

# Door-to-Door Service

A county bridges the gap between current needs and future expansions  
with mobile biosolids dewatering units

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**H**ighly populated counties tend to regionalize their water and wastewater treatment plants. However, smaller counties, such as Hernando County, Fla., usually have several smaller treatment plants dispersed throughout. According to census data, the Hernando County population increased 26% between April 2000 and July 2006. The 589-mi<sup>2</sup> (1526-km<sup>2</sup>) county, which currently has 165,000 residents, continues to experience high population growth. This growth is expected to affect the requirements of the county's wastewater infrastructure, particularly in the western portion, where growth has been concentrated.

As part of the county's sewer master plan to expand treatment services by 2025, mobile biosolids dewatering support facilities are proposed at four of its six wastewater treatment plants. These mobile dewatering units are an interim solution for dewatering from all of the county's plants until full regionalization has been implemented and permanent dewatering facilities have been constructed. The sewer plan will be implemented in phases, which are the focus of this article, to accommodate future population growth and regulatory requirements.

## Planning for Future Growth

Hernando County is a traditionally rural county located on the central-west coast of Florida, north of Tampa Bay. The county has six treatment plants (see Table 1, below) that are in various stages of upgrades. To meet projected flows for 2025, the county proposed the following milestones in its sewer master plan:

- The Airport plant will be expanded to an ultimate capacity of 6 mgd (22.7 million L/d).
- The Glen plant will be expanded to 3 mgd (11.4 million L/d).
- The Spring Hill plant will be decommissioned, and the wastewater currently being treated there will be rerouted to other plants, primarily to Airport.
- The Berkeley Manor plant will be decommissioned, and the wastewater currently being treated there will be rerouted to other plants, primarily to Glen.
- The Brookridge plant will not be expanded.
- The Ridge Manor plant will be expanded, with design beginning in the first quarter of 2009.

County treatment plant operators and staff were interviewed about solids handling at each plant. Currently, solids are lime-stabilized, pumped to a private contractor's tanker as Class B biosolids, and hauled to the contractor's permitted land application site. Biosolids are not dewatered and consist of up to 4% solids.

This is a labor-intensive process for all the facilities, with the exception of Spring Hill. At Spring Hill, a lime slurry created from the lime-storage silo is pumped to the holding tanks. At the other facilities, a lime slurry is manually mixed in a 50.2-gal (190-L) barrel and fed to the second digester tank. At the projected solids-production rates, this method would become impractical and restrict the ability of the operations staff to stabilize the solids adequately.

Based on hauling costs at the time of the evaluation, continuing with the existing lime-stabilization system is the most cost-effective option. However, as hauling costs approach \$0.061/gal (\$0.016/L), dewatering using mobile units and then either landfilling or hauling to a land application site are increasingly more cost-effective. The county's sewer master plan recommends the existing lime-stabilization process but also recommends budgeting for mobile dewatering units with landfill application in case solids hauling costs become too high or if Class B land application is no longer permitted.

## Phased Approach To Meet Future Needs

A phased approach will be required to treat the ultimate flows predicted for 2025.

### Phase 1

During Phase 1, the county will purchase one mobile dewatering unit. At press time, this unit was expected to be operating by early 2009 at three treatment plants even without support facilities in place to discontinue hauling liquid biosolids from these plants. To provide redundancy, these plants must maintain the ability to lime-stabilize and land-apply the biosolids.

The design of the support facilities for the mobile dewatering units will be placed on a fast-track design and construction schedule. Since Berkeley Manor and Spring Hill ultimately will be taken off-line, they will not be included in the rotation schedule. The Ridge Manor facility will be expanded in a future contract, so the design of support facilities there will be delayed to coincide with the plant's expansion.

For Phase 1, it is assumed that plant influent and biosolids will increase approximately 15%. With the exception of Berkeley Manor, the current

**Table 1. Hernando County Wastewater Treatment Plant Capacities**

Wastewater treatment plant	Current permitted capacity (million L/d)	Future permitted capacity (million L/d)
Airport	2.85	22.70
Spring Hill	9.50	N/A
Berkeley Manor	2.85	N/A
Brookridge	2.85	2.85
Glen	3.80	11.40
Ridge Manor	2.85	2.85
Total permitted capacity	24.7	39.8

L × 0.264 = gal.

waste activated sludge (WAS) production values were compared with predicted 2007 values, with the more conservative quantity used.

## Phase 2

During Phase 2, beginning approximately in the first quarter of 2010, the county will incorporate the second mobile unit into the rotational schedule. The rotation schedule for this phase will assume the six treatment plants are operating at their permitted capacities, with the exception of Berkeley Manor, which will not see flows greater than 0.2 million gal/d (0.76 million L/d).

