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**INNOVATIVE USE OF TECHNOLOGY
SOLVES CHALLENGE OF COASTAL DEVELOPMENT**

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ABSTRACT

Wastewater disposal can be a thorn in the side of coastal developers. Very often, beautiful coastal property lies fallow due to the lack of municipal wastewater services and the increasingly stringent regulatory requirements regarding waste disposal.

R.A. North Development, Inc. was faced with just such a situation. The company owned picturesque, valuable property along Carteret County's "Crystal Coast." The lack of municipal wastewater infrastructure essentially prevented any form of residential development from occurring. As a result, the land has remained undeveloped for many years, passing from one developer's hands to another.

The challenge was to find an environmentally-friendly means of treating wastewater that would produce high-quality reclaimed water that would fully comply with state and federal regulatory requirements for beneficial reuse. The solution was state-of-the-art membrane bio-reactor (MBR) technology.

The benefit of a significantly smaller footprint (2.6 acres including reject pond) and fully enclosed tankage helped offset the slightly higher initial capital costs associated with MBR technology. Since direct discharge was not a viable option in this coastal county, McKim & Creed determined that four areas located within the property could serve as infiltration basins with subsurface discharge through the soil to adjacent natural wetlands. With this concept in mind, the owner retained a landscape architect to create water features throughout the site to enhance the natural beauty of the site while also functioning as infiltration basins to dispose of up to 200,000 gallons of reclaimed water daily, even during peak hurricane season. Basin design included ample green space to allow the ponds to surcharge during wet weather by as much as three feet, and incorporated gently sloping, grassed overbanks that can be used by residents as park-areas during dry weather.

To provide additional reliability, McKim & Creed designed a groundwater collection system near the ponds to allow groundwater levels to be lowered during wet weather. This will prevent mounding under the basins that could limit infiltrative capacity. The collected groundwater flows by gravity to a pumping station that sprays the groundwater into buffers adjacent to natural wetlands on the site.

The design of the MBR treatment facility, infiltration basins and groundwater collection systems was completed and permits were received from NCDENR's Aquifer Protection Division in May

2005. As a result of finding a successful wastewater solution using membrane treatment technology, R.A. North Development was able to proceed with the design and construction of a new 530-lot, upscale, residential community called “Cannonsgate at Bogue Sound.”

KEY WORDS

Membrane, infiltration, aquifer, wastewater, residential

INTRODUCTION

Americans don’t want to simply vacation at the coast; we want to live there year-round.

More than half of all Americans live on or near a coast. But creating communities to accommodate those coastal residents can be challenging. Fragile coastal environments make providing even the most basic services, like municipal wastewater, a complicated ordeal.

Take the situation faced by R.A. North Development, Inc. The company owned picturesque, valuable property along North Carolina’s “Crystal Coast” in Carteret County. The property offered vistas overlooking the Intracoastal Waterway, Bogue Sound and the Atlantic Ocean, perfect for an upscale residential development.

Another developer had built an inland marina on the property, but the lack of municipal wastewater infrastructure essentially prohibited any form of residential development. As a result, the land remained undeveloped for many years, passing from one developer to another.

METHODOLOGY

Complexities abound

Other local developers in the area have had limited success with using small, pre-engineered wastewater treatment plants (“package plants”) to accommodate new residential developments. These facilities have historically been permitted with either surface water discharge or land application of the biologically-treated effluent. Unfortunately, most of the existing package plants in the area have failed to produce complying effluents, resulting in widespread water quality problems in local surface waters.

Environmental concerns, in recent years have caused the North Carolina Department of Environment and Natural Resources to enforce more stringent environmental regulations which effectively preclude new direct discharges from wastewater treatment facilities. The remaining alternatives include land application of biologically treated effluents or treatment to produce a reclaimed water that can be beneficially reused for irrigation, cooling water makeup, process water or other industrial uses. Both of these options are land intensive and require sites with favorable environmental conditions to obtain the necessary permits.

The wetlands that surround the site owned by R.A. North Development add considerably to both the aesthetic value of the location as well as to the complexity associated with designing a viable

wastewater treatment and disposal system to serve the new residents. R.A North Development required an environmentally friendly solution to their wastewater challenge. For these reasons and the high property value in the development, conventional solutions were not viable.

Emerging technology provides answer

If the property was to be developed, the challenge would be to find an environmentally friendly means of treating wastewater to produce a high quality reclaimed water that could be beneficially reused on the property. A number of wastewater treatment technologies have been developed in recent years that have reliably proven to produce high-quality product water which can be beneficially reused for such purposes as irrigation, cooling tower make-up, industrial process water, and car washing. On the recommendation of McKim & Creed, the owner's consulting engineer, R.A. North Development selected state-of-the-art membrane bio-reactor (MBR) technology which will reliably produce a reclaimed water that will fully comply with State and Federal regulatory requirements for beneficial reuse.

The benefit of a significantly smaller footprint (2.6 acres including reject pond) and fully enclosed tankage helped to offset the slightly higher initial capital costs associated with MBR technology. In addition, the higher quality effluent provided additional options to the Owner relative to beneficial reuse on the site.

Since direct discharge was not a viable option in this coastal county, the next challenge was to find a means of beneficially reusing the reclaimed water on-site. After completing extensive site and soil analyses, McKim & Creed determined that four areas located within the property had the potential for use as infiltration basins with subsurface discharge through the soil to adjacent natural wetlands. With this concept in mind, the Owner retained a landscape architect to assist him in creating water features throughout the site. The objective was to create natural-looking ponds as a means of enhancing the natural beauty of the site, while at the same time functioning as infiltration basins to dispose of up to 200,000 gallons of reclaimed water daily.

McKim & Creed was tasked with designing four ponds in areas where soils were conducive for infiltration and for insuring the system had capacity to infiltrate up to 200,000 gallons per day, even during peak hurricane season. To meet this challenge, McKim & Creed designed the basins with ample green space surrounding them to allow the ponds to surcharge during wet weather by as much as three feet. The design incorporates gently sloping overbanks which are to be grassed so that these green areas can be used by residents as park-areas during dry weather, but which can be flooded on a short-term basis during peak wet weather conditions. To provide additional reliability, McKim & Creed designed a groundwater collection system in the vicinity of the ponds to allow groundwater levels to be lowered during wet weather to prevent mounding under the basins that would limit infiltrative capacity. The collected groundwater flows by gravity to a pumping station that is used to spray the groundwater into buffers adjacent to natural wetlands on the site.

RESULTS

The design of the MBR treatment facility, infiltration basins and groundwater collection systems were completed and permits were received from NCDENR's Aquifer Protection Division in May 2005. Bids were received for construction of the facilities from three local contractors in September and construction was completed this summer. Total construction cost for the 0.2 MGD dual train MBR treatment facility including influent screen, influent equalization basin, biological nutrient removal system, MBR, UV disinfection system, lined five-day reject pond, odor control system, reclaimed water pumping station, reclaimed water distribution system, (4) one-acre infiltration basins, groundwater collection and pumping system, groundwater spray irrigation system, control building, access road, electrical and control systems was \$4.85 million (\$24.25 per gallon of treatment/disposal capacity). The facility has capacity to handle sewage flows from up to 530 residential homes on the property and will also accommodate septage collected at the inland marina.

CONCLUSIONS

As a result of finding a successful wastewater solution using membrane treatment technology, R.A. North Development was able to proceed with the design and construction of a new 530-lot, up-scale, residential community called "*Cannonsgate at Bogue Sound*".

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