CITY OF PALO ALTO

Memorandum

April 28, 2008

TO: CITY COUNCIL

SUBJECT: RECOMMENDATION TO REFER COMPOSTING FEASIBILITY STUDY RESULTS AND CONSIDERATION OF AN ELECTION THAT COULD ALLOW COMPOSTING TO CONTINUE ON A PORTION OF THE LANDFILL AFTER CLOSURE TO THE POLICY AND SERVICES COMMITTEE

The above-referenced City Manager’s Report (CMR:219:08) was provided earlier in Council’s packet of April 21, 2008.

Copies of CMR:219:08 are on file with the Public Works Department.

GLENN S. ROBERTS
Director of Public Works

EMILY HARRISON
Assistant City Manager
TO: HONORABLE CITY COUNCIL
ATTENTION: POLICY AND SERVICES COMMITTEE
FROM: CITY MANAGER
DATE: APRIL 28, 2008
DEPARTMENT: PUBLIC WORKS
CMR:219:08

SUBJECT: RECOMMENDATION TO REFER COMPOSTING FEASIBILITY STUDY RESULTS AND CONSIDERATION OF AN ELECTION THAT COULD ALLOW COMPOSTING TO CONTINUE ON A PORTION OF THE LANDFILL AFTER CLOSURE TO THE POLICY AND SERVICES COMMITTEE

RECOMMENDATION
Staff recommends that the Policy and Services Committee provide input on the Compost Feasibility Study Results and recommend to the City Council to direct staff to begin preparations for an election that would ask Palo Alto voters to continue green material composting operations on dedicated parkland atop the municipal landfill after it is capped and certified closed by the State of California Integrated Waste Management Board (CIWMB).

BACKGROUND
The City currently owns and operates a 7.5 acre green material composting facility at the Byxbee Park 126-acre landfill which is scheduled to close in 2011. The existing green material composting facility is a conventional windrow operation that processes 21,000 tons of green material per year. The material managed at the facility includes source separated yard waste such as lawn clippings, leaves, tree and shrub clippings, brush, and other vegetative materials generated through landscape maintenance activities. In addition, leaves accumulated through the City’s street sweeping operations “selected screened loads” and clean tree trunk/limb wood grinding (1 to 2 inch chips) are also deposited at the facility.

Nearly all of the green material delivered to the City’s composting facility is generated within the City limits. Approximately 63% is delivered from the Palo Alto Sanitation Company’s (PASCO’s) curbside and debris box collection operation, 14% from commercial landscape maintenance companies and contractors, 13% from City tree trimming or (leaf) sweeper operations, 7% from City contractors and 3% from residential self-haul.

On August 6, 2007, Council directed staff to:

1) Quantify the reduction in greenhouse gas emissions that would result from maintaining a composting facility in Palo Alto.
2) Compare the financial costs of composting in Palo Alto versus transporting green material off-site.
3) Compare the pros and cons of in-vessel composting with windrow composting, with particular attention paid to land acreage needed and overall cost.
4) Explore potential locations for a composting facility, including the current landfill site, other land in the vicinity of the Palo Alto Regional Water Quality Control Plant (RWQCP), the unused portion of the Palo Alto Airport bordering Embarcadero Road, and the Los Altos Water Treatment Plant.

5) Analyze the impact on Byxbee Park of maintaining a composting facility near the RWQCP.

The Council directive was prompted by a Colleagues’ Memo dated August 6, 2007 (Attachment A). To begin addressing these issues, Council approved a work plan on January 22, 2008 (CMR:116:08). This report represents the results of that work for Council consideration of further direction to staff. The major component of the approved work plan was the preparation of a Municipal Compost Facility Feasibility Study. This report summarizes the Feasibility Study and recommends Council actions based on economic factors and greenhouse gas impacts.

**DISCUSSION**

The study team consisted of staff members from the Planning, Public Works and Utilities departments and groups including Environmental Compliance, Resource Management, Refuse, Engineering, Planning, and the City Manager’s Office Sustainability Team. The final Municipal Compost Facility Feasibility Study (Attachment B) analyzed the environmental, financial and technical implications of two different composting operational scenarios: (1) a new City-owned and operated municipal compost facility and (2) utilization of one or more compost facilities outside the City of Palo Alto.

Staff evaluated available composting technologies, capital and operating cost estimates, the feasibility and implications of adding other organic feedstock to the composting operation and evaluated the market price for finished compost products. In addition, staff evaluated four potential sites to determine the suitability for locating and developing a new composting facility in Palo Alto including zoning/land use, permitting implications and environmental impacts.

**Alternate Facility Location Analysis**

Given the built conditions of the community and the value the community places on open space, all locations have challenges. Composting at the alternate sites identified in the Colleagues’ Memo is unlikely to be permitted due to issues such as vector control and odor concerns. There are also other issues associated with the identified alternate sites. Therefore, Location 1, the existing site at Byxbee Landfill is currently the preferred site.

Location 1, on the existing site at Byxbee Landfill is suitable in terms of size, odor control and compatible adjacent uses. However, because the site reverts to parkland following landfill closure, the continuing use as a composting site would require a vote of the people and an amendment to the Baylands Master Plan.

Location 2, on RWQCP property is problematic because of its small size, proximity to wetlands, and the impacts on future plant expansion opportunities. The impact on future plant expansion is especially problematic because the RWQCP is an existing regional facility. Dedication of a portion of the property to a Palo Alto composting operation could raise questions from the partner agencies. Staff at the RWQCP has also expressed concerns about additional odors from a composting operation next to the plant. Having two adjacent operations that could potentially cause odor
complaints will create potential conflicts and difficulties in differentiating and addressing the potential odor sources.

Location 3, the airport site, is a highly visible Baylands location and the current airport land use plan does not allow new structures. Location 3 is currently part of a lease still held by Santa Clara County. The lease expires in 2017; however per Council action on November 13, 2007, staff is currently negotiating early lease termination options (CMR:418:07). Large buildings to house the composting operation would be required to control dust and odors. Composting buildings would likely be taller than airplane hangars, and therefore, cause similar or worse visual impacts to the Baylands from Embarcadero Road as additional hangars that were proposed by Santa Clara County.

Location 4, the Los Alto Treatment Plant (LATP) site has environmental contamination and wetland impact concerns. The net usable area of the site is not yet known due to currently undefined wetland impact mitigation ratios. Numerous potential uses for the site have been identified including a new animal shelter, a new recycling center and household hazardous waste (HHW) drop-off, waste transfer station for City operations, utility pole storage, dewatering area for spoils from sanitary sewer and storm drain vacuum trucks, and as a staging area for City contractors. Staff will be presenting a workplan to Council in late May for preparing a Master Plan for the LATP site.

