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Establishing the Organics Cycle
in Washington State

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Executive Summary

The Washington State Department of Ecology is charged with protecting, preserving and enhancing Washington's environment; and promoting the wise management of air, land and water for the benefit of current and future generations. To support this mission, Ecology's Solid Waste and Financial Assistance Program and the Hazardous Waste and Toxics Reduction Program have together launched the Beyond Waste Project. This project will guide Washington in a new direction, from containing and managing wastes toward creating systems where waste does not exist – systems that prevent waste in the first place, view materials as valuable resources, and eliminate toxics.

Ecology's Beyond Waste vision:

"We can transition to a society that views wastes as inefficient uses of resources and believes that most wastes can be eliminated. Eliminating wastes will contribute to social, economic, and environmental vitality."

The consultants for this project, Cascadia Consulting Group and Ross and Associates, have identified organic wastes as a strong starting point for moving forward with Ecology's Beyond Waste Vision. Organic wastes are generated in large quantities by virtually every sector of the economy, including households, businesses, industry, and agriculture. Recovering these wastes has the promise to create jobs and economic vitality, improve soil health, create alternative energy, and influence other environmental concerns such as water quality.

The consultants have prepared an action plan to gradually transform the system to one where all organic wastes are recovered for beneficial use. This plan was assembled based on an analysis of the opportunities and benefits of recovering organic material, the barriers to economically-viable markets and infrastructure development, and the leverage points (places where small pushes can create large outcomes) available to induce change.

The plan focuses on actions Ecology and its partners can take to 1) Strengthen Markets; 2) Develop Infrastructure; and 3) Transform the System (through behavior change, economic incentives, and changes in product design). Following are recommended immediate (0 – 3 years), near-term (3-10 years), and long-term actions (10 – 30 years) to bring about the Beyond Waste Vision for organic wastes and materials.

RECOMMENDATION: DEVELOP INFRASTRUCTURE

New infrastructure will be required to collect and process organic wastes. The consultants recommend that the following actions be taken if Ecology chooses to purse the Beyond Waste vision for organics:

- **Immediate actions** should focus on: communicating the vision to, and obtaining commitments from, local governments and stakeholders; establishing goals and milestones; and conducting pilot projects, research, and feasibility studies.
- **Near-term actions** should focus on putting infrastructure in place, through direct contracts, stakeholder and government facilitation, economic incentives, and possibly legislative mandates.
- **Long-term actions** should focus on restructuring the current solid waste system from one optimized for disposal to one optimized for recovery. This applies to organics as well as other materials in the waste stream.

RECOMMENDATION: STRENGTHEN MARKETS

The consultant's research highlighted the need to create *demand pull* for organics, where end-users place a high value on recycled organics and seek out products with specific quality criteria. Processors develop and manage their operations based on the needs of end users, rather than on the *supply push* of organic wastes separated from the waste stream. Should Ecology choose to pursue the Beyond Waste vision for organics, the consultants' recommendations for strengthening markets would include the following.

- **Immediate actions** should focus on: launching a statewide education campaign to communicate the value of healthy soils, developing quality and content standards, researching new markets, and increasing government procurement requirements.
- **Near-term actions** should focus on researching and developing high-value products; demonstrating and communicating the benefits of using recovered organics; cleaning up the organics stream -- possibly instituting labeling requirements to communicate compost quality and content.
- **Long-term actions** should include the following, as needed: continued education and technical assistance to maintain demand, continued state government procurement requirements, and continued research and development into new products and applications.

RECOMMENDATION: TRANSFORM THE SYSTEM

In addition to infrastructure development and strengthened markets, some system-wide behavior, economic, and design changes could help facilitate creation of a viable organics cycle of collection, processing, and end-use. If Ecology chooses to pursue the Beyond Waste vision for organics, the following actions would be useful.

- **Immediate actions** should include forming a cross-agency team to integrate programs and reform regulations, evaluating and developing economic incentives to facilitate the organics cycle, and defining and evaluating approaches to address product design, feedstock contamination, and process issues.
- **Near-term actions** should focus on implementing economic incentives; enacting regulatory and institutional reform; pursuing initiatives to address product design, feedstock contamination, and process issues; and linking organics recovery to green energy, the carbon cycle, and climate change.
- **Long-term actions** should focus on using legislative action, incentives, and mandates, as needed; continuing regional and/or national initiatives to fully address product and process design issues.

The Action Plan presented in this paper provides a road map for Ecology and its partners to pursue to create significant momentum on the organics cycle. With focused attention on obtaining commitments to the Beyond Waste vision, creating favorable conditions for organics recovery, providing support for implementation of new programs, and targeting continuous improvement, Ecology and its partners can set the stage for a robust organics cycle in Washington State.

1. Introduction

This paper is about how the Washington State Department of Ecology (Ecology) and its partners can provide leadership concerning organics recycling, including the collection of organic, biodegradable materials from current waste streams and transformation into valuable products. To support its Beyond Waste vision and planning process, Ecology has been conducting research into what actions can be taken to dramatically shift the state's current approach to waste and materials management. Ecology's vision states that the elimination of wastes will contribute to an abundant society of social, economic, and environmental vitality. This paper supports this vision by defining current organic waste issues, exploring a menu of policy options, and recommending future actions the State can take to create vitality by producing valuable products and establishing a viable "return flow" cycle for virtually all organics.

Ecology's Beyond Waste vision:

"We can transition to a society that views wastes as inefficient uses of resources and believes that most wastes can be eliminated. Eliminating wastes will contribute to social, economic, and environmental vitality."

For the purpose of this paper, organic materials are those that are of biological origin and can safely be returned to the soil without depositing synthetic materials and toxins.[1] Focusing on these organic, biodegradable materials is a strong starting point for eliminating wastes in Washington because:

- **Organic wastes represent a large fraction of current waste streams** – they comprise about 40% of most municipal solid waste (MSW), and also are generated in large quantities by agricultural, forestry, and industrial operations;
- **The potential for beneficial use of organics is very high** -- in fact, many see recovery and use of organics as essential to a sustainable economy and natural resource base, and trends are underway (such as the increased use of organic matter in amending soils) to increase use of organic "waste" material; and
- **Washington is already significantly along the way towards establishing a viable organics cycle** – yard waste and biosolids, once disposed, are now being recovered for beneficial use at very high rates.

The purpose of this paper, then, is to recommend how Ecology and its partners can build on past successes and leverage existing trends to establish a viable, statewide system of organic material collection, processing, and end-use. A key component of such a system is that organic materials would no longer be considered waste, but would be considered feedstock for valuable products demanded by the public. This type of system has been described by Matt Cotton of the U.S. Composting Council as *demand pull* rather than *supply push* (Cotton and Stone 2002). In other words, consumers will place value on processed organic materials, and local governments will no longer have to push these materials into the marketplace. Such a system could achieve Ecology's waste reduction goals while also contributing to the economic vitality of the region. The

[1] This definition is adapted from McDonough and Braungart (2002). In some cases, a material (such as manure) may be present in such quantity that it could not be safely returned to the soil in its present form. It is still in its essence an organic material, and with proper handling, processing, and application could be returned to the soil.

goal of this report is to provide information about how the Department of Ecology can work with its partners to create such a future.

FOCUS IS ON RECOVERY, NOT SOURCE REDUCTION

As discussed above, this paper focuses on establishing a viable system of organic material recovery and reuse. However, solid waste managers often focus on source reduction, or eliminating waste in the first place. This report will emphasize strategies to encourage source reduction when appropriate, but we make the fundamental assumption that most organic "wastes" are necessary byproducts that have potential value as resources. For example, crop residues (such as wheat straw) and animal manures are necessary byproducts of food production, and cannot be eliminated through traditional "source reduction". Although some may consider these materials as wastes, the point of creating an organics cycle is that these materials are actually resources that have productive, beneficial uses. The goal then is to maximize the effective, beneficial use and value of each material so as to eliminate the "inefficient use of resources," as cited in the Beyond Waste Vision. In many cases, this transformation will require collection and processing systems; in other cases on-site methods may be the most efficient and effective.

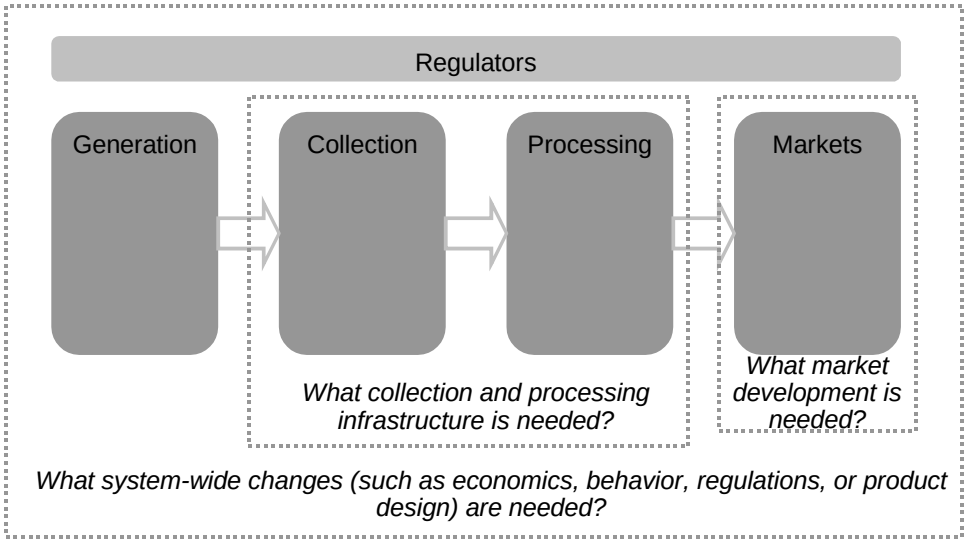
KEY QUESTIONS

The driving question fueling the research behind this paper has been *what changes are needed to recover most organics in Washington?* More specific, supporting questions this paper will address are:

- *What market development is needed?*
- *What collection and processing infrastructure is needed?*
- *What system-wide changes (such as economics, behavior, regulations, or product design) are needed?*

These questions were designed to uncover needed changes in a material recovery system's many stages, which are commonly characterized as *generation, collection, processing,* and *markets*. Figure 1 depicts how the key questions relate to these stages of the supply chain.

Figure 1: Key Questions Addressed by this Paper



METHODOLOGY

The research team relied on several means of collecting and analyzing information in preparation for this report.

- **Interviews and meetings** were conducted with members of Ecology, local governments, private processors, industry consultants, and representatives from trade associations. These conversations helped frame the current practices and issues of organics recovery and visions for a future, fully functioning organics cycle. Appendix A lists the people contacted as part of this research.
- **Literature research** enabled us to collect pertinent articles in industry and academic journals, and review the content of compost agency websites. This research supplemented personal interviews to further establish future possibilities and to help evaluate options. A list of sources consulted can be found at the end of this report.
- **The consultant's expertise in the field.** The consultant team has a long history of research, policy, and education work related to organic wastes in Washington. Our previous research, extensive library, personal experience, and attendance at recent conferences lent considerable detail to this process.

Scope of the Research

Work on this Issue Paper was limited by time and budget in several ways:

- First, the focus is on how to establish a viable organics cycle via expanded markets, improved economics, behavior change, and collection programs or on-site management -- not on how to eliminate organic wastes and materials in the first place (see "Focus is on Recovery", above.)
- Second, findings and conclusions are based on a literature review and interviews, rather than on in-depth analysis of primary data.
- Third, the assessment addresses policy level issues covering a broad range of organic materials and Economic Actor Sectors. Accordingly, it does not provide an in-depth feasibility analysis of the costs, benefits, and technology requirements of specific organics recovery options (such as food waste from residences or manure from dairy farms).

- **Economic research** consisted of compiling cost and price information at different points along the organics supply chain and gain insight into the current and future economic viability of system options.
- **An assessment of possible tools** consisted of evaluating possible actions by Ecology and its partners based on political and technical feasibility, cost-effectiveness, and expected outcomes.

Naturally, this analysis is limited by the inability to predict the future societal and economic trends that will influence both waste generation and the value of natural resources. Furthermore, the State has limited control over Washington's material economy and the economic parameters that strongly affect the marketplace. Nevertheless, the research team has focused its research and analysis on identifying opportunities where organized and concerted strategic actions by Ecology or other government entities can have significant future impacts.

The results of this work are presented below in four sections. Chapter 2 describes the current state of organics recovery. Chapter 3 outlines the opportunities, likely directions, barriers, and leverage points related to establishing the organics cycle. Chapter 4 evaluates the tools that Ecology and its partners could use to realize the opportunities and dissolve the barriers, and Chapter 5 sets forth an action plan to make these viable organics-recovery systems a reality.

2. Current Status

Recovery of organic materials has grown rapidly in the past 20 years, driven largely by government focus on waste diversion. Beginning in the mid to late 1980's, many local governments in Washington began turning to yard waste recovery (primarily grass clippings and leaves) as a means of increasing their recycling rates. Local curbside and drop-off collection programs, coupled in some cases with bans on disposing yard waste, have reduced the amount of yard waste being landfilled while increasing production of valuable compost. Statewide, the recovery of yard waste has grown from almost nothing in 1988 to about 450,000 tons in 2001 (WDOE 2001). This growth is a notable success story, and provides momentum to help recover even greater quantities of yard waste and other organics.

Similarly, recovery of biosolids from wastewater treatment plants has grown substantially in the last couple decades. In the early 1970's, virtually all biosolids were disposed in landfills or incinerated. Recovery of biosolids increased gradually to about 50% in the late 1980's, rising rapidly to the present rate of 80 – 85% recovery by the early 1990's (Dorsey 2002).

Currently, there is much discussion among government planners and private organics processors about the next frontier of organics collection. Discussions often center on food waste from residential, commercial, and industrial generators; and on agricultural wastes such as crop residues and manures. Certainly, there is room for

Yard Waste recovery in Central Puget Sound

Local governments in central Puget Sound have taken an aggressive tiered approach to yard waste recovery. By launching "Master Composter" programs and compost bin sales to encourage home composting, promoting Grasscycling through mulching lawnmowers, and implementing collection services with rate-based incentives, these local governments have more than doubled their quantities of yard waste recovered in the last 10 years.

improvement. Given the successes of yard waste and biosolids recovery in the span of less than 20-30 years, it is certainly reasonable to imagine a future organics recovery cycle that meets Ecology's Beyond Waste vision.

ECOLOGY'S ROLE

Local governments, private haulers, and organics processors have implemented most of the existing organics recovery programs in Washington. Ecology's role in these systems has been to provide financial assistance to local governments; technical assistance and training to compost facilities and their operators; and regulations to effectively manage the flow of organic wastes in the state. Ecology has also conducted the statewide biosolids program by developing regulations, issuing permits, and providing oversight and assistance for sewage treatment plants and other facilities that generate, treat, and use biosolids.

In addition, Ecology supports many local efforts by developing school curricula for solid waste issues, providing technical assistance and education to help industries reduce waste, and partnering with local agencies or companies to develop new projects, such as food waste composting at restaurants or emerging organics-processing technologies.

The challenge as Ecology moves forward in its Beyond Waste planning process is to use its existing authority to work with local governments and private sector stakeholders to achieve desired changes. As the central government body charged with overseeing the handling, disposal, and recovery of solid wastes, Ecology will have many opportunities to directly influence the future of waste in Washington. Still, there will likely be many desired changes outside of Ecology's direct oversight, for which creating lasting partnerships will be necessary.

The cultural changes required to achieve the Beyond Waste vision will happen over time. Nevertheless, by planning now for the possible futures and developing strong action plans, Ecology can take a big-picture approach to organize its partners and stakeholders, create effective incentives, and put in place the policies and infrastructure required to achieve its vision.

Ecology's new solid waste regulations

Ecology recently created new solid waste handling standards (WAC 173-350) to replace the previous minimum functional standards (WAC 173-304). A primary feature of the new regulations is an increased focus on waste diversion via composting. The new standards include exemptions for ***beneficial use****, a new regulatory concept that is intended to encourage organics recovery. The standards also include specific provisions for compost facility requirements and compost quality standards.*

CURRENT PROGRAMS AND WASTE GENERATION

Creating the future of organics recovery will necessarily involve understanding the waste stream and capitalizing on trends to transition from, or build upon, the current programs around the state. The following tables display estimates of the quantities of organic materials generated in Washington.

Note that larger quantities do not necessarily carry greater importance. For example, many crop residues are returned to the soil and do not require management as "wastes."

Table 1: Estimated Present and Future Quantities of Municipal Organics Generated in Washington State[2]

Material	Source	Est. Tons in 2002	Est. Tons in 2030
Food Waste	Residential	240,000	330,000
	Restaurants and Grocers	170,000	240,000
	Institutional	40,000	50,000
	Other Commercial (Offices, etc.)	60,000	80,000
Yard Debris	Residential	510,000	710,000
	Commercial (including self-haul)	380,000	530,000
Compostable Paper	Residential	200,000	300,000
	Commercial	200,000	300,000
	Total Municipal Organics:	**1,800,000**	**2,500,000**

Note: Numbers may not add to total due to rounding.

Table 2: Estimated Present Quantities of Agricultural and Industrial Organics Generated in Washington State[3]

Material	Source	Est. Tons in 2002
Manure	Dairy Cow	7,000,000
	Other Cow	7,000,000
	Human	360,000
Crop and Harvesting Residues	Pre-consumer food	1,000,000
	Crop residues	10,000,000
Industrial Residuals	Food processing operations	20,000
	Total Ag/Industrial Organics:	**25,000,000**

Note: Numbers may not add to total due to rounding.

Following are brief discussions of the organic materials generated by key sectors of the economy, the recovery systems currently in place for each sector, and emerging trends in organics recovery.

RESIDENTIAL

Washington's residents generate large quantities of organic wastes at their homes. These include wastes such as grass clippings, leaves, brush and twigs, and food. Other compostable items include soiled paper (paper that is contaminated with food or other

[2] The municipal organics numbers in this table were estimated by Cascadia Consulting Group based on the 1992 Washington State Waste Characterization Study (R.W. Beck 1993) and the 1999 California Statewide Waste Characterization Study (Cascadia 1999) combined with employment projections from the Washington Office of Financial Management. (WOFM 2001).

[3] Ag and Industrial numbers were estimated by Cascadia based on the 1992 Washington State Waste Characterization Study (R.W. Beck 1993), the Washington Agricultural Statistics Service (WASS 2003), and the World Resources Institute (WRI 2000). Sufficient data was not available to project quantities for 2030.

substances that makes it not recyclable), clean lumber, and some textiles. Local waste studies consistently indicate that these materials comprise roughly 40% of municipal solid waste (MSW) generated by the residential sector.

Table 3: Organics in the Residential Waste Stream[4]

Material	Fraction of disposed waste stream
Food	13-26%
Yard Waste	3-7%
Compostable Paper	4-6%
Clean Wood	1%
Textiles	2%
Total	~40%

Local programs to collect organic wastes from residents have focused primarily on collecting yard waste from single-family homes. Such programs are in place in most urban areas, and usually offer both curbside collection of yard waste and drop-off at transfer stations. Programs typically encourage participation by charging a collection or drop-off fee less than that for trash. Local governments either provide collection services themselves or offer them via contracted or WUTC-certificated private haulers. In rural areas, curbside collection services are less common, but in many cases drop-off facilities or private composters accept yard waste for recycling.

In the last few years, Seattle and King County have conducted studies testing the feasibility and potential return on investment of curbside collection of mixed organics, including food waste and compostable paper. Although these local governments are still evaluating the cost-effectiveness of these programs, a common perception is that curbside collection of food waste will be a reality in this region in the next several years.

King County Pilot Food Waste Project

King County is completing an eight-month long residential food-waste recovery pilot involving nearly 1,700 households. Goals of the study are to determine 1) which curbside residential collection services provide the greatest economic and environmental benefits to citizens, and 2) how food waste can be collected for composting in a manner that meets stringent health and safety standards while remaining economically sustainable and environmentally beneficial.

COMMERCIAL AND INSTITUTIONAL

Businesses and institutions generate large quantities of yard and food wastes, primarily via landscaping activities, grocery stores, and restaurants. Landscapers often haul their grass clippings, leaves, and prunings to disposal or recycling facilities, a practice that is often referred to as *self-haul*. Many public and private facilities accept yard waste for

[4] Based on a review of recent waste composition studies in several Washington communities, including Seattle, King County, Clark County, Lewis County, Snohomish County, and Whitman County. Jay Shepard at Ecology provided some of this data. Other waste composition studies are listed in the Bibliography at the end of this report.

composting at a reduced rate relative to the garbage tip fee. This cost savings provides an incentive for large generators to use this option instead of disposal. Although no information was available to quantify the success of these programs, the relatively low rates of disposal of yard waste in both commercial and self-haul waste studies suggest that when services are available and tip fee incentives are provided, landscaper yard-waste recycling is reasonably effective.

The commercial and institutional sectors generate large quantities of food wastes, most notably from grocery stores, restaurants, and institutions. However, the overall number of organizations utilizing food waste recovery options is still very small. Examples of some notable programs include a campus-wide composting program at WSU-Pullman (including manures, food wastes, coal ash, greenhouse wastes, and yard wastes), a new on-site food-waste recovery system at the state penitentiary in Walla Walla, and a few large generators in the Seattle area (such as Larry's Market) that contract for food waste collection service with private haulers. Some local pilot projects have tested the feasibility of widespread collection of food wastes from restaurants and grocery stores, a practice that is now being implemented in Portland, Oregon.

Table 4: Organics in the Commercial Waste Stream[5]

Material	Fraction of disposed waste stream
Food	13% – 25%
Leaves and Grass	2% –5%
Compostable Paper	5% - 6%
Clean Wood	3% - 5%
Textiles	2% - 4%
Total (rounded)	**30% - 40%**

AGRICULTURAL AND FOOD PROCESSING

Agricultural and food processing operations generate large quantities of organic material byproducts, such as manures, crop wastes, fruit pomaces, potato scraps, rendering wastes, and oils that are currently managed outside the existing solid waste infrastructure. Common handling methods include land application, burning, and on-site storage, and to a lesser extent composting or anaerobic digestion. Because practices such as burning crop wastes or storing manures have the potential to affect air and water quality, agricultural wastes are also a concern to other Department of Ecology programs, such as the Air and Water Quality programs.

Relatively little is known about the quantities of agricultural and food processing wastes and their management practices. Rough estimates

Western Polymer Corporation, Moses Lake, WA

Western Polymer recovers potato starch from local French fry and potato chip companies. They then supply the processed potato starches to paper mills throughout the Northwest.

[5] Based on review of recent commercial waste composition studies in Seattle (Cascadia 2002-2) and King County (Cascadia 2000).

indicate that several million tons of manures and crop wastes are generated annually in Washington, as indicated in Table 2. A current Ecology waste study in Eastern Washington may provide some pertinent information, but in general little is known.

However, momentum is building in Eastern Washington for the recovery of agricultural and food processing wastes. In particular, agricultural and industrial operations, local and state government entities, and private processors are increasingly seeking partnerships to recover large waste streams. In July of 2002, a new research institution called the Northwest Bioproducts Research Institute formed to develop methods for converting agricultural and food processing residue and wastes into bio-based fuels, power, and industrial products. This institute is a collaborative effort between Washington State University, Ineel, University of Idaho, and the Pacific Northwest National Laboratory, which is operated by Battelle (Northwest Bioproducts Research Institute 2002). Other organizations are planning other waste-recovery systems, such as anaerobic digesters. The Grant County PUD is planning an anaerobic digester to recover dairy manure and produce electricity (Solheim 2003), and Quincy Farm Chemicals has been considering the viability of a digester at another major Grant County dairy (Lamphere 2002). The Quincy Farm Chemical model would involve processing dairy manure combined with other agricultural and industrial food-wastes to recover methane biogas, residual fiber, and nutrient-rich water, all of which have potential markets. Similar projects are being considered in other areas, such as the dairy-farm rich Whatcom County.

Other trends may also influence the handling and processing of agricultural residuals. For example, the small but increasing consumer interest in alternative building materials has created a demand for strawboard products.

BIOSOLIDS

As mentioned above, recovery of biosolids is a success story. Biosolids are currently recovered from the sewer system at wastewater treatment plants (WWTP). Biosolids are then land applied in agricultural or forestry operations, or included as a compost ingredient with other materials, such as sawdust. In 2001, 60,000 tons of biosolids were recovered for beneficial use.[6] This represents approximately 80 – 85% of the biosolids generated at the WWTPs (Dorsey 2002). Most biosolids that aren't recovered are incinerated.

