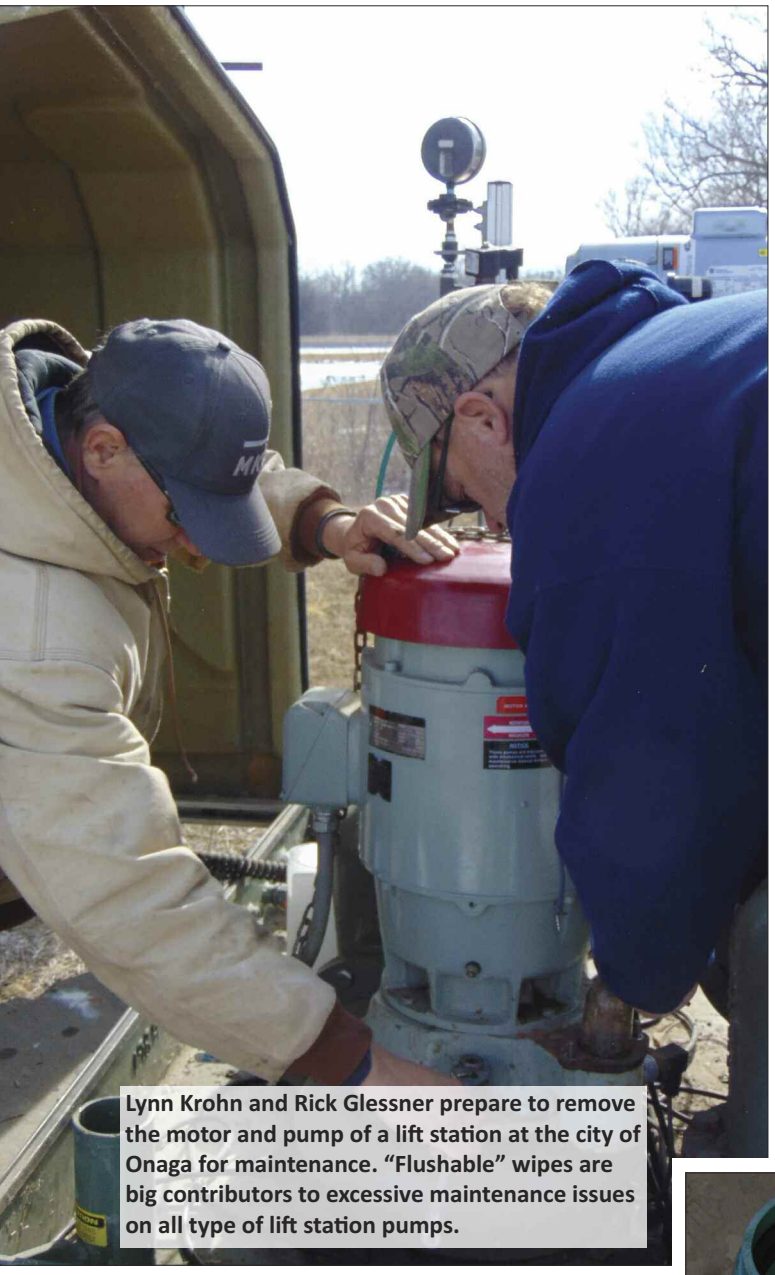
By Charlie Schwindamann, Wastewater Tech

Understanding the Basics of a Sanitary Sewer Collection System



Lynn Krohn and Rick Glessner prepare to remove the motor and pump of a lift station at the city of Onaga for maintenance. "Flushable" wipes are big contributors to excessive maintenance issues on all type of lift station pumps.

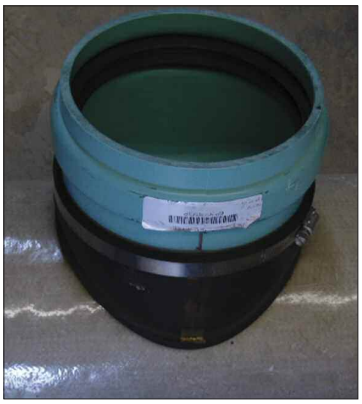
A sanitary sewer collection system is the network of pipes and other facilities such as lift stations to transport wastewater to whatever treatment facility or lagoon system the community has. EPA estimates there are approximately 500,000 miles of publicly-owned sanitary sewers and a similar amount of privately-owned sewer systems in the U. S. Kansas has 722 publicly-owned wastewater systems.

