

IMMOKALEE WATER AND SEWER DISTRICT – CASE STUDY OF EFFECTIVE BIOSOLIDS MANAGEMENT

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Introduction

The Immokalee Water and Sewer District (IWSD) is currently paying a premium to have their Biosolids dewatered and hauled to a landfill. The annual cost to IWSD for contract dewatering, hauling and landfill disposal has historically been upwards of \$500,000. Although landfill disposal of Biosolids is still common in Florida, it should not be viewed as a long term solution. Landfill disposal is considered to be environmentally beneficial only when the landfill is equipped to recover and convert methane gas into electricity. Landfills are carefully engineered and monitored to ensure protection of groundwater and surface water and stability of the landfill mass. As such, landfills have a limited capacity to accept Biosolids in proportion to the total tons of refuse received. Most importantly, landfill disposal does not take advantage of the nutrient value and soil-building properties of biosolids, and takes up landfill space that can be better used for other materials.

The updated Florida Biosolids regulation, Chapter 62-640, F.A.C., became effective on August 29, 2010. After three years, the full impact of this regulation is now being felt, particularly where Class B Biosolids are produced and disposal is required. These regulations limit the number of available disposal sites as each site is required to complete and submit a nutrient analysis plan to the State for approval. Typically, this nutrient management plan is completed at significant expense. In addition, the available sites for Class B Biosolids land application may now be much farther from the WWTP, thereby increasing transportation costs. Many WWTP operators are starting to incur increased costs to haul and dispose of Biosolids, directly attributed to the new state regulations. In some cases, the costs of properly managing and utilizing these solids have nearly doubled.

To address this concern, Class AA Biosolids, in conjunction with designated Fertilizer licenses from FDACS, are becoming the new Florida industry standard. A number of different factors should be considered when evaluating technologies that produce Class AA Biosolids. These factors include capital cost, operating cost, reliability, ease of operation, complexity and safety of operation, odors and side streams of the processes, required space, and the ease of disposal.

As part of a strategy to reduce operational costs and improve Biosolids management, IWSD directed their engineering consultant, Greeley and Hansen, to prepare and issue two RFPs in the summer of 2012. RFP-1 requested Design Build Finance (DBF) teams to provide a detailed lease to plan, design and finance the entire cost of a Class AA Biosolids production facility. RFP-2 incorporated a land-lease option to allow an outside vendor to design, build, finance and operate

the facility. Under each RFP, the total annual payment plus the annual O&M could not exceed \$470,000, the existing operating cost for Class B Biosolids dewatering and disposal. The facility would include permanent dewatering equipment, Class AA Biosolids processing equipment, and it needed to fit in a small footprint to be centrally located on the WWTP site where existing dewatering beds were located. After consideration of the various proposals, IWSD selected Schwing Bioaset's DBF proposal under RFP-1.

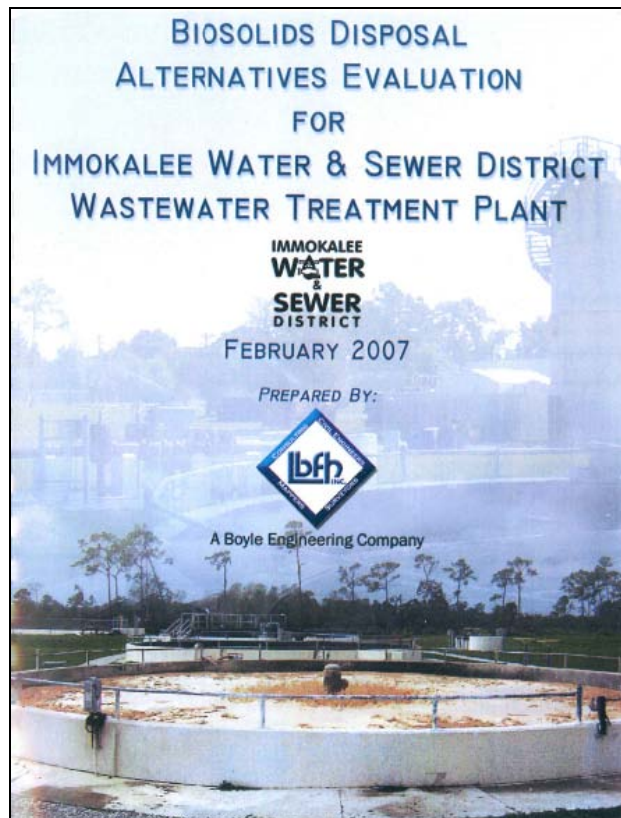
The lease-to-own agreement allows IWSD to purchase the facility at any time during the ten-year lease-to-own agreement. Initially, the annual cost savings will be over \$70,000 compared to the existing operations. At the end of the 10-year lease, the annual cost savings is expected to be almost \$400,000 and the equipment will be owned by IWSD. After giving consideration to the amount of interest that would be charged, the Board of Directors of the IWSD opted to pay for the system entirely from its own funds.

