Construction of Three Digesters and a Mixing Tank for the Brightwater Treatment System

Brightwater Wastewater Treatment System

Built with the Environment in Mind

To meet the growing service demands of the Puget Sound region over several decades, King County, Washington, is building one of the most sustainable wastewater treatment systems in the country. This 1.8 billion dollar project, with its conveyance outfall partly funded through the Clean Water Act State Revolving Fund, is King County's largest clean-water capital project in 40 years, and incorporates sustainable design and building practices in all facets of its construction and future operations.

Brightwater will treat on average about 36 million gallons of wastewater per day, using membrane bioreactor technology. Thirteen miles of pipes and pumps stretch underground, taking wastewater to and from the plant, with a marine outfall more than a mile long and 600 feet deep. The Brightwater Team will build a 15,000 square foot environmental education and community center with sustainable design elements on their 114 acre site, which also includes approximately 70 acres of public open space. Construction is expected to be completed in 2011.

From the beginning, the Brightwater Team made a commitment to sustainability. The architects, engineers, and contractors working on the project have been dedicated to protecting natural resources, limiting the impacts of construction, and leading the way in the development of sustainable practices.

Brightwater used four key sustainable practices including:

- Using Coal Fly Ash in Concrete as a Cement Substitute
- Retaining Excavated Soils Onsite to Visually Screen Wastewater Processing Areas
- Reusing Materials to Create Salmon Habitat & Reforestation Area
- Building Green Onsite Environmental Education & Community Center

Project Highlights

LOCATION AND BUILDING SPECS:

A 36-million-gallons-per-day regional waste treatment facility, located on a 114-acre site in Woodinville, Washington.

DESIGN:

Facility architects, engineers, and contractors incorporated a variety of sustainable design and building practices. The site includes a salmon habitat, a reforestation area, and an environmental education and community center.

MATERIALS REUSED OR RECYCLED:

The Brightwater Team **used 13,800 tons of fly ash** as a cement substitute, **reused and recycled construction and demolition (C&D) materials, reused 200 trees and root wads** for salmon habitat, **recycled 15,000 cubic yards** of compost material, and **used recycled materials** in the environmental education and community center.

IMPACT:

To date, the Brightwater Team has **diverted 67% of all C&D materials, reused more than 370,000 tons of material in construction**, and **saved more than $500,000** from the reuse and recycling of materials. Environmental benefits include **reducing 12,723 metric tons of CO_2 emissions** from the recycling and reuse of fly ash and concrete and **eliminating approximately 925,000 vehicle miles** through the reuse of excavated soils onsite.

Sustainable Practices: From Start to Finish

Using Coal Fly Ash in Concrete as a Cement Substitute. Concrete containing coal fly ash was used in the treatment facility, portal, and deep tunnel conveyance. The concrete mix utilizes 120 pounds per cubic yard of fly ash in lieu of cement. Since the start of the treatment plant construction, 13,400 tons of fly ash has been recycled by using it as a cement substitute. Similarly, in 2008, 400 tons of fly ash was used in the conveyance tunnel construction. Recycling these 13,800 tons of fly ash results in a 12,543 metric tons CO_2 emission reduction[1], which is equivalent to the annual greenhouse gas emissions from 2,297 passenger vehicles.[2]

Construction workers pour concrete containing fly ash

Retaining Excavated Soils Onsite to Visually Screen Wastewater Processing Areas. The construction team used excavated soil to create landforms and buffers—attractively screening processing areas from public view. By eliminating the need to haul excavated material offsite, the number of truck trips to and from the site was significantly reduced. Brightwater estimates that this saved 37,000 truck trips of 25 miles each—eliminating approximately 925,000 vehicle miles.

Creating a Salmon Habitat & Reforestation Area. The northern 43 acres of Brightwater have been redeveloped as a restored and enhanced salmon habitat and reforestation area.

[1] Estimated using EPA's Waste Reduction Model (WARM) (updated August 2008), http://www.epa.gov/warm

[2] Estimated using EPA's Greenhouse Gas Equivalencies Calculator (updated February 2009), http://www.epa.gov/cleanrgy/energy-resources/calculator.html

Reused trees and root wads in the salmon habitat

Features include:

- Reused more than 200 trees and root wads (cost savings: $20,000);
- Planted over 22,000 native plants including 5,000 seedlings;
- Recycled approximately 15,000 cubic yards of compost material (cost savings: $450,000);
- Restored approximately 1,350 feet of stream corridor and added 350 feet of new stream corridor;
- Created 29,000 square feet of pond habitat;
- Constructed 4 acres of enhanced emergent and forested wetland habitat; and
- Provided infiltration for stormwater runoff during construction in the established forest.

Building On-Site Environmental Education & Community Center. The Center is in the process of pursuing Gold level certification or higher through the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED)® standard.

Sustainable building design elements include:

- Incorporating natural ventilation and daylighting
- Installing energy efficient lighting and ENERGY STAR® appliances
- Utilizing temperature controls and radiant floor heating from waste treatment plant energy
- Purchasing low-flow toilets that use reclaimed water from the treatment plant
- Using reclaimed water for irrigation
- Building a green roof
- Educating the public about the green building elements

Cost Savings and Benefits

Overall, the Brightwater Team has achieved a 67% diversion rate of all construction and demolition materials to date. The Brightwater Team consistently looks for opportunities to first reuse materials onsite and then recycle where reuse is not possible. In all, more than 370,000 tons of materials have been reused in construction. Of this, 3,900 tons alone were concrete, and its reuse saved the project approximately $39,000. The concrete reuse also resulted in 180 metric tons CO_2 emission reduction,[1] which is equivalent to the annual greenhouse gas emissions from 33 passenger vehicles.[2] The reuse of landscaping debris and onsite compost material saved $470,000. In addition, using 13,800 tons of fly ash as a cement substitute resulted in a 12,543 metric tons CO_2 emission reduction, which is equivalent to the annual greenhouse gas emissions from 2,297 passenger vehicles. Additional cost savings and environmental benefits from the reuse and recycling of industrial materials are expected throughout the construction of this vital project.

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CONSTRUCTION INITIATIVE CASE STUDY
EPA PUBLICATION NUMBER: EPA530-F-09-005
JULY 2009

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