CONSTRUCTION, FORESTRY

Large quantities of wood waste are generated by businesses that build and demolish buildings. In many cases this wood is coated with paints or stains, or infused with chemical preservatives. This type of wood is not currently compostable or recoverable for other types of organic processing. Clean wood, on the other hand, is occasionally recovered and ground to make wood chips for landscaping use. The infrastructure to recover wood has been in place since the mid-1990's in urban Puget Sound, and has consisted of transfer stations, sorting and recovery centers such as Recovery 1 in Tacoma, and processing facilities. Similar systems have also been developing in other areas, helping to make recovery

Clean wood comprises about one-quarter of C&D waste

According to King County's recent study of C&D waste, 21% of the disposed C&D waste stream is clean wood, or about 30,000 tons annually. Another 24% is wood that is treated or stained.

[6] According to Ecology's Biosolids Information System

of construction and demolition materials (often referred to as C&D) one of the fasting growing sectors of the recycling industry (Cascadia 2002). In 2001, an estimated 500,000 tons of clean wood were recovered for other uses, including energy recovery, mulching, and paper production (WDOE 2001). Still, several hundred thousand tons are disposed annually.[7] For more information on recovery of C&D materials, see the consultant team's Beyond Waste Issue Paper, *Expanding Green Building Practices in Washington State*.

The forestry, pulp, and paper industries also generate large quantities of wood-derived wastes. Sawdust from lumber mills is sometimes used as a compost ingredient with biosolids or steer manure. Forestry slash is usually managed on-site, but when burned can create air-quality concerns. Although not usually a solid waste concern, forestry practices could change to use slash material as a beneficial resource through on-site processing practices other than burning. The pulp and paper industry produces many sludges that are sometimes recovered for productive use (Kunzler 2003). However, concern about potential toxic components such as dioxin and heavy metals could limit such beneficial uses (Washington Toxics Coalition 2000).

WHO IS LEADING THE WAY?

WASHINGTON

Clearly, Washington State is a national leader in its recovery of organic materials such as yard waste. Compared to a national yard debris recovery rate of about 50% (Franklin 2002) communities in Washington State are recovering up to 80% of total yard waste generated.[8] Yet Washington communities are continuing to expand their organics recovery programs. Both the City of Seattle and King County are piloting combined organics collection programs for residents, while the City of Tacoma is beginning to collect food waste from educational institutions.

Washington is also becoming a leader in the development of bioproducts made from agricultural and industrial waste. The newly-formed Northwest Bioproducts Research Institute will develop methods for converting agricultural and food processing residue and wastes into bio-based fuels, power, and industrial products (Northwest Bioproducts Research Institute 2002). This institute is a collaborative effort between state and federal government and the private sector.

OREGON

On the west coast, the state of Oregon has undertaken a variety of organics recovery programs including residential and commercial collection and large-scale processing as well as small on-site composting of organic materials. In fact, the Oregon State Department of Environmental Quality (DEQ) has permitted almost 30 compost facilities during the last ten years (a total of five existed in 1992), and express that "composters in the state can sell every cubic yard that they make" (Block 2001). The cities of Portland and Eugene have put DEQ grant funding to work in piloting organics collection and establishing on-site composting at food waste generating businesses and institutions

[7] Estimated by Cascadia Consulting based on a 2001 construction waste composition study in King County (Cascadia 2002-3) and other recent local and regional waste composition studies.
[8] State figures from City of Seattle, King County, Snohomish County Solid Waste Management Plans and corresponding waste composition studies published by Cascadia Consulting Group, Inc.

such as groceries restaurants, and elementary schools. Since 1999, Price Chopper Foods Market in Eugene has been using on-site composting technologies to handle roughly 200 pounds of food waste material each day (Oregon DEQ 2002). Both the Portland International Airport and Portland School District are training employees and students to segregate food waste for collection in conjunction with a citywide collection ramp-up in 2003.

CALIFORNIA

To achieve ambitious state-mandated waste diversion requirements (50% by the year 2000 and 70% by 2020), municipalities throughout the State of California are creating or stepping up organics recovery programs.[9] The City of San Francisco rolled out the "Fantastic Three" curbside recycling program in 2001, offering residential collection of combined organics (yard trimmings, food waste, and compostable paper) and curbside recyclables. About half of the City's residents are currently participating, recovering – along with food waste generating businesses – approximately 200 tons of organic materials per day (SFDOE 2003). Following suit, the City of Los Angeles is in the process of designing a pilot commercial organics collection project. In addition to a plentiful supply of organic materials for composting, there is in-state demand for compost products, in both the horticultural and agricultural communities. Napa Wine Company, one of a number of California's organic vineyards, began manufacturing their own compost about five years ago to fulfill an increasing demand for the material (Peterson 2002).

EAST COAST

East Coast states such as New York, Massachusetts, and North Carolina, governments, non-profits, and private industry are on the fast track, investing in collection infrastructures and compost technologies to handle large quantities of organic materials from residents, businesses, and agricultural sources. The State of Massachusetts listed commercial organics as a target feedstock in the most recent Solid Waste Management Master Plan. The state is currently piloting a full-scale commercial organics collection effort to better evaluate the diversion impacts, cost savings, and education required by commercial organics programs. The state's largest grocery chains are participating, diverting roughly eight to ten tons of waste per week per store of organic materials. The cost differential is about 40 percent less than disposal, resulting in a total savings of about $10,000 to $20,000 per year per store (Goldstein 2002). Institutions, such as correctional facilities, in North Carolina and New York have been installing a variety of on-site composting systems from aerated bins to in-vessel composters, gaining the ability to turn wastes into valuable compost products in just a few months time (Coker 2002).

INTERNATIONAL

Internationally, northern European countries boast organics recovery rates up to 85% following almost ten years of compost facility and collection infrastructure developments. Rohner Textil AG, a Swiss textile company, has completely eliminated toxic dyes from their manufacturing process, and therefore, is now able to compost their off-cuts at local farms to produce mulch for neighboring communities (Storey 2002). In Seoul, Korea

[9] AB939 mandates said diversion goals.

about 30% of food waste collected is recycled into animal feed or fertilizers. Japan is introducing grinders for food residuals and has recently established an Organics Recycling Association, sending representatives to BioCycle conferences to continue learning about organic waste management (Greene 2001).

Europe is leading the way when it comes to using anaerobic digesters to process animal manures and even municipal solid waste. More than 60 full-scale plants are operating, each with an average capacity of 15,000 to 20,000 tons/year (Goldstein and Roos, 2001).

3. The Beyond Waste Vision for Organics

As described in the introduction to this report, a future "Beyond Waste" society would view organic materials as resources. Local businesses, and society at large, would create programs to capture organic materials that otherwise would be waste because of their inherent value and the opportunity to create beneficial, even *essential* products demanded by consumers. This type of system, which has been described as *demand pull* rather than *supply push*, will contribute economic vitality and environmental health and awareness. This chapter describes the

- Key **opportunities** in recovering the organic materials that are currently disposed;
- **What needs to happen** to achieve the vision;
- The key **barriers** to achieving the vision for organics; and
- The key **leverage points** available to effect change – leverage points are places where a well designed action or initiative by Ecology or its partners could create big change with relatively little effort.

KEY OPPORTUNITIES

The recovery of organic materials from waste streams provides many opportunities to create beneficial products and improve environmental and economic vitality. Key opportunities are described below.

IMPROVE SOIL HEALTH

Adding organic matter to soils has a range of proven benefits for soils, including supporting beneficial organisms such as worms, improving soil structure, increasing the ability of the soil to hold water, and protecting plants from pests and diseases. However, using compost to improve soil health can also save farmers money and help save salmon. A cost-benefit analysis published in *BioCycle* found that the monetary benefits of compost application for most agricultural crops surpass the cost of compost application (Rahmani, Hodges, Kiker 1999). In the urban environment, coalitions of local governments and consultants, with support from Ecology, have developed a successful campaign, *Soils for Salmon,* which demonstrates the wide range of compost benefits. As the campaign extolled, the application of compost to lawn and gardens improves soil quality, which in turn requires fewer chemicals, regulates the flow of water, and binds pollutants, thereby contributing to improved water quality and salmon habitat (Marx et al.

1999). The use of organic material in creating healthy soils, and the associated positive effects, will be a lasting opportunity in both rural and urban environments. In fact, some local governments view improving long-term soil health as an *essential* use, not just a *beneficial* use, of compost.

OFFSET CHEMICAL USE

Use of recovered organic products such as compost, compost tea, mulches, biosolids, etc. provides valuable nutrient inputs and pest suppression, as discussed above. Accordingly, the use of such products can directly offset the use of chemical fertilizers and pesticides. Using fewer chemicals on lawns, gardens, and farmland means less runoff to contaminate waterways and threaten wildlife, including salmon.

CREATE JOBS, ECONOMIC VITALITY

The collection and processing of organic wastes adds jobs and contributes dollars to Washington's economy. A recent statewide study found that Washington's private organics processors employed at least 261 people in 2001 (Cascadia 2002). This figure does not include local or state government employees involved in organics processing, or employees of waste haulers that also collect organic wastes (such as Waste Management employees that operate curbside yard waste collection). In addition, the study found that private organics processing firms had over $41 million invested in equipment, vehicles, and land required to process organic wastes.

Given these findings, one of the benefits of increasing recovery of organic wastes in Washington is that it could add jobs and bring new investment and dollars to many local communities. This opportunity is supported by a national study commissioned by the EPA that found that recycling, including organics recovery, creates jobs, adds value to the economy, and spurs positive "downstream" economic impacts to other sectors such as landscape maintenance and horticulture ("Recycling is Working").

Finally, another economic benefit of creating the organics cycle is that it could increase the value of recovered organics, thereby developing significant market potential and helping to establish *demand pull*.

CREATE ALTERNATIVE ENERGY AND CARBON MARKETS

Science is rapidly producing technologies to create energy and fuels from sources other than fossil fuels. Many of these systems rely on organic materials as energy sources, either as pure feedstocks or in slurry form. As regional energy agencies such as Energy Northwest and Bonneville Power Administration begin to research smaller, regional energy solutions to alleviate the pressure on capacity expansion of the transmission grid, technologies such as anaerobic digesters and biomass "syngas" gasifiers that may become appealing to these agencies. In addition, energy providers may also look for projects that can be used to mitigate greenhouse gas emissions through "carbon trading." For example, Seattle City Light is looking for projects to which it can pay offsets to mitigate the greenhouse gas emissions from its Klamath Falls natural gas-driven generating facility, and has considered anaerobic digesters. Furthermore, enterprises to produce bio-fuels (such as ethanol and biodiesel) out of waste products are rapidly emerging and are already locating in Washington.

CREATE LINKS TO OTHER ENVIRONMENTAL CONCERNS

Recovering organic materials brings many positive benefits, many of which clearly relate to the goals of other agencies and other environmental concerns. The *Soils for Salmon* and alternative energy programs described above are clear examples of how the benefits of recovering organic material accrue to a larger population than simply the waste managers, processors, and direct customers. Another example is efforts to recover manure and crop residues for beneficial use, reducing the impact of these materials on water quality in the case of manures and air quality in the case of burning crop residues. Finally, linking the organics cycle with emerging programs to mitigate greenhouse gas emissions through carbon-trading markets can help promote organics recycling, through bio-gas generators and certain agricultural practices, and help reduce climate change.

Given these other benefits, one opportunity in dealing with organic materials is to develop relationships and partnerships with other agencies for mutual benefit, and to recognize the broad environmental gains brought by the recovery and beneficial use of organic materials from the waste stream. For example, compost has been used by the Department of Transportation to help control erosion on roadsides, and in filter berms to protect water quality by filtering stormwater.

DEVELOP ORGANIC AND TECHNICAL MATERIAL CYCLES THAT SUPPORT EACH OTHER

One of the fundamental concepts of McDonough and Braungart's design vision expressed in *Cradle-to-Cradle* is the creation of products that can enter either into technical or biological (organic) material cycles. In their view, products should be designed with their end-of-life clearly in mind, and be either safely re-used in industrial or technical processes or decomposed back into the environment. An example of a technical material is glass, which in some cases is continuously cycled through many generations of beverage containers. At the point of generation, most municipal wastes contain both organic and technical materials (some contained inextricably in the same products), and some material recovery facilities handle both types of materials. One opportunity, therefore, is to coordinate the development of the organic and technical nutrient cycles so that they support each other, use infrastructure efficiently, and combine to systematically and cost-effectively recover most current wastes.

Products can be designed to be compostable or recyclable.

Unfortunately, individual state governments usually have little traction to influence product design by national companies. To address this issue, state partnerships in producer responsibility initiatives are increasingly popular, especially with regard to electronics and computers. Pending success of current initiatives, future work could address design for recovery into the organics cycle.

WHAT WOULD NEED TO HAPPEN?

Recovering all organic wastes would likely require many fundamental transformations in Washington's "waste" infrastructure and even in its economy. These changes will necessarily happen incrementally, but must be unified so that over time a new system – from product design to material generation, collection, processing, and end-use – is internally aligned to facilitate the efficient and complete recovery of organic materials.

To envision a future system for organic wastes and materials recovery, the research team interviewed and met with numerous solid waste planners, organics processing managers and operators, and consultants, and conducted literature research. Our research attempted to find answers to the key questions posed at the beginning of this paper:

- *What market development is needed?*
- *What collection and processing infrastructure is needed?*
- *What system-wide changes (such as economics, behavior, regulations, or product design) are needed?*

This section presents the results of this research, and the general requirements of a future organics system in Washington State.

NEEDED MARKETS

Contacts surveyed during the consultants' research emphasized the need to establish markets where end-users place a high value on recovered organics, and seek out specific quality criteria based on how they will used the products. Then processors develop and manage their operations based on the needs of these end-users. Such a framework, termed *demand pull*, would ensure the viability of organics processors as they would be supported by the market rather than the "supply push" of material being collected through local government and other programs.

Current markets absorb about 800,000 cubic yards of compost, biosolids, and other materials in several major markets, including agriculture, horticulture/landscaping, and infrastructure projects. (WDOE 2001-2). Markets for processed organics have become increasingly robust over the past several years, but given the quantity of materials still to be recovered, **demand will need to increase if all organic materials in current waste streams are to be processed**.

Planning for an effective organics cycle will therefore need to include a focus on market development to create a system of *demand pull*, where prices paid by end-users are high enough to spur private sector infrastructure investment and program development to identify, collect, and process organic waste streams.

The future array of markets could reasonably include:

- **Continued focus on horticultural and landscaping applications** that have made yard waste composting the success story it is today, as well as remediation and forestry applications that utilize biosolids;
- **Increased attention to specialty markets** that can yield much higher prices, and are emerging for products such as food-waste-derived compost and compost "teas";
- **Continued growth in agricultural applications,** building on success of biosolids recovery programs and the rise of sustainable or "bio-intensive" farming practices, and including some specialty markets such as high-end vintners blends;
- **Continued development of bio-based products** that turn food processing or agricultural residues into polymers, building products, fuels, and other products; and

- **The emergence of biomass energy as a real player in the Northwest's "green" energy supply**, via the use of anaerobic digesters that can create biogas, electricity, and even hydrogen from agricultural and food processing wastes.
- **Uses that specifically link to other environmental benefits** such as erosion control and storm water protection (with compost filter berms.)

In any market, our research suggests that **quality standards** will be crucial as organics markets develop, as they will be needed to address current ongoing quality concerns and provide consumers valuable information to help judge appropriate use of each product. Increased testing and monitoring may be required to support such standards, and to ensure consumer confidence surrounding such persistent concerns as clopyralid or other contaminants.

NEEDED INFRASTRUCTURE

Waste management infrastructure has historically been set up to handle efficiently and cost-effectively wastes that are commingled. In the last 15 – 20 years, increasing focus on diversion and recycling has led many communities to establish separate collection of recyclables and yard waste. When carefully planned and efficiently executed, these programs have also been able to operate cost-effectively. However, the system is not yet optimized for the recovery of all organic wastes from each economic actor sector.

It is beyond the scope of this project to fully prescribe a future statewide organic waste collection infrastructure. State and local planning efforts will need to remain flexible and responsive to new technologies and trends, while continuing to recognize the importance of tailoring local solutions to local problems and opportunities. Furthermore, there is a difference of opinion among experts consulted and the industry literature about preferred collection and processing technologies.

Nevertheless, this section describes the types of systems that our research suggests will be required to establish the organics cycle. Note that the essential characteristics of any new system are that it be: cost-effective, flexible and adaptive to new technologies, acceptable to the public, and linked to market needs and opportunities. In addition, fully realizing the Beyond Waste vision will involve the establishment of new, optimized infrastructure to completely recover both organic and technical materials.

Our research focused on identifying infrastructure options for the following sectors:

- **Urban residential and small commercial.** This cluster includes urban single- and multi-family homes, as well as small urban businesses. These generators are grouped together because while they tend to produce small amounts of organics individually, they are present in sufficient densities to make collection of this material viable.
- **Large commercial and institutional.** This group includes large urban and suburban generators of organic wastes, such as grocery stores, restaurants, and hospitals.
- **Rural**. This sector has two major facets: dispersed large generators of organics, such as food processing operations and farms, and rural homes. Although our discussion of this sector focuses on the Beyond Waste possibilities for the large

generators, it also includes some suggestions for expanding recovery of organics from rural households.

Urban Residential and Small Commercial

According to the U.S. Census Bureau, nearly two-thirds of all households in Washington are located in urbanized areas, for a total of nearly 1.7 million households (US Census Bureau 2001). Households generate about three-quarters of a ton of garbage each year, (KCSWD 2000) about 40% of which is organic, compostable waste such as food waste, yard waste, and compostable paper. Urban small commercial waste has a similar composition (Cascadia 2002-2).

Capital costs are high in urban Washington

The combination of high real estate prices and stringent odor, air, and water quality requirements make the capital cost of modern, regional compost facilities about $10 million in urban and suburban Washington. Smaller-scale, lower-tech systems that serve urban areas can be built for about $2 million. In either case, the costs are much higher than systems practical in rural Washington.

To achieve the Beyond Waste vision, the current waste disposal system will need to be altered and optimized to shift from one primarily based on disposal to one primarily based on recovering the significant organic and technical material flows. Creating such a shift will involve careful planning to ensure that infrastructure investments are made at appropriate times and are coordinated to cost-effectively achieve the vision. Other changes will need to occur concurrently, such as shifting behaviors and attitudes, markets, and economics.

Recovering the full range and increasing amounts of organic wastes from urban residential and small commercial generators will require expanded infrastructure. For example, by 2030 at least 400,000 annual tons of additional capacity would be required to process expected residential food waste and compostable paper, assuming full recovery. Adding this amount of capacity will be equivalent to building six new “compost factories” like LRI’s Pierce County facility, or several smaller facilities. Given the growing population and expected increasing efficiency of yard waste collection programs, as well as potential recovery from small businesses, needed capacity will likely be several hundred thousand tons. The cost of building or expanding facilities to meet this demand will likely be tens of millions of dollars.

To recover this material, experts differ as to which collection and processing systems are the most feasible. However, they generally agree that the following will be necessary:

- **Expanded on-site composting.** For the residential sector, on-site options such as backyard composting are generally the least costly, as they do not require collection or centralized processing infrastructure. Even for small commercial generators, enclosed on-site systems are increasingly available and cost-effective for processing food waste.
- **Increased source-separated collection of organic wastes.** Several options are available, including collecting food waste and compostable paper with yard waste in one container or collecting food and yard waste separately. Also, some contacts have suggested expanding the use of in-sink grinders for food waste

from multi-family and some single-family households, although there are many limitations and potential drawbacks to this option.[10]

- **Processing facilities that address issues of scale and location,** especially considering system and capital costs, regulatory requirement, access to markets, public acceptance of and demand for the finished products, and opposition to the facilities themselves located near residential areas.

These infrastructure options are described in further detail in Appendix B.

As Beyond Waste planning evolves, the goal for Ecology will be to develop broad-based support among local governments for organics recovery. No one technology or system can provide the universal solution for each jurisdiction. Local governments and private processors will need to identify markets for specific end products and choose processing systems that can cost-effectively produce those end products, given the available local organic wastes.

Institutional And Large Commercial

In contrast to residences and most small businesses, some individual institutions and certain businesses generate very large quantities of organic wastes. In particular, restaurants, grocery stores, grocery warehouses, and institutions that contain eating establishments generate large quantities of food waste that in most cases are currently disposed.

Institutions and certain businesses (such as landscaping companies) may also generate large quantities of yard waste. Recovery programs and infrastructure have largely been very successful in collecting and processing this material, through reduced transfer station tip fees for yard waste recovery versus disposal.

Achieving the Beyond Waste vision for large commercial and institutional generators will require increased, and perhaps specialized infrastructure to handle large quantities of food wastes, which are typically heavier and wetter than other organic wastes such as yard waste or compostable paper. The following systems are generally considered viable:

- **Reuse systems, such as food gleaning programs --** Large generators, particularly grocery stores, generate large quantities of edible but unsaleable food products. The highest and best use of these organic "wastes" is to reuse them safely as food. Food-gleaning programs are able to recover large quantities of food waste for consumption.
- **On-site processing facilities --** On-site containerized or vermi-composting systems have recently emerged as increasingly viable options. Although they require initial capital investment, on-site technologies are now approaching cost-effectiveness when their annualized capital and operating costs are compared to disposal.

Food gleaning diverts large quantities

Northwest Harvest, based in Seattle, diverts nearly 8,000 tons of food annually by distributing it to 300 food banks in the State. One source of donations is grocery stores and distributors that pull items from the shelves just before the expiration dates.

[10] Proponents of in-sink food grinders cite the existing availability of the infrastructure, the relative ease of participation, and the fact that storage and further handling by the generator is not necessary. Opponents, particularly sewer system and wastewater treatment plant operators, cite increased burden on their facilities, increased operating costs, and accelerated treatment plant expansions that generate intense public opposition.

- **Source-separated collection** -- For businesses that generate large quantities of food waste or landscaping waste, disposal expenses can be significant. Reduced-rate organics-recovery systems can offer real cost savings to large generators via source-separated collection. The processing infrastructure needed to handle source-separated organic wastes from the large commercial and institutional sector is very similar to that for the residential and small commercial sectors, as the same facilities will likely handle wastes from both sectors. In addition, some analysts contacted during this study suggest that dewatering facilities will be helpful to manage the transportation costs of heavy food wastes.

Rural

Increasingly, technologies are emerging to handle the large, specific waste streams of the agricultural sector. In particular, Eastern Washington is starting to become a leader in bio-based products derived from agricultural and industrial "waste" products, and is beginning to consider anaerobic digesters to solve waste problems. Many local government and private sector contacts, as well as industry literature, cite anaerobic digesters as a promising future trend for:

- Their ability to handle liquid manures combined with other municipal and industrial wastes,
- Their relatively low cost, and
- Their ability to generate marketable products, including a fiber residual and energy.

The challenging economics of rural organics recovery

Making the economics of organics collection work in the dispersed rural system will pose a significant challenge – success may take longer and face more difficult economics than for urban systems. However, proximity to agricultural and potentially to energy markets may provide "leverage point" potential.

Even so, processor and local government contacts alike agree that these systems will not likely replace traditional compost infrastructure, because consumers will continue to demand compost and anaerobic digester systems do not typically handle yard waste effectively.

Collection of organic wastes from rural residents and small businesses will likely be difficult to implement cost-effectively given the dispersed population and relatively small quantities generated. Where curbside collection is not viable, new or expanded focus on on-site composting coupled with drop-off facilities (with corresponding incentives) will help to recover organics from this sector. Given the need to maximize efficiencies in these sectors, co-collection in split carts may be a viable option. In addition, a "dirty MRF" may be an effective way to recovery materials (both organic and technical) for recovery. In most cases, organic material from municipal sources will likely be best processed by traditional compost facilities. However, in some cases, municipally-generated organics could be a supplementary feedstock for anaerobic digesters.

Overall, our assessment concluded that two keys to creating the organics cycle in Washington's rural environment are to ensure that large generators of organic materials can effectively handle their materials on-site, or that the private sector can make the infrastructure investments necessary to collect organic wastes to create products, including energy and bio-fuels, and make a profit. But because of the large distances, variety of wastes, and localized markets, there is no "one-size-fits-all" infrastructure solution in the rural environment. Facilities will likely need to be sited near or at large generators and specially designed for local circumstances. This means that new facilities will be required at many large generators such as dairies and food processing

facilities, and close to end markets such as farms and potentially energy grids. However, the current economics do not appear to support the capital investments required to rapidly expand organics infrastructure in the rural environment.

NEEDED SYSTEM-WIDE CHANGES

Behavior Change

A variety of behavior and attitudinal changes are necessary to establish a comprehensive recovery system. In general, residents and businesses in Washington must become more accepting of the benefits of organics recovery, and be willing to participate in collection programs and use recovered organic waste products.

