WASTEWATER BIOSOLIDS MANAGEMENT WITH GREEN VISION

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The City of Goldsboro, North Carolina is located in the Neuse River basin which begins in the middle of the state and runs to the estuarine waters of the Pamlico Sound. This river basin was declared "nutrient sensitive" by the state of North Carolina in 1995. All permitted wastewater dischargers in the Neuse River basin were required by North Carolina to reduce the nitrogen discharged to the river by 30 percent from the baseline year of 1995.

After news of the nutrient problems in the Neuse River reached the City Council, it was decided that Goldsboro would be a leader in North Carolina in protecting the environment. A comprehensive environmental stewardship program was initiated with a goal to reduce nutrients going into the river. In 1995, the city's advanced biological wastewater treatment facility was discharging effluent of 14 mg/L total nitrogen to the Neuse River. In 1997, through plant control modification this was reduced to 4 mg/L in the effluent. By 2000, the city was able to finetune the plant control to further reduce the total nitrogen to 3 mg/L, a 76 percent reduction (from 1995). The plant was able to achieve total phosphorus levels of 0.03 mg/L. Treatment for both total nitrogen and phosphorus is done biologically, without any chemical addition. Even though the levels of nutrients in the treated wastewater effluent were very low, the City Council was determined to do more to protect the Neuse River.

CONSTRUCTED WETLANDS FOR NUTRIENT POLISHING

Two more nutrient reduction projects were planned and constructed. One built in 2002 was a 40-acre constructed wetlands. In a natural wetlands, aquatic plants remove pollutants in the water by plant uptake and by microbial action in the roots and stems of the plants. To mimic nature, 52,000 wetland plants of 13 different species were planted in diked, clay-lined basins, creating a wetlands environment. Four zone types were built in the wetlands; the shallow mixed marsh zone, the deep mixed marsh zone, the transition zone, and the littoral zone. The aquatic plants were selected to match the environment of each zone. Between one to four million gallons per day (mgd) of advanced treated wastewater were sent through the 40-acres of wetlands to "polish" nutrients from the water. The water entering the constructed wetlands had 3 mg/L total nitrogen. The resulting "polished" water had less than 1 mg/L total nitrogen remaining in it prior to being discharged in the Neuse River. The constructed wetlands project cost $3.3 million to build; $1.6 million in grant funds were provided by the North Carolina Clean Water Management Trust Fund to help pay for some of the construction costs. A future constructed wetlands project is being evaluated for the treatment of storm water in a large drainage area in the city to remove total suspended solids as well as nutrients from the urban storm water.

Another nutrient reduction project in 2002 involved building a reclaimed water irrigation system using advanced treated wastewater for use on the municipal golf course and 114 acres of farmlands. The reclaimed water used for irrigation both reduce nutrients from entering the Neuse River and conserve the city's potable water supply. The cost of construction was approximately $3 million. The North Carolina Clean Water Management Trust Fund provided $789,360 in grant funds to help pay for the project.

BIOSOLIDS COMPOSTING FACILITY

In 1997, Goldsboro, began planning a 3.4 mgd expansion of the city's 10.8 mgd wastewater treatment plant. In conjunction with this expansion, plans were made to construct a modified in-vessel composting facility for biosolids and chipped yard trimmings. Land application of biosolids was determined to be too problematic due to inaccessibility to fields during extensive rainy periods and also due to environmental liability. As part of the city's solid waste program, tree limbs are collected from the curb at city residences. The city had no reliable disposal method for these tree limbs. Composting both of these waste streams to create a desirable marketable product solved both problems.

The decision to build a composting facility came with a large price tag. It required a biosolids dewatering facility to be constructed for $2,275,000, in addition to the $7 million composting facility and associated equipment. The City Council decided the long-term advantages outweighed lower cost alternatives, such as land application. Modified in-vessel composting had the benefits of running year-round without weather related problems and creating a Class A, "Exceptional Quality" compost distributed as a soil amendment under the brand name of Gold Dust Compost.

The US Filter IPS composting system was selected as the preferred technology. ARCADIS engineering in Raleigh handled the engineering and project management for both the wastewater treatment and biosolids composting projects. Engineered Construction Company, the general contractor, built the compost facility during 2002. The current capacity of the biosolids composting facility is 7 dry tons/day (6 bays) but is expandable to 9 dry tons/day (8 bays). The biosolids dewatering facility was built at the wastewater treatment facility which is located nearby.

