Midwest Office
Sheaffer & Roland Inc. | 611 Stevens St | Geneva | IL 60134

telephone: (630) 208-9898 | fax: (630) 208-9895
information@sheafferandroland.com | sheafferandroland.com

GLENWOOD SCHOOL FOR BOYS AND GIRLS WATER AND WASTEWATER SYSTEM EVALUATION

June 9, 2015

Sheaffer & Roland, Inc. designed the Wastewater Reclamation and Reuse System (WWRRS) at the Glenwood School for Boys and Girls in 1992. Sheaffer & Roland, Inc. is both the wastewater and water supply systems Illinois Environmental Protection Agency (IEPA) licensed operator responsible for day to day operations of the facilities. The following is a description of the current facilities on site. Glenwood School for Boys and Girls was constructed in the early 1990's and consists of school and residence facilities clustered around a lake at 41W400 Silver Glen Road in unincorporated St. Charles, Kane County, Illinois. The facility is served by on-site water and wastewater systems.

I. EXISTING FACILITIES DESCRIPTION

A. Potable Water

The potable water supply system (PWD 10#0890080) at Glenwood School consists of two, 8-inch diameter sandstone (St. Peter Formation) wells. Well #1 currently produces 120 gpm and Well #2 produces 105 gpm. Only one well operates at a time. Both wells are located in close proximity to the Well House.

Approximately half the flow of raw water is softened and is blended with raw water to achieve an acceptable level of hardness. There are two ion exchange units rated at 80 gpm capacity each. The ion exchange units are regenerated with rock salt, and the spent brine is discharge to the sewer via floor drains.

Chlorine gas is used for disinfection with two cylinders mounted on a scale with vacuum regulators mounted on top of each tank, a carrier water pump and an ejector. Although the plant has fluoride dosing equipment, the raw water has natural fluoride, and none is added. The water treatment equipment is located in the Well House.

Finished water is stored in a 150,000-gallon elevated storage tank next to the Well House. The distribution system consists of 6" water main, which runs in a loop around the lake

and has individual building service connections. System pressure generally varies between 43 to 45 psi. Pressure in the system is maintained by the water surface elevation in the elevated water tank.

B. Fire System

The school has a separate water system for fire protection. There are two fire pumps, which draw water from the lake. One of the pumps is electric powered, the other pump is diesel engine powered. The pumps and the diesel fuel tank are located in the well house along with the potable water treatment system. Separate water mains, with hydrants, provide fire protection throughout the Glenwood facility. Water storage for the fire protection system is provided by the on-site lake.

C. Wastewater

The school has its own wastewater collection, treatment and disposal system. Wastewater is collected, pumped, treated in an aerated lagoon, polished in a storage lagoon, disinfected, filtered, and finally applied as irrigation water to grassed areas on the campus. No water is discharged from the property.

The collection system consists of 8-inch diameter sewer mains collecting sewage from lateral sewers at each building and conveying the sewage to the underground wet well at the grinder pumping station on the east side of the campus.

The grinder pumping station collects sewage in its 4-foot diameter wet well by gravity from the collection system. Sewage is ground by the pump cutter heads of the two submersible pumps and piped via an approximately 550 foot long, 2-inch diameter PVC force main to the aerated treatment lagoon. The two pumps are Myers WGX Series submersible grinder pumps with 3 horsepower, 230v/3 phase, 3450 rpm motors and are each rated at 50 gpm at 45.8' TDH.

Emergency power for the sewage pumping station is provided by a 20 KYV, natural gas fueled, Dayton Model 4W117 generator (120/240v, 1 or 3 phase). This generator is located in the Operations Building on the east side of the campus, south of the wastewater lagoons.

Wastewater treatment is provided by an aerated (aerobic) lagoon with a surface area of 13,808 sf. and a volume of 662,715 gallons (88,586 cf.). The lagoon has a hypalon liner to prevent untreated wastewater from percolating into the soil and contaminating groundwater. The lagoon has a design flow of 16,000 gpd and hydraulic retention time of 36 days.

Air is provided to the aerated lagoon by two Roots-Connersville, Type URAl rotary lobe blowers (70 cfm, 9.0 psi discharge pressure each) with 5 horsepower,

230v/3 phase, 1725 rpm Baldor motors. These blowers are also located in the Operations Building. Air is conveyed via 2-inch steel air headers to two Air-Aqua, 12- inch static tube vertical aerators located in the lagoon.

Treated effluent runs by gravity through a 4-inch diameter pipe to the adjacent treated wastewater storage lagoon, where it receives further aeration and is held for another 120 days detention time. The second lagoon serves a dual purpose; it provides polishing treatment and stores water during inclement weather when irrigation cannot be performed. The treated wastewater storage lagoon has a surface area of 35,948 sf and a working depth of 10 ft. with an additional 3 feet of freeboard. This lagoon has a working volume of 1,918,321 gallons (256,460 cf.) above a permanent depth of 2 feet. The permanent depth of 2 feet is needed to prevent liner displacement by groundwater. This lagoon also has a hypalon liner. Monitoring well MW #4, located nearby, is used for sampling and measuring the level of the groundwater. The groundwater level determines how low the second lagoon may be drained without causing the liner to float.