Operators need to understand the basics of the system they operate. The first step operators should do is to read the system's permit, sewer use and other ordinances. Ordinances vary from system to system. Ordinances stipulate who pays for connections, who does the connections, and who is responsible for those connections once installed.

For most systems it is the property owner who hires a contractor to install or replace the service line. These lines are also sometimes referred to as the building sewer or building service lateral. When it is time for the installation of the sewer tap on the main, the responsibility varies between the sewer system and the building owner's contractor. Sometimes the city staff taps the main and provides the tapping saddle. In other cases, the city provides the tapping saddle and allows the contractor to install the saddle, or the contractor provides the tapping saddle. Most homes and small businesses use connections that are 4-inch diameter. Large commercial businesses use mostly 6-inch diameter connections. Extremely large users will have services the size of mains and discharge to manholes.

Some systems prefer a wye while others prefer a tee-type saddle. Most systems also require that the saddle be installed on the top portion of the main at the 10 o'clock, 12 o'clock, or 2 o'clock position.

This reduces the chances of sewer backups into basements if there is a small blockage. If a plumbing code is used, the



This photo shows common types of sewer taps used for homes and similar installations. There is a variety of materials and ways to make the connection.

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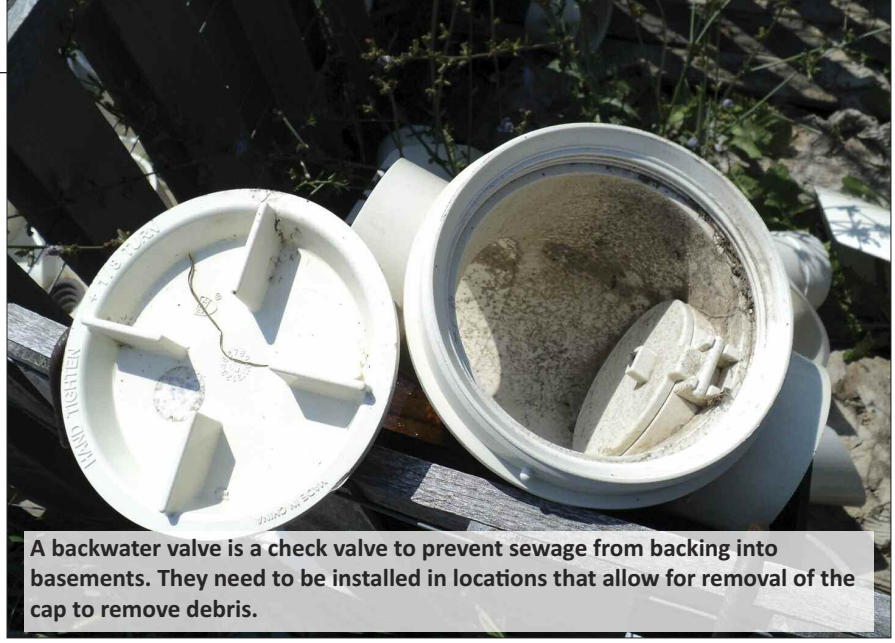


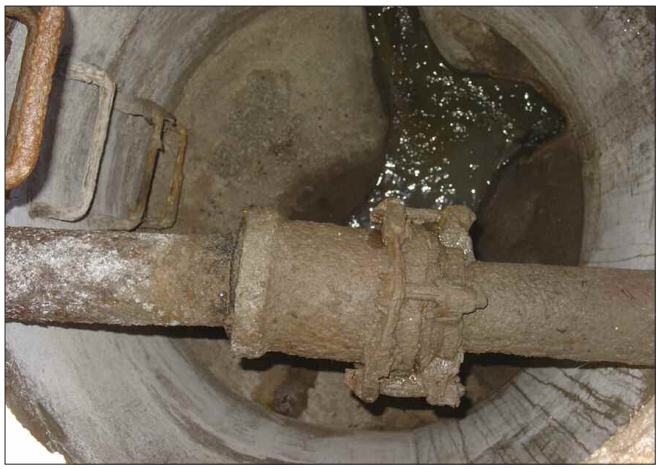
A backwater valve is a check valve to prevent sewage from backing into basements. They need to be installed in locations that allow for removal of the cap to remove debris.

service may be required to have a backwater valve (check valve) to prevent sewer back-up into the building. These are usually only required when there is a sewer line below the basement floor and the top of the upstream manhole is higher than the basement.

