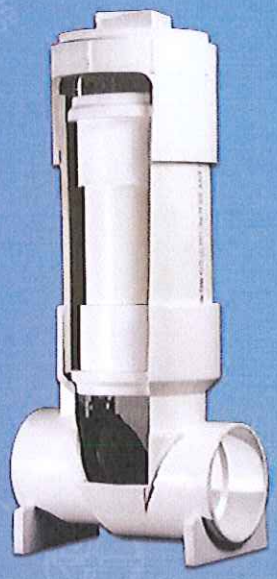
NO costly manhole - direct bury up to 12 feet.

NO more backwater valves indoors which could be hidden by cabinets, stairwells, or floor coverings.

NO more sewer gas or mess into the building during maintenance inspection.







Ground Level Access

CLEAN CHECK®

(Fig. A) Demonstration of flow:
The **Clean Check®** assembly includes: **(1)** lower collar with flapper, **(2)** upper collar & **(3)** valve body. When water flows through the system **(green arrows)**, the flapper opens allowing waste to flow from the home/building to the sewer. In the event of a backup **(red arrows)**, the flapper will seal preventing sewage backup into your home/building.

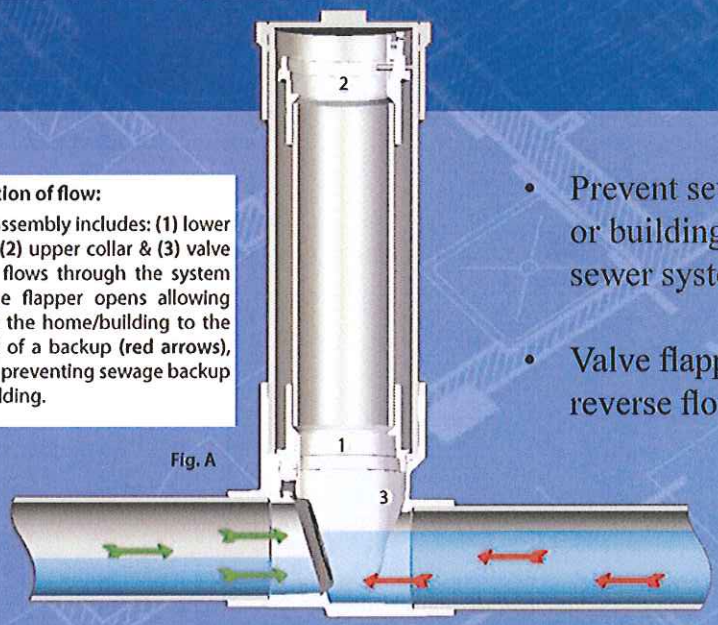
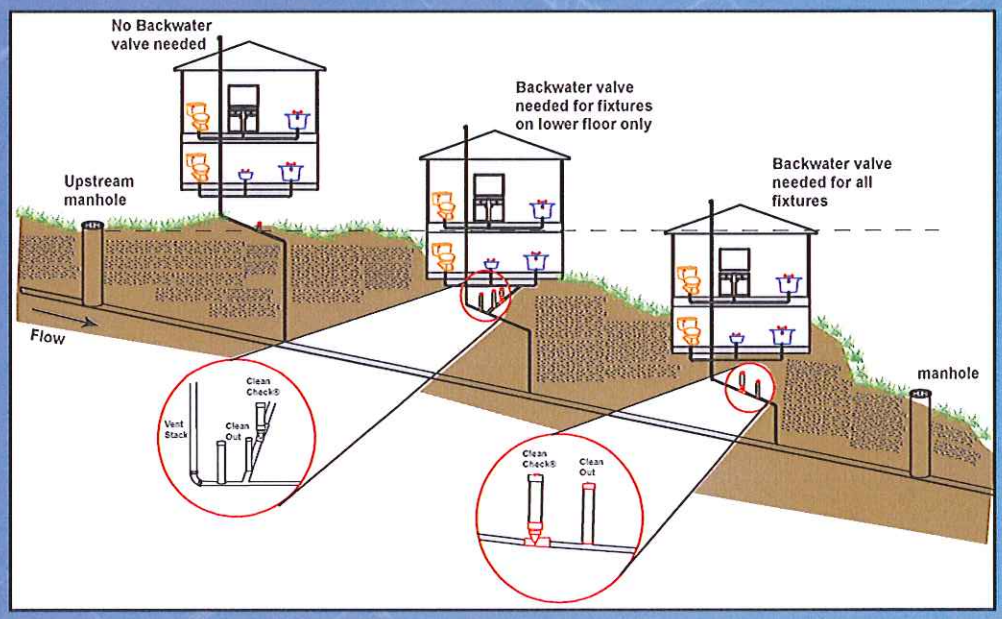


Fig. A

- Prevent sewage backup into a residence or building as a result of a plugged sewer system.
- Valve flapper seals the system, blocking reverse flow.

- The unique design allows accessibility at any burial depth, thus eliminating the need for vaults or manholes, it is direct buried using a riser pipe and standard cleanout plug.