More specifically, our research indicates that the transition to full organics recovery will require the following:

- **Willingness and ability to separate organic wastes (including food) according to the new systems put in place:** In particular, generators must learn and be willing to implement methods of maintaining sanitary conditions for recovery of mixed organics.
- **Acceptance of organics facilities in or near residential communities:** As discussed above, expanded recovery programs will require additional infrastructure, including processing facilities. However, siting such facilities has been historically very difficult, due to concerns about odor, noise, and property values. A shift toward increased acceptance of processing facilities in or near residential communities will be important if local governments continue to prefer local or regional processing rather than long-haul, super-regional facilities.
- **Understanding of importance of soil health to life:** Compost and other processed organics are extremely beneficial to soil health, which in turn supports a wide variety of plant, animal, and human needs. A widespread acceptance of these benefits will help create and sustain fundamental market demand for organics and high levels of participation in recovery programs or on-site management practices.
- **Adoption of agricultural processes that generate fewer wastes needing management, and acceptance of agricultural byproducts as potential feedstocks for new products** rather than as waste materials to be burned or stored. Some of these behavior changes are occurring already, as new restrictions on handling of manures and burning of crop residues take effect. For example, conservation programs have helped create conservation tilling and other practices that prevent waste generation.
- **Acceptance of fee structures that encourage organics recovery, and use of available services:** In order for organics recovery to be successful, local governments may need to institute changes in waste and recovery fee structures. For example, local authorities may adopt fee structures that encourage residents to dispose of less organic waste. Waste generators must accept these changes, and use the recovery services provided.

Economics

Existing studies and research indicates that recovery of organics from some sectors is economically viable and cost-effective relative to disposal. Even so, in nearly all cases

market prices for products are not sufficient to cover capital and operating costs of processing facilities. As a result, most processors charge a tip fee to accept organic material from generators. When this fee is competitive with landfill or transfer station disposal fees, then there is a clear incentive for generators to use processing facilities rather than disposal facilities. But processors report that it is not always possible to charge a sufficient tip fee and still have the cost be less than disposal. Similarly, local governments report that in planning for organics recovery programs, they must often prove that the total system costs (including collection, transfer, and processing) will be lower for organics recovery than for disposal. Achieving cost-effective programs in the short-term is particularly difficult, especially when food waste and other organics are added to collection programs (Bagby 2003). Clearly, organics programs must be cost-effective in the long term if they are to be viable.

Sample Compost Facility Economics*

	Costs per ton
Tip fee	$25 - $30
Processing	($30 –$40)
Product sales	$10 - $20
Bottom line	~$5

*Source: Jeff Gage, Compost Design Services; "Bottom Line" estimated by Cascadia Consulting

Several possible outcomes would help organics processing be economically viable:

- **Higher market prices.** Higher market prices would create incentives for processors to obtain organic material feedstock, and could drive down or eliminate processor tip fees, making recovery much more competitive with disposal.
- **Prices that more fully reflect externalities, other costs, and benefits.** The benefits of recovering organic waste are not limited to just potential cost savings. Some contacts and literature believe that the cost to society of landfilling waste is higher than the tip fee indicates, and that pricing structures should reflect such external costs and benefits more accurately.
- **Benefits to service providers** (haulers and composters), relative to disposal. Incentives to waste hauling and processing companies (via contract or financial incentives) would assist in creating systems that maximize organics recovery.

Economic difficulties are particularly acute in rural and Eastern Washington, where there are large uncertainties about potential markets and generator willingness to pay for services. Prices currently paid for products are currently not enough to support material processing, but demand is reportedly strong for those products (at a lower price). In Eastern Washington, the private sector is reportedly interested in expanding processing operations to recover dairy manure, food-processing residuals, and other industrial wastes, but perceives that the risk is too high and the return too low to warrant capital investment in facilities. Although Ecology's local government partners have provided grants to facilities, most processors (including those in the private sector) report that a sustainable system needs to be market-based. The challenge for Ecology and its partners is, in the long term, to assist in developing the markets and to provide incentives for generators to use organics recovery services. In the short term, reliable sources of capital or operating funding assistance may be required to initiate this market transformation.

Other System-Wide Changes – Product Design

Finally, our research indicates that one of the most promising – yet most difficult – changes is the transformation in product design. Currently, many consumer products that could be compostable are not because of contaminants. In some cases, this is

because products are composites of organic and technical nutrients (such as cotton/polyester clothing) that can be neither composted nor recycled. In other cases, products are contaminated with hazardous or toxic materials, such as preservatives in wood products. A comprehensive shift in product design to products that are clearly designed for compostability or clearly designed for recyclability, without contaminants, would greatly assist both the establishment of the organic cycle and the technical cycle.

KEY BARRIERS

This section examines the barriers to a fully functioning organics cycle. The information in this section comes from our interviews with local government and industry contacts, literature research, and professional experience in the field.

BARRIERS TO EXPANDED MARKETS

On-Going Concerns About Quality, Consistency, And Content

Effective markets are still hampered by on-going concerns about contaminants, content, consistency, and quality. For example, landscapers in King County feel that quality and consistency of organics need to improve (Cascadia 2000-3). In a focus group, landscapers reported that some products labeled as “compost” are:

- Not fully composted;
- Excessively moist;
- Inconsistent in texture, composition, and particle size; and
- Contain weed seeds, pathogens, metals, or other contaminants.

Therefore, one barrier to achieving a full organics cycle is the lack of consumer information or standards available to allow consumers to make informed choices about the quality, consistency, and content of the products they are purchasing, and be confident that they are getting what they pay for. In other words, there are a wide variety of compost and mulch products in the market, with a corresponding wide variety of applications, and there are not currently accepted standards by which consumers can judge the products. In his presentation to the Washington Organic Recycling Council annual meeting in December 2002, Matt Cotton of the U.S. Composting Council urged that the “New Compost Economics” have a strong focus on quality to improve consumer confidence and markets (Cotton and Stone 2002). The quality issue may be particularly important given the recent concern over clopyralid contamination in compost.

Feedstock Contamination

Related to the above barrier, feedstock contamination is a barrier facing processors in their goal to produce products that consumers trust. Although composting and other processing methods are very effective at breaking down many types of contaminants, there are still many that withstand most processing methods. In particular, the recent concern over clopyralid shows that some pesticides can be very persistent. In addition, there is still the potential for feedstocks to include physical contaminants like plastics or metals or chemical contaminants like heavy metals and dioxins. For organic materials to continue to be a valued commodity, some system must be in place to avoid, monitor, and mitigate feedstock contamination.

Insufficient Prices

In general, contacts report that the prices paid for processed organics are not yet sufficient to fully support most processing operations. This situation appears to be true across most sectors and waste types. Market prices for most products are not sufficient to support the capital and operating costs of processing the material. As a result, processors must still rely on other revenue streams such as tip fees or grants. As more materials are processed and supply increases, contacts report that it will be necessary to further expand demand into other markets, including specialty markets that pay higher prices for premium products.

Limited Market Demand

Organics markets have been growing steadily over the past 10 years, but markets will need to expand to absorb the future supply associated with achieving the Beyond Waste vision. For example, in the urban residential sector alone, demand will need to increase to at least 400,000 annual cubic yards by 2030 to process just the expected residential food waste and compostable paper, assuming full recovery.[11] Limited market demand may be linked to the on-going quality concerns mentioned above, as well as to the general lack of knowledge about soil health and role of recycled organic products in maintaining it.

BARRIERS TO INFRASTRUCTURE INVESTMENT

Limited Access to Capital in Private Sector

Some contacts interviewed as part of this study reported having trouble acquiring funds to perform feasibility studies or launch into full-scale recovery operations. In general, contacts report that the risk of capital investment in processing facilities is often too high given the expected return. For example, in rural Washington, despite large agricultural and industrial feedstocks, the markets and other revenue streams for these materials are usually insufficient to warrant capital investment. Although there reportedly is widespread *interest*, the current financial *risk* is just too high.

Difficulty in Achieving Economically Viable Collection and Processing Systems

For organics recycling programs to be highly effective, they must be able to operate at a lower cost than disposal. Faced with political forces and tight budgets, local governments are increasingly pressured to prove that recycling systems are cost-effective. Furthermore, many organics processors report that the landfill is their biggest competition. For example, one reported that their rates need to be about 80% of the landfill tip fee in order to provide enough financial incentive to generators to use his services rather than the landfill. But competition is tough – the median landfill tip fee in Washington is just $41 per ton.

Achieving cost-effective recovery programs is difficult, and requires high participation rates, collection and transfer efficiencies, established markets, and economies of scale (Bagby 2003). Local governments have shown that yard waste collection from residences can operate cost-effectively, especially in the most highly populated areas. But systems in dispersed rural regions have more difficulty. And, even in large population centers such as Seattle and King County, organics collection from

[11] Estimated by Cascadia Consulting

businesses and institutions (specifically food waste) is only cost-effective relative to disposal under certain conditions (Seattle Solid Waste Utility and King County Solid Waste Division 1996). Therefore, a key barrier in realizing a full organics cycle is the difficulty in achieving economically viable collection and processing systems.

Difficulty in Siting Processing Facilities

One of the largest challenges in developing organics processing infrastructure is the siting of processing facilities -- especially larger facilities. Many local governments describe the strong public opposition to facilities in or near residential neighborhoods. In some cases, contacts report that public resistance is so strong that citizens will file complaints (even odor complaints) before a facility is open. And, once operating, organized citizens complaints, even legal action, has threatened the existence of several facilities. To achieve the Beyond Waste vision for organics, more facilities will be required. These facilities will either need to be sited far away from neighborhoods (which increases transportation costs) or the public perception of compost facilities as smelly and intrusive, both real and perceived, will need to be overcome.

Some Processing Technologies are Still Evolving

Some of the processing options reported by contacts, in the industry literature, and in local studies have not been sufficiently developed, tested, and used to warrant widespread adoption. For example, although enclosed vermi-composting systems are popular with residential generators, and increasingly available for commercial operations, several contacts reported skepticism about their effectiveness. In addition, there is some debate about the appropriate uses of other technologies, such as the use of anaerobic digesters to handle municipal feedstocks. And, an increasing focus on food waste composting would bring a new need for appropriate odor and leachate controls. Although there seem to be appropriate technologies for most situations, the challenge to find demonstrated, sufficiently tested equipment remains a barrier to full implementation of the organics cycle.

OTHER BARRIERS

Public Resistance To Separation And Special Handling Of Organics

If organic wastes are going to be recovered as a resource, they will need to be separated from other wastes. But consumer and business willingness to separate organic wastes has proven to be somewhat limited. For example, in a pilot food waste study in Seattle, weekly participation was 20 to 25%; when households did not participate, they often reported (35% of households) that separating their food waste was too messy or smelly (Cascadia 2001-2). On the other hand, commercial willingness to separate food waste may be somewhat higher – in a 1996 survey in Seattle and King County, most food processors (75%), food services (73%), and wholesalers/retailers (88%) said they were willing to source-separate food waste (Seattle Solid Waste Utility and King County Solid Waste Division 1996). Whether these survey results would hold true in actual collection programs remains to be seen.

Complicated, Overlapping Regulatory Framework

Currently, there are a number of regulatory agencies—at both the local and state levels--that have some oversight over parts of the organics collection and processing process.

The fact that so many different people and agencies are involved in pieces of reviewing, permitting, and regulating the organics infrastructure and material/product flows makes it difficult to know how to handle a specific organic material, operate current facilities, bring new facilities on-line, and market finished products. The variety of applicable regulations include, but are probably not limited to, state solid waste, water, and air-quality regulations; local ordinances; and local surface water and land use requirements. Although these regulations serve valuable functions, they can be confusing to interpret and navigate. In addition, individual regulations may be changed without a comprehensive look at how each change will affect the other applicable regulations.

Lack of Processor Experience with Food Waste

Although food waste recovery has been slowly growing statewide, the collective experience of processors in handling the material is still rather limited. In particular, food waste brings increased odor and leachate concerns that not all processors are experienced (or interested) in facing.

KEY LEVERAGE POINTS

In seeking strategies to move towards the Beyond Waste vision, the research team has sought to find appropriate *leverage points* – places where focused effort could affect a significant waste-related decision and ultimately leverage broader change. In other words, leverage points are those places where a well-considered action by Ecology or its partners could have large impacts. These leverage points could be key decisions that could be influenced, or big trends and drivers that Ecology can exploit. In terms of creating the organics cycle in Washington, these leverage points are likely as follows.

PRICES AND OTHER ECONOMIC DRIVERS

These signals can help or hinder organics recovery programs. For example, high disposal fees can create incentives for generators to use organics recovery options, when those options provide cost savings.

GOVERNMENT SERVICES AND INVESTMENTS

A critical leverage point Ecology has to move forward with organics collection is the decisions that local government partners make concerning solid waste services and infrastructure. Municipal governments – through contracting (e.g. Seattle, Vancouver, Bellingham); direct ownership (e.g. Tacoma, Olympia, Spokane, Yakima), and ordinances (e.g. counties and some cities) – control what services are provided, and in turn what infrastructure exists to support those services. Local governments may be motivated by a wide variety of factors, including Ecology's or local goals, the closing of landfills, or economic considerations.

Municipal solid waste contracts, which typically last for 5 to10 years or longer, dictate what services private haulers offer to generators, and what materials private processors handle. For example, the City of Bellingham recently awarded a contract through 2015 to Sanitary Services Co. to provide curbside collection from residents. The periodic renewal of these contracts presents opportunities to include new organics-recovery programs. Figure 2 also shows a timeline of when key contracts are up for renewal.

Figure 2: Timeline of Major Projected Landfill Closures and Waste & Recycling Contracting Decisions

Event	Location	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2040	2050	2060	2070	2080	2090	2100
					2005					2010					2015					2020					2025					2030							2100
Major Landfills Projected to Close																																					
Ephrata	Grant				X																																
Port Angeles	Clallam					X																															
Cheyne Road	Yakima						X																														
Terrace Heights	Yakima									X																											
Horn Rapids	Benton										X																										
Cedar Hills	King											X																									
Northside	Spokane											X																									
Greater Wenatchee Regional	Douglas													X																							
Cowlitz-B	Cowlitz													X																							
City of Tacoma	Pierce													X																							
Okanagan Central	Okanagan																													X							
Sudbury Road	Walla Walla																													X							
LRI	Pierce																													X							
Stevens County	Stevens																														X						
Asotin County	Asotin																														X						
Delano	Grant																															X					
Roosevelt	Klickitat																																	X			
Columbia Ridge	Arlington, OR																																		X		
Waste-to-Energy Facility Overhauls																																					
Spokane Regional	Spokane																									X											
Contracting decisions																																					
Residential Waste/Recycling/Yard Waste	Seattle						X																														
Residential Waste/Recycling/Yard Waste	Bellingham														X																						
Residential Waste/Recycling/Yard Waste	Vancouver							X																													
Yard Waste Processing	Seattle							X																													
Yard Waste Processing	Tacoma					X																															
Yard Waste Processing	Spokane										X																										
Commercial Waste	Seattle							X																													
Columbia Ridge Disposal Contract	Seattle													X (opt out)														X									

Although Ecology does not directly control these contracts, the leverage point is still available via Ecology's local partners. Ecology may be able to form partnerships with local governments and/or facilitate a timely, coordinated transition from the current system to one where all organics are recovered along with all "technical nutrients", leaving a small percent of discards as waste. Timing will be important in this transition as well as integrated decision making in waste-sheds about investments in new facilities that are optimally designed for full recovery of food, yard waste, and other organics at least cost.

PLANNING FOR LANDFILL CLOSURES

Ten out of Washington's seventeen current landfills that accept municipal solid waste from the public are expected to close by 2015. These approaching closures may provide motivation for local governments to rethink their solid waste handling, particularly as the closures may cause costs to increase. This change in practices may provide an opportune time to add organics recovery services. Figure 2 also shows when major municipal landfills are expected to close.

PLANNING FOR ENERGY INFRASTRUCTURE

Local and regional investments in energy infrastructure may provide opportunities for small, regionally based electricity generation. Emerging anaerobic digestion technology may help expand and diversify energy supplies creating local electricity from organic wastes. The recent electricity price peaks, the continued supply uncertainty, and the prospects of reduced supply of hydropower associated with decreased snow-pack and climate change all underscore the significance of this potential leverage point.

ENDANGERED SPECIES ACT AND WATER QUALITY REGULATIONS

The decline of salmon and the deteriorating quality of rivers and streams throughout the state have focused attention on the role of soils in ecosystem health and the impact of the widespread use of fertilizers, pesticides, and herbicides in horticulture and agriculture on water quality. New regulations and practices to reduce these impacts provide opportunities for new applications of organic soil amendment products diverted from the waste stream and support investments in facilities to transform organic wastes into a valuable resource.

SUSTAINABLE AGRICULTURE

The emergence of organic farming is another potential leverage point to spur interest in new organic management practices, on-site reuse of organics, and demand for soil amendment products.

CODES AND SPECIFICATIONS

Codes (such as building codes) and specifications (such as in Best Management Practices or procurement policies) provide opportune places to induce or require the use of recycled, processed organic materials.

All of the above leverage points can be used to leverage change and help establish a viable organics cycle. The relative importance of each leverage point varies according

to the economic actor and specific material in question. Furthermore, there are certainly other leverage points that could be exploited to effect change. The action plan at the end of this report uses actions that target each of the above leverage points.

4. Tools

The preceding chapters provided an overview of the current status of organic wastes, the changes that will need to take place to achieve the Beyond Waste vision for organics, and the barriers that must be overcome to achieve those changes. This chapter identifies and evaluates tools and strategies to achieve the required changes. The assessment focuses on those strategies and alternatives that have a relatively high potential for achieving change, as identified by the experts and practitioners interviewed and by the consultant's own expertise in this field. Selected tools are assembled into an action plan in Chapter 5.

For each tool, we discuss the feasibility, cost-effectiveness, projected outcome, key challenges and success factors. Political feasibility, practical feasibility, and cost-effectiveness are treated as criteria and received rankings of high, medium, or low. Projected outcomes, key challenges, and success factors are treated as important information about each tool and received qualitative descriptions.

For the purposes of this study, these criteria and descriptors were defined and applied as follows:

- **Political Feasibility.** This criterion included such factors as the likelihood of political opposition from lobbyists or special interest groups, and the degree of difficulty of ensuring that funding for a tool is included in the appropriate budget.
- **Practical Feasibility.** This criterion focused on the technical aspects of adopting or using a tool, such as whether the expertise or technology exists to implement the tool, and the degree of organization and coordination that may be necessary.
- **Cost-effectiveness.** This criterion judged whether the cost of employing a tool outweighs the benefits that the State and the public are likely to receive from its use.
- **Projected Outcomes.** For this descriptor, we listed the likely results of applying each tool.
- **Key Challenges/Success Factors.** Items outlined under this descriptor include obstacles that must be overcome and strategies to do so.
- **Performance Measures.** These items are actions that Ecology and its partners can take to gauge the effectiveness of each tool over time.

The tools are organized into seven categories:

- **Contracting and Service Level Ordinances.** These tools are choices that local governments can make to directly influence the availability of organics collection and processing services in their jurisdictions.
- **Economic incentives, fees, and rate structures.** This class of tools comprises ways that Ecology and its partners could make organics recovery more attractive to generators, haulers, processors, and end-markets. For the most part, these tools would help to surmount the cost and resistance to change barriers.
- **Regulatory/Legislative Requirements.** These tools are regulatory, legislative, or organizational actions the State could take to both effectively lead the transition to Beyond Waste and encourage or require local governments to participate.
- **Education and Technical Assistance.** This category includes tools that capitalize on Ecology's and local government's skills at developing educational programs for consumers and industries, and that would work to overcome the lack of awareness and resistance to change barriers.
- **Government Lead by Example.** This group includes ways that the Washington State government could expand awareness of organics recycling and create markets through changing its own current practices.
- **Market Development.** This class of tools includes strategies to solidify and expand markets and research and develop new emerging opportunities.
- **Strategic Partnerships.** Ecology could form strategic partnerships with other agencies to advance the organics cycle.

These tools are designed to take advantage of a variety of leverage points and overcome the barriers discussed in the previous chapter.

CONTRACTING AND SERVICE-LEVEL ORDINANCES

One of the key leverage points identified in Chapter 3 was the decision local governments make about services and infrastructure investments. Although Ecology does not make (or directly control) these decisions and services itself, it could reasonably work with its local partners to collectively pursue the Beyond Waste vision.

Fundamentally, for full recovery of organics to become a reality in Washington State, local governments that contract directly for residential solid waste and recycling collection services (such as the Cities of Seattle, Bellingham, and Vancouver) will need to specify the collection of those organics in their contracts. In addition, local governments that provide their own collection services (such as Spokane, Tacoma, Olympia, and Yakima) will need to implement

Residential vs. Commercial Recycling

In considering contracting approaches, it is important to remember that although residential recycling (including organics collection) is a regulated industry, commercial recycling is unregulated. In other words, the types of contracts and service-level ordinances possible for residential recycling are not usually available to influence commercial recycling. Even so, local governments can provide direct service or issue contracts for commercial recycling service, but they must do so in competition with private companies. This type of contracting strategy can be effective in helping to influence rates and ensure that all businesses have the opportunity to recycle their organic wastes.

such services. Finally, counties that operate under the franchise system will need to adopt service level ordinances specifying source- separated recovery of organics under the WUTC framework, at least where source-separated collection is economically and practically viable.

This pair of tools, contracting and service-level ordinances, focuses on the means local governments have to control what services are offered in their jurisdictions.

Ecology may wish to develop a decision support tool, such as a spreadsheet or computer model, to assist local governments in designing the most cost-effective infrastructure and services. (see Tool #17.– Develop Technical Analysis Capacity).

TOOL #1.–CONTRACTING

Many cities in Washington directly contract for residential solid waste service with a private hauler. Contracting is an established means of providing residential service – one that many cities find is a useful means of controlling costs and setting service levels. In many of these contracts, cities have specified recyclables collection and curbside yard waste collection. If other organics, such as food waste, are going to be collected from residents in these areas, the contracts must clearly specify the services to be provided. For example, the City of Seattle's current residential collection contracts specify yard waste collection, but also include an option to collect food waste, at the city's discretion.[12] However, the City of Seattle has not yet exercised this option.

While contracting for residential service is widely practiced, contracting for commercial service is less common. In particular, contracting for commercial recyclables (including organics) is particularly rare, partly because local governments cannot legally make exclusive contracts for such service. This is because the collection and transport of commercial recyclables is an unregulated industry, unlike residential recycling. Even so, some cities have experimented with contracting for commercial recyclables collection as a way to ensure some availability of service. However, businesses are not obligated to use this service, and may choose another, or no other, recyclables hauler.

In addition to organics collection, contracting is also used by cities to provide organics processing. For example, in late 2002 the City of Tacoma established a contract with Soos Creek Organics to process municipally collected yard waste, through 2006. If Tacoma wanted to collect food waste and have it processed by Soos Creek Organics, it would need to include it in the contract.

The contracting tool is directly available not to Ecology, but to its city partners. If Ecology wants to effect change with this tool it will need to work with and coordinate these city partners to move in a coordinated fashion. (See Tool #25.– Form Local Stakeholder Partnerships)

The following evaluation focuses on the use of contracting by cities to increase organics collection service.

[12] The City of Seattle would have needed to notify its haulers by April 1, 2002 if it wanted to exercise this option. The contract is available on-line at http://www.ci.seattle.wa.us/util/solidwaste/contracts.htm#Residential

Contracting for increased organics service.

Political Feasibility: *Low.* The use of contracts to specify yard waste collection and processing services is well established and encounters little political opposition. However, adding food waste service via contract has been highly contentious, due primarily to the perception of food waste collection and processing as smelly and vector-prone. For example, the City of Seattle has encountered opposition in the City Council that has slowed plans for food waste collection (Hadley 2003).

Practical Feasibility: *Medium.* Developing and negotiating contracts takes time, and requires careful planning with many years of foresight. Even so, many local governments have become very experienced. Many contracts are available on the web (such as on the City of Seattle's web site) to offer model language. Developing contracts that include food waste may offer additional challenges, as the economics of mixed organics/food waste collection are still uncertain.

Cost-effectiveness: *High*. In general, many cities have found contracts the most effective tool to guarantee reasonable rates for the services they require. Although the cost-effectiveness of mixed organics/food collection is uncertain, the cost-effectiveness of the contracting process in general is high.

Projected Outcomes: Contracts could be very effective at making mixed organics/food waste service available, but truly effective organics recovery programs require a variety of factors to be in place, in addition to the service being offered. Still, providing service is the necessary first step.

Key Challenges/Success Factors: A key challenge in issuing contracts is to plan for desired programs in advance of issuing the contract. Although contract amendments are possible, the most cost-effective method is to clearly specify all requirements at the outset.

Performance measures: Performance measures could include measures of costs and benefits (per ton and per household) over time as compared to the pre-contract situation or to other similar areas.

TOOL #2.–LOCAL SERVICE-LEVEL ORDINANCES

WUTC-certificated waste and recyclables haulers serve residents in many medium-sized and smaller cities, and all unincorporated counties in Washington. Local governments have influence over what services are provided in their jurisdictions through service-level ordinances. These ordinances allow local governments to establish service level boundaries and set minimum levels of service for residential recycling collection. The ordinances notify the WUTC to implement the minimum levels of service for recycling in the Solid Waste Management Plan and direct the certificated haulers to file tariffs associated with these service levels. The WUTC then approves rate structures[13] and billing systems consistent with the solid waste management priorities set forth under RCW 70.95.010.