Effluent from the treated storage lagoon is pumped to irrigation fields from the irrigation pumping station using one Simflo Model SG6C, 4 stage, vertical turbine pump. This pump is rated at 100 gpm at 200' TDH and has a 7.5 horsepower, 230v/3 phase,

3450 rpm motor. The pump can operate either off a float system or a timer. Chlorine solution is introduced into the wet well to provide disinfection.

Chlorine disinfection is accomplished using sodium hypochlorite solution pumped by Milton Roy LMI Series A15 reciprocating pumps with 0.01 to 1.0 gph adjustable flow rate and dual manual control. The normal dose is 10 mg/1 chlorine. The irrigation pumping station wet well and pump discharge piping serve to provide adequate detention time prior to spray irrigation. Chlorine introduction takes place prior to tertiary filtration.

Intermittent sand filters were originally installed for tertiary treatment following the storage lagoon, but the sand filters have since been abandoned and removed. These consisted of two cells with dimensions of 34 ft x 34 ft on the bottom, 64 ft x 64 ft on the top. These filters were cleaned by manual raking with the debris utilized on site as a soil conditioner.

Turbo-disc Filters were installed in 2005 to replace the intermittent sand filters. Pumped effluent from the treated storage lagoon is filtered in these units under pressure prior to irrigation. The system consists of two skid-mounted modular filters with their own controls and piping. The turbo-disc filters are Miller-Leaman Model AA-ATD2(2)x3-1OOM-AC-MOD2 and are located inside the Operations Building along with an air compressor needed for backwashing. The filtration media consists of stacked rings of

porous plastic material that filter fine particles from the effluent. An air and water backwash cycle is initiated to clean the filter based on the operations schedule or when the head loss becomes excessive, whichever is first to occur. Waste backwash water is then drained back to the aerated lagoon.

The irrigation area consists of 4.1 acres of lawn in the campus area around the gym, academic and administration buildings. Several types of Rainbird sprinkler heads, connected by 1-inch diameter schedule 80 PVC piping, provide disposal of disinfected, tertiary effluent during the irrigation season. The spray heads have pop-up nozzles, which retract when not activated to permit lawn mowing. Several types of heads are utilized in order to avoid spraying onto walkways and road surfaces. The soils in the irrigation areas consist of Miami, Octagon, Saybrook and Harvard silt loam soils, which are generally amenable to irrigation systems, with moderate permeability and well drained.

The lawn irrigation area is divided into several watering zones, which are alternated by a control panel. The irrigation pumping rate is 100 gpm as determined by the vertical turbine pump. There are two monitoring wells located nearby the lawn irrigation areas. Samples are taken and analyzed regularly for nitrate, nitrite, ammonia nitrogen, chlorides, sulfates and total dissolved solids. Water table elevation is also monitored at the wells to identify periods of high groundwater level when irrigation cannot be performed. Precipitation and wind velocity are also monitored to identify weather conditions that preclude irrigation operations.

II. CONDITION AND CAPACITY EVALUATION

A. General

B. Water System

All components of the potable water system are sized to accommodate well in excess of the target population of 160 PE.

The firm pumping capacity (capacity with the largest unit out of service) of the wells is 105 gpm, or 151,200 gpd. IEPA requires that the well supply be able to meet the maximum day demand with the firm capacity. Assuming a baseline water use of 100 gpcd and a max to average ratio of 3:1, the wells can serve a population of approximately 500 PE.

The minimum recommended potable water storage volume for a campus-type facility is also equal to the maximum day demand. The 150,000 gallon volume, therefore, can also accommodate up to 500PE. Alternately, the existing storage volume can supply the target population of 160 PE for three days at the maximum demand level.

The water treatment components (ion exchange units and chlorination system) are similarly sized and can serve well over the target population of 160 PE. The water mains are appropriately sized for potable water mains, exclusive of fire protection.

C. Wastewater System

The sanitary sewer collection system, consisting of the 8-inch diameter gravity sewers, has a capacity in excess of the target 160 PE. For reference, an 8-inch sewer at minimum slope can serve up to 1100 PE assuming a peak factor of 4.5.

Based on the information provided in the previous section, the firm pumping capacity of the grinder pump station (with one pump out of service) is 50 gpm. or 160 PE, assuming a peaking factor of 4.5. The wet well operating level fluctuation is set at 2 ft. In the 4 ft diameter wet well, this equates to a detention time at average flow (with 160 PE) of approximately 17 minutes, less than the maximum allowable of 30 minutes. The pump cycle time with one pump out of service is 4 starts per hour, below the recommended maximum of 8 starts per hour. The grinder pump station is, therefore, appropriately sized for the target population of 160 PE.

The wastewater treatment and disposal system (also referred to as a wastewater Reclamation and reuse system) -was originally permitted by the IEPA for a capacity of 160 PE.

III. CONCLUSIONS

The systems have been maintained in good operating condition during the time in which Sheaffer & Roland has been operating the facilities. Necessary repairs have been made in a timely fashion by the current owner. The equipment condition is consistent with its age and good maintenance practices.

The capacity of the existing system components is summarized as follows based on IEPA Permits and flow capacity:

Potable Water Supply System 500 PE
Sanitary Sewer Collection 1100 PE
Grinder Pump Station 160 PE
Aerated Treatment Lagoon 160 PE per IEPA Permit
Storage Lagoon 160 PE per IEPA Permit
Spray Irrigation Equipment and Field 160 PE per IEPA Permit

SHEAFFER & ROLAND, INC.

Jason C. Fowler, P.E.
Vice President