- Backwater valves are required under the model code when the flood level rim of the lowest fixture in a structure is below the first upstream manhole cover and they must be accessible for inspection and service.



- Complies with the requirements of IAPMO/UPC, ICC, IPC and CSA Standards.

Code	Description	Qty. per Case
	Clean Check - ABS	
96903	3" ABS	6
96904	4" ABS	6
96913	3" ABS w/adapter & plug	4
96914	4" ABS w/adapter & plug	4
	Clean Check - PVC	
96923	3" PVC	6
96924	4" PVC	6
96926	6" PVC	3
96933	3" PVC w/adapter & plug	4
96934	4" PVC w/adapter & plug	4

All replacement parts including the flapper are individually available.

RECTORSEAL

UPC File No. 4068

ES ICC ESR-1148
IPC (International Plumbing Code)
IRC (International Residential Code)

RectorSeal®
2601 Spenwick Dr., Houston, TX 77055
PH 713-263-8001 800-231-3345
FAX 713-263-7577 800-441-0051
www.rectorseal.com

BACKWATER VALVE-OPTION 2

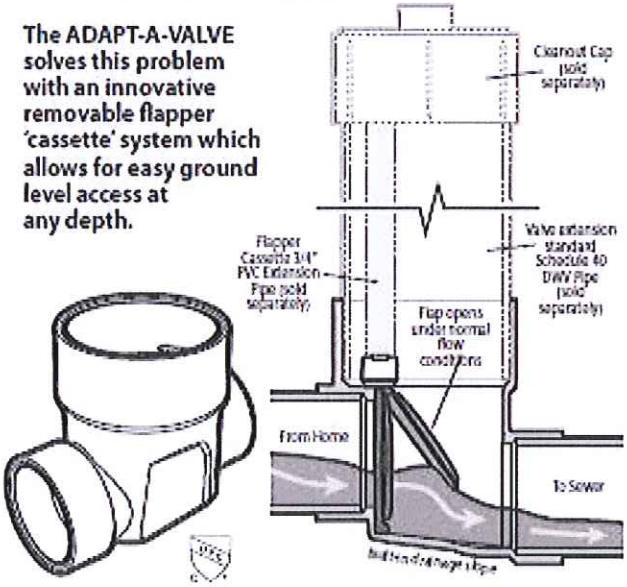
canplas PRICE LIST USP-107 SPECIALTY PLUMBING PRODUCTS MARCH 29, 2010

NEW! MAINLINE

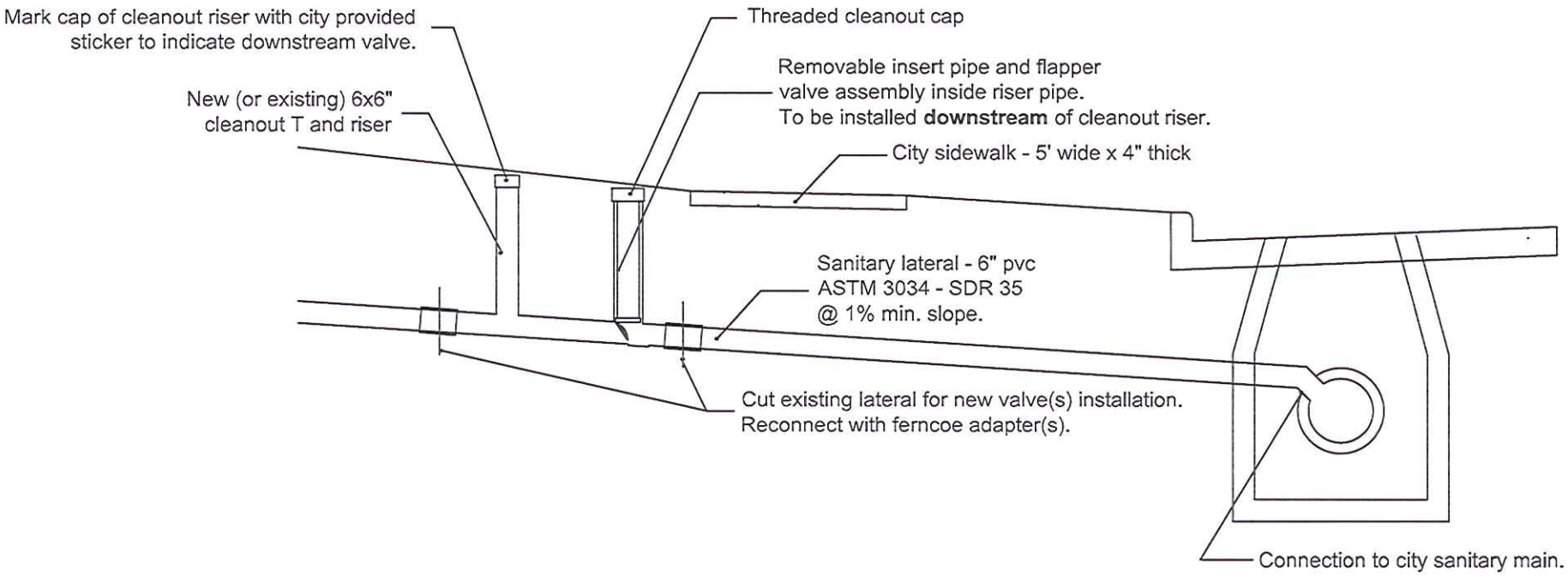
EXTENDABLE
ADAPT-A-VALVE
Backwater Valves™

The plumbing code states that a Backwater Valve must be accessible for maintenance and servicing. The traditional way of accomplishing this for in-ground installations was to build a large concrete pit with an access lid, which was a very expensive and time consuming.