Permanent support facilities will be installed for the mobile dewatering units at Glen and Brookridge. The expansion of the Airport treatment plant will include a fixed dewatering system; therefore, the support facility at this plant will be designed as a more permanent structure and will provide additional protection from the elements. The facility will include provisions and space for a mobile dewatering unit to operate simultaneously with the fixed dewatering system.

Infrastructure will be installed to enable flows from Berkeley Manor and Spring Hill to be diverted to Airport for treatment after Airport has been expanded. Lime stabilization and land application will continue at Berkeley Manor and Spring Hill, since they will be decommissioned.

The county also will have to maintain the ability to lime-stabilize and land-apply at all plants, because the second mobile unit will not provide full redundancy. Therefore, the county will keep the current hauling contract through Phase 2.

Because the proposed plant expansions will not be complete, the existing WAS storage tank volumes were used in this evaluation. As with Phase 1, the WAS production values provided by plant staff were compared with predicted WAS production values from the sewer master plan, and the more conservative quantity was used.

## Phase 3

The goals of Phase 3 are as follows:

- Airport treatment plant will have an expanded treatment capacity of 6.02 million gal/d (22.8 million L/d).
- Spring Hill and Berkeley Manor will be decommissioned.
- Glen will have an expanded treatment capacity of 3 million gal/d (11.4 million L/d).

The Airport treatment plant expansion should be complete in approximately 3 years and will include a permanent dewatering facility and new WAS storage. Therefore, the mobile dewatering units will have to operate only at Ridge Manor, Glen, and Brookridge. Ridge Manor also should have a permanent support facility for the mobile units. Due to the flexibility of the mobile units,

**Table 2. Phase 1 Solids-Production Calculations**

	WAS holding tank volume (million L)	Thickened WAS concentration (mg/L)	Total solids in WAS holding tank (dry kg)	Total solids captured during dewatering (dry kg)	Dewatered WAS concentration (mg/L)	Volume of dewatered cake (m <sup>3</sup> )	Number of truck-loads
Brookridge	0.777	19,568	15,177	15,025	200,000	2350	4.8
Airport	1.064	9000	9553	9458	200,000	1479	3.0
Glen	0.790	12,200	9620	9524	200,000	1490	3.0

WAS = waste activated sludge.

L × 0.264 = gal.

kg × 2.20 = lb.

m<sup>3</sup> × 264.2 = gal.

**Table 3. Phase 1 WAS Holding Tank and Dewatering Calculations**

	Existing WAS holding tank volume (million L)	Wasting rate (L/d)	WAS concentration (mg/L)	Wasting rate (dry kg/d)	Thickened WAS concentration (mg/L)	Available storage (days)	Time required to empty WAS holding tank (hours)
Brookridge	0.777	14,733	17,568	258	19,568	58.8	13.6
Airport	1.064	66,074	17,568	461	9000	20.7	18.7
Glen	0.790	53,481	10,200	544	12,200	17.7	13.9

WAS = waste activated sludge.

L × 0.264 = gal.

kg × 2.20 = lb.

the Airport treatment plant design does not require a redundant centrifuge. One mobile unit can provide redundancy for Airport while the other unit rotates between the remaining three plants.

Additionally, by Phase 3 completion, the county no longer will have to maintain lime stabilization for redundancy. While all units are operational, the county can leave one mobile unit at any treatment plant and rotate the other mobile unit between the remaining two. Since Ridge Manor is the only plant on the county's east side, it may be cost-effective to keep one mobile unit at the plant under normal operation.

Since dewatered solids from these facilities will be landfilled, the WAS holding tanks will not have to act as digesters and are not required to achieve a minimum solids retention time, although the current practice of thickening in clarifiers most likely will continue at Brookridge for ease of operation. It may be advisable to provide sufficient storage volume to meet solids retention time requirements should the county want to produce Class A biosolids in the future.

## Dewatering Equipment Selection

The county invited several dewatering equipment manufacturers to pilot-test their products at the Airport plant. In addition, several mobile dewatering installations currently in operation were surveyed to evaluate their performance and the manufacturers' responsiveness. Rotary presses can be installed with up to six channels, but each channel is limited to a capacity of 10 gal/min (38 L/min). This equates to a total throughput capacity of 3 gal/min (114 L/min), which is insufficient for this application.

Belt filter presses are limited by solids loading, whereas centrifuges are limited by hydraulic throughput, in most cases. Since each treatment plant thickens to a different concentration prior to the WAS holding tanks, the throughput of belt filter presses will vary at each plant. Since mobile centrifuge units can provide a throughput of at least 151 gal/min (570 L/min) at each facility, centrifuges would provide the county with much more flexibility in the rotation schedule. Based on this, the county elected to use centrifuges in its mobile unit design.