IWSD took the opportunity to achieve a cost savings versus the current Class B operations. The result is a long-term Class AA Biosolids production facility owned by IWSD that will meet the needs for many years into the future. The permanent dewatering facility will be directly connected to the Class AA process and will be housed under the same roof in a compact operation, which optimizes materials handling. The agreement allows IWSD to maintain ownership of the Class AA biosolids and utilize them on its sprayfield as is currently permitted through FDEP. IWSD currently leases the 300-acre sprayfield land to a cattle farmer and is required to fertilize the property annually. The use of the Class AA fertilizer produced at the new Biosolids facility will eliminate the need and cost for commercial fertilizer and at the same time eliminate the hauling and disposal costs of material taken to the landfill. The new facility will be fully operational in early 2014.

The paper will focus on the IWSD case study to provide a cost-effective solution for biosolids handling, which is a challenge that other smaller utilities are struggling with due to the increase in hauling and disposal costs resulting from the new disposal regulations.

Background

The Immokalee Water and Sewer District's WWTP currently produces Class B biosolids. The WWTP was originally designed with six sludge drying beds and had space for three more to be constructed at a later date. At the time the WWTP was designed, the common practice was land application of Class B biosolids on agricultural land. IWSD had six permitted land application sites. In 2007, USDA and FDEP were contemplating changes to the biosolids land application regulations which would add phosphorus limits and thus restrict land application of Class B municipal biosolids on agricultural lands. IWSD's consultant at that time, LBFH, wrote a report titled "Biosolids Disposal Alternatives Evaluation for the Immokalee Water and Sewer District Wastewater Treatment Plant". This report compared several alternatives, but ultimately recommended the short-term solution of contract dewatering and hauling until the pending regulations came into effect to be sure that whatever was designed for the long-term solution would be in conformance with the regulations.



Therefore, in 2007, the IWSD entered into a contract with Synagro for dewatering the Class B biosolids and hauling the dewatered solids to a landfill for disposal. IWSD “piggybacked” on a bid and contract from Martin County with Synagro. Originally, the contract price was \$46.00 per 1,000 gallons, resulting in an annual cost of \$309,000. However, the contract allowed Synagro to use the Cost of Living Adjustment (COLA) to adjust disposal charges each year during the term of the contract. For the term of the contract, the biosolids have been disposed of at the Okeechobee landfill, which is located 102 miles from the IWSD WWTP. The total annual cost for biosolids disposal has reached \$470,000 due to increased sludge quantities and unit disposal cost. The IWSD realized that they needed to explore options to reduce this cost. Also, the current contract with Synagro expired on 5/31/2013. The IWSD Board voted to renew the contract for one year. The current price is \$50.73 per 1,000 gallons.

