Slick Solutions: Fairforest Grease & Septage Receiving Station

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Figure 1: Original Grease and Septage Receiving Station

Steve Cavanaugh Jr., P.E., is the founder and president of Cavanaugh & Associates, a engineering, surveying, and utility services firm headquartered in Winston-Salem, North Carolina. Janet Hurley Cann, P.E., is a project manager with Spartanburg Water, a utility which operates the Spartanburg (South Carolina) Water System and the Spartanburg Sanitary Sewer District.

Spartanburg Water, a water and wastewater utility in Spartanburg, South Carolina, began upgrading its Fairforest Wastewater Treatment Facility in 1999. By 2007, Phase VI of these upgrades was completed, including state-of-the-art screening, biosolids storage and handling, odor control, and instrumentation. The entire facility was advanced with the exception of the grease and septage receiving system. The existing system consisted basically of a "hole in the ground" where haulers could discharge directly to the plant headworks (Figure 1).

There were several issues with the simple system:

1. The station received a high volume; on average the wastewater treatment facility received 40 loads of grease and 180 loads of septage per month.
2. The single "hole in the ground" was cumbersome for haulers to use and resulted in a traffic jam of trucks at the treatment plant entrance, an inconvenience for the haulers and a nuisance for plant operations.
3. There was no treatment of the grease and septage before they entered the process train, creating challenges to the balance of the facility and putting downstream treatment components at risk of damage.
4. A cumbersome record-keeping system provided a large margin of error in treatment facility influent records. Spartanburg Water has a rebate program in place that applies to residences inside the Spartanburg Sanitary Sewer District service area where public sewer service is not available. Although this is a great service for residents with no public sewer availability, the record-keeping system placed an added strain on the wastewater treatment facility staff.

Spartanburg Water officials felt strongly that these shortcomings must be addressed in order to protect their investment in the Fairforest Wastewater Treatment Plant.

The Solution

Spartanburg Water retained the services of Cavanaugh & Associates, P.A., to investigate options for a more efficient grease and septage receiving station. Working together, the Spartanburg/Cavanaugh team brainstormed concepts for the perfect station, which would include:

1. Separating grease and septage.
2. Providing pretreatment before integration into the plant process train.
3. Providing better metering, control, and record keeping.
4. Allowing for multiple integration locations of grease and septage.

5. Moving traffic away from the wastewater treatment plant entrance.
6. Providing multiple discharge points to alleviate traffic jams.

The final design exceeded these basic needs. Using an existing side entrance to the plant and vacant real estate within the fenced area of the facility, a three-bay receiving station was sited (Figure 2). The main components of the design are highlighted in the following sections.

Station Accessibility & Convenience

The concept for the layout of the drive and roadway system was to create a separate ingress and egress into the plant, along with sufficient mobility so that haulers can drive in, circle the septage and grease storage tank, and select an available discharge bay. Where possible, the existing paved area was used; where necessary, heavy-duty paving was installed except in the bays themselves, where concrete pads were poured.

Unloading Bay

The three unloading bays provide truck drivers with a secure connection of the truck discharge pipe to a four-inch Kamlok Quik Disconnect. The disconnect is located in the sump adjacent to the drain gate, which is depressed to allow for a full tanker drain. Both the bay drain grate and the pipe connection sump are drained to the structure drain sump-and-pump station that returns the flow to the plant headworks area.

The unloading bays are covered by a lighted canopy. It is equipped so that the Spartanburg Sanitary Sewer District may allow for 24-hour load delivery if necessary in the future. Currently haulers unload from 6 a.m. to 6 p.m.

Automated Flow Control and Record Keeping

The driver swipes a Dallas key and enters the load type (septage or grease) and location information. Upon receiving input on the load type, a three-way selection plug valve, driven by an electric actuator, selects the corresponding pipe position to either septage or grease. Load flow is delivered once the hauler manually opens the truck valve. The flow is then locked out until the appropriate sequence and identification are obtained.

Flow is measured by a bullet-nosed mag meter upstream of the three-way plug valve, which is elevated above the Quik Disconnect vault to ensure a full pipe for appropriate measurement. Also, the controls software has the ability to print load information for the hauler and track actual gallons delivered for further analysis by Spartanburg Water. The hauler also receives a printed receipt.

Controls/Rebate Integration

The former system for implementing the rebate system was antiquated and cumbersome for treatment plant staff. When a hauler delivered a load, he provided the location address to the Spartanburg Water. The address was verified by hand against a map at the plant to make sure the residence was eligible for the rebate. A letter was then generated manually and forwarded to the resident, with hard-copy reports provided to the accounts payable department to generate the rebate.