Operators of numerous systems have contacted KRWA when there has been a sewer backup and the homeowner will not correct the problem. Very few sewer ordinances have the proper language to allow the city any recourse to require that the owner repair the problem. The ordinance with the most viable recourse for the sewer system is in the "nuisance ordinance" which usually allows for immediate action by the system to resolve the issue. This is because many problems, such as condemning homes, blight, weeds, and debris in yards are covered by the nuisance ordinance. It is appropriate to reference the nuisance ordinance in the sewer use ordinance as well. This will allow the system to resolve the issue quickly, usually in a matter of hours or days instead of weeks or months. That's all the more reason that operators be familiar with their system's ordinances.

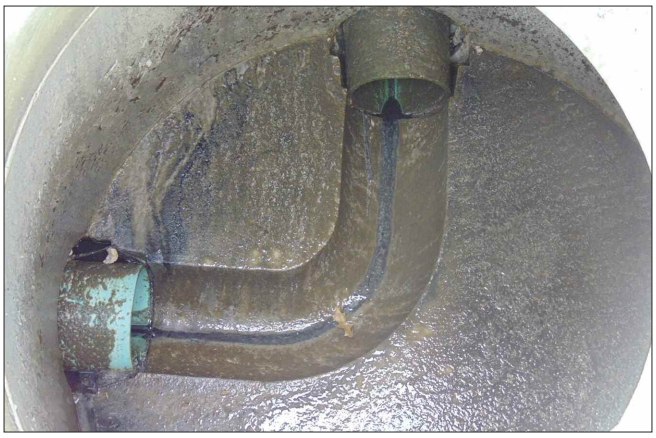
The next question is who is responsible for the tap. Most systems are only responsible for the main sewer line, and not the tap. Systems may take responsibility for the tap and maybe one foot of the service line or more, depending on how much responsibility they want to assume. Those systems that are only responsible for the main line have trouble convincing the owner the city is not responsible for the tap. I recommend a drawing of where the responsibility for the system and the owner starts and ends. That could be included in the sewer use ordinance.

Most systems use gravity sewer for the collection system. The individual service taps are made into the mains. The minimum design standard for main size by the Kansas Department of Health and Environment (KDHE) is eight inches. Many years ago, some small systems had 6-inch mains installed. These were usually installed before the regulation for minimum design standards became law. Some were installed as private lines providing services to several customers, usually referred to as "party lines" where the responsibility was usually a hand shake agreement to split



The sewer main shown in this manhole was discovered many years ago as part of a water system replacement project. The water main was relocated to the edge of the street to meet the required minimum horizontal separation distance of ten feet.

cost if anything went wrong. Unfortunately, when one of the "parties" is no longer there it becomes an issue. It is why systems do not allow party lines to be installed. The sewer mains for some very small systems may only have 8-inch in diameter mains as their largest pipe. Larger towns having mains of 8-inch to 24-inch diameter or larger is quite common.



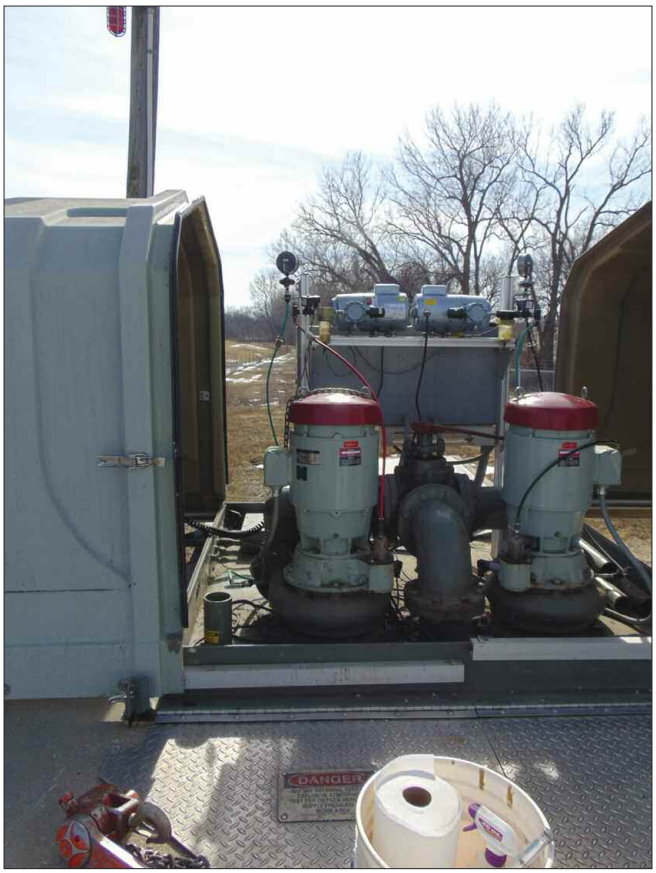
This photo shows the need to have manholes at all changes of direction to allow for cleaning and repairs.