As with contracts, service-level ordinances are available to local government partners, not directly to the State. The following evaluation focuses on the use of service-level ordinances by local governments to increase organics collection. Tool #25.– Form Local Stakeholder Partnerships addresses Ecology's ability to work with these partners to coordinate the transition to full organics recovery.

[13] As directed in RCW 81.77.030.

Service-Level Ordinances

Political Feasibility: *Varies (generally Low-Medium).* Adding new organics collection programs could spark opposition from the WUTC-certificated haulers if the service is not demonstrated to be cost-effective and adequate concessions are not made to benefit the haulers. Note that local circumstances and economics vary.

Practical Feasibility: *High.* To implement a service-level ordinance, local governments need to convene their SWAC, have a public hearing, and pass the amendment ordinance. This is a common process that does not usually encounter practical or technical obstacles.

Cost-effectiveness: *Low.* Although the service-level ordinance itself is not expensive, and helps implement services that can achieve significant results, the services themselves may not be cost-effective. Since service-level ordinances are a tool used mainly by counties with largely dispersed populations, increased curbside organics collection is likely not cost effective *at this time*.

Projected Outcomes: Service-level ordinances would establish organics collection services that are necessary to recover organic wastes in areas where local jurisdictions do not contract directly with haulers or provide services themselves.

Key Challenges/Success Factors: A key challenge is showing that programs are cost-effective. Where this is not currently the case, the State or local governments will need to use other tools to establish demand or employ other incentives to justify adding the service. Another key success factor is getting local haulers on board, possibly by providing other incentives to assist haulers or processors in gearing up to provide the new service.

Performance measures: Performance measures could include tracking the disposal of organic wastes before and after ordinances are implemented, as well as the costs of the service over time. Another way to gauge success would be to track participation rates in the program over time.

ECONOMIC INCENTIVES

As discussed above, the economics of expanding organics recovery to achieve the Beyond Waste vision are problematic – significant new capital investment will be required and currently the cost of full organics recovery is higher in many cases than the cost of disposal.

The State and local governments have a variety of tools and strategies available to influence these economics. These are described and assessed below.

TOOL #3.– TIP FEE INCREASES

Tip fee increases can be instituted through a surcharge at the state or local level. Such fee increases both raise the cost of disposal (making recovery programs more attractive economically) and generate revenue that could be applied directly to organics recovery programs. Such a surcharge could be similar to Washington's previous solid waste surcharge, in effect between 1989 and 1995. This 1 percent surcharge generated $10 million in revenue per biennium (Future of Recycling Task Force 1996).

Tip fee increases are likely to be highly effective if they are large enough to influence the underlying economics of disposal versus organics recovery or if they provide consumers

with enough of a price signal to change behavior. At this point it is difficult to determine how much fees would need to increase to provide a meaningful incentive for expanded organics recovery. Although little published research explores the elasticity of demand in response to solid waste tip fee increases, unpublished modeling conducted by King County suggests that a tip fee doubling has only a 10% effect on overall waste disposal (Rist 2002). Thus, a 1% surcharge such as that previously in place in Washington would generate revenue but have little effect on waste disposal. Nevertheless, many private organics processors report that the landfill is their biggest competitor, and call for tip fee increases to encourage use of recovery programs.

It is certainly hard to dispute the notion that if organics recovery programs are to be effective, they will have to compete economically. Our rough analysis suggests that in urban Western Washington an increase in the range of up to $5 per ton could be required to make organics recovery fully competitive. In Eastern Washington, where tip fees are generally much lower, increases in the range of $10 per ton *or more* may be required to make organics recovery cost-competitive. In the last 3-4 years, several other states have attempted tip fee surcharges in the neighborhood of $3 - $4/ton, and have faced much resistance. Wisconsin initially attempted an increase of $16/ton, but reduced it to $4/ton after organized political opposition (Triuni 1999).

Accordingly, the rationale for and value created by such increases at a local or statewide level will need to be fully communicated to stakeholders, maximizing the possibility of support. Fee increases are technically feasible, cost-effective and certainly a commonplace means of funding infrastructure investments and program improvements for solid waste handling systems. Imposing solid waste fee surcharges would require further research into the elasticity of demand in response to such fees in order to set appropriate surcharges.

Tip Fee Increases

Political Feasibility: *Low*. The solid waste industry is an organized and powerful lobby that strongly opposes increases in tip fees. In addition, the public could be expected to oppose this “tax” on what they often view to be their right – low-cost trash disposal.

Practical Feasibility: *High.* Tip fee surcharges are practically and technically relatively easy to implement.

Cost-effectiveness: *High*. Tip fees surcharges raise revenue, cost very little, and have noticeable, although variable, impacts.

Projected Outcomes: Tip fee increases would be effective as a direct waste reduction tool only if they raised the cost of disposal enough so that recovery could compete economically. Even so, the expected effects are difficult to quantify. Tip fee surcharges would raise revenue that could be directly applied to organics programs.

Key Challenges & Success Factors: These include conducting sufficient research to set an appropriate fee, adequately communicating rationale to stakeholders, and making sure preferred recovery infrastructure is in place. Another key challenge is overcoming the potential increase in illegal dumping following a tip fee increase, potentially through increased fines and monitoring of potential dumpsites.

Performance measures: Although it is hard to isolate and measure the effect of tip fee surcharges on waste reduction, it may be possible to compare waste disposal and use of recovery programs before and after a tip fee increase. Governments could survey self-haulers and those who use alternative organics recovery programs to determine what role the tip fee increase plays in their waste management decisions.

TOOL #4.– TAX EXEMPTIONS FOR INFRASTRUCTURE INVESTMENT AND USE OF ORGANICS

The State can and frequently does use tax policy as a way to encourage private investment and purchasing decisions. Some alternatives that may work to stimulate organics recovery and use of finished product include:

- Providing sales tax exemptions for purchases of either equipment for organics processing or the finished product (compost, soil amendments etc., made from organics).
- Remove the sales tax exemption on chemical fertilizers currently available to agriculture, but provide an exemption for organic composts and other soil amendment products.
- Exempt organics processing facility revenues from the B&O tax. The Oregon business energy tax credit program is an example of this type of exemption.
- Reduce or waive property tax for green energy producers. California and Oregon currently do this, but Washington does not.

Approaches such as these have been used in other areas, such as the Recycling Equipment Tax Credit in California (Cal EPA and CIWMB 1995) and several special tax provisions in North Carolina that apply to recycling and resource recovery land, facilities, and equipment (Coker 2000). Furthermore, there is some precedent for this type of approach in Washington. For example, in the 2001 session, the Legislature amended House Bill 2070 to provide several tax preferences that encouraged purchase of equipment for processing (including composting) rather than burning crop wastes. In addition, there is currently a sales tax exemption on the purchase of equipment to produce alternative energy from photovoltaics, landfill gas, wind, and fuel cells, but not from anaerobic digesters (Database of State Incentives for Renewable Energy, 2003). Governor Locke added fuel cells in 2001, and conceivably could be influenced to add anaerobic digesters as well.

Using the tax system to provide incentives for additional organics recovery will be difficult in the current climate, given the state's large budget deficit. However, over the longer term, using tax policy to promote "sustainability" behaviors and investments may become acceptable. On the other hand, providing exemptions can have adverse or unintended consequences; once in place an exemption is difficult to repeal, even after it is no longer needed. Finally, the Tax Structure Study Committee report submitted to the Washington State Legislature in December 2002 noted that exemptions can and do undermine the viability of Washington State's tax system (Washington State Tax Structure Study Committee 2002).

Tax Exemptions

Political Feasibility: *Varies.* Although reduced taxes are popular with businesses, they reduce some state revenue, and would not likely be popular with lawmakers until the state's economy and budget outlook improve.

Practical Feasibility: *High.* The development and legislative process for tax credits should be fairly easy, as previous Washington experience, as well as that in other states, could provide guidance.

Cost-effectiveness: *Varies.* Some types of organics processing facilities (especially those for agricultural wastes in rural areas) are in great need of incentives and assistance with capital. Incentives for these types of generators could encourage large results, whereas tax incentives for urban processors may be less needed and therefore not produce significant results.

Projected Outcomes: These tools would help address the reluctance of the private sector to invest in new processing facilities.

Key Challenges & Success Factors: A key challenge will be to communicate the availability of the tax changes, and rationale for doing so. It may also be necessary to work with stakeholders, if there is opposition or concern. In addition, it may be wise to have the exemption "sunset" at some point, ideally when the credit is no longer needed.

Performance measures: Track the number of new facilities using the tax credit, and the amounts of organics that they divert from the landfill.

TOOL #5.– TAX-EXEMPT BOND FINANCING

Investments that meet certain tests for public purpose and use of assets and revenues are eligible for tax exempt financing under state and federal laws, and are typically executed through a non-profit development authority known in the trade as a "6320." Such financing provides access to new sources of capital, lowers the cost of capital, and shares the risk of new projects between the public and private sectors. In Washington, such bonds are available via the Industrial Revenue Bond (IRB) program, which is administered by the Washington State Business Assistance Center, a division of the Washington State Department of Community, Trade and Economic Development. Under certain circumstances, compost facilities, anaerobic digesters, and other organics processing facilities may be eligible for this type of bond financing. However, although there has been a precedent of states using this type of authority, in autumn 2001 the IRS ruled that the use of these bonds for recycling facilities is ineligible. However, tax law insiders report that the IRS may soon reverse course on this issue (Kinander 2002). In addition, processing of some types of materials is not considered "recycling" by IRS definitions, and so may still qualify.

In any case, there may be some opportunities for the use of such bonds for organic processing facilities. In particular, even under the new IRS regulations it may be possible for tax-exempt bonds to finance anaerobic digesters. For example, in California tax-exempt bond financing is available for anaerobic digesters via the California Power Authority (California Power Authority 2002). Given that the largest problems with capital are in the processing of agricultural wastes for which anaerobic digesters are suited, it is probable that tax-exempt bond financing is currently a viable method for recovering large quantities of organic wastes.

Tax Exempt Bond Financing

Political Feasibility: *High.* Despite the current state budget troubles, this type of tool should be highly politically feasible, as it will likely benefit the economy.

Practical Feasibility: *Medium.* If the IRS reverses course on the use of tax-exempt bonds for recycling facilities, this tool would be highly practical. However, under current regulations crafting appropriate rules would require careful navigation.

Cost-effectiveness: *Medium-High.* The cost of issuing the tax-exempt bonds is relatively low, and the potential impact is fairly high, particularly in rural areas with agricultural wastes.

Projected Outcomes: These tools would help address the reluctance of the private sector to invest in new processing facilities.

Key Challenges & Success Factors: As mentioned above, a key challenge and success factor is accurately navigating the current IRS law on the topic, and monitoring any new developments.

Performance measures: Track the number of organics recycling operations utilizing tax-exempt bonds and their success at recovering organic wastes.

TOOL #6. VARIABLE RATE PRICING

Variable rate (VR) or Pay-As-You-Throw (PAYT) rate structures (also called unit-based pricing) charge customers more when they dispose more. Although the pricing structures may take many forms, a common method is to charge residents by the size of their garbage can or by the number of garbage cans (or bags) they set out. Industry literature suggests that VR or PAYT programs are among the most effective tools to increase waste diversion. A national study by Skumatz Economic Research Associates found that these programs reduce residential landfilled tonnage by 17%, with about 5 to 6 percentage points going to recycling, 4 to 5 percentage points going to yard debris programs (where available), and 6 percentage points going to source reduction (Skumatz and Green 2001).

VR and PAYT pricing is already the norm in Washington, but it takes many forms. For example, the Washington Utilities and Transportation Commission's (WUTC) rates are currently variable, in that they charge more for more waste. Seattle's rate structure is even more aggressive in that it is essentially "linear", where the cost of collection increases in direct proportion to the quantity of garbage. (Such a pricing system would not be feasible in WUTC areas where rates must be tied to the actual cost of service.) Over 200 Washington communities already have some form of VR or PAYT pricing.

Although VR and PAYT pricing structures are already commonplace, it may be possible to expand these strategies to focus more specifically on organics. For example, local governments could attempt strategies to increase rates for customers with large quantities of organic wastes, or institute aggressive pricing structures where the cost of garbage collection increases with volume beyond the actual marginal cost of the service.

Variable Rate Pricing

Political Feasibility: *Low.* Given the current WUTC framework, further expansion of VR/PAYT beyond that currently in place is not likely. Although cities with strong initiative (and local control of rates) still have some opportunities to institute more aggressive forms of VR/PAYT, this strategy has likely gone as far as it can reasonably go in most areas, barring major regulatory changes.

Practical Feasibility: *Medium*. In cities with local control of rates, implementing new rate structures is not technically difficult, especially considering the existing literature and collective experience on the topic. However, further increasing existing VR/PAYT rate structures in areas with WUTC oversight would likely not be feasible, as WUTC regulations prohibit pricing in excess of the cost of service.

Cost-effectiveness: *High.* Variable rate pricing appears to be one of the most cost-effective means of reducing waste and increasing recycling. The rates produce measurable impacts, and may generate additional revenue.

Projected Outcomes: In general, variable rate programs are very successful. However, given the existing prevalence of them in Washington, additional VR/PAYT requirements may not achieve results that are quite as significant as those cited in the Skumatz study, discussed above.

Key Challenges & Success Factors: Local governments with the interest and ability to further implement VR/PAYT would need to publicize new rates and conduct education (through utility bill inserts).

Performance measures: Measure program use and diversion rates from organics recovery programs before and after new pricing structures.

TOOL #7.– GREEN ENERGY INCENTIVES FOR ANAEROBIC DIGESTERS

Currently, a number of economic incentives are available in Washington to support new investment in renewable energy technologies. At the state level, these incentives include sales tax exemptions for the purchase of renewable technologies, a rebate program on photovoltaic (solar) panels, a corporate excise tax exemption on the development of new renewable technologies, and net metering for small generators (Database of State Incentives for Renewable Energy 2003). Many other incentives exist in specific public utility districts, including Whatcom, Chelan, Grays Harbor, and Pacific. Other possibilities include the “Green Tags” incentives offered by Bonneville Environmental Foundation for generation of “green” electricity.

However, many of the available incentives do not apply to electricity generated from dairy manure and other wastes at anaerobic digesters (AD). For example, although Governor Gary Locke recently added fuel cells to the list of technologies eligible for the sales tax credit, and landfill gas is already on the list, anaerobic digesters do not currently qualify.

State agencies could work to get anaerobic digesters included in state green energy incentive programs. Given that an AD system costs several million dollars, a sales tax break on this equipment could provide several hundred thousand dollars of relief. These savings may be enough to substantially assist private companies considering building such a facility. For example, a proposed AD facility in Eastern Washington has had trouble securing needed capital, and projects that annual costs will exceed identified revenue by about $250,000 (Lamphere 2002-2). A sales tax break on the capital costs could help make up this difference, at least initially. Finally, some contacts reported that

the process of connecting to the electric grid via utility inter-ties could be difficult for anaerobic digesters. According to Jim Kerstetter, Chief Scientist with the WSU Energy Program, utilities in Washington are required to purchase green power, and the equipment to connect a digester to the grid is standard technology that is readily available (Kerstetter 2003-2). Still, individual power companies each have specific equipment and safety standards that can make inter-ties difficult.

Green Energy Incentives

Political Feasibility: *Medium-High*. Although there would likely not be large opposition, it may be difficult to build enough support for this lesser-known technology and gain enough political capital to include anaerobic digesters in existing green energy programs.

Practical Feasibility: *Medium.* Additional research may be required to substantiate including anaerobic digesters in existing green energy programs.

Cost-effectiveness: *Medium.* It would not likely be very costly to add anaerobic digesters to existing incentives, and the potential quantity of material recovered is quite large (there are several million tons of dairy manure generated annually in Washington). However, green energy incentives are only one tool, and would not likely be enough to spur widespread investment in AD facilities.

Projected Outcomes: Additional incentives will help the private sector overcome the perceived financial risk of investing in AD systems.

Key Challenges & Success Factors: Working with the WSU Cooperative Extension Energy Program and the Washington Office of Trade and Economic Development's Energy Policy Division would likely be a necessary step, as these organizations would be key partners in advancing incentives for anaerobic digesters.

Performance measures: Track the annual number of AD facilities brought on-line, before and after the incentives, plus anecdotal information on the appeal of this incentive to the private sector.

TOOL #8.– GRANTS TO LOCAL GOVERNMENTS

Currently, Ecology administers a variety of successful grant programs, including the Coordinated Prevention Grants, or CPG, program. The Model Toxics Control Act (RCW 70.105D) provides authority and funding for the CPG, which are available to local governments, primarily counties, for hazardous waste management and solid waste management plans and programs (WDOE 2001-3). Ecology could consider targeting future CPG funds to plans and projects that help achieve the Beyond Waste vision for organics, such as development of service-level ordinances, infrastructure investments, or pilot programs to collect food waste from residences or small quantity generators.

One advantageous aspect of the CPG program is that new grants must include output and outcome performance measures (WDOE 2001-2). These performance measures will allow Ecology to estimate the effectiveness of the programs funded under the grants at diverting organics from the landfill and raising consumer awareness of the benefits of and need for organics recovery.

In general, local governments are very happy to avail themselves of grant resources, and it is Ecology's prerogative to formulate criteria for disbursing the grants. Therefore,

the political feasibility of aligning this program with the Beyond Waste vision should be high. Also, Ecology has been managing this program since the Model Toxics Control Act was passed in 1988, so it has plenty of experience with crafting and implementing guidelines. This tool should result in additional provision of organics collection and processing services to state residents, thereby helping to create supply as well as demand for organics recovery.

Ecology Grants to Local Governments

Political Feasibility: *High*. This grant program is entirely within Ecology's purview, and should be aligned with the Beyond Waste vision. Local governments appreciate this program, and should be supportive.

Practical Feasibility: *High.* Ecology staff are highly skilled at administering this grant program already.

Cost-effectiveness: *High.* Providing local governments with funds to establish new organics recovery programs is an effective use of Ecology staff time and resources.

Projected Outcomes: The possible outcomes of this tool include increasing demand for organics recovery services among state residents through pilot programs, increasing the supply of recovered organics, and generating information on the feasibility of a variety of approaches to organics recovery.

Key Challenges/Success Factors: Key success factors include development of effective criteria for new organics plans and programs.

Performance measures: Track the number of new organics recovery programs that are implemented using CPG funding. Evaluate the success of these programs at diverting organics from the landfill and raising consumer awareness of the possibility of organics recovery. Monitor programs to see whether they continue after the grants expire.

REGULATORY/LEGISLATIVE REQUIREMENTS

For many reasons motivating waste generators and stakeholders through incentives and education to recover organics is the preferred way to achieve the Beyond Waste vision. After all, most citizens and businesses respond more favorably to voluntary, benefit-based inducements than to mandates. Nonetheless, it is important to consider possible regulatory actions that may accelerate implementation of organics recovery systems and practices. In addition, our assessment revealed that there are certain regulatory barriers that need to be addressed to maximize the potential for success.

This section addresses possible regulatory tools, strategies, and initiatives associated with effectively recovering organics from the waste stream.

TOOL #9. CHANGES IN THE REGULATORY STRUCTURE

One of the most commonly cited difficulties in moving forward with organics recovery is the difficulty in determining which wastes, materials, and activities are managed and regulated by what agencies, and how to then navigate the regulatory environment. This type of regulatory confusion, although not exclusive to organics, has made it difficult to truly establish *demand pull* for organic materials, as processors and markets find

navigating the regulations daunting. The distinction between different types of wastes (e.g. solid, industrial, and agricultural) and products (e.g. fertilizers, soil amendments) is not always clear. As an example, crab shell slurry from food processing operations may be considered a solid waste, a fertilizer, or a soil amendment, depending on different agencies' and users' perspectives. But from the perspective of the Beyond Waste vision, these potential regulatory distinctions, although important, may mean less than the potential of this material as a recovered organic resource.

Although Ecology has made some progress clarifying the regulatory structure in its new solid waste handling standards, a strong next step could be to work with the various agency authorities, examine trade-offs associated with conflicting regulations, establish priorities, and create a comprehensive framework for dealing with organic materials as they travel through the economy.

Such an approach could involve either (1) coordinating the various agencies to agree on the goal of organic recovery, centralize information, clarify where regulations do and do not apply, and facilitate any needed revisions; or (2) create a whole new regulatory structure to define and regulate a new class of materials, "recovered organics."

In either case, this task could be accomplished by a Cross Team, as discussed in Tool #24.– Establish Cross Team.

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Regulatory Changes

Political Feasibility: *Low-Medium.* The process of modifying the existing regulatory framework, much less creating a whole new one, would likely be contentious. For one, other agencies have regulations for good reasons, and may be unwilling to cooperate in reforming regulations for the goal of recovering organics.

Practical Feasibility: *Low-Medium.* The process of assembling, understanding, and streamlining the myriad of regulations would be challenging and difficult. In some cases, it may not be possible to resolve competing priorities are revise regulations to facilitate organics recovery.

Cost-effectiveness: *Medium.* Although it is difficult to determine how long and expensive a process regulatory reform would be, it would likely produce significant return and be cost effective in the long term.

Projected Outcomes: Regulatory reform could substantially assist in the siting, building, and operating or organics processing facilities, and help to establish *demand pull*.

Key Challenges & Success Factors: A key success factor would be the establishment of an effective body to direct and carry out the regulatory reform process. See Tool #24.– Establish Cross Team for more information.

Performance measures: Track the number and reported ease of siting organics processing facilities after the change, as well as incidence of breaches of environmental compliance before and after the change.

TOOL #10.– ORGANICS RECOVERY GOALS

As Ecology moves forward with convincing other stakeholders to adopt and then work to achieve the Beyond Waste vision for organics management, it will likely be important to

establish goals and/or milestones tied to this vision. These goals begin to commit everyone to the actions required to achieve the vision, not just to the vision itself.

Goals have been an integral component of Washington State's approach to waste management, and have been largely effective at motivating change at the local level. Currently, Washington RCW 70.95.010 establishes the statewide goal of 50% recycling by 2007, which cities and counties are instructed to make their own priority as well. Many cities and counties have used their goal as a fundamental tool when planning waste reduction and recycling programs. Goals have also been used aggressively by Oregon and California. Oregon sets individual recycling goals for each major waste-shed, and California requires compliance with its aggressive goals.

Given the scope of the Beyond Waste vision, an ambitious but largely attainable goal could be full recovery of organic wastes by a certain year. Such a goal could help commit local governments to designing and optimizing new, cost-effective systems for the long term rather than continuing to incrementally add service to achieve short-term goals. Milestones such as achieving a certain percentage of diversion by a certain year should also be helpful in motivating changes in policies and behavior practices. However, goals and milestones are not necessarily followed with action or change. A key challenge in using goals is to effectively plan and put tools in place to reach those goals.

Goals can either be mandatory, such as those legislated in the Waste Not Washington Act, or incorporated into local government planning frameworks, where they are essentially voluntary.

Organics Recovery Goals

Political Feasibility: *Medium (if legislated)-High (if inserted into planning framework.)* Goal setting has been an integral part of Washington's approach to solid waste, and agreeing to set a new goal should not be difficult. As long as the goal seems realistic given the timeframe, the public and legislative body will likely find it to be reasonable, especially if inserted into the local government planning framework via RCW 70.95.010. On the other hand, establishing a new goal via legislation (like the Waste Not Washington Act) attains only a rank of "medium" political feasibility.

Practical Feasibility: *High.* The system and precedent for establishing goals is already in place. Achieving those goals involves using other tools (see Key Challenges, below.)

Cost-effectiveness: *High.* Although not a recovery program in itself, goals are necessary, and are not expensive to develop.

Projected Outcomes: New goals can provide impetus for action and program development.

Key Challenges & Success Factors: Given the ambitious nature of the Beyond Waste project and its vision, developing realistic and aggressive goals, and managing public reaction, will be essential challenges and success factors. Making progress towards the goals, of course, is an even greater challenge that involves the use of many other tools, and careful planning. The action plan at the end of this report assembles a group of tools to achieve the Beyond Waste vision.

Performance measures: Measure individual city and county adoption of, and progress toward, the State's goals for organics.

TOOL #11.– DISPOSAL BANS

Bans on the disposal of selected materials are a common technique for keeping undesirable items out of the waste stream and encouraging environmentally preferred behaviors, such as composting or recycling. Yard waste is currently banned from the garbage in many local jurisdictions in Washington including King County and Seattle, and in 24 states in the Midwest and East (Fickes 2002). In addition to yard waste, local governments and/or the State could impose a ban on the disposal of compostable food wastes and possibly other organic materials as a means of securing a change in behavior and accelerating the shift to full recovery of organics from the solid waste stream. Such bans could be applied selectively – say to food service establishments, groceries, and other large generators of organics – or across the board, to all waste generators.