The table below summarizes some of the key land use considerations analyzed during the study.

<table>
<thead>
<tr>
<th>TABLE 1 - LAND USE CONSIDERATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Can be done without Voter Approval</td>
</tr>
<tr>
<td>Location 1 – Landfill</td>
</tr>
<tr>
<td>Location 2 – RWQCP</td>
</tr>
<tr>
<td>Location 3 – Airport</td>
</tr>
<tr>
<td>Location 4 – LATP</td>
</tr>
</tbody>
</table>

Greenhouse Gas Impact
Staff has estimated that an additional 1,100 metric tons of carbon dioxide would be emitted through increased vehicle emissions were the City to utilize a regional composting facility in the future. The additional emissions were based on the assumptions that all of the City’s green materials would need to be hauled to nearby transfer stations [for example, the Sunnyvale Materials Recovery and Transfer (SMART®) Station], then ground up and hauled to regional composting facilities in the South County. To put the increased emission number in context, one could compare it to the City’s entire vehicle fleet that emits approximately 1,900 metric tons of carbon dioxide per year. Other air pollutants, including nitrogen oxides, carbon monoxide and particulate matter would also be emitted during the transportation. If Council decides to minimize greenhouse gas emissions, staff recommends that Council begin taking action that would allow conventional windrow composting of green material to continue at the current landfill site.

Technology Analysis
The study thoroughly examined three composting technologies: windrow composting, ag-bag/static pile composting, and in-vessel composting. These technologies and others are more fully described
in Attachment B. Alternate composting technologies types were found to be less economically feasible than conventional windrow composting due to the initial capital costs needed for development. Due to extreme differential settlement issues on the top of the landfill, alternative composting technologies that require buildings or other solid equipment foundations are not recommended. However, open windrow composting could continue on top of the landfill without the need for a stable foundation.

The table below shows where each technology would be appropriate based on the various site locations being considered.

<table>
<thead>
<tr>
<th>TABLE 2 - COMPOSTING TECHNOLOGIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Windrow Composting</td>
</tr>
<tr>
<td>---------------------</td>
</tr>
<tr>
<td>Location 1 – Landfill</td>
</tr>
<tr>
<td>Location 2 – RWQCP</td>
</tr>
<tr>
<td>Location 3 – Airport</td>
</tr>
<tr>
<td>Location 4 – LATP</td>
</tr>
</tbody>
</table>

Windrow composting is most appropriate for the landfill location due to the large area (7.5 acres) required. Ag-bag/aerated static pile composting is possible but would be more expensive because of the need for an air compressor facility and a well compacted pad. In-vessel technology could be feasible at Locations 2, 3 and 4. However the technology requires a significant initial capital cost with buildings covering about 60,000 square feet.

**Economic Analysis**

Site development costs for each location were developed based on the appropriate and least expensive technologies. These cost estimates are preliminary and conceptual in nature and are provided solely for the purposes of relative comparisons between the alternatives. They are not intended as final cost estimates for budgetary or financing actions and should not be utilized for those purposes. Costs will change depending on final design, conditions of permitting and approval, and actual year of construction.

<table>
<thead>
<tr>
<th>TABLE 3 - CAPITAL COST CONSIDERATIONS (x 1,000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Election Costs</td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Location 1 – Landfill</td>
</tr>
<tr>
<td>Location 2 – RWQCP</td>
</tr>
<tr>
<td>Location 3 – Airport</td>
</tr>
<tr>
<td>Location 4 – LATP</td>
</tr>
<tr>
<td>Regional Facility</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Except for the landfill location, all other sites would require in-vessel technology. The In-vessel facility costs include large building construction to help control dust and vector problems. Construction costs for windrow composting at Location 1 would be absorbed into the landfill closure.
One of the most significant costs relating to Location 1 is the cost to conduct the election. Although higher than the cost for an election, the facility design, permitting and construction costs for Location 1 relate primarily to anticipated additional storm water controls that would be incorporated into and constructed during the landfill closure capping process. The City already owns the specialized mechanical equipment for operating windrow composting (e.g. scarab, grinder, screener, etc.). Location 1 is remote from other land uses, so odor control equipment would not be required. No odor controls exist for the current operation.

Locations 2, 3, and 4 would incur large costs for design, environmental studies, permitting and actual facility construction. Facility construction costs are very significant for these locations due to the large buildings and odor control equipment required. For a 15 to 20-year facility life cycle, this initial capital investment results in significantly higher per ton costs for compost compared to Location 1 or the regional facility (SMaRT Station) approach. The table below summarizes the projected operation costs based on current tonnages (21,000 tons per year processed at City Facility or 17,400 tons per year of City-controlled green material sent to SMaRT from PASCO collection and City operations). The numbers below are derived in Attachment B, Table 3. The unit costs below include annualized capital costs, transportation costs, tipping fees, revenue, and ongoing operation and maintenance costs.

<table>
<thead>
<tr>
<th></th>
<th>Windrows Green Material (City Facility)</th>
<th>SMaRT Green Material (Regional Facility)</th>
<th>In-Vessel Green Material (City Facility)</th>
<th>In-Vessel Mixed Organics (City Facility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Unit Cost</td>
<td>$54/ton</td>
<td>$41/ton</td>
<td>$124/ton</td>
<td>$81/ton</td>
</tr>
<tr>
<td>Land Rent to GF ($100,00 per acre per year)</td>
<td>$750,000</td>
<td>$0</td>
<td>$300,000</td>
<td>$300,000</td>
</tr>
<tr>
<td>Unit Cost not including Rent</td>
<td>$17.86/ton</td>
<td>$41/ton</td>
<td>$109/ton</td>
<td>$72/ton</td>
</tr>
</tbody>
</table>

**Impact on Byxbee Park**

The operation of a composting facility in Byxbee Park currently creates a visual impact. The piles of compost are clearly visible from East Bayshore Road, Highway 101, and West Bayshore Road. The visibility of the compost piles will continue if Location 1 is selected but, staff will explore various screening options.

Other impacts include dust, litter, vectors and odor. During screening operations, dust generated is sometimes mistaken for smoke from a fire. Litter mixed in with green material can be blown from the operation area and onto the public park area and also attracts vectors such as flies and rodents. On days when wind blows from the east, the composting operation can produce a noticeable and distinctive earthy odor on East and West Bayshore Roads.