The IWSD Board was split on whether to purchase the biosolids processing equipment or to simply act as the landlord and let another entity handle the operations. The Board decided to issue two RFPs in July 2012. RFP-1 was for Design-Build-Finance of the biosolids facility at the existing WWTP site. Under this option, the IWSD would own and operate the equipment. RFP-1 Part 1 was for handling the sludge from the Immokalee WWTP only, and RFP-1 Part 2 was for converting the facility into a regional facility. RFP-2 also had two parts. RFP-2 Part 1 was for a land lease for an entity to rent land from the IWSD for the sole purpose of constructing a regional Class A biosolids handling facility. RFP-2 Part 2 was for contract dewatering and hauling, similar to the current arrangement with Synagro while the regional facility was designed, permitted and constructed.

Greeley and Hansen assisted the IWSD in developing the following criteria for RFP-1:

1. 188,000 gallons per week of 1.5% solids WAS – Immokalee Only
2. Provide dewatering equipment to process 1.5% solids sludge to 18% solids
3. Expandable to Regional Facility to handle an additional 27,000 tons of 18% solids sludge (from Collier County facilities)
4. Convert dewatered solids into a beneficial fertilizer/soil amendment product
5. Utilize existing 200 Amp 460 Volt, Three Phase electric service
6. Provide a metal roof structure to house the equipment
7. Equipment footprint had to fit in one of the three cross-hatched areas available as shown in the aerial photo below.



8. Dried solids must meet Class A requirements (minimum)
9. Structural designs based on
 - a. 100 mph sustained winds, 120 mph gusts
 - b. Exposure Class B
 - c. Occupancy Category II
 - d. 20 psf Roof Live Load
10. Signed & Sealed structural drawings
11. Maximum of 16 hours/day operation
12. Provide a list of references and FDEP permitted installations in Florida.
13. Provide a list of Technology Supplier's, Engineer's, General Contractor's, and Sub-Contractors' personnel who will be working on this project. Include documented similar experience and resumes.

14. Provide documentation of the financial strength of the entity or entities providing project financing.
15. Provide a general layout and general equipment arrangements for both Phase 1 and Phase 2.
16. Provide a process flow diagram for Phase 1 and Phase 2.
17. Provide a narrative detailing the process for sludge treatment that specifically states the method of compliance with the FDEP 62-640.600 and 40 CFR 503 regulations. Include details for transporting sludge from the dewatering equipment to the sludge process equipment, plus details for accepting sludge from other facilities for Phase 2, as well as a narrative detailing the transition from Phase 1 to Phase 2. Also include the expected N-P-K values of the final fertilizer/soil amendment product.
18. Provide a detailed list of equipment being provided for Phase 1 and Phase 2, including electrical phase, voltage, full load amps, and horsepower requirements. (460V, 3-phase is available).
19. Provide a detailed capital cost breakdown including engineering, installation, and equipment for Phase 1 and Phase 2.
20. Provide a minimum of three (3) current quotes for each chemical required from different sources.
21. Provide a detailed annual O&M cost breakdown for Phase 1 and Phase 2 with calculations including chemical dosing ratios based on the average chemical cost from the sources obtained above, electrical cost of \$0.08 per kilowatt-hour, diesel fuel cost of \$4.25 per gallon, plus all assumptions made.
22. Provide a statement regarding the Treatment Plant Operator Class required to operate the system.
23. Provide a detailed lease-to-own plan to finance the entire cost, specifically stating the monthly payments, fixed interest rate and length of term. For Phase 1, the total annual payment plus the annual O&M costs shall not exceed \$470,000.
24. Provide a tentative project schedule indicating the number of days from Notice to Proceed until completion of construction for Phase 1 and Phase 2.
25. Provide information regarding training technical support and maintenance responsibilities during the lease period.
26. Provide detailed information regarding the lengths and types of warranties being provided after the ownership transfer occurs when the equipment has been paid off.

Greeley and Hansen also assisted the IWSD in developing the following criteria for RFP-2:

1. 188,000 gallons per week of 1.5% solids WAS – Immokalee Only
2. Provide a list of references and FDEP permitted installations in Florida.
3. Provide a list of Technology Supplier's, Engineer's, General Contractor's, and Sub-Contractors' personnel who will be working on this project. Include documented similar experience and resumes.
4. Provide documentation of the financial strength of the entity or entities providing project financing.
5. Provide a general layout and general equipment arrangement.
6. Provide a process flow diagram.