Disposal bans have proven to be effective in achieving solid waste management goals. (Fickes 2002). This has been true for the diversion of yard waste as well as keeping toxic materials out of the landfill. Experience indicates that bans work best when alternative means of managing the banned material are available, including collection infrastructure. For example in King County and Seattle, yard waste is banned from disposal, convenient and lower-cost collection alternatives exist, and customer compliance and acceptance of the ban is high. For example, yard waste now comprises less than 3% of residential waste in Seattle, whereas before yard waste was banned and collection was offered yard waste comprised 17% of residential waste (Matrix 1991). Furthermore, residents may be willing to accept a ban on food waste -- in a recent food waste collection pilot study, about one-third of participants said they participated because they thought it was required (Cascadia 2001-2). However, bans would not necessarily be as well accepted in all areas of the state. The success of the yard waste ban in Seattle must be partly attributable to the existence of convenient alternatives and a generally environmentally aware populace. Note that it is important to remember that bans are not particularly effective options in themselves, as they require collection infrastructure or other alternatives to be accessible, convenient, and acceptable to the waste generator. Bans should therefore only be used once such alternatives are in place.

Food waste bans are very rare in the United States, but are being considered by some cities and states. For example, Massachusetts is considering a ban to take effect in 5 – 10 years (Greene 2001). In Europe, food waste bans are currently being implemented in some countries not only as a waste reduction strategy but also as a means of reducing greenhouse gas release from landfills. The Netherlands has already banned food waste (Gerlat 1995) and Norway is considering such a ban (Cole 2002).

Disposal bans can be implemented feasibly, but are not always readily enforced. Political viability varies, depending on the inconvenience and costs associated with the alternatives to disposal. Banning food waste from residential garbage collection in urban areas of Washington would likely spark considerable opposition, as surveys and pilot studies show that only a small percentage of households accept the idea and practice of food waste separation at this time. Bans can backfire, if public opposition is so strong that the original program goals (like full organics recovery) are undermined and modified by elected officials responding to the tool of the ban as a means of achieving the goal.

One noteworthy approach is the strategy in which bans are used only after successful programs are already in place. Service is first provided, followed by on-going education and technical assistance. A ban is only used once the program is already successful to

encourage even further recovery. This may be an attractive option in Washington, where a ban would receive much stronger opposition in some areas than in others.

Disposal Bans

Political Feasibility: *Varies*. Additional bans would likely be moderately to highly feasible in areas where bans are already in place, but rather unfeasible in other areas.

Practical Feasibility: *High.* Establishing a ban is easy, but enforcing it is very difficult.

Cost-effectiveness: *High.* Unless significant resources are spent on enforcement, disposal bans generally achieve measurable results for minimal cost.

Projected Outcomes: *Varies.* It is difficult to assess the outcome of bans since they are not stand-alone tools. Still, bans should be effective at communicating preferred actions, and be considered part of a suite of Beyond Waste tools. However, a disposal ban without a collection infrastructure could result in illegal dumping or burning.

Key Challenges & Success Factors: It would be very important to introduce bans that are carefully timed with program implementation and needs. One successful approach may be to wait to institute a ban until a program has already achieved measurable success.

Performance measures: Track waste diversion before and after the implementation of a disposal ban.

TOOL #12.– MANDATORY SOURCE-SEPARATED COLLECTION

Washington State law requires that counties and cities develop comprehensive solid waste management plans that include a waste reduction and recycling element. According to RCW 70.95.090 (7), residential waste reduction programs must include source-separated collection of recyclables in the urban areas and drop boxes or buy-back centers in the rural areas. However, cities and counties need only include yard waste if ”the county or city submitting the plan finds that there are adequate markets or capacity for composted yard waste within or near the service area to consume the majority of the material collected.” The State could consider revising this language to require local governments to offer yard waste or mixed organics collection by a certain date. This may be an effective tool, given that the current requirement for recyclables service has reportedly been a very effective instrument in developing recycling service.

Mandatory Source-Separated Collection

Political Feasibility: *Low-Medium.* Some local governments would likely oppose this measure as it would be difficult to implement cost-effective programs in some areas. Still, if enough time were given, it would likely be possible to require service, as long as flexibility is allowed for local governments to design appropriate programs.

Practical Feasibility: *High.* Amending the state law could take time administratively, but is not otherwise technically difficult. The real challenge would come at the local government level, as planners would need to analyze and evaluate options.

Cost-effectiveness: *Medium.* This type of action would not require significant costs at the State level, and would require local governments to plan for Beyond Waste. However, the planning costs at the local level could be somewhat of a barrier, but very likely cost-effective in the long run.

Projected Outcomes: Local governments would be required to plan and implement residential mixed organics collection.

Key Challenges & Success Factors: Each local government would likely find it challenging to effectively design a cost-effective system. Ecology or a coalition of local governments could assist by developing an analytical tool, similar to Seattle's Recycling Potential Assessment/System Analysis model, that local governments could use and modify.

Performance measures: Count the number of cities and counties adopting plans for, and implementing, residential mixed organics collection.

EDUCATION & TECHNICAL ASSISTANCE

Washington State is already a leader in the field of education and technical assistance about organic waste, with local governments creating model education programs such as the "Soils for Salmon" initiative and partnership-based programs to educate the public about soil health and stimulate demand for compost products.

Education and technical assistance programs are generally politically feasible, as most stakeholders support such activities. Funding for education, however, does not always receive the same level of support. Although education and technical assistance are commonly thought to be vital to effective programs, it is often difficult to directly tie education or technical assistance to outcomes. As a result, the program evaluation necessary to secure funding can be difficult.

Those interviewed for this research suggested many different options for education and technical assistance activities that would support the effort to divert more organics from the waste stream. These options are summarized below.

TOOL #13.– EDUCATION & OUTREACH TO THE PUBLIC

Educating the public about the importance of soil health could lead to increased acceptance of curbside programs to separate and recover organics and increased demand for soil amendments products. This education could also help achieve a more fundamental transition to a more sustainable approach to landscaping, horticultural practices, and agriculture. Education could stress practices that use fewer or no chemicals, which would help human health and the environment and maintain a clean organics stream. Additionally, education and promotion would also be needed to publicize new services, promote their use, and educate the public about correct source separating of organic wastes. Finally, such an effort could include documenting and publishing success stories associated with the use of recycled organics in landscaping and agricultural applications.

Education and technical assistance materials and programs can be difficult to develop, costly, and become outdated when programs change. However, much work has already been done in Washington, including the Soils for Salmon partnership and many other

programs conducted by local governments and assisted by Ecology. This work should provide a solid foundation.

There are many different approaches to education and technical assistance. Several alternatives are summarized in the tools matrix found in the consultant's Beyond Waste issue paper *Achieving the Beyond Waste Vision: A Framework for Moving Forward.*

Education and technical assistance will be critical to a successful transition to the full recovery of organics – to gain public acceptance for these changes, to provide the needed understanding of how to make those changes, and to create demand for the finished product. Education programs, marketing campaigns, and technical assistance activities are, however, expensive and not always effective. Adequate funding will be required as well as evaluation mechanisms to measure program effectiveness.

Education and Outreach to the Public

Political Feasibility: *Medium.* Bold education materials may elicit some resistance from stakeholders, but in general are feasible both with decision-makers and with other stakeholders. However, they are not always supported because it can be difficult to demonstrate direct results.

Practical Feasibility: *High.* Given the long history and demonstrated success of education and outreach programs in Washington, there should be little trouble continuing this trend.

Cost-effectiveness: *Low-Medium* Education and outreach programs can be expensive (especially if they involve mass media promotion or one-on-one contact) and have few directly measurable results. Still, most local governments have found them to be successful, even essential, to spread the word about available services and preferred behaviors. An in the long term, they will likely be necessary to bring the public along toward the Beyond Waste vision.

Projected Outcomes: Education and outreach programs give the public the information they need to participate in the organics cycle.

Key Challenges & Success Factors: Initially, a key challenge and success factor is designing effective information and campaigns that are accurate, compelling, inspire action, and are accessible to residents for whom English is not a native language. Later challenges involve reaching so-called "late-adopters" – residents who do not initially respond to education efforts. Increasingly, local governments are also finding that when possible, pledges and commitments are key success factors to increase citizen follow-through, a practice inspired by the notion of "Community-based social marketing" promoted by Doug McKenzie-Mohr (McKenzie-Mohr and Smith 1999). Finally, funding education programs can be difficult, as it can be hard to demonstrate their impact on behavior change.

Performance measures: A common means of assessing education efforts is to conduct surveys of residents.

TOOL #14.– PROGRAMS IN SCHOOLS

Given the long-term nature of Beyond Waste planning, it will be important to educate many generations of Washington residents about the organics cycle and other aspects

of Beyond Waste. One such means is by developing school programs that teach students the process, uses, and benefits of recycling organic matter.

Many such successful programs are already in place. For example, King County offers "Soils for Salmon" workshops to secondary schools about the benefits of healthy soils and the role of compost in amending soil. Other schools couple organics recovery programs with education. For example, the Portland school district is currently collecting food waste from 38 of 60 elementary schools. The schools involve students and staff in periodic waste "audits" to educate them about the benefits of composting and also to teach them about proper practices, techniques, and materials that should not be composted. Taking the process even another step further, at the Orca Elementary School in Seattle, a student club collects food from the cafeteria for their worm bins, which in turn provide compost for the garden. Club members and other students involved in garden elective classes maintain the worm bins, rake leaves for yard waste compost, and use the compost to grow plants which are sold at an annual plant sale. Students are able to see the direct tangible benefits of healthy soils in the complete cycle of food production, and occasionally sell their produce at a weekly farmers market across the street.

There are many possible avenues to encourage such education programs. One such vehicle is grant money. The Orca school, mentioned above, was a 1991 recipient of an award as part of Ecology's 1991 School Waste Reduction and Recycling Program.[14] Another is by providing educational material and resources to schools. A third option would be to insert organics recycling education requirements into existing elementary or secondary school curricula. This last approach could involve modifying the existing environmental criteria in the Essential Academic Learning Requirements or the curriculum of the Washington State Commission of Student Learning.

Because the first two options listed above are essentially already underway, following is an evaluation of the feasibility of modifying required curriculum to include education on Beyond Waste goals and practices.

Programs in Schools

Political Feasibility: *Medium*. It may be politically difficult to insert new requirements into curricula, particularly requirements that don't address topics covered in standardized tests.

Practical Feasibility: *Medium*. Need to develop and approve curriculum, which could be somewhat time consuming.

Cost-effectiveness: *Medium-High (long-term).* Schools programs are likely to be cost-effective in the long-term, as education now will likely pay off later through prevention.

Projected Outcomes: Educate the next generation of consumers and environmental leaders.

Key Challenges & Success Factors: Experience in other areas has shown that getting School Board and public support has been crucial to educators trying to implement compost education programs. Additionally, inserting new curriculum may require superintendent mandates (SPI).

[14] This grant funding is no longer available.

Performance measures: Conduct tests to measure student retention of key messages.

TOOL #15.– TECHNICAL ASSISTANCE TO GENERATORS AND PROCESSORS

Experts interviewed for this study cited lack of experience with handling food waste as a major barrier to increase food waste collection and processing. Food waste recovery brings with it odor and and leachate concerns that require some skill to handle and minimize. Currently, few organics collectors or processors have these skills. This tool calls for technical assistance to organics processors to help them build capacity for processing food waste, minimizing odors, and maintaining consistent quality standards.

In addition, generators of food waste, ranging from households to restaurants to food processing plants, may not be familiar with best management practices for separating and storing food waste such that rodent and odor problems are minimized. Ecology or its partners could provide technical assistance to generators through seminars or on-site visits to help them prepare their food waste for recovery effectively.

Technical Assistance to Generators and Processors

Political Feasibility: *Medium-High.* Technical assistance is already part of Ecology's and many other agencies' activities.

Practical Feasibility: *Low-Medium.* Technical assistance to individual waste generators is very resource-intensive, and requires additional follow-up to be truly successful. Technical assistance to organics processors is more feasible, as there are a limited number of processors many of whom are already accustomed to technical assistance from Ecology or another agency.

Cost-effectiveness: *Varies.* The cost-effectiveness of technical assistance to generators in the short-term is low, as significant resources are required to provide the assistance. However, in the long term, assistance to generators is easier to justify, since the initial investment to inspire a change hopefully generates many years of waste elimination and recovery. Technical assistance to processors regarding food waste processing is likely highly cost-effective, as the skills provided will allow for the recovery of large quantities of organic wastes.

Projected Outcomes: In the long term, technical assistance to generators and processors provides businesses the tools they need to participate in organics recovery, and therefore has a great impact.

Key Challenges & Success Factors: A key success factor in a technical assistance program is sufficient follow-up to reinforce desired behaviors and build momentum.

Performance measures: For generators: record self-reported or audited level of commitment one year after technical assistance ends. For processors: measure reported success processing new materials, and the number of odor complaints.

TOOL #16.– TECHNICAL ASSISTANCE TO END-USERS

Contacts interviewed for this study emphasized the need to assist end-users, particularly in agriculture and landscaping, in using recovered organic products. Establishing a strong *demand pull* from these users will be crucial in expanding and strengthening markets.

Technical Assistance to End Users

Political Feasibility: *High.* Technical assistance to end-users is already part of conservation district and WSU activities.

Practical Feasibility: *Medium.* Technical assistance can be resource-intensive. However, sufficient expertise is likely already available. While some landscapers and farmers are likely amenable to new ideas and products, others may be set in their ways and less likely to adopt new practices.

Cost-effectiveness: *Medium-High.* Although technical assistance can be resource-intensive, each farm is a very large potential market. Landscapers, on the other hand, generally require fewer material inputs. Still, since there are relatively few end-users (compared to generators, for example), each with the potential to use a significant quantity of product, a successful technical assistance program should be highly cost-effective.

Projected Outcomes: Some type of assistance will be vital in shifting current agricultural and landscaping practices to value healthy soil and use recovered organics. Technical assistance, with proper scientific, stakeholder, and peer backing, should be successful in establishing very large markets for recovered organic materials.

Key Challenges & Success Factors: A critical challenge would be having sufficient evidence of success, experience with methods, and peer support to convince the end-users, many of whom haven't dramatically altered their practices in many years. Even for users that are amenable to change, follow-up technical assistance (consistent "hand-holding") may be necessary to reinforce proper practices.

Performance measures: Record self-reported or audited level of product use one, two, and five years after initial technical assistance.

TOOL #17.– DEVELOP TECHNICAL ANALYSIS CAPACITY

In moving to Beyond Waste, a high degree of coordination with local governments will be required to transition to the infrastructure and programs necessary to recover all organics (See Tool #25.– Form Local Stakeholder Partnerships) Although each local government is responsible for planning for its waste and recycling infrastructure, the degree of analytical sophistication of these planning efforts varies according to need and resources available. Consequently, the State could assist the planning and coordination by developing technical analysis tools to evaluate the costs and impacts of various program options.

Sophisticated computer models and technical feasibility studies have been developed or commissioned by several local governments. Most notably, Seattle Public Utilities has spent the last two decades developing its "Recycling Potential Assessment/System Analysis Model" to support its planning and policy initiatives. Their model forecasts waste tons generated, recycled, and disposed, as well as the total system costs associated with solid waste management under numerous program options (Seattle Public Utilities 1998). The State could work with local partners to develop a robust, accurate, and detailed model to assist local governments with their planning and policy decisions. Seattle, and other local governments with similar experiences, could assist in

the development of this tool. The State could oversee its development and assign staff resources to assist with its use.

Develop Technical Analysis Capacity

Political Feasibility: *Medium-High.* Although there would not likely be strong opposition, the political feasibility of this tool would likely range with the expected costs.

Practical Feasibility: *Low-Medium*. Developing the analytical model within a state agency would be a huge task, and Ecology itself does not have the direct experience that its local partners have. Alternately, Ecology could facilitate the development of the model jointly by the local partners, perhaps through the partnership described in Tool #25.– Form Local Stakeholder Partnerships. In either case, the challenge of making a model and gaining staff expertise necessary to develop a statewide planning tool would be significant.

Cost-effectiveness: *Medium.* In the short term, this process is not likely to be cost effective, as it produces few short-term results but potentially large short-term costs. However, in the long-term, the investment in a robust model and technical analysis capacity to make coordinated and cost-effective decisions about Beyond Waste infrastructure investments should pay for itself.

Projected Outcomes: The development of technical analysis capacity would have a great effect on the ability of local governments to plan for the next generation of infrastructure –designed for full organics and technical nutrient recovery – and therefore have a great impact.

Key Challenges & Success Factors: Key challenges and success factors include the successful information and tool-sharing by local governments, and the creation of a model and staff expertise that would be useful to the ranging needs and variables of local governments.

Performance measures: Track the number of local governments using the technical analysis capacity in their planning process.

GOVERNMENT LEAD BY EXAMPLE

Government can play a leading role in achieving the Beyond Waste vision for organics, through the following actions:

- Implementing model programs to recover organics from the waste stream at all government facilities; and
- Procurement of compost and other soil amendment products made from diverted organics.

Governments have already been a significant driver in the development of certain organics markets. For example, the Department of Transportation has been a large consumer of compost made from yard waste produced in Puget Sound. While procurement and government leadership is in theory effective, the value of this approach is often limited by challenges associated with inter-agency coordination, conflicting priorities, and funding constraints. The Governor's Executive Order on Sustainability, if

aggressively implemented, should help realize the full potential of this tool for this organics initiative as well as other goals associated with the Beyond Waste vision.

TOOL #18.– IMPLEMENTING MODEL PROGRAMS

Reaching the Beyond Waste vision will involve the development of many new programs and services to eliminate and recover wastes. While the State will be taking a leadership role in setting goals, coordinating partners, providing financial assistance, and numerous other activities, it can also serve as a role model by implementing model programs at its own facilities. Such programs could help the State "walk the talk", recover significant quantities of wastes, and set a powerful example for other agencies, businesses, and residents. Programs could include the following:

- Landscaping practices that use organic or integrated pest management (IPM) approaches, with aggressive use of compost and nutrient "teas." Such an approach would model appropriate behaviors, as well as demonstrating the positive impacts of these practices on soil and plant health.
- Aggressive collection programs of organic wastes. This applies to both landscaping wastes from campus grounds as well as the large quantities of food wastes and compostable papers generated in cafeterias. The EPA facility in Research Triangle Park, Virginia could serve as an example.[15] The State could then contract with a hauler or processor to collect the material, or continue serving as a model by doing the following.
- Developing on-site processing systems. These could range from low-tech windrow composting to in-vessel aerobic, anaerobic, or vermi-composting systems. Many such systems are available that operate cost-effectively relative to disposal.
- Purchasing materials that are reusable, compostable, or readily recyclable, and toxic-free. Cafeteria-ware could be a logical first choice, as many re-usable or compostable items are available in the marketplace. Again, the EPA facility in Research Triangle Park, Virginia could serve as an example.

Model Programs

Political Feasibility: *High*. Model programs could easily be part of a variety of state agencies' strategy in complying with the Governor's Executive Order on Sustainability.

Practical Feasibility: *Medium-High*. State agencies have likely already started down the path of some such model programs. Other programs could be implemented in order of ease, but all model programs are technically feasible, although in some cases there is not extensive existing experience in implementing them.

Cost-effectiveness: *Medium-High*. Most model programs are cost-effective, especially when the educational "ripple" effect is considered.

[15] As could programs at the Evergreen State College in Olympia or the Washington State Department of Corrections, particularly the Walla Walla penitentiary.

Projected Outcomes: Model programs would help state agencies comply with the Executive Order, recover organic wastes, purchase environmentally preferable high-performing products, develop markets, and educate employees and the public about the direction and practices of "Beyond Waste behavior."

Key Challenges & Success Factors: One key challenge would be to select appropriate programs and equipment and adequately communicate goals and expected behaviors to staff and, in some cases, contractors (such as landscaping contractors).

Performance measures: An agency-wide organics recovery rate could be calculated and used to measure internal success of the program. In addition, an informal survey of staff could track employee attitudes about the programs, and whether they have transferred these behaviors into other home or business practices.

TOOL #19.– INCREASING PROCUREMENT REQUIREMENTS FOR RECYCLED ORGANICS

In addition to the programs discussed in Tool #18 above, state agencies can increase their purchase of recycled organic products. Such products can be used in landscaping on building grounds, but also in projects around the state, such as highways, developments, and remediation sites overseen or managed by state agencies.

Potential products to be added to the procurement requirements include compost and mulch, but also many of the wide variety of other products made from recycled organic materials: nutrient "teas," seeding medium, anaerobic digester residuals, and even green electricity from anaerobic digesters, if available.

Procurement Requirements for Recycled Organics

Political Feasibility: *High.* Procurement requirements can be part of state agencies' strategies to comply with the Governor's Executive Order on Sustainability.

Practical Feasibility: *High.* Inserting new procurement requirements could take some time, but otherwise should be very feasible. In most cases, potential products and their uses are available and understood, but quality standards would be helpful.

Cost-effectiveness: *Medium-High*. In most cases, the use of recycled organic materials is cost-effective, as they are competitively priced with, and often offer increased benefits over, other products.

Projected Outcomes: Procurement requirements will help Ecology and other state agencies "walk the talk", improve their environmental performance, and stimulate markets for recycled organics.

Key Challenges & Success Factors: One likely success factor would be incorporating quality standards, as they emerge through the implementation of Tool #21.– Quality Standards and Labeling, into the specifications to most accurately match products to desired and appropriate uses.

Performance measures: Track the quantity of recycled organic products purchased, over time. Evaluate the performance of those products, as measured by staff using or applying them.

MARKET DEVELOPMENT

One of the keys to increasing recovery of organics is developing strong, deep markets for recycled organic products. The set of tools described below works to establish such markets through development of quality standards, research and development, and economic tools. These tools help to overcome several barriers described in the previous chapter, including on-going concerns about quality, insufficient prices, and limited market demand.

TOOL #20.– SOIL QUALITY STANDARDS THAT CALL FOR USING RECYCLED ORGANIC MATERIAL

Landscaping associated with new construction projects, particularly tract developments, represents a potentially significant source of new demand for compost and other organic soil amendment products. In addition, proper conditioning of the soils associated with such developments can reduce the need for watering as well as runoff and the application of pesticides and herbicides. Setting organic content standards for soils as part of zoning requirements or building codes is one way to stimulate such demand and ensure soil health.

This approach has been pursued in King County, resulting in zoning code KCC 21A.16.085, which contains the following general requirements:

- "For all new turf areas (except all weather, sand-based athletic fields) a 2-inch-thick layer of organic material, cultivated a minimum of six inches deep is required."
- "A soils analysis must be conducted to measure the texture and organic content of the soil (five percent or more of organic content to a depth of six inches is required), as well as the pH and infiltration rate of the soil."
- "All other areas must have enough organic content to provide adequate nutrients and moisture-retention."

Officials in King County advocated for this type of regulation as one way to ensure adequate demand for compost and, more importantly, to provide for adequate soils associated with new construction projects. Others interviewed as part of this research from Puget Sound but also from Eastern Washington were also supportive of this approach. Currently, Ecology's draft stormwater Best Management Practices (BMP) includes suggestions that go beyond King County's code, above, but which are currently actively debated. The goal of many experts is to incorporate the text of these BMPs into other county permits and building codes. Even so, it should be noted that these types of requirements can currently be met without using compost or other soil amendment products made from recovered organic material. For the most part, this is for good reason. For example, soil quality standards like those currently under development can be met by leaving native soil in place. Since healthy soil has been shown to need less fertilizer and chemical inputs this type of strategy is also beneficial as a hazardous waste prevention strategy (Marx 1999). One possibility might be to require the use of recycled organic matter or compost, if soil amendment is necessary to meet the standards.

It is too early to fully assess the effectiveness of this type of regulation on changing behavior related to soil health, use of soil amendments and the markets for compost made from yard and/or food waste. In King County, the building industry was initially

opposed to such standards, suggesting some problems with political feasibility. However, many landscapers in the county have welcomed requirements for better soil health. No data were obtained on the impact of this approach on compost markets, although studies have been conducted estimating a significant level of potential impact (Cascadia Consulting Group and E&A Environmental 2000).

Soil Quality Standards

Political Feasibility: *Low-Medium*. The prospect of adding requirements to county building codes and zoning requirements could initially generate strong opposition by the largely conservative building industry. However, there seems to a growing acceptance of compost in landscaping use (Cascadia 2000-3) and this could potentially transfer to the building industry. If using compost doesn't cost much and healthy soils are shown to be desired by the public, such standards could gradually gain acceptance.

Practical Feasibility: *Medium.* Contacts interviewed for this study reported that one soil quality and depth standard would not be ideal given the large variety of existing soil types in Washington. So, many different variables would need to be considered in designing different, or variable, standards. Furthermore, standards would need to be inserted into each county's codes and requirements.

