Chapter 7

Biosolids Recycling and Energy Recovery

Biosolids are the nutrient-rich organic material produced by treating wastewater solids. After they are processed and treated, biosolids can be beneficially reused as a fertilizer and soil amendment. RWSP biosolids policies guide King County to continue to produce and market Class B biosolids and to evaluate alternative technologies to produce the highest quality marketable biosolids, including Class A biosolids.[1, 2] In addition, the policies call for the county to use methane, also produced during solids processing at the treatment plants, for energy and other purposes where cost-effective.

This chapter describes biosolids recycling and energy recovery accomplishments in 2008 in the following areas:

- Production and use of biosolids
- Biosolids research studies
- West Point Treatment Plant digestion improvements
- West Point Treatment Plant influent screening improvements
- Transition to International Organization for Standardization (ISO) 14001
- Request for Information on market options to supplement, strengthen, or diversify existing biosolids program
- A proviso in the 2009 King County Budget (adopted in November 2008) relating to the biosolids program
- Producing energy from methane that is generated during solids treatment
- Energy efficiency efforts.

More information on the Wastewater Treatment Division's (WTD) biosolids program is available at http://www.kingcounty.gov/environment/wastewater/Biosolids.aspx.

More information on WTD's energy recovery efforts is available at http://www.kingcounty.gov/environment/wastewater/EnergyRecovery.aspx

[1] Class B biosolids refer to biosolids that have been treated to significantly reduce pathogens to levels that are safe for beneficial use in land application.

[2] Class A biosolids refer to biosolids that have been treated to reduce pathogens to below detectable levels. Biosolids that meet this designation can be used without site access or crop harvest restrictions and are exempt from site-specific permits. Federal regulations require Class A level of quality for biosolids that are sold or given away in a bag or other container or that are applied to lawns or home gardens.

7.1 Production and Use of Biosolids in 2008

In 2008, WTD continued to produce high-quality Class B biosolids at the South and West Point Treatment Plants. Approximately 116,000 wet tons of biosolids were produced during the year, all of which was beneficially recycled and used as a fertilizer and soil amendment for forestry and agricultural applications and to make compost. The sale of biosolids generated $141,000 in fertilizer revenue from customers.

King County's biosolids were used as a fertilizer and soil amendment for a variety of applications:

- 5,220 acres of dryland wheat in Douglas County as part of the Boulder Park Soil Improvement Project
- 1,375 acres of hops and wheat at Natural Selection Farms located in the Yakima Valley
- 311 acres of state forestlands and 1,188 acres of Douglas-fir plantations in Hancock's Snoqualmie Forest as part of the Mountains to Sound Greenway Biosolids Forestry Program.

In addition, about 3 percent of King County's biosolids were used in GroCo compost. For more than 30 years, GroCo, Inc., has been producing and marketing this compost, which is a mixture of biosolids and sawdust, for use in residential and commercial landscaping, home gardens, and soil restoration.

Figure 7-1 shows the breakdown of how King County's biosolids were used in 2008.

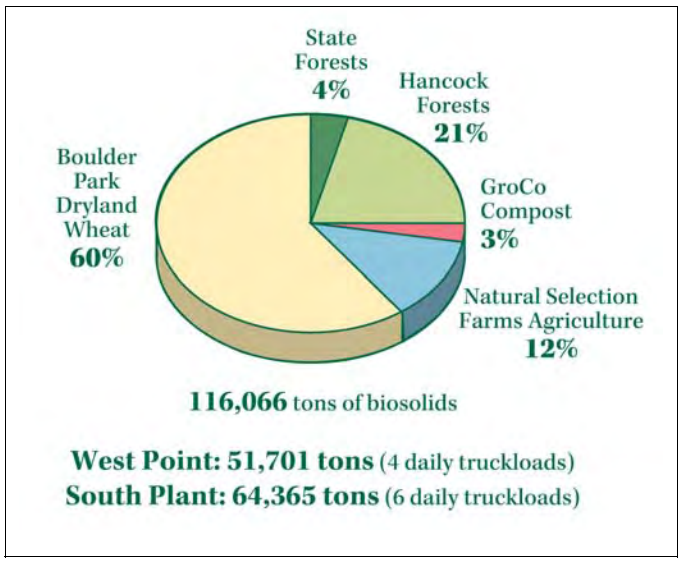

Figure 7-1. Breakdown of King County's Biosolids Uses in 2008

7.2 Research Studies

WTD participates in biosolids research studies through its membership in the Northwest Biosolids Management Association (NBMA). The NBMA is composed of more than 200 wastewater agencies and private companies that manage biosolids in Washington, Oregon, Idaho, Alaska, and British Columbia.