Four mobile centrifuge manufacturers were included in the initial comparison: Andritz (Graz, Austria), Alfa Laval (Lund, Sweden), Centrisys (Kenosha, Wis.), and USFilter (now Siemens Water Technologies; Munich and Berlin, Germany). An effort was made to examine mobile applications

closely matching Hernando County's intended application, as most skid-mounted centrifuges are used in permanent installations. The most important factor for each brand was the centrifuge throughput on the desired skid size and trailer size. Centrisys had several mobile installations with throughputs of 251 gal/min (950 L/min) and greater, which was the highest of the brands evaluated.

## Mobile Unit Support Facility

County operators have Class A, No. 5, restricted commercial drivers licenses, which do not permit them to operate full-size semitractor trailers. Therefore, the mobile centrifuge system will use a gooseneck trailer that attaches to a dump truck with a pintle hitch. Each treatment plant will have a covered area that the truck can enter. After the centrifuge is positioned to shelter it from the weather, the driver will then detach the trailer and pull in adjacent to it so that the centrifuge can discharge into the truck.

The dump truck will be equipped with a tarp system to shield the solids from rain and contain the solids. While the dump truck is en route to or from the landfill, the mobile centrifuge will discharge dewatered solids into a dump trailer. The dump trailer can be pulled with a county-owned heavy-duty pickup truck. When the dump truck returns, the pickup truck will haul the dump trailer to the landfill. The shelter will include an enclosed storage area with two roll-up doors to store the dump trailer.

Florida Department of Transportation regulations do not permit any vehicles on public roadways that weigh more than 80,159 lb (36,360 kg). For this reason, the dump truck cannot tow the mobile centrifuge when it has a full load of dewatered solids.

Since the solids concentration in the centrate will be small, it was omitted from previous calculations. However, it is necessary to determine the amount of centrate that will be returned to the head of the oxidation ditches at each treatment plant to determine if the size of the existing plant drain-pump stations are sufficient in returning process water to the headworks. A mass balance was used to determine centrate flows 235 to 239 gal/min (889 to 904 L/min), with an assumption of 99% solids capture and final product of 20% total solids.

## Dewatered Solids Production and Disposal

The landfill is the limiting factor in solids disposal. The landfill's hours of operation are

Monday through Saturday from 7:30 a.m. to 5 p.m. This schedule allows only enough time for each truck (dump truck and pickup) to be filled and emptied twice, at most. The volume of dewatered solids produced by each treatment plant and the number of truckloads were calculated for Phase 1 (see Table 2, p. 60) and used to configure a plant wasting schedule.

### Plant Wasting Schedule

The number of truckloads of solids produced, the time required to empty the WAS holding tanks, the days of storage in the WAS holding tanks, and the projected wasting rates were all factors in determining the plant wasting schedules and rotation schedules for each dewatering unit. The storage time calculations were based on maximum month sludge-production values. The time required to empty the WAS holding tanks for Phase 1 at Brookridge, Airport, and Glen are calculated in Table 3 (p. 60). Since the WAS holding tanks provide minimal storage, it was assumed that decanting will increase WAS concentration by an additional 2000 mg/L at each plant. (The data in this table are used for the example plant wasting schedule in the following section.)

### Mobile Unit Schedule

The design of the mobile dewatering system will facilitate a smooth, quick setup and breakdown. Once the mobile unit arrives at the site, operations staff will connect the feed line, electrical lines, and centrate line; level the trailer; and press the "start" button on the programmable logic controller. The manufacturers estimate approximately 1 to 1.5 hours for setup and 1.5 hours for washdown and moving the unit to another facility.

At the end of each rotation schedule, it is assumed the dewatering unit would return to the first treatment plant, and the cycle would repeat unless the WAS holding tanks have ample space to allow the unit to remain idle for some time. For times when dewatering is needed and the

landfill is not open, it was assumed the unit would dewater solids until the dump truck and dump trailer are both full. The solids would be taken to the landfill when the landfill is open again.

In Phase 1, the plants are operating below their permitted capacities and have a significant amount of WAS storage space, allowing much flexibility with the rotation schedule. The following is a suggested rotation schedule for Phase 1:

- Dewater at Brookridge for one 8-hour shift for 3 consecutive days or two 8-hour shifts in 1 day.
- Dewater at Airport for one 8-hour shift for 3 consecutive days or two 8-hour shifts in 1 day and one 8-hour shift in the following day.
- Dewater at Glen for one 8-hour shift for 3 consecutive days or two 8-hour shifts in 1 day.

At Brookridge and Glen, if the dewatering is not completed in a single day, then an extra 8-hour shift is required, because the time to start up and shut down the units must be included. Since there are at least 17 days of storage at each plant, the dewatering unit could be allowed to rest between plants or rotations. During Phase 1, the dewatering units are not required to

operate for more than one 8-hour shift per day, but as the plants approach capacity, the hours of operation will have to be extended.

As seen, mobile dewatering units provide an interim solution for dewatering from all of the county's wastewater treatment plants until full regionalization is complete and permanent dewatering facilities have been constructed.

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