Cost-effectiveness: *Medium.* It could take significant resources to implement these new standards statewide, but they could have significant market development effects.

Projected Outcomes: Soil quality standards associated with new construction, to the extent that they require or lead to the use of recovered organic material to amend damaged soils, could have significant impacts on compost markets.

Key Challenges & Success Factors: One significant challenge would be to develop soil standards that were not "one-size-fits-all" but rather based on a variety of inputs such as climate, existing soil type, slope, etc. The Natural Resources Conservation Service would be a logical partner in developing such standards. Once these were established, success would depend on the ability to insert the standards into existing codes and zoning requirements.

Performance measures: Track the number of counties with "post construction soil quality and depth" requirements, the reported compliance with these requirements, and the measurable effect on compost markets.

TOOL #21.– QUALITY STANDARDS AND LABELING

One of the key barriers cited in Chapter 3 was the on-going concern about quality, consistency, and content of recovered organic products, especially mulch and compost. Ecology's new solid waste handling standards, WAC 173-350, contain specific requirements about the composting process, metals content, nitrogen content, pathogen content, and stability. However, contacts interviewed for this report, as well as market research, suggest that more standards are needed to assure quality and improve consumer confidence. In addition, consumer understanding of quality is vital to enable users to match products to appropriate uses.

Quality standards and labeling need not only apply to compost, however. As other recycled organic products continue to emerge, such as residuals from anaerobic digesters and various nutrient "teas," some quality standards will need to develop so that

consumers know what they are getting, know how to use it, and are confident in its quality.

New compost standards could be administered via industry partnerships. Following is an evaluation of this tool. However, some information is also included about the feasibility of mandating standards and labeling statewide.

Quality Standards and Labeling

Political Feasibility: *Medium*. The process of convening a group of industry representatives to develop new standards should be largely politically feasible. However, there may be opposition to heavy government involvement from industry, but perhaps also from government decision-makers who feel that public resources should not be spent on assisting the private sector in developing its products. Stakeholders would likely react even more strongly if Washington State was to require product labeling.

Practical Feasibility: *Medium.* Developing standards, via partnerships, to satisfy the broad range of producers and users would be challenging.

Cost-effectiveness: *High.* Standards and labeling are likely to be one of the most effective tools at developing consumer confidence, and disseminating information on appropriate product use.

Projected Outcomes: Increased standards, communicated to the public via labeling, would help consumers match products to particular uses, assuage quality concerns, and help create *demand pull.*

Key Challenges & Success Factors: The key challenge would be to convene a group of industry and government representatives with a clear mission and the willingness to work together for the common goal. The U.S. Composting Council would likely be an invaluable resource and partner, as they have made much progress developing testing, directions for product use, and data sheets, as would the Washington Organic Recycling Council. Another key success factor would be finding appropriate partners and resources to address quality standards for other products, such as those from anaerobic digesters, that aren't yet as prevalent in the marketplace.

Performance measures: Gauge consumer knowledge and trust in recovered organic products, as measured by household surveys and industry focus groups; track the average price paid for various products before and after standards are in place.

TOOL #22.– FACILITATE RESEARCH AND DEVELOPMENT OF NEW TECHNOLOGIES

A number of initiatives are already underway to study new technologies for recovering organic wastes. Activities include lab research, pilot studies, and product and equipment testing. For example, the Northwest Bioproducts Research Institute formed in 2002 to develop methods for converting agricultural and food processing residue and wastes into bio-based fuels, power, and industrial products. This institute is a collaborative effort between Washington State University, Ineel, University of Idaho, and the Pacific Northwest National Laboratory (operated by Battelle) (Northwest Bioproducts Research Institute 2002). Other new technologies are also available to separate and process organics from residential or commercial generators. These technologies could prove to be useful options in the future, and the State could help assist their development.

Similarly, the State could assist by conducting pilot studies or trials of certain, highly - promising technologies. This type of action could tie in with Tool #18.– Implementing Model Programs as the State could adopt a system, such as a vermicomposter, to process organic waste at State facilities.

Facilitate R&D of New Technologies

Political Feasibility: *Medium.* A low-resource facilitation of R&D of key technologies would be mostly feasible, but contributing significant resources to technology development would not be politically feasible, as R&D is usually carried out by the private sector.

Practical Feasibility: *Low-Medium.* The State may not have the expertise or funds to contribute actively to R&D efforts. A more likely scenario would involve the State using particular technologies on a trial basis, and assisting with pilot projects.

Cost-effectiveness: *Medium*. While current technological solutions seem to fill most needs, some highly promising technologies need further trials and development. In the long term, assistance with these systems is likely to be cost-effective, as speeding up their effective implementation will help to recover more organics sooner rather than later.

Projected Outcomes: R&D will help bring about new solutions to organic waste processing.

Key Challenges & Success Factors: A key success factor would be to choose technologies that fit with Beyond Waste goals.

Performance measures: Measure the applicability of new technologies to existing organic waste recovery challenges.

TOOL #23.– STUDY ECONOMICS OF ANAEROBIC DIGESTERS

One of the biggest reported barriers to recovery of dairy wastes and other rural organics, such as industrial organic wastes, is the perceived high risk of investment in processing facilities, and the corresponding lack of capital available to fund such projects. In the short term, solutions to this problem seem difficult to come by (although Tool #7.– Green Energy Incentives for Anaerobic Digesters poses some possible sources.) A possible long-term solution is to first study the economics of anaerobic digesters and then identify sustainable funding sources. Ecology is already working with one private company, Quincy Farm Chemicals, on a project in Grant County, but contacts report that more information and support is needed.

One promising development is that in the summer of 2002, King County issued an RFP to study the economic feasibility of anaerobic digestion of dairy waste in King County (Pacific Biomass 2002). The study, begun in January 2003, will recommend the appropriate technology, evaluate the trade-offs of centralized versus individual on-farm digesters, conduct a cost-benefit analysis, and assess different ownership and funding options. In addition, the study will reportedly be looking into potential digester funding sources such as the USDA's Environmental Quality Improvement Program (EQUIP), the sale of "Green Tags" issued by the Bonneville Environmental Foundation, funding available through Title IX of the 2002 Farm Bill, and greenhouse gas offsets to be purchased by the City of Seattle to offset emissions at its Klamath Falls natural gas-

burning facility (Kerstetter 2003). The study is a partnership between Puget Sound Energy, Bonneville Environmental Foundation, King County, Seattle Public Utilities, the King County Conservation District, and Washington State University.

Pending results of this study, the State could join this partnership to conduct follow-up studies to apply or demonstrate the results of the King County study to other areas of the state. The following analysis evaluates the feasibility of the State partnering with the above agencies, as well as other possible partners such as energy service providers.

Study Economics of Anaerobic Digesters

Political Feasibility: *High*. Given that dairy manure and green energy (which can be provided by anaerobic digesters) are increasingly relevant concerns, this research should not be objectionable.

Practical Feasibility: *Medium-High.* Given the wide range of systems, feedstocks, and market conditions across Washington, it would be somewhat difficult to conduct a study that was applicable to all areas of the state. Still, given the existing lack of information, it would not be difficult to make considerable headway and provide valuable research.

Cost-effectiveness: *High.* Given the high number of partners and high potential payoff, the cost-effectiveness of these studies should be high.

Projected Outcomes: A study and demonstration of the economic feasibility of anaerobic digesters is a necessary first step in developing long-term solutions to many organic wastes generated in rural Washington.

Key Challenges & Success Factors: From the State's perspective, a key success factor would be ensuring that research was relevant to the entire state and that potential solutions address its Beyond Waste objectives.

Performance measures: Check for completion of research that conclusively demonstrates the economic parameters of anaerobic digesters, and incentives needed, if any.

STRATEGIC PARTNERSHIPS

TOOL #24.– ESTABLISH CROSS TEAM

The first recommendation of the Recycling Assessment Panel in the organics section of the 2000 report "Revitalizing Recycling in Washington" was to "increase communication, coordination, and integration of organic material recycling at a state level" (Recycling Assessment Panel 2000). The panel's recommended approach was to establish an organics cross team to enhance the understanding of the benefits of organics recycling and to integrate the variety of programs in the state. Such a cross team could include, but not be limited to, representatives from the Departments of Ecology, Agriculture, and Natural Resources, the Washington Organic Recycling Council, local governments, health districts, the soil conservation districts, agriculturalists, universities, and energy service providers.

Given the magnitude of moving to Beyond Waste, the establishment of an inter-agency cross team could provide some coordinated assistance in removing the barriers discussed in Chapter 2.

Establish Cross Team

Political Feasibility: *Medium-High.* Given that waste is a high priority for Ecology this biennium, and that the momentum and opportunities for organics recycling are so great, the establishment of a cross team should not be difficult.

Practical Feasibility: *Medium.* It may be somewhat difficult to define all the appropriate agencies and the best representatives from each. Furthermore, the feasibility of unifying the existing regulations under a single organics umbrella is difficult to determine, and may encounter unforeseen barriers.

Cost-effectiveness: *Medium.* Organizing and convening the cross team could require significant resources, but could likely be accomplished with existing staff. However, the potential pay-off is large, as a unified organics body could dramatically improve the current regulatory framework, establish realistic goals, and assist with other aspects of implementing the Beyond Waste vision for organics.

Projected Outcomes: An organics cross team would help, in an organized fashion, gain support and momentum for the Beyond Waste vision for organics and help erode barriers to its success.

Key Challenges & Success Factors: A key success factor in establishing the cross team would be to have clear leadership, commitment, and direction from the governor so that the members of the cross team can resolve conflicting priorities and objectives. Other key factors include having the right, committed members that are willing to work together, and effective facilitation. Finally, it would likely be helpful to build on and learn from the experience of a similar organics cross team formerly in effect in King County.

Performance measures: Check for timely development of goals and consolidation of regulatory framework.

TOOL #25.– FORM LOCAL STAKEHOLDER PARTNERSHIPS

Ecology long has recognized the value of partnerships with other stakeholders, including local governments and the private sector, in attaining environmental goals. Such partnerships allow different interests to work together to coordinate actions and strategies to achieve a desired outcome. Achieving the Beyond Waste vision will be no different.

Strategic partnerships are likely to have a particularly significant role in successfully moving toward the Beyond Waste vision for organics. Many of the other tools described in this chapter rely on such partnerships, including developing service-level ordinances and contracts for organics recovery, creation of soil quality standards, and provision of new grant-funded services. Local governments control provision of residential waste management services, and as such are key allies in moving toward Beyond Waste for organics. The private sector provides critical processing services for organics, and may be interested in providing more. For the rural sector, partnerships with energy related entities such as public utility districts, rural cooperatives, and the BPA, in addition to local governments, are likely to be essential to a successful strategy. For urban areas, partnerships with local governments as well as the private sector will be key to

addressing critical needs and opportunities associated with transforming the supply chain for organics.

Given the large number of local governments and other stakeholders that are important to the Beyond Waste vision, Ecology may wish to consider forming several groups to coordinate new programs, based on such criteria as geography or similar needs or issues. Ecology could use the Water Resource Inventory Area (WRIA) system as a model for bringing local stakeholders together to examine organics recovery issues and to develop tailored solutions that will work locally to achieve statewide goals. Alternatively, Ecology could work through the existing Solid Waste Advisory Committee (SWAC) structure.

Form Local Stakeholder Partnerships

Political Feasibility: *Medium* -- Local governments may feel that they do not need assistance in designing the most appropriate cost-effective collection infrastructure. However, they would likely respond to a coordinated, yet flexible approach where Ecology provides tools, resources, and motivation to collectively plan for the future organics infrastructure.

Practical Feasibility: *Low-Medium.* Effectively facilitating the large number of local governments over such a large geographic area would certainly be time-consuming and administratively challenging, but should be possible.

Cost-effectiveness: *Medium*– Facilitating such a group should not require significant additional resources, but would rely on significant staff time from existing solid waste personnel. However, the facilitation will likely be effective at moving forward in a coordinated manner in developing infrastructure to achieve Beyond Waste.

Projected Outcomes: The outcomes of this process would likely be a series of pilots and studies, conducted at local levels, a decision support tool (see Tool #17.– Develop Technical Analysis Capacity), and ultimately a coordinated, effective implementation of collection infrastructure.

Key Challenges/Success Factors: Success factors for this tool include finding ways to organize local governments and other stakeholders in ways that make effective and efficient use of their time, and ensuring that they find value in the process.

Performance measures: Track the number of new programs designed or developed through this tool. Measure diversion rates that result. Survey participants to determine their satisfaction with the process.

TOOL #26.– PRODUCT STEWARDSHIP AND DESIGN

The Northwest Product Stewardship Council defines product stewardship as follows.:

> Product stewardship means that whomever designs, makes, sells, or uses a product takes responsibility for minimizing its impact on the environment. This responsibility spans the product's life cycle – from selection of raw materials to design and production processes to its use and disposal (WEPSI 2002).

Currently, several regional and one national initiative are focusing on using product stewardship strategies to address the growing problem of electronic waste. However, product stewardship can be applied to other sectors and wastes, as the Northwest Product Stewardship Council is demonstrating. One possible tool could be to partner with other states on a product stewardship initiative that focuses on designing products

to be either compostable or recyclable. Such an initiative could help bring about the *Cradle-to-Cradle* vision of industrial designers William McDonough and Michael Braungart (McDonough and Braungart 2002) who have been working with some key Northwest manufacturers, such as Oregon-based Nike and Pendleton, on ecological design.

Although politically and practically it is still in its infancy, product stewardship holds great promise in establishing the organics cycle in the long-term. The following table evaluates the use of product stewardship in establishing the organics cycle.

Product Stewardship

Political Feasibility: *Medium-High* – Product stewardship initiatives are reasonably politically feasible when purely voluntary, and so beginning a voluntary product stewardship initiative for compostability should be very feasible.

Practical Feasibility: *Low.* Launching a voluntary initiative would not be particularly difficult. However, creating one that has a high-probability for success would involve developing design guidelines for every product sold or produced in Washington. Given that Washington has little influence over national and multi-national corporations, this is not practically feasible *at this time*. However, slow progress, and building on the success of other product stewardship initiatives, does have great promise in the long term.

Cost-effectiveness: *Undetermined.* There is not enough experience in current product stewardship initiatives to evaluate the cost-effectiveness of this approach.

Projected Outcomes: Although it is too early to evaluate the potential success of product stewardship initiatives that focus on the very core of every product's design, the long-term opportunity is to have an economy based on products that are designed with a specific end-of-life in mind.

Key Challenges/Success Factors: A key success factor would likely be to work with other western states to acquire sufficient political capital to make such initiatives politically and practically feasible.

Performance measures: Track the percent of products sold and produced in Washington, over time, that are designed in accordance with the initiative.

5. Action Plan

As discussed in Chapter 3, Washington would need to undergo many broad changes to establish a fully functioning organics cycle. In particular, to achieve the Beyond Waste vision for organics:

- **Markets** will need to expand and strengthen. *Demand pull* would need to be established, products developed to match consumer end-uses, and quality of products demonstrated, and, in some cases, improved.
- **Infrastructure** will need to be developed to collect and process all organic materials from MSW and non-MSW waste streams and meet product specifications of end-users.
- **Other, system-wide changes** will need to take place, such as economic parameters, product design, and attitudinal and behavioral shifts in Washington's public, private, and government sectors.

The following Action Plan presents the consultant's assessment of what tools and strategies could be implemented if Ecology decides to pursue the Beyond Waste vision for organics. These recommendations in this plan represent the consultant's best professional judgment on how to proceed, based on our assessment of the needed changes, the barriers to change, the leverage points available, and the tools discussed in Chapter 4.

It is important to note here that while the strategies below were developed for Ecology, the Department could pursue them in a variety of ways. Ecology could take the lead role in some actions, but in others it might act as a coordinator, a cheerleader, or a partner. Partnerships with other state agencies, the private sector, and non-profit organizations will be crucial to achieving the Beyond Waste Vision for organics in Washington State. Where possible, the consultant team has provided suggestions for Ecology's role. However, Ecology is the best and final judge of its strengths, partnerships, and authority.

The Action Plan presents strategies under three timeframes:

- **Immediate Actions** (0-3 years). Actions in the immediate term focus on building support among local governments, private sector stakeholders, and the public for the Beyond Waste vision for organics; developing initial best practices for full organics collection and processing, and establishing quality and content standards for processed organic products. In addition, research on some of the system-wide, near- and long-term goals and actions would need to begin.
- **Near-Term Actions** (3-10 years). These actions focus on building infrastructure, developing and marketing new products, documenting benefits of recycled organics, assisting end-users with product use, and linking the organics cycle to the carbon cycle and climate change.
- **Long-Term Actions** (10-30 years). Many of the actions taken earlier should start to bear fruit in this time period, although legislative action may still be needed to fully recover all organic materials. Major actions in the long-term would focus on optimizing the "waste" infrastructure for recovery rather than disposal, focusing on design so that everyday products are designed for entry into the organic or technical cycles, and creating a decentralized energy supply.

Within each timeframe, the actions are organized around the three goals embedded in the three questions that guided this paper. Each section also contains strategies to evaluate progress toward the Beyond Waste Vision in Washington State.

IMMEDIATE ACTIONS (0-3 YEARS)

DEVELOP *DEMAND PULL* MARKETS

In the immediate term, market development will need to focus on solidifying consumer confidence and increasing demand for recycled organic products. If the public begins to place value on healthy soils, feel confident in product quality, and understand how to match products to desired uses, then markets will grow – a necessary step to create enough demand for the projected future quantities of organic materials available in the marketplace.

Goals

- The public values healthy soils.
- Long-standing quality issues are being effectively addressed.
- State Government is a leading market for recovered organics.

Actions

1. **Launch a statewide education and marketing campaign to communicate value of healthy soils and the role of organic matter in maintaining them.** This basic understanding will help lay the groundwork for effective recovery programs, as the public will, if the effort is successful, understand the opportunities and benefits involved in organics recovery. In addition, initial campaigns can include information on natural gardening and integrated pest management (IPM) -- practices that decrease use of chemical pesticides – and their benefit to water quality and a clean organics stream. This action will begin to address the barriers of limited market demand and feedstock contamination, and can leverage the endangered species act and water quality regulations to the extent that improved soil health would help water quality and salmon habitat.
2. **Establish quality and content standards for MSW compost and related products.** Our research clearly documented that quality is fundamental to the current viability and future expansion of strong, robust organics markets. Much work has been done in this arena and is ongoing, but our assessment suggests that more needs to happen for markets to prosper, as on-going concerns about quality, consistency, and content are a key barrier. Accordingly, an industry partnership could assertively develop and implement statewide quality standards. These standards will likely need to encompass not just different grades of compost (including high-end specialty blends), but also the increasing array of other products, such as fiber residuals from anaerobic digesters and nutrient-rich "teas". Ecology is already working with the U.S. Composting Council and Washington Organic Recycling Council on the deployment of certain standards for compost quality. These activities could be continued and advanced, perhaps culminating in: 1) setting minimum standards for content and consistency that all commercially sold compost must meet; and 2) a market based approach to providing consumers with information about the quality and value of compost and

other organic materials produced by different processors. Possible approaches include developing a *Consumer Reports* type information source for organics products sold in Washington or the paint industry's "good, better, best" marketing of various grades of paint.

3. **Increase government procurement of recycled organic products.** Washington DOT, Ecology, and other state agencies can institute procurement policies, as part of direct compliance with Executive Order #02-03, to use more recycled organic material in their projects. DOT reportedly currently uses large quantities of compost in certain projects, but contacts report that there are several other products, such as the medium for hydroseeding, which could be made from recovered organics. Ecology could first work with the Washington Organic Recycling Council to identify potential products, and then coordinate with state agencies to ensure their use via procurement requirements. Procurement could be required through legislation for all state government agencies. These increased procurement requirements will directly aid markets, help to establish *demand pull*, and model successful end-uses.

4. **Initiate research into new markets.** New products (including those with higher value) can be developed to strengthen markets. To aid these efforts, Ecology can:

    a. Coordinate with other states/entities on new or higher-value compost-related markets, such as special nursery or vineyard mixes. In Washington, the Washington Organics Recycling Council would be a useful partner. This action would help address the barriers of "insufficient prices" and "limited market demand."

    b. Partner with Northwest Bio-Products Research Institute on products sourced from agricultural and food-processing organics wastes.

EXPAND INFRASTRUCTURE

The overarching infrastructure goal in the immediate term is to commit stakeholders to achieving the vision, make initial design and investment decisions consistent with that vision. And start developing or documenting best practices for infrastructure development. These steps will set the stage for rapid infrastructure development in the near term (3 – 10 years). Some local governments and private companies will likely proceed on their own with collection and processing infrastructure investment before 2006, and these investments should be consistent with the Beyond Waste vision for organics.

It is important to note that the residential and commercial sectors generate most of the organic wastes in the urban environment, and so they should be the focus of urban efforts. However, in the rural environment industrial and agricultural organics dominate, and so should be the focus of rural efforts.

Goals

- Most local governments, service providers, and key stakeholders are committed to full organics recovery.
- Best practices for collecting and processing MSW organics are under development and/or have been developed.

- Washington State leads by example in collecting and processing organics from its facilities.
- Public and private sector investments in collection and processing infrastructure are consistent with the Beyond Waste organics vision.

Actions

5. **Communicate the vision and obtain commitments to achieving full organics recovery.** Communicating the Beyond Waste Vision to local governments, service providers, and other key stakeholders, and obtaining commitments from them to work toward the Vision, are crucial to the success of the Beyond Waste Plan. A successful partnership will ensure that creating the organics cycle is a high priority as local government and stakeholders make service and investment decisions and plan for landfill closures, two key leverage points cited in Chapter 3. Several alternatives means of convening stakeholders could be pursued. Ecology could organize a statewide organics summit bringing together representatives from all economic actor sectors and regions to discuss the vision and plans for moving forward. Alternatively, Ecology could organize smaller forums with stakeholders from each of the major economic actor sector/organics clusters identified earlier in this Issue Paper: Urban Residential and Small Commercial, Institutional and Large Commercial, and Rural. This approach could have the benefit of addressing the specific conditions and issues faced by each type of Economic Actor Sector. Either way, these summits could best be organized in conjunction with state and regional associations such as WORC and WSRA.
6. **Establish statewide goals for organics recovery.** Aggressive but obtainable organics recovery goals would provide clear direction and guidance for local governments and the private sector responsible for organics management. These goals could be established voluntarily or potentially, if conditions support such an initiative, through legislation. Goals rated very high in the consultant's analysis of tools, and have, of course, been used before in the state as part of the Waste Not Washington Act of 1989. Although state and local government recycling targets have not always been met, a specific goal for organics could create more focus than broad, cross-material recycling rate goals.

   Goals could be set as diversion targets or, potentially, as milestones for the number of communities, households, businesses, or agricultural establishments with access to full organics recovery services or systems. If appropriate, separate targets or milestones could be established for different types of organics and/or different economic actor sectors. Whatever approach is used, the targets and milestones need to based on the long-range vision of achieving full organics recovery within a specified time frame (e.g. 2030). Once new goals and targets are established, Ecology will then need to upgrade its material and waste tracking systems to develop the means to measure or estimate the recovery levels for each target sector and organic material.
7. **Develop the analytical capacity to evaluate the costs and impacts of alternative infrastructure options.** Ecology can work with its local partners (as described in Tool #16) to develop a robust, accurate, and detailed model to assist local governments with their planning and policy decisions. Seattle, and

other local governments with similar experiences, could assist in the development of this tool. At a minimum, capacity should be developed to model the technical and economic feasibility of the following options:

a. Integrated, least cost systems to recover source-separated organics and technical nutrients from the MSW stream --the consultant's research found that making incremental changes to infrastructure is often not cost-effective. In the long-term, the system will need to be redesigned and optimized for recovery rather than disposal. Still, in many areas some solutions can be implemented in the short term – progress that should not be sacrificed in favor of long-term development. One area where progress could likely be made is in food waste collection in the urban environment, as follows.

b. Urban residential and commercial food waste recovery and processing considering all system variables (including organic product prices, alternative processing technologies and facilities, and alternative collection systems and frequencies).

c. Rural organics recovery from agricultural and industrial generators, possibly including integrating residential organics into these systems.

Ecology could work with local governments to develop these capabilities and analyze alternatives.

8. **Initiate model programs to demonstrate the viability of full organics recovery.** Ecology and other state agencies can implement model collection, processing, and end-use programs. These programs will help demonstrate the viability of the Beyond Waste vision for organics to local stakeholders, and help Ecology and other state agencies "walk the talk."

   a. Washington State implements collection and processing of food waste and all organics at selected facilities -- Such programs could be modeled after the recent food-waste recovery system implemented in the EPA's Research Triangle Park facility,[16] including on-site processing systems.

   b. Local governments lead in conducting pilot projects to collect urban residential and commercial food waste – Some such pilots have already been conducted, and could lead directly to the establishment of initial best practices. This action would help address the lack of processor experience with food waste, a key barrier cited in Chapter 3.

   c. Ecology provides technical assistance to public and private entities to implement already-proposed anaerobic digester projects – anaerobic digesters have considerable potential, but need to be further modeled and demonstrated. While some projects have been proposed, they could benefit from assistance, including help identifying funding and revenue opportunities. Once established, the projects could be monitored and lend experience and insight to future projects. These actions could help overcome the limited access to capital and the perception of risk in the private sector.