The NBMA has cooperative agreements regarding biosolids-related research with the University of Washington (UW), Washington State University (WSU), Oregon State University, and the University of Arizona's National Science Foundation Water Quality Center. Recent research efforts have focused on using biosolids as a tool to reduce greenhouse gas emissions by storing carbon in the soil. In 2008, a UW-WSU collaborative research project funded by the Washington State Department of Ecology was launched to quantify the carbon sequestration benefits of using biosolids and other organic residuals as a soil amendment for land application. Soils with and without biosolids are being sampled at existing field sites in Washington State, including long-term research plots and commercial farms, and the samples are being measured for carbon sequestration, water-holding capacity, and nutrient status. The researchers hypothesize that the use of biosolids as a soil amendment has the potential to reduce carbon footprint and at the same time help secure the sustainability of agriculture in the state. The study is expected to be complete in early 2009.

7.3 West Point Treatment Plant Digestion System Improvements

The West Point Treatment Plant Digestion System Improvements project will enhance the reliability of the plant's solids digestion system and reduce the risk of digester upsets under current and future solids loading conditions. The project includes installing tools such as monitors and sensors, modifying the blending storage tank (Digester 6) to enable its use as an emergency backup digester in the event of system instability or failure, improving the mixing system of Digesters 4 and 5, and upgrading the digester feed and transfer system. These improvements will increase operational efficiency and help further the production and recycling of high-quality biosolids into the future.

Project activities in 2008 focused on completing predesign. Final design is expected to begin in 2009 and be complete in 2010.

7.4 West Point Treatment Plant Influent Screening Improvements

Amendments to the state's biosolids management rule (Chapter 173-308 WAC) were made in June 2007. One of the amendments (WAC 173-308-205) requires "significant removal" of manufactured inerts from biosolids by July 1, 2012. Manufactured inerts are wastes such as

plastic, metals, ceramics, and other manufactured items that remain relatively unchanged during wastewater or solids treatment processes.

WTD is carrying out a project to design and construct the necessary modifications to the West Point plant's influent screening facilities to meet this new requirement. The project will replace the current bar screens that have five-eighths inch openings with bar screens that have three-eighths inch openings. A request for proposals for design and engineering services was issued in October 2008, and predesign work is expected to begin in summer 2009.

7.5 Transition to International Organization for Standardization 14001

In 2008, WTD began efforts to make a transition from its existing environmental management system (EMS) for biosolids to the International Organization for Standardization's EMS, known as ISO 14001. The ISO 14001 standard has international name recognition and broad public acceptance, is applicable to more of WTD's operations than other EMS certifications, and fits into the division's vision of "Creating Resources from Wastewater."

An EMS consists of a series of standard procedures and practices that organizations put in place to manage their environmental obligations. It provides a framework through which an organization looks at how its activities interact with the environment and how it can minimize any adverse impacts. Under an EMS, environmental stewardship becomes part of the daily responsibility across the entire organization.

Activities in 2008 focused on developing a manual that outlines how WTD will meet the requirements for ISO 14001 certification. The manual is scheduled to be finalized and published in February 2009. The next step in the transition process is to achieve ISO 14001 certification for the solids "fenceline."[3] This fenceline consists of source control/pre-treatment; removal and transport of grit and screenings; solids digestion, dewatering, and hauling; and land application of biosolids.

Anticipated near-term milestones in the ISO 14001 certification process are as follows:

- Compile necessary operating procedures and other documents related to the solids fenceline by June 2009
- Conduct internal solids audit in fall 2009
- Evaluate how the EMS is being implemented in the solids fenceline in winter 2009 and recommend other WTD fencelines for ISO certification
- Conduct the first official ISO certification audit for the solids fenceline in early 2010.

[3] "Fenceline" refers to a functional area of WTD operations and supporting activities identified by WTD for ISO certification.

7.6 Request for Information

In July 2008, WTD issued a request for information (RFI) to learn about market options available for supplementing, strengthening, or diversifying its existing biosolids program. Because the county is occasionally approached by vendors promoting other potential uses of biosolids, such as using biosolids as an alternative energy source or for land reclamation, WTD was interested in learning more about and comparing various options. It was especially interested in options that (1) avoid or manage the impacts of winter weather on biosolids transportation; (2) reduce the amount of diesel fuel used for transportation; or (3) use biosolids as a tool to reduce emissions of greenhouse gases. The goal of the RFI process is to provide the county with information on options for biosolids management in the next decade that are reliable, cost-effective, publicly acceptable, and provide multiple environmental benefits.

Twelve responses to the RFI were received in October 2008. The responses included information on using biosolids as an energy source, as a fertilizer and soil amendment, as material for compost, and as a tool to reclaim disturbed sites such as mines and gravel pits. Evaluation of the uses of biosolids provided in the responses is expected to be complete in early 2009. A summary of the findings will be included in the report that responds to the proviso in the 2009 King County Budget (described in the next section).

7.7 Budget Proviso

The 2009 King County Budget, which was approved by the King County Council in November 2008, includes a proviso directing WTD to transmit a report to the council for review and approval by motion. The report is to cover (1) the status of the work program for the biosolids program; (2) an analysis of alternative uses of biosolids being considered, but not limited to those proposed via a Request for Information in 2008, with the analysis including attributes, risk and reliability, flexibility, community support, cost and benefits; (3) recommendations for next steps; and (4) a schedule of potential implementation of biosolids alternatives utilization. The budget proviso calls for the report to be submitted by April 1, 2009.