**Timing**

Assuming that a ballot measure can be placed on election within 18 months time, a revised permit for a continued composting operation on the landfill could be obtained by early 2011. In-vessel
technology implemented at the alternative sites would require nearly the same amount of time for completion. The table below summarizes the project scheduling assumptions.

<table>
<thead>
<tr>
<th>Location 1 - Landfill</th>
<th>Location 2 - RWQCP</th>
<th>Location 3 - Airport</th>
<th>Location 4 - LATP</th>
<th>Regional Facility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Voter Approval Process</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Design and CEQA</td>
<td>3</td>
<td>12</td>
<td>12</td>
<td>n/a</td>
</tr>
<tr>
<td>Permitting</td>
<td>6</td>
<td>12</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Comp Plan Amendment</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>n/a</td>
</tr>
<tr>
<td>Facility Construction</td>
<td>1</td>
<td>8</td>
<td>8</td>
<td>n/a</td>
</tr>
<tr>
<td>TOTAL</td>
<td>31</td>
<td>32</td>
<td>32</td>
<td>n/a</td>
</tr>
<tr>
<td>End date based on start date of 7/1/2008</td>
<td>February-2011</td>
<td>March-2011</td>
<td>March-2011</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**Summary**

Staff has determined that a composting operation (very similar to current operations and in the current location) is an economic and practical solution for retaining a municipal composting facility in Palo Alto. However, when land rental to the General Fund is included in the analysis, a regional facility approach, at current fuel rates, is slightly more economical than the windrow composting option. However, use of a regional facility would result in a significant increase in greenhouse gas emissions due to transportation impacts.

In addition to minimizing vehicle emissions, other benefits of retaining a composting operation in Palo Alto include having readily available compost for City parks and landscaping operations, regular compost give aways for Palo Altans, and revenue from the sale of compost to nurseries, material yards, landscapers and private residents. The composting operation could also be viewed as an educational opportunity and an example of how waste generated locally can be processed and renewed locally. As fuel costs and traffic congestion increase, regional facilities become less cost effective. Keeping composting in Palo Alto could be viewed as a more sustainable solution.

**RESOURCE IMPACT**

Based on staff’s recommendation, the expected resource impacts are:

- Additional workload for City Clerk’s Office. The Clerk’s Office would need to conduct and coordinate an election to request a change in park usage.

- Funding the election would impact the Refuse Fund. An election would cost approximately $200,000. Actual costs depend on how many other measures are on the ballot and when the election is conducted. An election is not currently budgeted or planned in the upcoming budget for fiscal year 2008-09.

**ENVIRONMENTAL REVIEW**

Preparation of the Municipal Compost Facility Feasibility Study is exempt under section 15262
of the California Environmental Quality Act (CEQA) Guidelines. All required environmental review will be done accordingly when the project is defined.

**POLICY IMPLICATIONS**
The recommendation reflects a need to compromise between existing City policies. The recommendation is consistent with Council priorities relating to reducing greenhouse gas emissions. The recommendation also fits well with the Council sustainability guidelines. However, the Zero Waste Plan recommends the use of a regional facility for composting both green material and other organics like food wastes after landfill closure in 2011. Additionally, the Baylands Master Plan indicates the landfill site will become pastoral park after landfill closure. Conversion of a portion of that proposed pastoral park usage back to a municipal composting operation would require a vote of the people per the 1965 Park Dedication Ordinance.

**ATTACHMENTS**
Attachment A: Colleagues Memorandum dated August 6, 2007
Attachment B: Final Municipal Compost Facility Feasibility Study dated April 2008

**PREPARED BY:**

[Signature]
MATTHEW A. RASCHKE
Senior Engineer

**APPROVED BY:**

[Signature]
GLENN S. ROBERTS
Director of Public Works

**CITY MANAGER APPROVAL:**

[Signature]
EMILY HARRISON
Assistant City Manager
ATTACHMENT A

CITY OF PALO ALTO

COLLEAGUES MEMORANDUM

Date: August 6, 2007
To: City Council Colleagues
From: Vice Mayor Klein and Council Members Barton and Drekmeyer
Subject: Recommending the Council to Direct Staff to Study the Pros and Cons of Maintaining a Composting Facility in Palo Alto

We ask our colleagues to join us in directing staff to study the pros and cons of maintaining a composting facility in Palo Alto. Specifically, staff would be asked to:

1) Quantify the reduction in greenhouse gas emissions that would result from maintaining a composting facility in Palo Alto.

2) Compare the financial costs of composting in Palo Alto versus transporting green waste off-site.

3) Compare the pros and cons of in-vessel composting with windrow composting, with particular attention paid to land acreage needed and overall cost.

4) Explore potential locations for a composting facility, including somewhere on the current landfill site, other land in the vicinity of the Palo Alto Regional Water Quality Control Plant (RWQCP), the unused portion of the Palo Alto airport bordering Embarcadero Road, and the Los Altos Water Treatment Plant.

5) Analyze the impact on Byxbee Park of maintaining a composting facility near the RWQCP.

Background
The City of Palo Alto is developing a Zero Waste Operational Plan focusing on reducing solid waste. We also have made climate protection a City priority. We should try to make these two policies compatible whenever possible.

Palo Alto currently receives more than 17,000 tons of green waste per year at the City's 7.5 acre composting facility. Approximately 14,800 vehicles per year deliver this green waste. While transporting green waste off-site would continue to enable composting, it would add to our greenhouse gas emissions.

If Palo Alto closes its composting facility, the 14,600 vehicles delivering green waste would likely be directed to the Sunnyvale Materials Recovery and Transfer (SMaRT) Station where the waste would be consolidated and transported to the Z Best Composting Facility near Gilroy. In addition to generating greenhouse gases, the transportation of waste increases quantities of
other air pollutants such as nitrogen oxides, carbon monoxide, hydrocarbons and particulate matter.

**Conclusion**
We believe it is in the interest of both Palo Alto's Zero Waste Operational Plan and Climate Protection goal that we study the potential for maintaining a composting facility in Palo Alto. We hope our colleagues will join us in directing staff to provide the necessary information to help us make a well-informed decision.

This memorandum has been reviewed by City staff.
The City of Palo Alto
Compost Facility Feasibility Report

City of Palo Alto Public Works Department
April 2008
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Compost Facility Feasibility Report For the City of Palo Alto

Summary

This report was developed in response to an August 6, 2007 Council request to explore options for retaining a composting operation within Palo Alto City limits.