[16] Environmental Protection Agency. "Environmentally Preferable Purchasing – Green Cafeterias." http://www.epa.gov/opptintr/epp/ppg/case/cafeteria.htm

This work could be undertaken in partnership with local governments (some of whom are already piloting new ways to collect and process food and other organics). Funds from Ecology's Grant programs could be targeted to support this type of locally based research, piloting, and feasibility testing.

9. **Define initial best practices for organics collection and processing, based on available research and ongoing pilot projects.**

    a. For urban residential and commercial organics: document the best practices for 1) food waste recovery as an incremental collection service and 2) full MSW organics recovery by implementing source-separated organics and technical nutrient recovery programs.

    b. For large commercial and institutional: document best practices for collection and on-site processing of food waste.

    c. For rural agricultural/industrial: evaluate results of pilot projects and feasibility studies as the basis for subsequent efforts to define best practices.

    Ecology could develop these best practices in partnership with local governments.

TRANSFORM THE SYSTEM

System-wide changes focus on economic, regulatory or design parameters that would greatly facilitate the establishment of the organics cycle. These changes help align other aspects of the economic and regulatory environments with the infrastructure and market transformations to create a system that fully supports organics recovery.

Goals

- A new framework for/approach to regulating organics at the State-level from the MSW source to the end user has been developed and agreed to by key stakeholders.
- Economic incentives for full organics recovery have been formulated.
- Options to effectively address product and process design issues have been identified and analyzed.
- Opportunities to minimize unnecessary organic waste generation are identified, and options developed.

Actions

10. **Establish an inter-agency cross team to develop recommendations to reform regulations and better integrate programs consistent with achieving the Beyond Waste vision for organics.** Given the need to achieve significant momentum on organics recovery across a number of state agencies, and the specific charge of centralizing and standardizing organics processing regulations, state agencies will need to be coordinated and aligned to facilitate the organics cycle. One way to accomplish this alignment is to convene a cross team, as recommended by the Recycling Assessment Panel in 2000. The cross team would be charged with identifying and recommending options to removing the barriers discussed in chapter 3, specifically working on the "complicated,

overlapping regulatory framework." The team could be enacted either through inter-agency agreements, via legislation, or under the direction of the Governor. It will be important to provide sufficient authority for the cross-team to address effectively inter-agency barriers and formulate legislation or an executive order to enact recommended changes.

11. **Evaluate and develop recommendations for incentives to improve the economics of organics recovery.** Chapter 4 presented several types of economic incentives to help promote organics recovery. While the consultant evaluated the general use of these incentives, specific applications will need to be evaluated and developed in each of the following categories:

    a. Tip Fee Surcharges – Statewide or local tip fee surcharges would help organics programs compete with disposal and raise needed funds for program implementation.

    b. Green Energy Incentives – The use of anaerobic digesters for the processing of manures and food-processing wastes and production of energy would benefit from such digesters being included in existing green energy programs.

    c. Tax exemptions – such as on sales tax, B&O tax, or property tax, would encourage infrastructure investment and the purchase of recycled organic products. Tax exemptions could also help address the limited access to capital in the private sector, a key barrier cited in Chapter 3.

    d. Tax-exempt bond financing – through a non-profit development authority, for infrastructure investment. This could also help address the limited access to capital in the private sector, a key barrier cited in Chapter 3.

12. **Define and evaluate alternatives approaches to addressing product design, feedstock contamination, and process issues that are barriers to organics recovery.** In the long term, focusing on product design, and producer responsibility, is likely the most effective means of achieving the Beyond Waste vision. When manufacturers design their products so that waste does not exist, they have numerous incentives to take back products with technical nutrients, and design all other products to enter the organics cycle. In the long term, such a system could achieve 100% elimination of waste. The state could consider product stewardship, regulatory, and tax based incentive programs to encourage these developments. One particularly viable approach would be to form alliances with other state governments to develop region-wide or, potentially, national solutions. By combining the political capital of several states, actions to foster "green" design and new product development will have more impact.[17]

13. **Develop options for increased organic material efficiency and "source reduction."** One central assumption of this report has been that most organic "waste" materials are necessary byproducts of plant or animal growth, processing, and consumption. Nevertheless, there may be opportunities for increased efficiency, particularly in commercial processing, retail, restaurants, or residences. Ecology could work with industry groups or other parties to identify opportunities for true "source reduction" and increases in organic material

[17] For more information of creating the organic and technical nutrient cycles see the *Transform the System* action steps in the near-term and long-term, as well as Appendix C.

efficiency, and then develop options to effect change. This action should take place in the immediate term in case projected results decrease organic material available for—and hence design of — recovery programs.

EVALUATE PROGRESS

Actions in the immediate term focus on creating the necessary conditions for building needed infrastructure, markets, and system-wide changes in the near and long term. As such, evaluation in the immediate term should focus on qualitatively assessing whether the above actions are proceeding successfully and making appropriate mid-course, corrections. In addition, the following action will be important to set the stage for future evaluation:

14. **Establish milestones for full recovery and beneficial use of rural organics, based on best practices and results of feasibility studies and pilot projects.** Although the ultimate goals is full recovery and beneficial use, it will be important to set check points along the way with which to evaluate progress.

NEAR-TERM ACTIONS (3-10 YEARS)

DEVELOP *DEMAND PULL* MARKETS

Actions in the immediate term focused on public education, development of quality and content standards, researching new markets, and instituting government procurement requirements. Subsequent actions in the near term build on these actions to assist in new product development and marketing, ensuring product quality and consistency, documenting and communicating product benefits, and providing technical assistance to processors and end-users.

Goals

- Consumers understand and are confident in the quality and content of recovered organic products. Quality and consistency issues are no longer barriers to markets.
- New products diversify and strengthen existing markets.
- Agricultural markets demand recovered organics.
- Horticultural and landscaping markets are strong.
- Market prices for recovered organics increase, supporting *Demand Pull.*
- Washington State is a leader in consuming recovered organic material.

Actions

15. **Conduct research and provide technical assistance to processors to develop and market new products from recovered organics.** Action #4 in the immediate term focused on researching new markets. In the near term, Ecology and Washington State University can help processors tap into these new markets by providing technical and marketing assistance.
16. **If needed, institute labeling requirements to provide consumers with adequate information on compost quality and content.** Labeling

requirements, via legislation, would be an effective approach to communicate the quality and content of compost products if the voluntary, market-based approach proposed in action #2 is not successful. A labeling requirement would give buyers the same type of information they have come to expect with many other types of products. Industry transparency is a goal cited by private processors and local governments alike, and on-going concerns about quality, consistency, and content was a key barrier cited in Chapter 3. Although mandatory labeling may encounter some political obstacles, the partnership cited above might be able to find common ground and propose requirements that satisfy all stakeholders.

17. **Continuously test and monitor the quality and consistency of commercially available compost and mulch products. Disseminate results to industry and consumers.** Using the standards developed in the immediate term, it will be important to conduct testing and monitoring to solidify industry and consumer knowledge and trust in compost and mulch products and ensure the appropriate use of the standards.

18. **Ban persistent and widespread contaminants, if necessary.** If testing and monitoring reveals consistent particular harmful contaminants in finished products, then the State could take action by banning the contaminant. Such a ban could focus on ending the use of a certain chemical in applications where it likely ends up in an organic material feedstock, as was executed for clopyralid in Washington.

19. **Continue education campaign emphasizing the role of recovered organics in maintaining soil health. Expand marketing campaign to emphasize participation in collection programs.** This action builds on the campaign launched in the immediate term, and will help make the connection between participation in collection programs, recycled organics products, and soil health. This action will help overcome public resistance to separating and handling food waste.

20. **Expand government procurement and use of recovered organics; serve as a test market for innovative new products and applications.** This action builds upon increased government procurement initiated in the immediate term to further boost markets.

21. **Conduct studies to determine and document the benefits of using recovered organics in agricultural applications; disseminate results.** Ecology, Washington State University, and potentially other colleges and universities can build on existing studies and experience to study and document the benefits of using recovered organics in agriculture.

22. **Providing technical assistance and training to agricultural users to increase use of organics.** Washington State University or Conservation Districts could increase efforts to demonstrate and assist agricultural operations in the appropriate use of recycled organic materials. One leverage point to take advantage of is the trend towards certified Organic agriculture. Even farms that are not interested in certification may be developing increased awareness in bio-intensive practices that call for increased organic matter. This action could help address the “insufficient prices” barrier, if products are found to increase production or decrease funds spent on chemical fertilizers.

EXPAND INFRASTRUCTURE

Near-term actions focus on rapidly implementing infrastructure to collect organics from urban residential and commercial generators; and on demonstrating best practices, conducting studies, and providing assistance concerning industrial and agricultural organics infrastructure.

Goals

- Food waste collection is commonplace in the urban residential sector.
- Systems to collect and process source-separated organics and technical materials are being implemented in selected municipalities.
- Organics recovery programs are commonplace in the commercial sector.
- Agricultural and industrial organics collection and processing is continuing to develop.
- Washington State government achieves full organics recovery.

Actions

URBAN RESIDENTIALORGANICS

23. **Provide technical assistance and support to local governments and the private sector to implement food waste collection and/or organics/technical material recovery systems. Ecology can provide leadership by:**
    a. **Working with local governments that are considering changes to their MSW collection and processing infrastructure to design and implement full organics recovery programs.** The cities of Seattle, Vancouver, and Bellingham all face contracting decisions for their MSW programs. These communities can be targeted as well as others, such as King County that are facing decisions associated with landfill closures.
    b. **Facilitating investments in infrastructure, contracting, and service-level ordinances by local governments and private haulers.** Moving in a coordinated fashion will benefit all parties.
    c. **Targeting Coordinated Prevention Grants (CPG) to residential, commercial, and institutional organics collection programs.** Ecology can target its CPG funding to local governments, primarily counties, interested in conducting pilot studies or executing service-level ordinances to increase organics collection.
24. **Local governments with contracting authority issue contracts for collection and processing of food waste or all organics from residential generators.** The contracts will call for systems based on the best practices developed in the immediate term (action #9), and on the technical assistance and support provided by Ecology (action #23).

LARGE COMMERCIAL AND INSTITUTIONAL ORGANICS

25. **Implement large commercial and institutional food waste collection; target the largest food waste generators and generators in urban areas for full**

recovery of organics by 2013. Organics recovery will need to compete with disposal if commercial and institutional generators are to participate. Possible alternatives include:

a. **Issue contracts for commercial food waste collection to ensure a minimum level of service.** Contracting could be a useful tool if *demand pull* has not yet caused commercial haulers and processors to set up their own programs to collect food waste from commercial food waste generators. Cities can contract for organics collection service, but must do so in competition with private haulers.

b. **Transform the economics of commercial on-site processing systems.** Apply tax incentives or tax-exempt bond financing to investment in on-site processing facilities. These strategies could particularly help grocery stores and restaurants, with very small profit margins, make the initial capital investments required to purchase on-site systems. Education and technical assistance will be vital to ensure effectiveness of on-site systems. Finally, on-site systems produce a high-quality product that could potentially be sold at premium prices. Some research and marketing assistance could help set prices and develop markets. Ecology and local governments can work together on this action.

26. **Systematically establish full organics recovery programs at all state government facilities**, except where such programs are demonstrated to be clearly uneconomical. Include programs for food waste, landscaping debris, and agricultural materials.

RURAL ORGANICS

27. **Implement model agricultural and horticultural organics recovery and processing systems.** The participation of state universities, particularly Washington State University, will be critical. Model systems can involve both collection/processing systems as well as low-tech, on-site practices such as conservation tilling or mulching.

28. **Study the long-term economic potential of integrating small-scale bio-gas generators into electricity infrastructure.** In the immediate term, the consultant recommended assisting currently planned projects to identify funding and overcome technical hurdles. Beyond the relatively few immediately available funding options, further research is needed to determine the long-term economic viability of anaerobic digesters and other emerging technologies. For technologies such as anaerobic digesters that can generate energy, Ecology could partner with Energy Northwest and Bonneville Power Administration to consider the role of anaerobic digesters and other forms of biomass energy in upcoming energy transmission replacements and upgrades. The goal of this study would be to determine how to optimize the energy transmission system given the potential avoidance of new or upgraded transmission infrastructure to rural areas served by decentralized energy, such as anaerobic digesters.

29. **Develop best practices for rural organics recovery and processing.** Study the model programs, pilot projects, and analytical models implemented in the immediate term to define best practices for organics recovery and processing.

Include best practices for industrial organics, agricultural organics, and the possible integration of rural residential organics into these systems, where appropriate.

30. **Provide financial and technical assistance to potential processors of agriculture and industrial wastes.** Use results of economic feasibility and best practices assessments to provide direct assistance to potential processors in establishing cost-effective facilities. In addition to existing funding opportunities, tax incentives could be particularly useful (see actions #11 and #32).

TRANSFORM THE SYSTEM

Actions in the near term focus on implementing regulatory reform, economic incentives, and product and process design initiatives developed in the immediate term, as well as increasing the connection of the organics cycle with alternative energy and the carbon cycle.

Goals

- The regulatory system and government programs effectively support full recovery and beneficial use of organics
- Organics recovery is cost-effective compared to disposal
- Product and process design issues are effectively being addressed.
- Organics recovery contributes to climate change initiatives.

Actions

31. **If necessary to achieve milestones and goals associated with the Beyond Waste vision, require residential and commercial organics recovery in urban areas, possibly through a ban on organics disposal.** The year 2013 could serve as a target date for implementation of programs in all urban areas. Practically speaking, establishing a ban on disposal may be the most feasible means of requiring service. Establishing bans (or other means of requiring service) will require legislation.

32. **Implement incentives as needed to improve the economics of organics recovery.** In most cases, this will require legislative action. Select incentives based on results of previous assessments of:

    a. Tip Fee Surcharges

    b. Green Energy Incentives

    c. Tax exemptions

    d. Tax-exempt bond financing

33. **Enact and implement regulatory and institutional reforms developed by the cross team.** The cross team formed in the immediate term will be recommending reforms to address regulatory barriers. These recommendations will need to be adopted by stakeholders (including the State) in the near term.

34. **Pursue initiatives to address design, contamination, and process issues.** Fully develop and enact regional and or national regulatory, incentive, and/or

product stewardship initiatives – as appropriate based on results of previous efforts and progress towards achieving goals.

35. **Enact legislation as needed to enable conversion of bio-gas into energy.** Increased focus and requirements on alternative, decentralized energy will benefit green energy suppliers, including anaerobic digesters.

36. **Research and then enact programs and policies that link organics recovery to mitigating statewide emissions of gasses that contribute to global warming.** These could include further development of carbon-trading markets, low-emission biofuels, and production of hydrogen from agricultural wastes.

EVALUATE PROGRESS

In the near-term, evaluation of progress should take a critical look at which actions have effective at advancing the Beyond Waste vision, and which sectors are most rapidly advancing towards it. Evaluation could occur multiple times in this period, such as at five years and at ten years.

37. **Use indicators and milestones to measure progress toward full organics recovery.** The milestones established in action #14 will serve as useful checkpoints on the way to full organics recovery. In addition, it will likely be useful to develop additional indicators to measure behavior change, economic impacts, and other aspects or benefits of establishing the organics cycle. Several possible indicators for the organics cycle and other Beyond Waste initiatives are proposed in Consultant Team Issue Paper #7 -- Improving Waste and Materials Tracking in Washington.

LONG-TERM ACTIONS (10-30 YEARS)

DEVELOP *DEMAND PULL* MARKETS

Although some new issues will certainly emerge in the long-term, the proposed immediate and near-term actions will hopefully set the stage for robust, demand-pull markets. Long-term actions can then focus on maintaining consumer demand, staying abreast of new market opportunities, and continuing State government procurement requirements.

Goals

- Demand pull is the norm in horticultural, agricultural, industrial, and energy markets.
- Demand for organic material has largely supplanted markets for chemical fertilizers and many pesticides/herbicides.

Actions

38. **Continue education and technical assistance as needed to maintain demand.** Education and technical assistance will likely still be needed in the long term. Ecology, WSU, and conservation districts can continue in their roles. But as natural gardening, integrated pest management, and bio-intensive agriculture gain strong footholds, peer-to-peer assistance and support will be increasingly common and successful.

39. **Continue State government procurement of organics; eliminate use of chemically based pesticides and fertilizers on government property.** The State should now have enough experience with using recycled organics that it can phase out and eliminate use of synthetic chemical pesticides and fertilizers.

40. **Continue research and development into new products and applications, if needed, for strong markets.** If education and technical assistance in the immediate and short-term is successful, little further government assistance of this type should be necessary. Still, Ecology, Washington Organics Recycling Council, WSU, and the Northwest Bioproducts Research Institute can aid the private sector, as needed, in continuing research and development.

EXPAND INFRASTRUCTURE

Goals

- The materials recovery infrastructure has been restructured – optimized to collect and process all organic and technical nutrients. *Recovery levels exceed 80%.*
- A network of businesses thrives on transforming agricultural and industrial waste materials into beneficial products.
- The energy infrastructure is decentralized and includes biogas facilities.

Actions

41. **Fully restructure and optimize residential, commercial, and large generator "waste" infrastructure for full recovery of all organic and technical nutrients**. Local governments and waste haulers, with assistance from Ecology, will need to work together to restructure the current "waste" infrastructure to one that is fully optimized for recovery, not for disposal. Analytical modeling in the immediate term (action #7) will have helped define what long-term, cost-effective solutions can look like. Although incremental changes will have taken place in the immediate and short-term (such as adding food waste collection), the challenge in the long term is to restructure the entire system for maximum cost-effectiveness and full recovery. This action will overcome the difficulty in achieving economically viable collection and processing systems, a key barrier cited in Chapter 3. It will also take advantage of the "government services and investment" leverage point.

42. **Foster resource efficiency and energy security by creating decentralized energy supply, including biogas facilities.** Many energy technologies are evolving simultaneously that will make decentralized energy production very possible in the next couple decades. For example, fuel cells, solar, biomass, geothermal, and wind technologies are increasingly available and cost-effective for small, decentralized generators. Decentralized energy requires dramatically less transmission infrastructure and is more secure, protected from natural disaster or deliberate disturbance. It is also is more efficient, as less electricity is lost through transmission, and generates less pollution (World Alliance for Decentralized Energy 2002). According the World Alliance for Decentralized Energy, an alliance of several major companies and national industry associations formed in June 2002,

> "Decentralized energy systems are no longer limited by either technology or cost. Rather, they are kept from the market by increasingly outdated energy policies and regulations which apply, like central power, to a different age. Those policies can and should be modernized."

Energy policy and infrastructure planning is beyond the ability and mandate of Ecology. However, Ecology can support these efforts and exploit opportunities, as available, to demonstrate the economic feasibility and environmental benefits of decentralized electricity generation in Washington.

TRANSFORM THE SYSTEM

Actions in the long term focus on continuing and strengthening actions taken in the immediate and near terms.

Goals

- All government economic and regulatory incentives are fully aligned to support full organics recovery, processing, and beneficial use.
- Products are designed to enter either into organic or technical nutrient cycles, with minimal cost associated with contamination or hybrid products.
- Full organics recovery and beneficial use is the norm in Washington State.
- Opportunities to minimize unnecessary organic waste generation are identified.

Actions

43. **Take more aggressive legislative action as needed to achieve targets: further incentives and mandates (including disposal bans) should be considered if needed.**
44. **Continue regional and national initiatives to fully address product and process design issues; enact legislation if voluntary initiatives are not effective.**
45. **Continuously monitor and improve incentive and regulatory programs, as needed to achieve goals.**

EVALUATE PROGRESS

In this long-term, evaluation will continue to be a critical piece of achieving the Beyond Waste Vision. The State will need to measure – and publicize – its progress towards its goals, and be ready and willing to make mid-course corrections if necessary. Without evaluation, measuring progress and making effective and efficient changes will not be possible. Continued evaluation will allow the State to follow trends, capitalize on momentum, and act upon emerging leverage points.

46. **Measure progress toward the goal of full organics recovery.** This action is at once simple and complex. The State should continue to use the indicators and milestones developed in the immediate and near terms, and to measure new ones where necessary to capture emerging trends. The State should use this information to identify new trends, and develop programs to foster beneficial ones and counteract detrimental ones.

Table 5: Summary of Organics Action Plan

	Immediate Actions	Near-Term Actions	Long-Term Actions
Develop *Demand Pull* Markets	▪ Launch a statewide education and marketing campaign to communicate value of healthy soils and the role of organic matter in maintaining them. ▪ Establish quality and content standards for MSW compost and related products. ▪ Increase government procurement of recycled organic products. ▪ Initiate research into new markets.	▪ Conduct research and provide technical assistance to processors to develop and market new products from recovered organics. ▪ If needed, institute labeling requirements to provide consumers with adequate information on compost quality and content. ▪ Continuously test and monitor the quality and consistency of commercially available compost and mulch products. Disseminate results to industry and consumers. ▪ Ban persistent and widespread contaminants, if necessary. ▪ Continue education campaign emphasizing the role of recovered organics in maintaining soil health. Expand marketing campaign to emphasize participation in collection programs. ▪ Expand government procurement and use of recovered organics; serve as a test market for innovative new products and applications. ▪ Conduct studies to determine and document the benefits of using recovered organics in agricultural applications; disseminate results. ▪ Providing technical assistance and training to agricultural users to increase use of organics.	▪ Continue education and technical assistance as needed to maintain demand. ▪ Continue State government procurement of organics; eliminate use of chemically based pesticides and fertilizers on government property. ▪ Continue research and development into new products and applications, if needed, for strong markets.

	Immediate Actions	Near-Term Actions	Long-Term Actions
Expand Infrastructure	▪ Communicate the vision and obtain commitments to achieving full organics recovery. ▪ Establish statewide goals for organics recovery. ▪ Develop the analytical capacity to evaluate the costs and impacts of alternative infrastructure options. ▪ Initiate model programs to demonstrate the viability of full organics recovery. ▪ Define initial best practices for organics collection and processing, based on available research and ongoing pilot projects.	**Urban Residential** ▪ Provide technical assistance and support to local governments and the private sector to implement food waste collection and/or organics/technical material recovery systems. ▪ Local governments with contracting authority issue contracts for collection and processing of food waste or all organics from residential generators. **Large Commercial/Institutional** ▪ Implement large commercial and institutional food waste collection; target the largest food waste generators and generators in urban areas for full recovery of organics by 2013. ▪ Systematically establish full organics recovery programs at all state government facilities **Rural** ▪ Implement model agricultural and horticultural organics recovery and processing systems. ▪ Study the long-term economic potential of integrating small-scale bio-gas generators into electricity infrastructure. ▪ Develop best practices for rural organics recovery and processing. ▪ Provide financial and technical assistance to potential processors of agriculture and industrial wastes.	▪ Fully restructure and optimize residential, commercial, and large generator “waste” infrastructure for full recovery of all organic and technical nutrients. ▪ Foster resource efficiency and energy security by creating decentralized energy supply, including biogas facilities.

	Immediate Actions	Near-Term Actions	Long-Term Actions
Transform the System	▪ Establish an inter-agency cross team to develop recommendations to reform regulations and better integrate programs consistent with achieving the Beyond Waste vision for organics. ▪ Evaluate and develop recommendations for incentives to improve the economics of organics recovery. ▪ Define and evaluate alternatives approaches to addressing product design, feedstock contamination, and process issues that are barriers to organics recovery. ▪ Develop options for increased organic material efficiency and "source reduction."	▪ If necessary to achieve milestones and goals associated with the Beyond Waste vision, require residential and commercial organics recovery in urban areas. ▪ Implement incentives as needed to improve the economics of organics recovery. ▪ Enact and implement regulatory and institutional reforms developed by the cross team. ▪ Pursue initiatives to address design, contamination, and process issues. ▪ Enact legislation as needed to enable conversion of bio-gas into energy. ▪ Research and then enact programs and policies that link organics recovery to mitigating statewide emissions of gasses that contribute to global warming.	▪ Take more aggressive legislative action as needed to achieve targets: further incentives and mandates should be considered if needed. ▪ Continue regional and national initiatives to fully address product and process design issues; enact legislation if voluntary initiatives are not effective. ▪ Continuously monitor and improve incentive and regulatory programs, as needed to achieve goals.
Evaluate Progress	▪ Establish milestones for full recovery and beneficial use of rural organics, based on best practices and results of feasibility studies and pilot projects.	▪ Use indicators and milestones to measure progress toward full organics recovery.	▪ Measure progress toward the goal of full organics recovery.