7.8 Producing Energy from Methane

Digester gas is energy-rich methane gas naturally produced during solids treatment by microorganisms degrading solid organic matter. It can be used to generate heat, electricity, and natural gas. This section discusses energy recovery efforts in 2008 at WTD's regional treatment plants.

7.8.1 Energy Recovery at South Treatment Plant

At South plant, digester gas is used to fuel a boiler that provides heat for plant processes and buildings. The remainder of the gas is naturally "scrubbed" and sold to the local natural gas utility because this is the most cost-effective operating scenario right now. During months of

high energy use, a turbine cogeneration system consisting of two gas turbines and one steam turbine (Figure 7-2) may be used to generate supplemental heat and electricity and reduce peak load utility charges for the plant. The gas turbines run on scrubbed digester gas; the steam turbine runs on heat recovered from the gas turbines.

In 2008, about 0.23 million kilowatt hours of electricity were produced at South plant, which is enough to power 25 typical Seattle homes, and 2.1 million therms of natural gas was sold to Puget Sound Energy, which is enough to serve more than 2,500 homes.

1-megawatt steam turbine

3.4-megawatt gas turbine

Figure 7-2. Turbine Cogeneration System

7.8.2 Energy Recovery at West Point Treatment Plant

At the West Point plant, digester gas is used to fuel (1) internal combustion engines that provide power to run the raw sewage pumps and (2) boilers that provide heat for plant processes and buildings. About 28 percent of the digester gas produced at West Point is used for these purposes.

WTD is carrying out a Waste-to-Energy project at the West Point plant to install a new cogeneration facility so that digester gas can again be used to generate electricity at the plant. The previous power cogeneration engines, installed in 1984, were removed from the plant site in 2008 after reaching the end of their useful life. The Waste-to-Energy project includes installation of two new internal combustion engines capable of supplying up to 4.6 megawatts of power. The engines are expected to begin producing power in 2012. Efforts in 2008 focused on work to secure a U.S. Environmental Protection Agency (EPA) grant to help fund the project. Work also included completion of National Environmental Policy Act requirements for establishing grant eligibility, which resulted in EPA issuance of a Finding of No Significant Impact for the project in May 2008. Final design efforts began in September 2008 and are expected to be complete in spring 2009. EPA grant appropriation will occur when design documents are 100 percent complete.

Efforts in 2008 also included work to ensure compliance with the National Historic Preservation Act (NHPA). Because the West Point plant site contains archaeological sites eligible for listing on the National Register of Historic Places, the NHPA requires development and execution of a memorandum of agreement (MOA). The MOA must describe how impacts to archaeological resources will be avoided and how any archaeological resources disturbed by the project will be

handled. WTD began working with the Muckleshoot Indian Tribe, the Suquamish Tribe, the Tulalip Tribes, EPA, the Washington Department of Archaeology and Historic Preservation, and the King County Historic Preservation Program to develop the MOA in 2008. The goal is to have the MOA negotiated and signed by these parties in 2009.

In 2008, efforts were also under way to negotiate a renewable power purchase agreement with Seattle City Light. The agreement will include information on the amount of electricity that WTD will have available for sale to City Light, the rate structure, and applicable renewable energy credits associated with project implementation.

7.8.3 Energy Recovery Efforts at Brightwater Treatment Plant

Some of the digester gas that will be produced at the Brightwater Treatment Plant will be used to fuel a boiler that generates heat for the digestion process and for buildings. In addition, plans are under way to develop an Energy Technology Demonstration Facility (ETDF) at the plant site for research of potential technologies for producing alternative forms of energy from digester gas. The goal of the ETDF is to provide a versatile platform for researchers and manufacturers in the Pacific Northwest to beta test a wide variety of nearly or commercially ready equipment using methane gas from the Brightwater plant for fuel.

Friends of the Hidden River, a community group of local teachers, continues to work with King County to develop broad support and secure funding for the ETDF. In 2007, grant funding was secured for civil and structural design, which was completed in 2008. In 2008, the county received $75,000 from the Washington State Legislature to complete the electrical design. Final design of the facility is expected to be complete in May 2009. Funding for construction is being sought from a mix of private and public sources.

7.9 WTD Energy Efficiency Efforts

The King County Energy Plan, drafted in 2007, contains two specific goals for WTD to reach by 2012: (1) achieve a 10 percent reduction in energy use, based on both the amount of water treated and the level to which it is treated, and (2) use renewable sources to satisfy 50 percent of WTD’s energy demand.

Since 2007, WTD has been working on an energy plan to meet these goals and maintain a reliable energy supply. Treatment plant staff energy teams meet regularly to discuss ways to reduce energy usage at the plants. Energy audits are planned for WTD facilities that are high energy users (South and West Point plants and various pump stations). The goal of the audits is to identify opportunities to increase energy efficiencies at these facilities. In addition, the division is seeking funding to carry out other projects focused on energy efficiency and energy recovery. One recent example includes incentive funding from Puget Sound Energy to help defer initial capital investment costs associated with replacing two preaeration blowers at South plant with more efficient blowers.