Palo Alto’s existing conventional windrow composting operation accepts approximately 21,000 tons of source separated green material per year from curbside collection, debris box, self-haul and from City tree trimming and sweeper operations. The City’s composting facility receives an average of $800,000 per year both from tip fees and from the sale of compost products. The City’s actual operating costs are approximately $550,000 per year (not including land rent to the general fund). It is possible that additional feedstock materials such as food scraps, compostable paper and untreated wood could be composted along with green material as is permitted at three regional composting facilities within Santa Clara County. However, composting food scraps and compostable paper would be very difficult within highly developed Palo Alto due to odors, vectors (flies, rodents, birds etc.), dust, noise and potential product contamination.

Three general types of composting technologies may be feasible for a medium to large scale composting facility in Palo Alto: 1) conventional windrow technology; 2) ag-bag or aerated static pile technology; and 3) in-vessel technology. Generally, conventional windrows, ag-bag or aerated static piles are simpler to operate, require more acreage, and cost less than in-vessel technologies. In-vessel technology provides more control of the air flow and moisture content - speeding up the composting process, is more environmentally friendly (containment of odors, vectors, runoff etc) and requires less land.

Processing residual organic wastes such as food scraps, restaurant grease and slaughtering wastes with the Regional Water Quality Control Plant (RWQCP) raw sewage sludge could produce a compost feedstock (biosolids) and create methane gas that could be utilized for electricity generation. For this to occur, large anaerobic digesters would need to be installed at a cost of $20-30 million. The City has invested $10 million into the current sludge incinerators that may have a useful life until 2024. The City will commence a Master Planning process for the RWQCP in 2009 and during that time, a detailed analysis of options will be conducted including options to participate in the master planning of other nearby sewage treatment plants. It could be that the most advantageous approach will be to construct a joint facility. The literature will be reviewed in the course of the master planning process to evaluate the likelihood whether a more aggressive energy recovery process would be available in the 2015-2020 time frames.

Four potential composting facility locations were proposed in the City Council’s colleague’s memorandum and have been evaluated as part of this report. They are portions of the following properties:

1. The Palo Alto Landfill;
2. The RWQCP property;
3. The Palo Alto airport (adjacent to Embarcadero Road); and
4. The former Los Altos Treatment Plant (LATP).

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Three of these sites, the RWQCP, the Airport and the LATP are in close proximity to offices, maintenance buildings and/or daycare centers and would require a large building with in-vessel technology to contain and filter the air through the use of a biofilter. Generally, waste processing facilities such as composting facilities are better suited for remote areas with a large amount of land and large buffer zones due to environmental impacts such as dust, odors, vectors, noise and traffic. Most of the regional composting facilities in the Bay Area have large sites and are rural located including the Pacheco Pass facility-18 acres, Z Best - 77 acres and Newby Island Landfill-18 acres. The four potential sites evaluated within the City limits are between 2 and 7.5 (plus) acres and have buffer zones between zero and 1,000 feet from the nearest neighbors.

Due to the issues outlined above, the most feasible location and operation that could be successfully permitted would be at the current landfill location utilizing the current conventional windrow technology composting only green material. It is anticipated that after landfill closure, the existing solid waste facility permit “SWFP” could be amended requiring only a mitigated negative declaration. If a new facility is sited on either of the other three sites, then it is expected that a new SWFP would be required requiring a full Environmental Impact Report and possibly requiring Waste Discharge Requirements.

The least expensive option ($41 per ton) for composting the City’s green material is to transport the material directly to SMaRT to be ground and transported to a regional composting facility. The City’s current conventional windrow technology system is estimated to cost $54 per ton if land rent of $100,000 per acre to the general fund is applied (7.5 acres). In-vessel technology is more expensive due to the large amount of capital necessary for development of the infrastructure.

| Cost Comparisons |
|------------------|-----------------|------------------|
| Management Method | Cost per Ton | Cost Per Ton Without Rent |
| Transport to SMaRT then to regional composting facility | $41 | N/A |
| Conventional Windrow Method (Green Material Only) | $54 | $18 |
| In-Vessel Technology (Green Material Only) | $124 | $109 |
| In-Vessel Technology (All Organics) | $81 | $72 |

**1 - Current Operations**

The City currently owns and operates a green material composting facility located on a 7.5 acre section of the 126 acre landfill. The composting operation is a conventional windrow operation that receives yard trimmings from residential and commercial sources and from City crews. Green material managed at the facility includes source separated yard waste such as lawn clippings, leaves, tree and shrub clippings, brush, and other vegetative materials generated through landscape maintenance activities as well as leaves accumulated through the City’s street sweeping operations.

Nearly all of the green material delivered to the City’s composting facility is generated within the City limits. Approximately 63% is delivered from PASCO’s curbside and debris box collection operation, 14% from commercial landscape maintenance companies and contractors,
Compost Facility Feasibility Report For the City of Palo Alto

13% from City tree trimming or (leaf) sweeper operations, 7% from City contractors and 3% from residential self haul. Table 1 lists the quantities of green material received at the Palo Alto Facility, the tip fees and revenues received, and the cost of operations during the last five years.

<table>
<thead>
<tr>
<th>Year</th>
<th>Quantities Accepted (Green Material)</th>
<th>Tip Fees Collected</th>
<th>Sales Revenue (Final Product)</th>
<th>Total Facility Revenue</th>
<th>Cost of Operations (Does not include rent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>16,900 tons</td>
<td>$174,875</td>
<td>$52,749</td>
<td>$227,624</td>
<td>N/A</td>
</tr>
<tr>
<td>2004</td>
<td>16,700 tons</td>
<td>$553,820</td>
<td>$51,593</td>
<td>$605,413</td>
<td>$551,538</td>
</tr>
<tr>
<td>2005</td>
<td>18,500 tons</td>
<td>$500,130</td>
<td>$119,351</td>
<td>$619,481</td>
<td>$480,217</td>
</tr>
<tr>
<td>2006</td>
<td>21,100 tons</td>
<td>$589,110</td>
<td>$181,225</td>
<td>$770,335</td>
<td>$523,495</td>
</tr>
<tr>
<td>2007</td>
<td>21,200 tons</td>
<td>$676,176</td>
<td>$171,392</td>
<td>$847,568</td>
<td>$550,336</td>
</tr>
</tbody>
</table>

Finished compost is distributed to the following entities: approximately 55% as bulk commercial sales to nurseries and materials yards, 29% is sold to landscapers and residents, 11% is given to residents on giveaway events and 5% is utilized by City crews for planting, parks etc. Finished compost is sold and utilized both outside and within City limits. The finished compost is sold as four separate products: 1) sold as finished compost; 2) sold when blended with a mixture of imported sandy loam as “topsoil”; 3) sold after being mixed with both sandy loam and wood fines as “soil conditioner”; or 4) sold as “potting soil” after soil conditioner is mixed with lava rock.