The new system, developed by Avid Solutions, is fully automated with touch screens and easy-to-use features. County tax information is integrated into the programming, eliminating the need to verify the address against a hard-copy map on the wall. Letters are generated automatically to residents who are qualified for the rebate, and the system communicates directly with the finance department. The new control system generates reports for review and management purposes.

Discharge Routing

The hauler indicates the type of discharge he is delivering at the bay. The automated three-way plug valve directs the flow to either grease or septage piping, where it flows by gravity to the appropriate screening area. The septage is screened before continuing to the septage wet well, which is sized to handle approximately 3,000 gallons (just over one truck load).

Flow is pumped into the septage holding area of the storage tank. At the completion of the septage dump cycle, a solenoid valve opens and delivers hot water to flush the open line following load delivery. The parallel system for grease operates in the same manner.

Screening

The screening station handles septage and

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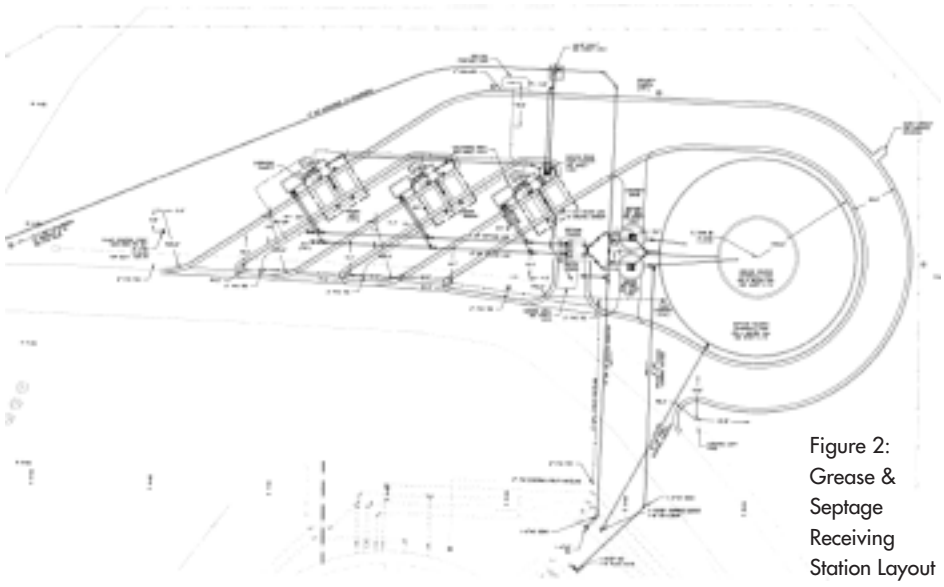
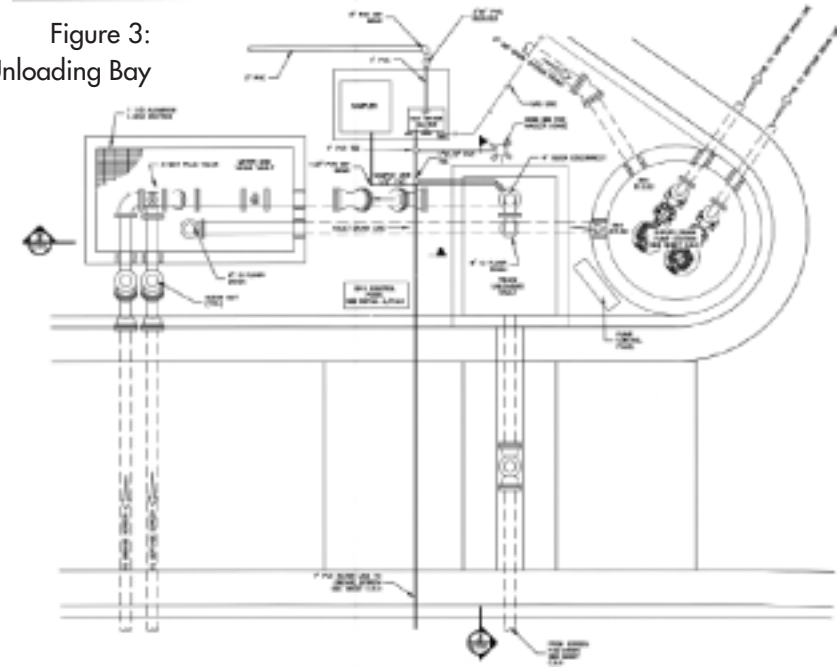