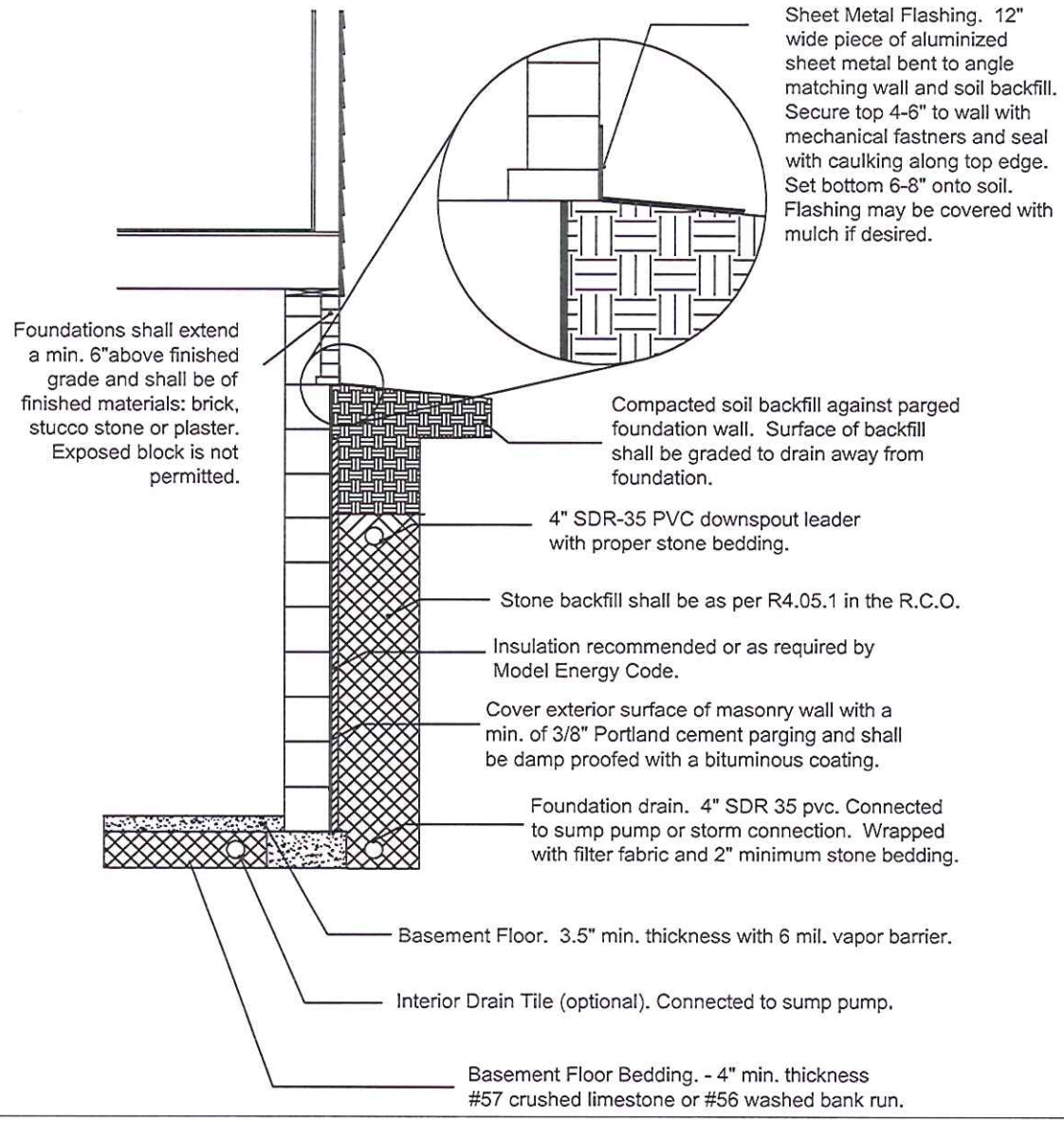
The ADAPT-A-VALVE solves this problem with an innovative removable flapper 'cassette' system which allows for easy ground level access at any depth.



SANITARY BACKWATER VALVE INSTALLATION



NOTE: Horizontal scale of drawing shortened for illustration.

FOUNDATION DRAIN AND DAMP-PROOFING REQUIREMENTS

Sheet Metal Flashing Detail