Description of the Operations
Incorporating loads of green material are deposited on a paved storage area where the material is stored and accumulated prior to grinding. The green material is visually screened for contaminants such as oversized and non-compostable materials. Green material grinding operations take place every few days near the asphalt pad using a rubber-tired loader to load the material into a horizontal grinder. After the green material is ground, it is suitable to be feedstock for the composting operation. The finer grade feedstock is piled and processed by a “Scarab” windrow composting machine into windrows approximately 300 feet long, 15 to 20 feet wide (at the base) and 6 feet in height. Selected materials that have been pre-ground such as wood chips from City tree maintenance operations or leaves collected by City street sweepers are entered directly into the windrows without grinding. Typically, 6 to 8 windrows are in process during normal operations.

Windrow temperatures are monitored to ensure pathogen reduction standards have been met. Irrigation water consisting of 50% reclaimed water from the PARWQCP and 50% from an onsite hydrant is applied on an as-needed basis determined by the weekly temperature monitoring program. As the compost matures over a three to four month interval, the windrows are turned on a weekly cycle to enhance composting activity through mixing and aeration of the material. The finished compost is stored in a finished compost stockpile area to await final screening.

Finished compost is screened using a trommel-type screen to separate the fine-grain compost from undesirable materials such as large pieces of woody material and other non-compostable contaminants. The finished screened compost is sampled and analyzed for metal concentrations.
Compost Facility Feasibility Report For the City of Palo Alto

as well as fecal coliform and salmonella. The finished screened compost is stockpiled for storage or mixed onsite with imported feedstock materials to produce other soil amendment products prior to sale.

2 - Potential Feedstock Materials and Final Product Markets

There are some cities in Santa Clara County that collect food scraps and compostable paper along with their green waste. These materials can be composted together to produce a sellable compost product. The main issue associated with processing these feedstock materials is contamination from undesirable materials such as plastic bags and glass containers. Untreated wood waste can also be added as a compost feedstock however most processing facilities use this material to produce wood mulch that can be colored and sold. Composting biosolids presents the greatest set of challenges. Some of these issues include foul odors, costly processing technologies, and the likelihood that buyers would choose green waste compost over compost containing biosolids. In addition there are no facilities in Santa Clara County that compost biosolids and only a handful outside the county that use biosolids as feedstock to produce compost.

The market for finished compost appears to be good. The prices that compost facilities sell their products range from $7 per ton to $63 per ton. The City currently sells it unblended compost for $21 per ton ($10 per yard) and its blended compost for $54.60 per ton ($26 per yard). It appears that Palo Alto is competitive in the unblended compost market. It is more difficult to tell how competitive the City is for the blended compost. There are many factors that can affect the compost market. The main factors include fluctuations in the economy and weather, bans on the transportation of compost outside of the county due to disease or insect infestation and contamination by a pesticide(s). Additional regulatory requirements may affect how the compost is processed including requiring compost to be processed inside a facility to capture gas emissions. In addition the City may want to look at producing a certified organic compost product as a way to diversify and be competitive.

Feedstock Research

One of the assigned tasks included evaluating other possible organic feedstock wastes. Specifically four organic wastes to be studied included food scraps, compostable paper, untreated wood waste, and biosolids. A discussion of issues related to the collection of the feedstocks, the handling of the feedstocks, the processing of the feedstocks, and ultimately the use of the compost or recycled material generated from these four feedstock materials is discussed below.

Feedstock materials are organic compostable materials which have the potential to be diverted from the solid waste stream (garbage), composted and sold as a usable product. Based on the Waste Composition Analysis, identified in the City of Palo Alto – Zero Waste Operational Plan (June 2007), a total of 20,281 tons per year of food scraps, untreated wood waste, and compostable paper are being landfilled. The feedstock material tonnages are based on data from single-family residential, mixed commercial and multi-family residential, industrial (open-top drop-boxes), and self-haul. In addition, 5,475 tons per year of biosolids are being converted to approximately 1,095 tons per year of ash and then landfilled.
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Table 2 Organic Feedstock Quantities Other than Green Material

<table>
<thead>
<tr>
<th>Feedstock Material</th>
<th>Annual tonnages generated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food Scraps</td>
<td>12,380</td>
</tr>
<tr>
<td>Compostable Paper</td>
<td>5,360</td>
</tr>
<tr>
<td>Untreated Wood Waste</td>
<td>2,541</td>
</tr>
<tr>
<td>Biosolids</td>
<td>5,475</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>25,756</strong></td>
</tr>
</tbody>
</table>

Food scraps

Food scrap waste includes items such as meat scraps, dairy products, egg shells, and fruit or vegetable peels. Food scrap waste can be co-composted with green waste to produce compost. Food scraps make up the largest feedstock materials at 12,380 tons per year.

Issues associated with the collection, processing, and the sale of compost containing food scraps include:

- Identifying what types of food scraps can be put into the bin (for example are bones collected and can they be processed).
- How the food scraps are collected can affect how the material is processed and the quality of the final product.
- Ensure collection trucks are air tight to prevent liquid leakage and offensive odors.
- Contamination from plastic bags.
- Contamination from glass containers.
- Food scrap processing generates offensive odors. Need to manage the odors effectively.
- Food scrap composting can attract vectors such as flies, birds, or vermin.
- Negative public perception. Not in my backyard (NIMBY).
- Additional Best Management practices (BMPs) may need to be put into place due to the high water content of food scraps.
- Tougher emission regulations may require a change in the composting process such as requiring the facility to be indoors or to capture any gases being generated from the composting process.
- Need additional space to incorporate feedstock into current compost operations.
- Need additional equipment such as in-vessel technology to incorporate feedstock into current compost operations.
- Need additional monies to purchase and operate equipment to process feedstock.

Benefits associated with the local collection, processing, and sale of compost containing food scrap waste include:

- Helps the City’s diversion rate goals.
- Keeps compostable material out of the landfill.
- Provides a source of revenue in the sale of compost.
- Reduce greenhouse gas emissions.
- Save on transportation and tipping costs by processing the organics ourselves.
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- If in-vessel anaerobic digestion is utilized, then the City could capture the methane to produce energy.

Compostable paper

Compostable paper includes items such as waxed cardboard, paper towels, pizza boxes, and other food soiled paper products. Compostable paper makes up the third largest feedstock material at 5,360 tons per year. Compostable paper can be composted with green waste to produce compost.