Most older sewer mains are made of vitrified clay pipe. Most newer systems use PVC, PE or HDPE, depending on location and depth. Cast iron and ductile iron pipe are still occasionally used for sewer lines under highways, railroads, and also aerial crossings across creeks or waterways.

The sewer mains are designed for the proper size and slope by engineers to carry the flow. When annexation occurs, the engineer needs to consider the proper main size and slope as well as how will the extra flow effect the downstream pipe. If too large of an area is added the existing pipe may not handle the additional flow. The pipe size is designed using 100 gallons per capita per day. This means design is for every person using 100 gallons per day. There are other calculations for businesses, and schools. Hospitals for example have a design for flow by the projected number of people using water daily. Minimal design flow for sewer mains is two feet per second, with the maximum design flow of ten feet per second.

Sewer mains must be deep enough to receive flow from basements, to prevent freezing, and be deep enough to be protected from surface-imposed loads. If mains have shallow cover, heavy loads over the sewer main might crush the pipe. Sewer mains must be installed to protect water mains from cross contamination. Sewer mains must be installed with at least ten feet of horizontal separation between the sewer and water mains and at least 24 inches of vertical separation with the water main on top. Water pipelines should be located so they do not come in contact with sewer manholes.

Maintenance of sewer mains should be a priority for all systems. The following statement is directly from a wastewater permit, the permittee is the owner system. "Facilities Operations: The permittee shall take all necessary steps to minimize or prevent any adverse impact to human health or the environment resulting from noncompliance with any effluent limits specified in this permit,



This vacuum, prime-type lift station is common throughout Kansas.

including such accelerated or additional monitoring as necessary to determine the nature and impact of the non-complying discharge." This is why it is recommended that systems have a maintenance program for cleaning of the sanitary sewer system. I believe it will soon be required. The most common sewer maintenance program is to have one-third of the system cleaned annually. I recommend to systems that have never cleaned or televised their sewer system, that they set up the program that if one-third of the mains are cleaned per year, then televise that same one-third. This can assist the system in evaluating if any issues such as broken or settled mains. These are but two examples of many problems that could be found. By finding the problems a system can plan for repairs before they become major issues such as a collapsed line that could cause back-ups.

Manholes are designed for the purpose of providing access to the sanitary sewer mains for cleaning, to perform inspections and testing for flow, and to perform repairs. Manholes are required at the end of each sewer line, at all changes in pipe grade, pipe size, or alignment. They are required at all pipe intersections, where pipes change directions or meet. Manholes are required at distances not greater than 400 feet for pipe diameters of 15 inches or less, and 500 feet for pipe diameter of 18 inches to 30 inches. Manholes may be allowed at a distance of 600 feet for special approved cases. The approved cases may include highway, and railroad crossings as examples. Manholes have a minimum barrel diameter of 48 inches and a minimum access diameter of 22 inches, with normal design being 24-inch diameter access. Manhole materials may be concrete, brick, block, or composite with the most common materials for new installation being precast concrete.

Wet well lift stations are the most common type of lift stations. They utilize submersible pumps or suction lift type pumps. Submersible pumps usually do not exceed 2500 gallons per minute and require removal to perform pump or motor maintenance. Suction lift pumps have the pumps and motors located above the wet well and in a dry setting. Most suction lift pumps have effective lift of around 13 feet.

All lift station pumps and motors require maintenance and operators should follow the operations manual for their specific pump.

Charlie Schwindamann has been Wastewater Tech at KRWA since September 1999. Charlie holds Class II Water and Class I Wastewater Operator certification. He has also served as a member of the Marysville, Kansas city council.