7. Provide a narrative detailing the process for sludge treatment that specifically states the method of compliance with the FDEP 62-640.600 and 40 CFR 503 regulations. Include details for transporting sludge from the dewatering equipment to the sludge process equipment, plus details for accepting sludge from other facilities. Also include the expected N-P-K values of the final fertilizer/soil amendment product.
8. Provide a detailed list of equipment being provided.
9. Provide a tentative project schedule indicating the number of days from Notice to Proceed until completion of construction. Be sure to include adequate time for permitting.

For both RFPs, proposers were directed to utilize the same costs for electricity, diesel fuel, etc. In addition, each proposer was directed to provide three quotes for all chemicals that would be utilized in their process, and to utilize the average of the three quotes for each chemical in developing the anticipated annual cost of operations.

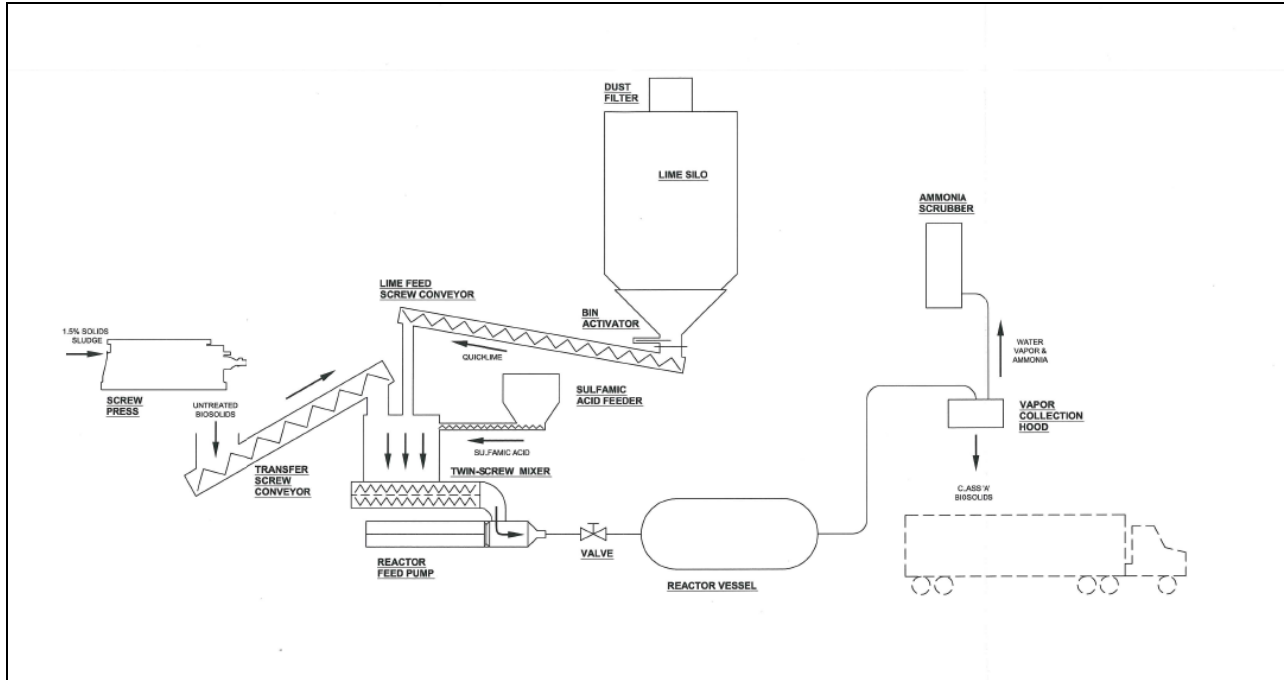
Prior to issuing the RFPs, IWSD met with representatives of other local municipal utilities regarding the possibility of developing a regional facility and with Collier County officials regarding expanding their current conditional use (zoning) to cover the sprayfield area. Expanding the conditional use proved to be a difficult process. Also, the other utilities could not commit to participating in the regional facility. Accordingly, IWSD decided to move forward with the turnkey D-B-F option for the IWSD sludge volumes only and reject all submittals received for RFP-2.