Issues associated with the collection, processing, and the sale of compost containing compostable paper include:
- Identifying what types of paper can be put into the bin (for example wax coated paper cups).
- Compostable paper products can be light and may get blown out of bins, trucks, or get distributed while making a delivery of the material to the composting facility.
- How is the compostable paper collected – green waste single stream (collect along with the green waste), food scrap waste single stream (collect along with food scraps), or separate bin (collect independent of green waste). Separate bin collection allows for easier screening of contaminants but may increase the transportation and handling costs and requirements.
- Plastics are a source of contamination when collecting compostable paper.
- Food soiled compostable paper may generate offensive odors.
- Food soiled compostable paper can attract vectors such as flies, birds, or vermin.
- Tougher emission regulations may require a change in the composting process such as requiring the facility to be indoors or to capture any gases being generated from the composting process.
- Need additional space to incorporate feedstock into current compost operations.
- Need additional equipment such as in-vessel technology to incorporate feedstock into current compost operations.
- Need additional monies to purchase and operate equipment to process feedstock.

Benefits associated with the collection, processing, and sale of compost containing compostable paper include:
- Helps the City’s diversion rate goals.
- Keeps compostable material out of the landfill.
- Provides a source of revenue in the sale of compost.
- Save on transportation and tipping costs by processing the organics ourselves.
- Reduce green house gas emissions.
- If in-vessel anaerobic digestion were utilized the City could capture the methane to produce energy.

Untreated wood waste
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Untreated wood waste includes wood from building, manufacturing, landscaping, packaging (e.g. pallets), or demolition activities that does not contain any paint, stain, varnish, or other chemical treatment. Untreated wood makes up the third highest amount of feedstock material at 2,541 tons per year. Untreated wood waste can be chipped and composted with green waste to produce compost. However other uses of untreated wood should be considered such as mulch and colored mulch, use as feedstock for engineered wood products, and biomass (fuel). This will help to create a more diverse market for untreated wood waste (see Market Variability discussion below).

Issues associated with the collection, handling, processing, and the sale of compost containing untreated wood waste include:

- Contamination from treated wood.
- Need a grinder to grind the untreated wood waste into a fine enough particle size to be co-composted with the green waste.
- The material is dry and can affect the composting process.
- Can create a lot of “over’s” which may not be easily composted and will have to find another use for them such as converting into a mulch product or selling the material to the biomass industry. It should be expected that a portion of the wood waste may be used for something other than compost.

Benefits associated with the collection, processing, and sale of compost containing untreated wood waste include:

- Helps the City’s diversion rate goals.
- Keeps compostable material out of the landfill.
- Provides a source of revenue in the sale of compost.
- Save on transportation and tipping costs by processing the organics ourselves.
- Other uses may be found for untreated wood waste including reuse, recycling, and remanufacture into engineered wood products such as wood I-joists
- Chip, color, and sell as decorative mulch. Colored mulch can be sold for $30 per yard vs. compost which is sold for $10 per yard.

Biosolids

Biosolids are nutrient-rich organic materials which result from the treatment of sewage sludge and wastewater. Currently the Palo Alto Regional Water Quality Control Plant (RWQCP) produces approximately 5,475 tons per year of raw sewage sludge. This sludge would have to be treated to produce biosolids. Based on their pathogen levels and metal concentration levels, the biosolids receive a certain classification. There are three basic classifications for land applying biosolids – Class B, Class A, and Exceptional Quality. Class B rated biosolids may contain low levels of pathogens and metals; Class A rated biosolids are free of pathogens but contain metals; and, Exceptional Quality rated biosolids are free of pathogens and contain lower levels of metals. Based on the biosolids rating and other land application restrictions biosolids could be used for agricultural land, forest, reclamation sites, and residential lawn and home gardens. Biosolids could be co-composted with green material and sold as a compost product.

Issues associated with the collection, handling, processing, and the sale of compost containing
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biosolids include:
- Foul odors.
- Biosolids can contain heavy metals, pathogens, and other chemicals.
- The handling and processing of biosolids can attract vectors such as flies.
- Negative public perception.
- The type of treatment would determine the class of biosolids and ultimately the class of compost produced.
- Biosolids containing compost would have to compete against non-biosolids containing compost.

Benefits associated with the collection, processing, and sale of compost containing biosolids include:
- Helps the City’s diversion rate goals.
- Keeps compostable material out of the landfill.
- Provides a source of revenue in the sale of compost.
- Saves on transportation and tipping costs by processing the organics ourselves.
- Keeps sludge ash from being landfilled as a hazardous waste thereby providing a cost savings.
- If anaerobic digestion is utilized can collect the methane to produce energy.

Currently the raw sewage sludge is incinerated, converted into ash, and shipped off to be landfilled in a Class I (hazardous waste) landfill. The ash is considered hazardous waste due to high metal concentrations. The Regional Water Quality Control Plant is looking at ways to reduce the metals concentrations.

Conclusion

Food scraps are the largest potential source of feedstock to be added as a compostable material. There are Cities which currently collect food scraps along with green waste at the curbside. These materials are then composted. The main drawback to food scraps composting is plastic and glass container contaminants. Both materials can reduce the quality of the final compost product. Public education, quality control, or technologies can be utilized to help minimize these contaminants.

Compostable paper can be collected along with food scraps. The main challenge associated with compostable paper composting is plastic bag contamination. Additional handling requirements may also be needed to reduce paper litter. Other Cities are already collecting compostable paper along with food scraps and green waste as a single stream collection process.

Untreated wood waste can provide an addition feedstock source. The main challenges of untreated wood waste are contamination from treated wood products and metal pieces Public education, quality control, or technologies can be utilized to help minimize these contaminants. In addition special equipment may be needed to optimize the processing of this feedstock material.

The use of biosolids as a feedstock material presents the greatest challenge out of the four
Compost Facility Feasibility Report For the City of Palo Alto

feedstock materials. Untreated sewage sludge would have to be processed into biosolids. The treated biosolids could then be co-composted with green waste to produce compost. The main issue with biosolids is that they can contain pathogens, metals, and other chemicals that may make compost containing biosolids less desirable.

Market Research
In addition to evaluating potential feedstock materials City staff were asked to research local and regional markets for selling the final compost product. Below is a summary of pricing other facilities sell their compost for, how much the City sells its compost products for, the markets to which the City sells its compost product to and factors that can affect the compost market.

There were approximately 298 composting and organic material processing facilities in California that produced an estimated 10 millions tons of compost and mulch in 2003. Of these, 219 facilities were composters and 79 facilities were chip and grind. There were about 15 composting facilities that were permitted to process food waste and 18 facilities were permitted to compost biosolids.