Figure 2: Grease & Septage Receiving Station Layout

Figure 3: Unloading Bay



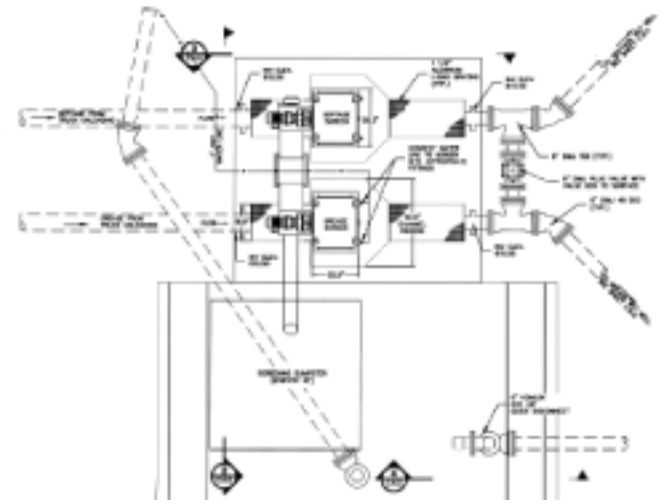


Figure 4: Screening Area

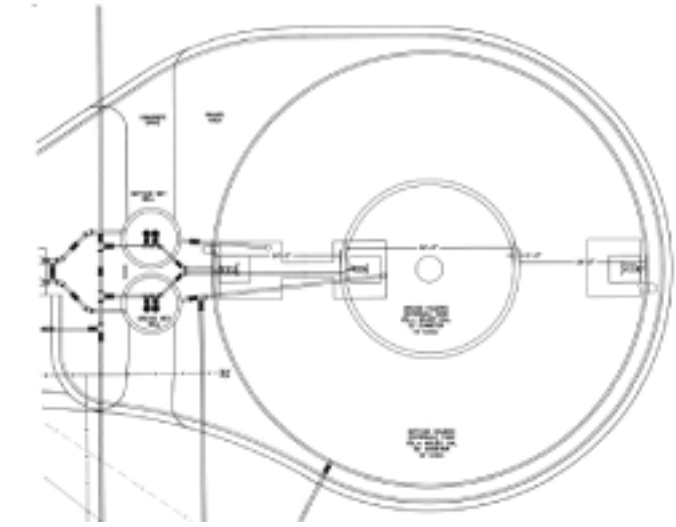


Figure 5: Holding Tank

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grease independently (Figure 4). A Hydrodyne Screen (Model # HF26-18-117-6L) was selected for this application. The flow passes into the screen and is diverted through a grid on each side of the unit. The unit has stainless steel elements that separate solids and convey screenings out of the channel.

At the top of the unit, a hot-water spray washes the solids into the screenings washer and compactor. Organics and wash water are returned to the channel, while solids are conveyed to the dumpster area. Although both the septage and grease screens are equipped with their own wash system and compactor, there is a common conveyer to the dumpster. All screenings are bagged before dropping into a full-length, roll-off dumpster.

Septage & Grease Holding Tank

The holding tank is a Crom prestressed concrete tank with a dome cover to prevent odors from developing in the storage of the grease and septage (Figure 5). The tank size of 600,000 gallons (344,000 gallons for septage and 66,000 gallons for grease) was appropriate, based on historic load data (1,981 loads of septage and 441 loads of grease).

Septage Tank Mixing

The prestressed concrete tank is equipped with appropriate inlet and outlet connection points constructed for the septage and grease storage tanks. A plug valve controls flow from the septage holding area back to the wet well for recycle into the tank. This recycle is augmented by submersible mixers. All piping is routed beneath the tank floor.

Grease Tank Mixing

Similar to the septage tank mixing, grease is also mixed through recycle using the pumping system with augmented mixing. Grease flows back to the grease wet well and is controlled by a plug or pinch valve. Flow and piping is arranged from the wet well to provide complete wet well drainage and recirculation for cleaning.

Grease Treatment & Disposal

There is a separate hot-water recirculation system located at the exit end of the grease screening chamber that is engaged after the load delivery is started. Hot water liquefies any solidified grease and flushes the lines. The ultimate fate of grease options are:

1. Delivery to the plant digester.
2. Delivery to the load station for loading and delivery for beneficial reuse.
3. Delivery to the head works of the plant.