CONCLUSION

Organics recovery presents an exciting opportunity for Washington State to achieve its Beyond Waste vision. Ecology and its partners already have demonstrated spectacular success with diverting biosolids and yard waste from the landfill. This analysis suggests that the next frontiers will be (1) developing the market conditions to view organic materials as resources and establish *demand pull* and (2) investing in collection and processing infrastructure that in the municipal waste environment is optimized for recovery rather than disposal, and in the agricultural and industrial environment is flexible and adaptive to the local feedstocks and markets. A number of trends, including the increasing use of soil amendments in horticulture and agriculture, indicate that the time is ripe for initiating programs to recover current organic "wastes" and use them as resources. The Action Plan presented in this paper provides a road map for Ecology and its partners to pursue to create significant momentum on this organics cycle. With focused attention on obtaining commitments to the Beyond Waste vision, creating favorable conditions for organics recovery, providing support for implementation of new programs, and targeting continuous improvement, Ecology and its partners can set the stage for a robust organics cycle in Washington State.

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Appendix A. List of Contacts

The following people were interviewed as part of this study. Interviews took place as group meetings (one held with Ecology staff on November 5th and one held with some local government and private sector staff on November 6th); in-person interviews, phone interviews, or in a couple cases e-mail correspondence.

Contact	Organization	City
Ecology Headquarters Staff		
Cheryl Smith	Ecology – Headquarters	Lacey
Holly Wescott	Ecology – Headquarters	Lacey
Jon Bennett	Ecology – Headquarters	Lacey
Kyle Dorsey	Ecology – Headquarters	Lacey
Ecology Regional Staff		
Chuck Mathews	Ecology – SWRO	Lacey
Daniel Thompson	Ecology – CRO	Yakima
Laurie Davies	Ecology – SWRO	Lacey
Marietta Sharp	Ecology – NWRO	Bellevue
Mark Fuchs	Ecology – ERO	Spokane
Marni Solheim	Ecology – ERO	Spokane
Peter Severtson	Ecology – CRO	Yakima
Steven Williams	Ecology – NWRO	Bellevue
Wyn Hoffman	Ecology – SWRO	Lacey
Local Government Staff		
Ann Murphy	City of Spokane	Spokane
Gabriella Uhlar-Heffner	City of Seattle	Seattle
Jenny Bagby	City of Seattle	Seattle
Josh Marx	King County	Seattle
Sego Jackson	Snohomish County	Everett
Jim Darling	Port of Seattle	Seattle
Alex Cuyler	City of Eugune	Eugene, OR
Jennifer Erickson	Portland Metro	Portland, OR

Contact	Organization	City
Organics Processors or Consultants		
Bill Lamphere	Quincy Farm Chemicals	Quincy
Dan Caldwell	WSU	Pullman
Jeff Gage	Compost Design Services	Olympia
Jerry Bartlett	Cedar Grove Compost	Seattle
John Sinclair	Soos Creek Organics	Covington
Larry Sasser	Tetra Tech	Seattle
Steve Martin	Columbia Compost	Dayton
Energy Providers, Policy Analysts, and Government Staff		
Jim Kerstetter	WSU Energy Program	Olympia
Daniel Porter	Energy Northwest	Richland
Jeremy Ames	Environmental and Energy Study Institute	Washington, D.C.
Zhiqin Zang	California Energy Commision	California

Appendix B: Infrastructure Options

It is beyond the scope of this study to recommend specific infrastructure options for the collection and processing of organic wastes. However, the literature research, interviews, and meetings conducted as part of this study helped define the range of possibilities available, and preferred, in Washington. Our research focused on identifying infrastructure options for the following sectors:

- **Urban residential and small commercial.** This cluster includes urban single- and multi-family homes, as well as small urban businesses. These generators are grouped together because while they tend to produce small amounts of organics individually, they are present in sufficient densities to make collection of this material viable.
- **Large commercial and institutional.** This group includes large urban and suburban generators of organic wastes, such as grocery stores, restaurants, and hospitals.
- **Rural**. This sector has two major facets: dispersed large generators of organics, such as food processing operations and farms, and rural homes. Although our discussion of this sector focuses on the Beyond Waste possibilities for the large generators, it also includes some suggestions for expanding recovery of organics from rural households.

The charts in this appendix show the collection and processing infrastructure options generally considered as feasible by at least some of our contacts. Options outlined in grey (as opposed to black) are generally discounted by local government planners. Note that not all contacts agree on the viability of remaining options. In particular, the use of in-sink food grinders sparks considerable debate: while some continue to advocate its use for residential and some small commercial generators because of its ease of use and widespread availability, opponents cite the increased maintenance costs of plumbing and sewer systems, in addition to the increased capacity and expansion issues faced by the wastewater treatment plants that would ultimately receive food waste placed down in-sink grinders.

URBAN RESIDENTIAL AND SMALL BUSINESS

Because of the limitations of on-site composting programs, expanded collection systems will be needed to recover organic materials. These programs can take many forms, but commonly involve the generator separating their organic waste and setting it out for collection in a bag or specialized container. In urban Washington, the likely future trend is towards commingled collection of food and yard waste, as King County and Seattle have ruled out other options such as separate collection of food waste. Some persistent issues with food collection remain, however, such as generator willingness to separate and handle the material, and health department concerns about rodent attraction to the collection containers.

One option that most urban local governments have ruled out is a “dirty” MRF or mixed MSW composting. These systems involve collection of mixed municipal solid waste for centralized sorting or composting. Although practiced in other areas, they are not considered priority options by local governments because of current success of and

investment in source-separated programs and perceived elevated toxics in compost products from mixed waste systems.

In addition to collection programs, facilities will also need to be made available for residents to self-haul their waste, in the event that collection service is not practical or quantities are larger than the collector will accept.

PROCESSING OF SOURCE-SEPARATED MATERIAL

Material collected from residential and small commercial generators usually is processed via aerobic composting, which has been the preferred method by local and state governments and for which the science and practices have been clearly established. For example, Ecology's new solid waste handling standards (WAC 173-350), to be adopted in early 2003, clearly state the processes to be used in composting organic material.

However, many other possible options exist for processing organic wastes. Although the goal of this report is not to evaluate or even list all the possible processing options, the following technologies have been used successfully in other states and countries and have been considered by some local governments in Washington.

- Composting
- Anaerobic digestion
- Aerobic digestion
- Fermentation
- Conversion to bio-fuels
- Processing for animal feed
- Vermiculture

In the planning time scale of Beyond Waste (30-50 years) these or other technologies may become increasingly viable, necessary, or beneficial. In particular, the vibrant biotechnology industry will likely introduce organisms that could play a role in material digestion or transformation, particularly for food wastes. However, because of the difficulty in predicting future technological and market forces, the consultant believes a more pertinent question is the appropriate scale at which processing should be accomplished. Centralized processing of source-separated residential and small commercial food waste can be accomplished at three geographic scales: *local, regional, or super-regional.*

- **Local processing,** operating at a neighborhood level, is not widely practiced in Washington because of increased operating costs and siting requirements of using numerous smaller facilities to accomplish the same goal as one more centralized facility. However, changing technologies and increased focus on organic materials as resources may create increased incentives for neighborhood-scale systems in the future. Currently, such systems are common in northern European countries.
- **Regional processing**, in which organic material is collected from a city or county and composted in (usually one) central location, is the most common system in Washington. Regional processing facilities can more easily achieve economies of scale, but their size and proximity to populated areas makes them difficult to site. Local governments often prefer this option because the finished product (compost or otherwise) is usually readily available to their constituency and the original material generators.

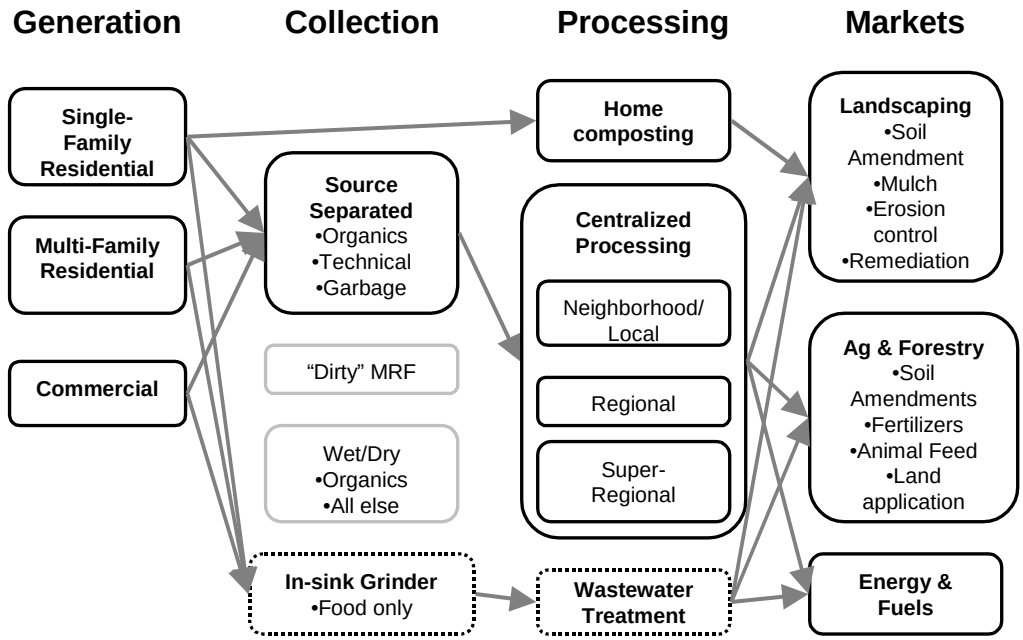
- **Super-regional processing** involves long-hauling organic waste to a facility outside the immediate area for centralized composting at a large "mega-facility." This is generally not a popular option, and those that have tried it have done so based largely on financial considerations in areas where compost markets were underdeveloped. However, once organic wastes are shipped long distances, it is usually not practical to ship them back again.

Choices between the above infrastructure options will likely be driven by system and capital costs, regulatory framework, access to markets, and public acceptance of and demand for finished products.

Collection of food-waste via in-sink food grinders

One option for collection food waste is to use in-sink grinders and the sewer system for collection, and the wastewater treatment plants (WWTP) for processing. Food residuals would therefore be included in biosolids recovered from the treatment plants. Although not generally promoted, many households do currently dispose of some food scraps in their in-sink grinders. Some experts think that in-sink grinders could serve as the primary means of collection food waste from households and small business generators. Such proponents cite the existing availability of the infrastructure, the relative ease of participation, and the fact that storage and further handling by the generator is not necessary. However, others report a whole host of problems associated with increased organics in the wastewater system. Opponents, particularly sewer system and wastewater treatment plant operators, cite increased burden on their facilities, increased operating costs, and accelerated treatment plant expansions that generate intense public opposition.

Figure 3: Summary of Supply Chain Options for Organics Generated by Urban Residents and Small Businesses



Grey boxes indicate options that are generally discounted by local governments.
Dashed boxes indicate options that are actively debated.

INSTITUTIONAL AND LARGE COMMERCIAL

To achieve the Beyond Waste vision for large commercial and institutional generators will require increased, and perhaps specialized infrastructure to handle large quantities of food wastes, which are typically heavier and wetter than other organic wastes such as yard waste or compostable paper. The following figure shows how prevalent food is in many business' waste stream.

Figure 4: Estimated Food Waste Disposed by Institutional and Large Commercial Generators in Washington[18]

Business Type	% Food (by weight)	Estimated Annual Food Waste, Statewide	Estimated Annual Food Waste per establishment
Grocery Stores	66%	170,000 tons	50 tons
Restaurants	62%	330,000 tons	30 tons
Food wholesale and warehousing	62%	110,000 tons	21 tons
Schools	45%	Not available	Not available
Medical	20%*	40,000 tons	4 tons*
Hotels	33%*	30,000 tons	19 tons*

* These categories include establishments that do not have cafeterias or restaurants; therefore the food waste generated by each establishment that does have a cafeteria or restaurant would be greater than the figures cited here.

The infrastructure needed to handle organic wastes from the large commercial and institutional sector is very similar to that for the residential and small commercial sector, as the same processing facilities will likely handle wastes from both sectors. However, a couple possibilities particular to large businesses and institutions are reuse systems such as food gleaning programs and on-site, in-vessel processing systems. The three options – reuse systems, on-site processing, and source-separated collection – are described below.

Reuse Systems

Large generators, particularly grocery stores, generate large quantities of edible but unsaleable food products. The highest and best use of these organic "wastes" is to reuse them safely as food. Food-gleaning programs are able to recover large quantities of food waste for consumption. These programs, such as Northwest Harvest and Food Lifeline, typically work in conjunction with local food banks and other non-profits. To contribute to these efforts, the government may find it valuable to establish a "waste hierarchy" for organic materials that recognizes the efforts of local charities, and encourages large food waste generators to donate rather than dispose edible food.

Expanded On-site Processing

[18] These estimates are based on a recent waste composition by industry group in Los Angeles (Cascadia Consulting 2001) applied to Washington on a per-employee and per-establishment basis.

Institutional and large commercial generators such as large restaurants and grocery stores have long recognized that a significant portion of their solid waste is food. Until relatively recently, disposal was in most cases the only option. In addition to food-waste collection services now available, on-site containerized or vermi-composting systems have recently emerged as increasingly viable options. Although they require initial capital investment, on-site technologies are now approaching cost-effectiveness when compared to disposal. Systems are available to handle various throughputs at processing costs (including the initial capital investment) of $35 - $100 per ton. With tip fees in Washington averaging $40 per ton plus hauling fees, these systems are in some cases currently viable but underutilized. An added benefit of many systems may be the ability to sell the finished product for premium in-bag prices of $60 per ton or more.

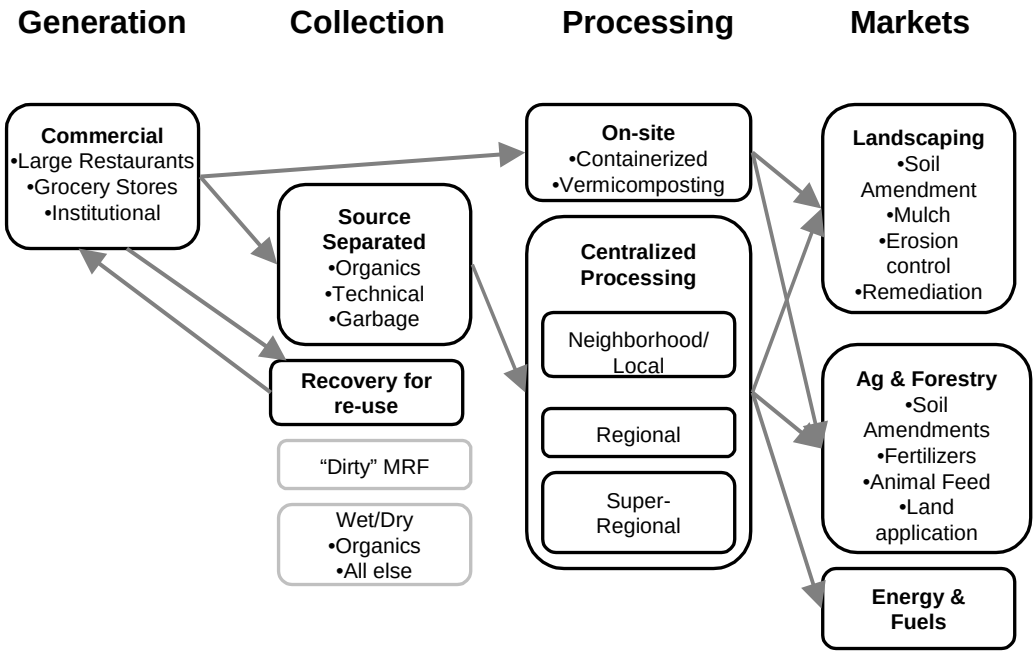
On-site processing technologies are available at a range of capital costs and capacities

In-vessel composting or Vermicomposting systems are currently available for investments as little as $20,000 up to several hundred thousand dollars. More expensive systems have lower operating costs, and require less labor. Systems (some of which are modular) are currently available to meet throughput demands from 30 tons/yr to 15,000 tons/yr.

Expanded source-separated collection

For businesses that generate large quantities of food waste or landscaping waste, disposal expenses can be significant. Reduced-rate organics-recovery systems can offer real cost savings to large generators via source-separated collection. However, availability of services and cost savings are currently fairly limited. Increasing the availability of a competitive service will require working with local governments, haulers, and processors to create a viable system that is acceptable to haulers, processors, and regulators while remaining financially preferable to the waste generator. Some experts believe that such a system will need to involve dewatering facilities to reduce transportation costs.

Figure 5: Summary of Supply Chain Options for Organics Generated by Institutional and Commercial Generators



Grey boxes indicate options that are generally discounted by local governments.

RURAL

To meet Ecology's Beyond Waste goals, **more facilities will be required** to handle the variety of wastes and feedstocks generated in rural Washington. Experts generally agree that because of the large distances, variety in wastes, and local markets, facilities will need to be sited near large generators and specially designed for the local circumstances. In addition, contacts emphasized the need for infrastructure and for money to support these capital investments.

Collection of organic wastes from rural residents and small businesses will likely be difficult to implement cost-effectively given the dispersed population and relatively small quantities generated. Where curbside collection is not viable, new or expanded focus on on-site composting coupled with drop-off facilities (with corresponding incentives) will help to recover organics from this sector. In some cases, a "dirty MRF" may be the only effective way to recovery materials (both organic and technical) for recovery.

Overall, experts report that the key to creating the organics cycle in Washington's rural environment is to ensure that the private sector can make the infrastructure investments necessary to collect organic wastes to create products, including energy, and make a profit. Currently, the economics do not support the capital investments.

Following is a short characterization of the different processing options likely to be available in rural Washington.

Compost Facilities

As mentioned above, experts in eastern Washington forecast a continued need for compost facilities in rural environments. Capital costs for facilities in rural Washington

are usually much lower than those in urban Washington, because low-tech methods such as windrow composting can effectively operate due to cheaper land, a more arid environment, and somewhat less intense community concerns over odor. Capital costs are as low as $200,000 - $300,000, compared to several million dollars in the urban environment.

In rural Washington, co-composting of manures and/or biosolids with municipal yard waste is much more common than in the urban environment. Processors report that a mixed biosolids-yard waste product can receive the "Exceptional Quality" rating and receive premium market prices compared to Class A or B biosolids.

In addition to traditional aerobic composting, vermicomposting operations are starting to be employed as well. A new operation in Whatcom County is processing dairy manure, and was recently profiled in *BioCycle*.

Anaerobic Digesters

Many experts cited anaerobic digesters as a promising future trend for large waste streams such as manures and agricultural wastes due to three factors:

- Their ability to handle liquid manures combined with other municipal and industrial wastes,
- Their relatively low cost, and
- Their ability to generate marketable products, including a fiber residual and energy.

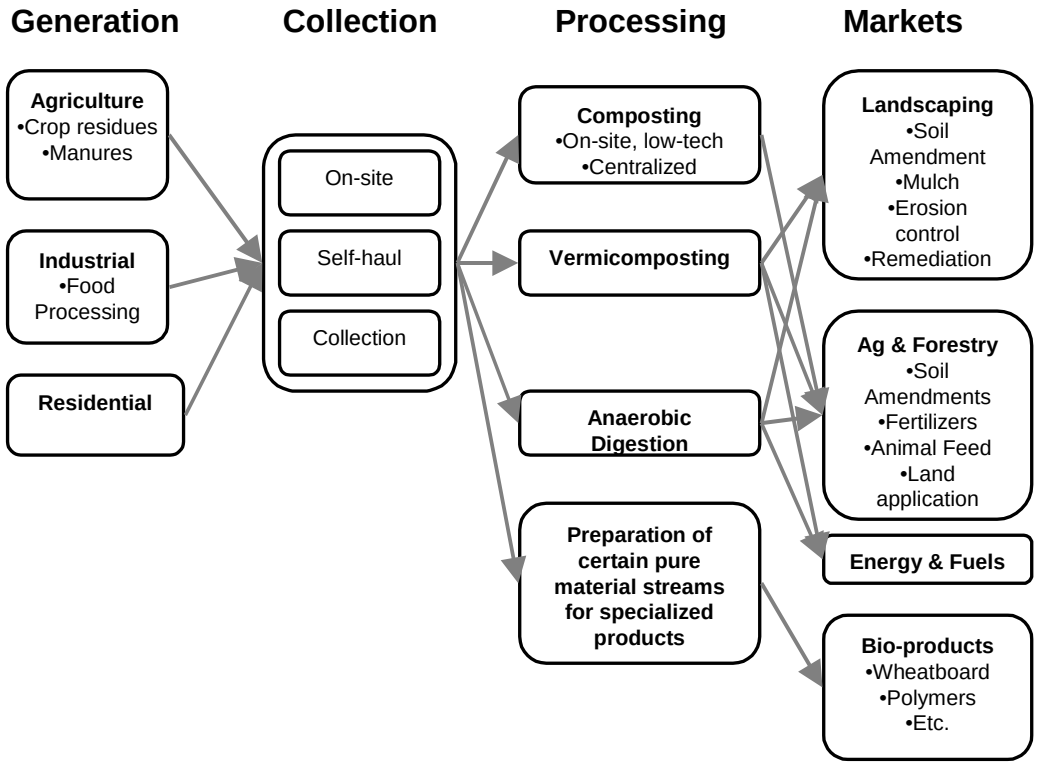
Even so, processor and local government contacts alike agree that these systems will not likely replace traditional compost infrastructure, because consumers will continue to demand compost and anaerobic digester systems do not typically handle yard waste effectively.

Bio-based products

Another emerging trend is the new focus on creating bio-based products, or new materials made from biological feedstocks. For example, the Pacific Northwest National Laboratory, the Idaho National Engineering and Environmental Laboratory, the University of Idaho, and Washington State University recently joined together to form the Northwest Bioproducts Research Institute. The goal of this institute is to "examine and develop methods for converting agricultural and food processing residue and wastes into bio-based fuels, power and industrial products" (Northwest Bioproducts Research Institute 2002). Such efforts could result in organic wastes such as potato waste, rice hulls, corn fibers, or fruit pomaces being used as feedstocks to create pharmaceutical products, solvents, paints, or fuels.

Regardless of the products developed, collection and processing infrastructure will be necessary to manufacture them. In order to ensure high quality feedstock, manufacturers likely would favor source-separated collection programs.

Figure 6: Summary of Supply Chain Options for Rural Organics



Appendix C. Creating the Technical Nutrient Cycle

One of the 30-year goals listed in Chapter 4 was that products are designed to enter either into organic or technical nutrient cycles. This goal stems from work completed by William McDonough and Michael Braungart, some of which is discussed in their book *Cradle to Cradle : Remaking the Way We Make Things* (McDonough and Braungart 2002). A technical material is one that can remain in a closed-loop system of manufacture, reuse, and recovery (which McDonough and Braungart refer to as a technical metabolism), maintaining its value through many product life cycles. These valuable resources, such as plastic or metal, are typically lost when items are disposed. By the *technical nutrient cycle*, the consultant means a system of collecting and processing technical nutrients from the economy so that they can remain in these technical metabolisms. Such a system would be similar to current recycling systems, but would more thoroughly involve the producers, eliminate material contaminants, and minimize "downcycling" materials into lower-value products.

Two essential components of such a system would be:

- **Product design**, where (as described in Chapter 4) products are designed to enter either into organic or technical nutrient cycles; and
- **Systems to collect materials from consumers.** Although not all materials would need to be collected (because of re-use, return to producers, retailers, or take-back centers), there would need to be some organized infrastructure to collect materials that are not otherwise recovered. Currently, the solid waste stream is comprised of about 40% organic materials, 40% technical materials (or ones that could be), and 20% materials that are currently neither, because they are mixtures of both, and may include contaminants.

One of the themes of this report has been the likely need to restructure the current solid waste system and optimize it for the recovery of nearly all solid waste as valuable resources. Although in this report we have addressed strategies Ecology and its partners could pursue to implement the organics cycle, the infrastructure for both the organic and technical nutrient cycles could best be developed concurrently. One piece of evidence for this restructuring is that the current marginal costs of incrementally adding services are too high to make many new programs cost-effective. For example, the marginal cost of adding additional organics to most municipal recovery systems has been found to be cost-prohibitive (Gibson Economics 1999). However, the long-term system costs of restructuring and optimizing the system to recover all organics and all technical nutrients could be more feasible. While it is likely best to pursue the organic and technical cycles together in most areas, the consultant doesn't recommend sacrificing short-term for long-term progress (or vice versa, for that matter.). Studies early on in each waste-shed (as recommended in the "immediate actions" of the action plan) will be needed to optimize the economics of each system, and not be "one size fits all."

To go about this restructuring would require analytical capacity and a coordinated, strategic approach among local governments and Ecology, as discussed in the Action Plan.