In September 2012, IWSD evaluated submittals received for RFP-1. Schwing Bioset was selected, due to the number of permitted installations they have in the State of Florida, the experience of their Design-Build team, and their financial strength.

The Schwing Bioset Process:

The Schwing Bioset process consists of blending the sludge cake with quicklime and sulfamic acid and allowing the reaction to occur under pressure to meet the requirements of the State's Chapter 503 Rule. To accomplish this, it is necessary to control the flow of the biosolids through the reactor, and dose them with quicklime and sulfamic acid such that the retention time and temperature rise achieved within the reactor match the required temperature set forth by equation 2 in Chapter 503.32.

Additionally, this dosage of quicklime raises the pH of the biosolids above 12 per Chapter 503.33. The final lime and sulfamic acid dosages for a specific application are designed such that EPA requirements are fulfilled for pathogen and vector attraction reduction, while also taking into consideration the local costs of chemicals. The goal is to strike the optimum balance between regulatory requirements and processing economies.



Schwing Bioset Process Flow Diagram

Key features of the Bioset process include:

- Totally Enclosed
 - Contains dust
 - Contains odors
- Ideally suited to operate as a regional facility:
 - Accommodate fluctuations in percent solids of the incoming wet cake
 - Accommodate rapid increases and decreases in throughput
 - Accommodates biosolids from any wastewater process (aerobic, anaerobic, etc) without any modifications to operations.
- Fully automated
 - Chemical feed rate adjusted based on reactor temperatures for Phase 1
- Long-term product stability
 - Regional facilities and fertilizer marketing operations require a product that is stable and can be stored for extended periods to span growing seasons and/or periods of unstable weather.
- Easy to Operate and Maintain
 - Simple processes that do not require multiple shifts of operators or complicated and/or potentially dangerous operating conditions are generally preferred technologies.

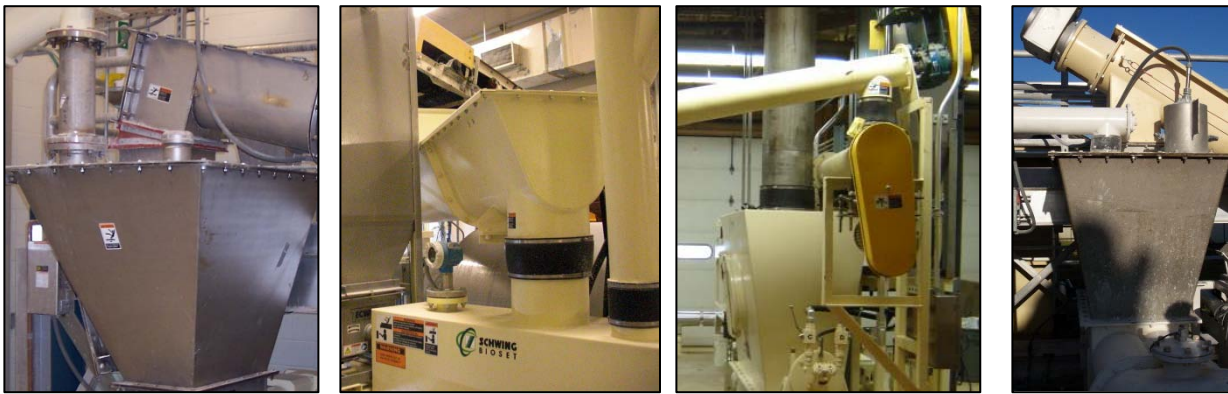
Mixing Design

Poor lime/sludge mixing is a problem observed with other lime stabilization systems where portions of unreacted lime can be found in the discharged cake. The Schwing Bioset system uses a twin auger mixer with counter-rotating, intermeshing augers. Mixing continues with turbulence induced in the piston pump control valve housing. The thoroughly blended product

can be seen with a homogeneous consistency and coloration. The homogeneous product is evidence that all the biosolids are uniformly treated and unreacted lime is not wasted.

