

Case Study: Small Scale Waste Water Treatment System

Product application: A small-scale sewage treatment plant uses 2,592 Infiltrator Systems chambers for a discharge facility serving a rural community.

Small cities, townships, and counties nationwide face many complex wastewater treatment issues, as well as diverse opinions regarding their solution.

Protection of natural resources, including water supply and quality where wells are the predominant home water source, and concern about the loss of community identity are just two challenges faced by these communities. Developing high-quality, cost-effective wastewater management solutions, while protecting the character of the community, can be a difficult goal to meet.

In areas of the United States that do not have sewer service, reducing non-point source pollution is a major concern that is forcing a shift in how treatment is provided and managed. In this case, designing small-scale treatment facilities that consistently meet high treatment standards by using advanced products combined with proper management is a cost-effective, environmentally responsible solution.

Four Corners, Mont., located just west of Bozeman, Mont., in the popular and rapidly growing Gallatin County, overcame several hurdles in an effort to improve its wastewater management and allow for future development. Since it is not located within an incorporated area, until 2004 there were insignificant public water and wastewater systems in place. Most of the existing residents used onsite wells and septic systems to provide for their needs.

In 2002, a group of property owners in the area formed the Four Corners County Water and Sewer District to provide water and wastewater services to subdivision projects they were undertaking and also to provide capacity for adjoining properties whose owners were interested in participating. Shortly after its forming, a few residents who claimed that they were dealt with unfairly filed a lawsuit, which caused the loss of bonding abilities that would have provided financing for the public water and wastewater systems. At that point, a privately owned, public utility known as Utility Solutions, LLC, was formed to accomplish the task of planning, designing, constructing, and operating the new public water and wastewater infrastructure.

Management plan

The task of providing a new wastewater system involved collecting, transporting, treating, and disposing of the wastewater in the area. To begin the process, a facility plan was developed to predict wastewater flows during the next 20 years. The plan provided for flows up to 0.6 million gallons per day (mgd) that would be treated by an oxidation ditch primary treatment plant with secondary clarification, aerobic sludge digestion, UV disinfection, and subsurface disposal in rapid infiltration basins. Permitting challenges included Montana Department of Environmental Quality (MDEQ) and Gallatin County Health Department review of all infrastructure plans, including the facility plan, and a rigorous groundwater discharge permitting process, also conducted by MDEQ. By using industry standards and innovative ideas, infrastructure designs were developed and ultimately approved by the reviewing agencies.

Meeting regulatory and industry standards proved to be more achievable than negotiating the political aspects of the project.

Many of the existing homeowners were deeply concerned about potential sewage contamination that might affect their existing wells and the health of the nearby Gallatin River. They were convinced that the new wastewater system would not perform to expectations and would contaminate their drinking water along with the Gallatin River basin. In addition, many homeowners had their own opinion about how wastewater should be handled in Gallatin County, with some advocating a central wastewater treatment facility many miles to the northwest at the headwaters of the Missouri River. With a controversial climate, the reality was that development in this area would exceed the responsible use of onsite wells and septic systems very quickly, and other alternatives were at best many years away. The debate will likely go on for years to come, but construction of the initial phases of the much needed infrastructure is complete, and the Four Corners area now has a viable, safe, modern, and dependable means to handle wastewater for those who wish to participate.

System design and installation

Wastewater is collected via a conventional collection system of manholes and sewer piping, then it is pumped by a series of lift stations to an upstream wastewater treatment plant that provides secondary treatment with disinfection. Following treatment, the effluent is transported to the disposal site where it is stored in two 11,000-gallon fiberglass dose tanks. A submersible duplex lift station also is located on the disposal site to finish moving the water from the dose tanks into the rapid infiltration basins that are composed of a subsurface chamber system. The complete wastewater system is designed for modular construction with future expansions in mind according to facility planning.

There were a few options considered for wastewater effluent disposal, including surface water discharge, spray irrigation, and groundwater discharge. A surface water discharge to any nearby waterway could be a practical and most likely a permissible option, but the process would be lengthy and there would be political opposition. Spray irrigation also is viable, but requires a large amount of land and can only be utilized during the summer growing season. The option of subsurface groundwater disposal made the most sense from a practical, economical, and timing standpoint.

Gravel trenches were considered for the subsurface discharge area, but because of the cost of gravel and the storage dose volume requirements of the design, a chamber system ultimately was chosen. The infiltration basins were designed for use in gravelly soils, 3 feet below the ground surface, and utilize 2,592 Infiltrator Systems Quick 4 High Capacity chambers for the first 12 of the 36 potential zones. When all 36 zones are complete, there will be 6,912 chambers beneath the ground surface with a total capacity of 0.5 mgd. The zones are designed with phasing in mind to accommodate flows as they materialize without forcing the utility to put in the whole system up front. The disposal system can be built in 50,000-gallon-per-day (gpd) increments, according to the facility plan. A standard zone comprises four laterals with a length of 218 feet each and a discharge rate of 617 gallons per minute.

To satisfy permitting requirements and provide efficient, reliable wastewater effluent disposal, the chamber rapid infiltration basins work in conjunction with other important components.

These components include a pressure dosed design with automated butterfly valves operating each of the zones individually, high water alarm floats connected to the chambers, flow metering, and a supervisory control and data acquisition system that allows Utility Solutions, LLC, operators to monitor the system remotely, keeping them up to date on everything that happens on the site.

Expansion for future growth

The wastewater infrastructure that is now a reality at Four Corners will continue to provide a challenge to Utility Solutions, LLC, as it forges forward into new territory serving an ever changing and growing area. Growth in the Four Corners area is already approaching the original facility plan flow predictions of 0.6 mgd.

The utility is in the process of expanding its service area to reach more properties that are beyond the boundaries of local municipalities and water/sewer districts. Construction of future phases of infrastructure improvements, including the subsurface chamber rapid infiltration basins, will be ongoing to keep up with demands. The disposal system is currently equipped for up to 200,000 gpd.

Ultimate build-out predictions indicate that by 2026, the Utility Solutions, LLC, wastewater system could be serving 6,000 homes and handling flows of 1.5 mgd.