Construction Schedule

Original schedule:

- Notice to Proceed—July 6, 2009

- Substantial Completion—January 4, 2010
- Readiness of Final Payment—March 6, 2010

Current schedule:

- Notice to Proceed—July 6, 2009
- Substantial Completion—March 11, 2010
- Readiness of Final Payment—May 12, 2010

Several circumstances impacted the construction schedule for the project. First, after a 10-year drought, the flood gates opened and the drought ended, resulting in multiple rain delays. Second, as with most existing treatment plant sites, there were unforeseen underground obstacles. On the chosen receiving station site, the team dealt with typical brownfield conditions, bad subsurface conditions, and debris, including the remnants of an abandoned digester.

The Budget

The original project estimate, developed in 2007, was $1.8 million. The project is now complete (see Figures 6, 7, and 8). Considering a few unknowns as stated above and cost effective modifications to the automation of the station, the current construction cost is summarized in Table 1.

Project Benefits

- ***Stewardship of Resources*** – After investing millions in the Fairforest Wastewater Treatment Plant upgrade, the development of this grease and septage receiving station protects that expenditure.
- ***Separation of Grease & Septage*** – By separating grease and septage, operators have more control. Grease can be eliminated from the process train altogether by either sending it to the digester or hauling it to the landfill.
- ***Hauler Accountability*** – The automation of the new receiving station provides more accurate record keeping.
- ***Hauler Acceptability*** – The three-bay system eases traffic jams by allowing multiple discharges at one time, thus making it easier for haulers to access.
- ***Final Fate Options*** – Operators have more control over when, where, and at what rate grease and septage are introduced into the plant.
- ***Make It Easy to Prevent External Dumps*** – Eventual 24-hour access to a state-of-the-art receiving station makes it easy to "do the right thing."
- ***Easy and Separate Access*** – Moving the receiving station away from the wastewater treatment plant entrance and designing it for smooth traffic flow to ease congestion and confusion.

Lessons Learned

Canopy Footing

The extent of the footing for the canopies was underestimated. At the shop drawing stage, it was learned that canopy footings were four feet by four feet by four feet to accommodate wind load, etc. There was conflict relative to the actual placement of these footings; however, an adjustment was made during the course of the submittal and shop drawing

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Figures 6 & 7: The Completed Unloading Area

Figure 8: Completed Grease & Septage Storage Tank

Table 1: Construction Costs

Description	Amount
Site Work	253,000
Unloading Bays	92,500
600,000 Gallon Prestressed Holding Tank	407,000
Septage & Grease Tank Mixer	75,000
Grease/Septage Screening Station	195,700
Septage Pump Station	68,000
Grease Pump Station	68,000
Drain Pump Station	60,000
Hot Water Flush System	21,000
Electrical, Camera, SCADA, Instrumentation	359,500
Mobilization & Miscellaneous	36,400
Unsuitable Subsurface Condition Restoration	12,400
Total	1,648,500

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process to modify to a cantilevered canopy that would be accommodated more easily in the bay area.

Lighting

During the course of construction, the restrike sequence was evaluated closely. It was determined that the amount of time between haulers entering the facility and lights moving to full luminosity should be minimized. Higher-efficiency lighting with lower restrike times was selected during the shop drawing and submittal process.

Moving the Tank

During the pre-bid meeting, it was determined that 10 to 14 working feet were needed circumferentially around the prestressed concrete tank. The tank was moved for the appropriate adjustment and ease of construction while the project was still out for bids.

pH Probe

Initially pH probes were designed for the facility; after the start of construction, it was determined that the maintenance and the harsh environment for these pH probes were not the right application. These were deleted from the overall process.

Timing Matters

At the outset of construction, the schedule was very aggressive. It is important to note that weather delays and ongoing construction and delivery schedules must be managed proactively; flexibility for unforeseen conditions at a brownfield site (buried concrete, unsuitable material, etc.) should have been expected.

Team/Inspector Competency

The strongest asset for moving this project forward was the manner in which the partnership was established among the contractor, the engineer, the owner, and the owner's representatives. This partnership was a model of how to do a project and work through inclement weather conditions, changes in the field, and cost-effective end results.

Conclusion

The Spartanburg Water septage and grease receiving station has proven to be an innovative, unique system employing three discharge bays and a unique separation system. The $1.6-million facility provides a valuable service to Spartanburg Water customers and promotes environmental protection and consciousness by providing a safe, convenient, easy method for septage and grease disposal.