Dust Control

Historically, biosolids treatment processes that use lime have been plagued by dusty conditions that create unpleasant working conditions for plant staff. Even some of the original Bioset process installations had these same issues. As a result, a common reaction to a proposed lime stabilization system is a knee-jerk negative response. However, since Schwing America, and later Schwing Bioset, took over the marketing of the Bioset process technology, controlling fugitive lime dust was recognized as one of the most important issues for a successful installation. With this in mind, great care has been made to ensure that the handling of lime does not result in dusty conditions. Below are photos of equipment supplied by Schwing Bioset that illustrate the connections into the mixing hopper. All of the connections are either hard-piped or sealed with a flexible boot to ensure that lime dust cannot escape and a clean working environment is provided.



Odor Control

Another common complaint related to biosolids treatment technologies that utilize lime is the associated odors. Some competitors' systems and legacy Bioset systems create overpowering amounts of unpleasant odors that have adverse impact on plant operations. As shown in the photos above, Schwing Bioset has addressed this issue by completely enclosing the system where the mixing is taking place. The Bioset reactor, a pressurized pipe, completely contains the odors until they are released at the reactor discharge. This single point location results in a strategic location to capture the odors. Schwing Bioset includes a pinch valve at the reactor discharge to flatten the sludge flowing out of the reactor to create additional surface area to allow the ammonia and other compounds to be released and subsequently captured and scrubbed under the collection hood. The resulting end product has an "odor" similar to wet concrete as a result of the lime content, which is not offensive at all. Typically, the first comment prospective customers make when touring a Bioset installation is how clean the system is and the obvious lack of odors.



Maintainability

A remarkable feature of the Bioset process is how little maintenance is required, as there are very few moving components. Aside from the two feed augers that require normal drive and bearing maintenance, the only other item that requires regular maintenance is the piston pump. The Bioset system uses piston pump technology as manufactured by Schwing Bioset. These pumps were originally developed for pumping concrete and have over the past 25 years been adapted to other industries. The basic pump models offered by Schwing Bioset are designed for pumping concrete, essentially a mix of rock and sand, at operating pressures up to 1,500 psi. By anyone's account, this is considered a severe duty application. When used in Bioset applications, by comparison, the duty is much less severe as biosolids will contain a small percentage of grit and the system will operate at less than 50 psi. As a result, the wear lives of the replaceable parts in the piston pump are capable of exceeding 5,000 hours of run time.