There were a total of 14 composting facilities in Santa Clara County, 13 of which were privately owned and 1 (Palo Alto) which is publicly owned. Of the 14 composting facilities located in Santa Clara County 9 process agricultural wastes, 3 process food wastes, 7 process green waste, 8 process manure, 1 process mixed municipal waste, 1 processes wood waste, and no facilities process biosolids.

How much are other facilities selling compost for?

A summary of compost product prices are listed in the table below. The information was obtained from a 2004 Certified Compost and Greenwaste Mulch: Sources and Product Information table and from a phone survey.

<table>
<thead>
<tr>
<th>Company</th>
<th>County</th>
<th>Material Price (per yard)</th>
<th>Material Price (per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jepson Prairie Organics (Vacaville)</td>
<td>Solano</td>
<td>$7</td>
<td>$14.70</td>
</tr>
<tr>
<td>Z-Best Compost Products (Gilroy)</td>
<td>Santa Clara</td>
<td>$9</td>
<td>$18.90</td>
</tr>
<tr>
<td>South Valley Organics (Gilroy)</td>
<td>Santa Clara</td>
<td>$10</td>
<td>$21</td>
</tr>
<tr>
<td>BFI – Newby Island Compost Facility (Milpitas)</td>
<td>Santa Clara</td>
<td>$10</td>
<td>$21</td>
</tr>
<tr>
<td>Grover Landscape Services (Modesto)</td>
<td>Stanislaus</td>
<td>$12</td>
<td>$25.20</td>
</tr>
<tr>
<td><strong>City of Palo Alto</strong></td>
<td><strong>Santa Clara</strong></td>
<td><strong>$13</strong></td>
<td><strong>$27.30</strong></td>
</tr>
</tbody>
</table>

*The prices are for the lowest priced compost product. There may be higher priced products which are not listed.

The City of Palo Alto Organics Yard sells unblended compost for $27.30 per ton. The average
Compost Facility Feasibility Report For the City of Palo Alto

price for compost based on the companies listed above is $21.35 per ton.

What are the compost products and to whom is the City of Palo Alto selling to?

The City of Palo Alto Organics Yard sells four products that contain compost. The current prices for these products is listed in the table below. The cost for compost made from green waste is $21 per ton and is sold as unblended material to be used for a soil amendment, top dressing, or feedstock for blending your own soil mixtures.

<table>
<thead>
<tr>
<th>Product</th>
<th>Composition</th>
<th>Use</th>
<th>Price (per yard)</th>
<th>Price (per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Palo Alto Compost</td>
<td>Compost</td>
<td>Soil amendment, top dressing or feedstock for soil blending</td>
<td>$10</td>
<td>$21</td>
</tr>
<tr>
<td>Soil Conditioner</td>
<td>Compost, wood fines, and sandy loam</td>
<td>Soil additive</td>
<td>$20</td>
<td>$42</td>
</tr>
<tr>
<td>Topsoil Blend</td>
<td>Compost and sandy loam.</td>
<td>Soil amendment</td>
<td>$26</td>
<td>$54.60</td>
</tr>
<tr>
<td>Potting Mix</td>
<td>Wood fines, compost, sandy loam, and lava fines</td>
<td>Potting soil</td>
<td>$26</td>
<td>$54.60</td>
</tr>
</tbody>
</table>

Market Volatility
In order to address issues that could affect the compost market volatility an analysis of three different factors were considered: feedstock supply, processing capacity, and final product marketability. It should be noted that any one factor could impact a composting program in any number of ways. It is the purpose of this analysis to look at general market factors that could make the compost market more volatile.

Factors Affecting Feedstocks
Factors that could affect feedstock materials include pesticide contamination and the infection of feedstock by a disease or pest. Finding pesticide in the compost during testing could compromise product quality and make it less desirable. Compost contaminated with a pesticide can lead to a product that no one wants to buy. Infestation of compostable organic material by a pest or disease can add additional handling and operational requirements resulting in delays or halting the composting operation. Regulatory agencies may require addition processing or curing time and may add limits on where the material can be sold. Although in the case of the Light Brown Apple Moth the California Department of Food and Agriculture and the United States Department of Agriculture determined that the standard composting process was enough to kill the Apple Moth and no restrictions were placed on the sale of compost across county lines.

Factors Affecting Processing
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New regulations can affect processing operations. More stringent standards may require new equipment or modifications to existing equipment. This can add to the operational cost and affect the bottom line.

Odors generated from the composting process may cause the public or other concerned individuals to limit the compost process. This could slow down processing operations and affect product throughput.

Other factors that can affect the compost processing include the following:
- Increase in operational costs such as having to build an indoor composting facility to compost food scraps or biosolids.
- Equipment breakdown and downtime can slow down the composting process.

Ways to reduce or plan for market variability:
- Have a good operations and maintenance program to prepare for equipment breakdowns.
- Have a good quality control program to minimize contaminants and maximize feedstock quality:
  - May require using technology to screen out unwanted materials such as plastics and glass contaminants.
  - Provide outreach to residents and businesses to educate them about the importance of keeping unwanted materials out of the feedstock waste stream.

Factors Affecting Final Products
In the San Francisco Bay Area the main use of compostable organic material (primarily green waste) is for alternative daily cover (ADC). Composters compete directly for green waste feedstock with ADC users. The cost of composting can be significantly more than the cost of using green waste as ADC. In some cases the use of green waste as ADC is revenue generating. Ox Mountain in San Mateo County exclusively uses green waste for this purpose. The 2004 CIWMB survey points out that over 50% of the green waste is being used as ADC.

AB32, the Global Warming Solutions Act of 2006, is a bill developed to reduce green house gas emissions. The California Air Resources Board has the responsibility of developing and implementing the details of the bill. ADC is seen as a source of green house gas emissions as well as a barrier to the composting market. If the use of green waste as ADC is banned the market could be flooded with compost and prices would most likely drop.