Dewatering consists of a 1-million gallon biosolids storage tank where all the waste activated sludge (0.58 percent total solids) from the advanced biological tertiary treatment plant is held and aerated. A 3,300 square foot building houses two SernaTech belt filter presses (2-meter). The dewatered biosolids (18 percent Total Solids) are carried by screw conveyors to hoppers for loading on the compost mixing trucks.

Tree limbs are brought to the composting facility and placed in the vicinity of a Morbark horizontal grinder (40 tons/hour). The chipped amendment is stored under cover in the nearby 5,000- square foot building to prevent rain from raising its moisture content.

Since the dewatering facility is five-minutes away from the composting operation, two, 22-cubic yard Roto-Mix trucks are used to transport the cake. Each morning prior to loading the compost mixing trucks, moisture content analyses are performed at the city's testing laboratory of samples of the chipped wood amendment and the biosolids cake so the compost mixture "recipe" for the day can be determined.

The compost mixing trucks have scales on them so that the weight-based "recipe" can be measured. First the operator will load a compost mixing truck with chipped wood amendment at the Compost Facility prior to picking up biosolids cake at the wastewater treatment facility. The compost mixing truck uses a large diameter rotor that lifts the ingredients up to two side augers that thoroughly mix the wood amendments and biosolids cake together prior to dumping the loads on the floor in the composting building.

Once inside the composting building (40,000 square feet), the mixture is loaded into one of eight bays by a large heavy-duty loader (Volvo) with a 4 cy bucket. Each bay is 10-feet wide and 235-feet long and 7-feet high. Each new "charge" (10'x 14'x 6') loaded in a bay is assigned a charge number by a computer for tracking purposes.

Agitators mounted on rails mix and reaerate the compost as well as move each charge forward in the bay by 10 feet each day. Each charge has its temperature tracked daily by thermocouples mounted inside the bay walls. This data is sent back to the main control/data-tracking computer to verify that all PFRP (pathogen reduction) and Vector Attraction Reduction requirements have been met. A computer report is generated for each charge verifying compliance. The main control/data-tracking computer also regulates the frequency and duration of operation of 24 blowers that feed air through piping under the compost in the bays.
A 15,000-sq. ft. biofilter was constructed to treat building and process air. The building air is exchanged 12 times each hour into the biofilter by three 60-hp exhaust blowers capable of moving 19,400 cubic feet of air per minute. Plastic "curtains" at each end of the bays help contain process air, improving odor treatment efficiency. The 6-feet high biofilter is built from various layers of materials, as follows (starting at the bottom): small stone, 10-inch air piping, larger stone, coarse pine wood chips, a biofilter mixture (2:1:1 = softwood chips: hardwood chips: leaf compost), and a layer of coarse pine wood chips on the top. An irrigation system is installed to keep the biofilter moist to promote the growth of microorganisms that "scrub" odors.

"GOLD DUST" PRODUCTS
Typically, each compost mixture charge moves to the end of the compost bay in 21 to 25 days. After the charge reaches the end of the compost bay, it is removed by a heavy-duty front end loader to a separate curing building (12,000 square feet). The compost is cured for at least 30-days prior to screening. A 150-ton/hour Ex-tec trommel screen is used to screen the compost to either one-inch or three-eighth inch. The finer screened compost (3/8") is sold as "Gold Dust Compost". The coarser material (1") is sold as "Gold Dust Mulch." The "overs" from the trommel screen are recycled back to the front of the plant.

The City of Goldsboro has enrolled in the U.S. Composting Council's Seal of Testing Assurance (STA) program, becoming the fifth member in North Carolina. Samples of Gold Dust Compost are sent to a STA laboratory every 60 days for testing. A July 2003 analysis showed an N-P-K value of 1.9-2.4-0.43 (dry weight basis), 57.8 percent organic matter, pH of 7.71, and soluble salts of 3.51 dS/m. Gold Dust Compost carries a guaranteed analysis of 1.5-2.0-0.25. The product is also registered with the North Carolina Department of Agriculture as a fertilizer. The city sells Gold Dust Compost mainly to garden centers and landscapers, and it is used in city parks and at the city golf course. The compost product, made from two municipal waste streams, is a perfect fit for the city's goal of environmental stewardship.

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