Screw Press Dewatering Process

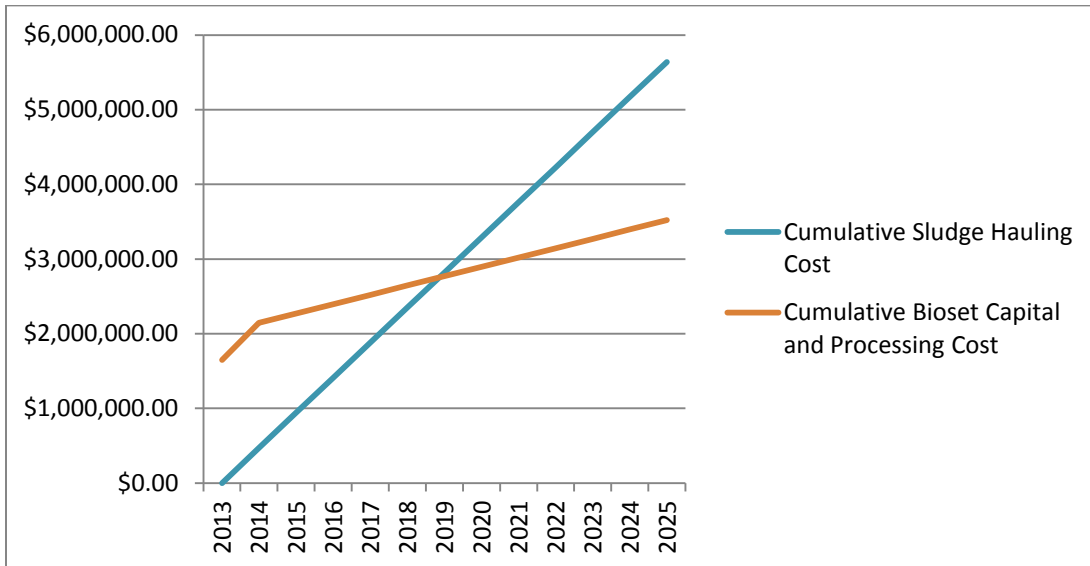
While there are many methods of dewatering municipal biosolids in wastewater treatment plants, Screw Press technology has emerged as a low energy alternative to these historical technologies. Until recently screw press technology has been unable to deliver dewatering performance capable of competing with these legacy technologies thereby limiting their market appeal. A new High Performance Screw Press offers improved throughput, capture, and consistent high dry solid content for the full range of capacities providing wastewater plant operators the features, benefits, and low energy consumption expected from a screw press with the performance similar to high speed centrifuges.

Schwing Bioset has introduced an Advanced High Performance Screw Press for high solids cake to the American market. The Advanced High Performance Screw Press offers a flexible dewatering solution for a wide range of facilities for digested and undigested biosolids. The precision machined screen and replaceable sealing lip produce high solids capture rates with low power and wash water consumption. Wash cycles occur without interrupting the dewatering process allowing greater uptime and dewatering capacity. The Advanced High performance Screw Press offers simple start up and shut down cycles as well as the ability of fully automatic and unattended operation.



Financial Considerations

The following chart shows the cumulative amounts the IWSD would have spent on sludge hauling (disposal) over the next few years compared to the capital and processing costs of running the Schwing Bioset Equipment (including chemical costs and electricity). The chart indicates a break-even point around the year 2019.



Fertilizer License

IWSD further decided to obtain a bulk fertilizer license from FDACS. The IWSD had a staff competition to select the name for the product. The winning entry was Organi'Kalee. The IWSD's FDACS fertilizer license was issued on February 7, 2014.



Construction of the facility is proceeding, and IWSD expects to begin processing Class AA biosolids by April 2014.



Facility Under Construction - Small Footprint

IWSD utilized Thornton Laboratories to determine the guaranteed analysis of the fertilizer product and will provide a copy of their label to purchasers of the product in accordance with FDACS rules.

Brand Name: Organi'Kalee
3-1-0
Guaranteed Analysis:

Total Nitrogen (N).....	3.00%
1.00% Water Soluble Nitrogen	
2.00 % Water Insoluble Nitrogen**	
Available Phosphate as (P ₂ O ₅).....	1.00%
Soluble Potash (K ₂ O).....	.00%
Calcium (Ca).....	17.00%


Derived From: Biosolids and Calcium Hydroxide
FDACS Permit Number: F002089

** 2.00% Slowly Available Nitrogen from biosolids.

Additional Information: pH 11.5

This biosolids product meets the Class AA criteria of subsection 62-640.700(5)(b), F.A.C.

Guaranteed by:
Immokalee Water and Sewer District
140 White Way
Immokalee, FL 34142



Recommendations on Proper Storage: Do not stockpile more than one dry ton of unapplied product for more than seven (7) days unless appropriate precautions are taken to prevent the following:

1. Runoff of product
2. Runoff of stormwater that has come in contact with product
3. Violation of odor prohibition of subsection 62-296.320(2), F.A.C.
4. Vector attraction

Recommendations on Usage: Apply this product at a rate that does not exceed your specific crop or plant nutrient needs.

When the facility goes into operation in April 2014, IWSD will begin to realize a significant savings in their annual cost of biosolids disposal.