Other factors that can affect the compost market and make the market volatile include the following:
- Economy. When the economy is good more landscaping projects occur.
- Weather. Poor weather generally leads to less compost being purchased. This is probably due to fewer projects being done which use compost such as landscaping.
- The market becomes flooded with cheap excess compost which can cause prices to drop.
- Competing with local and regional facilities:
  - There are currently three facilities located within Santa Clara County (SCC) that compost green waste, food scraps, and compostable paper; these facilities include:
Compost Facility Feasibility Report For the City of Palo Alto

- Newby Island Compost located in Milpitas approximately 20 miles from the City.
- Pacheco Pass Landfill/South Valley Organics Composting located in Gilroy, approximately 55 miles from the City.
- Z-Best Compost located on Highway 25 near Hollister, approximately 55 miles from the City.
  - There are three composting facilities located outside SCC, but within approximately 85 miles (one-way) of the Palo Alto, these facilities include:
    - Grover Landscaping located in Vernalis approximately 80 miles from the City,
    - Jepson Organics located in Vacaville approximately 85 miles from the City,
    - West Contra Costa County Sanitary Landfill Compost located in Richmond approximately 50 miles from the City.

Ways to reduce or plan for market variability:
- Certify the compost products.
- Diversify compost products such as producing an organic compost.
  - The City can expand into the organic compost market by producing an organic compost and get the product certified. Certification can be obtained from the Organics Material Review Institute (OMRI) which certifies products for use in organic production and processing.
- Increase resources to the composting program and run like a for profit business.
- Find alternative uses for compost and prioritize these uses such as primary use: compost as a soil amendment; secondary use: compost as erosion control; tertiary use: waste to energy; etc.
  - Compost has diverse uses including landscaping, top soil manufacturing, turf management, agriculture, erosion control, bioretention ponds, and green roofs.
- Modify local ordinances:
  - Require the City to use more compost.
  - Require new City projects to use compost.

Compost Market Restrictions
Compost quality appears to be the number one factor that could affect the purchase of compost. Facilities that compost food scraps with green waste find that the final product can contain pieces of plastic (bags and foodware) as well as broken pieces of glass. Having contaminants in the compost makes it less desirable.

The use of biosolids as a feedstock may also make the compost less desirable. There are concerns about the amounts of metals and other chemicals that can be found in biosolids. Co-composting biosolids with green waste can introduce these constituents into the compost and make the compost less desirable. Furthermore, green waste contamination from pesticides or contamination of untreated wood waste feedstock from treated wood products can also introduce chemicals into the compost and make the final compost product less desirable.
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Conclusion
The City of Palo Alto is the only city in Santa Clara County that operates its own composting facility. All other Cities use contract haulers which transport compostable materials to local processing facilities. Compost prices from local and regional processing facilities range from $15 to $27 per ton. Palo Alto currently sells it unblended compost for $27 per ton. There are many factors that could affect the compost market such as the economy, infestation by a disease or pest, and a glut in the market. Compost produced from food scraps and compostable paper contains contaminants such as glass and plastics. The City may have to adjust operations to remove these materials to maintain high quality competitive compost.

3 – Municipal Composting Technologies

Summary of Available Composting Technologies
Three general types of composting technologies as described below may be feasible for usage at a medium to large scale composting facility in Palo Alto: 1) conventional windrow technology; 2) ag-bag or aerated static pile technology; and 3) in-vessel technology. It is feasible that all three of these technologies could process and compost all of the City’s green material as well as additional organic feedstock material including food scraps, compostable paper and untreated wood wastes. However, composting food scraps and compostable paper would be very difficult within highly developed Palo Alto due to odors, vectors (flies, rodents, birds etc.), dust, noise and potential product contamination.

Generally, conventional windrows, ag-bag or aerated static piles are simpler to operate, require more acreage, and cost less than in-vessel technologies. In-vessel technology provides more control of the air flow and moisture content - speeding up the composting process, is more environmentally friendly (containment of odors, vectors, runoff etc) and requires less land.

The option of anaerobically digesting green material or other organics with sewage sludge is also discussed below.

Conventional Windrow Technology:

As described in Section 1 the City currently operates a conventional windrow composting facility located on a 7.5 acre section of the landfill. Windrow composting is the most commonly used method in the industry for composting green material and other organics when producing large volumes of compost. Incoming green material is first ground and placed in windrows. The windrows are periodically sprayed with water and turned with a scarab windrow turner to increase the moisture and oxygen content in the material. This windrow type composting process can typically take three months to complete. Another month or two for further curing of the compost can help produce a more stabilized product. The final compost is screened to remove plastic and oversized woody material that did not break down during the composting process.

Acreage Required: The City’s current 7.5 acre composting operation is at it’s maximum limit in terms of managing the 20,000 plus tons of green material feedstock annually. Any increase to the amount of feedstock received will need an appropriate amount of increased facility area. For
example, if the City chooses to add an additional 25% of other organics (approximately 5,000 tons per year) to the existing windrow composting facility, then another two acres of acreage would need to be added (9.5 acres).

**Equipment Costs:** Windrow composting generally requires a rubber tired loader, a scarab windrow turner, a grinder and a trommel screen. All of this equipment together would typically cost approximately $850,000 if purchased new.

**Facilities Using This Technology:** The Newby Island Composting facility in Milpitas operates a windrow type operation for green material composting.

**Pros:**
- Windrow operations are simpler to operate;
- Easy to form into windrows;
- Simple to aerate using the scarab windrow turner;
- Provides easy access to temperature measurements;
- Costs less; and
- The facility can be located on compacted soils instead of pavement.

**Cons:**
- Difficult to control moisture and air flow (exposed to the environment);
- Susceptible to wind-blown dust and odors during processing;
- Fires can occur more often with windrow composting;
- Stormwater or irrigation water runoff can be generated; and
- Windrow technology can take longer to compost than the more controlled composting technologies.

**Aerated Static Piles and Ag-Bag Composting**

**Aerated Static Piles:** Aerated static pile composting technology can be active or passive. In a passive system, the feedstock is ground and placed in a pile (or trapezoidal shaped rows) and allowed to compost over time adding water and only utilizing natural air currents. A passive system would probably not be able to compost the City’s annual throughput of green material. An active system involves placing a pile of the mixed feedstock over rigid or flexible perforated piping connected to fans that will either push or pull air through the composting mass, thereby increasing the oxygen supply to the compost. Aerated static piles can also be covered to better control the moisture and oxygen content of the compost and be a barrier against vectors (birds, rats and flies). Covered aerated static pile technology allows the collection and treatment of the process air prior to venting. Typically a one to two month composting period is needed followed by a one to two month cure time.
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Ag-Bag Composting: Ag-bag composting is similar in many aspects to the covered aerated static pile method described above and is sometimes described as an in-vessel composting technology. The incoming material is ground and mechanically pushed into a typically 200 foot long plastic bag (also called pods). The bags also contain perforated piping the length of the bag connected to fans that are used to increase the oxygen content. Because the composting material is contained within the bags, the moisture and oxygen content of the compost can be controlled better and be a barrier against vectors as well as to collect and treat the process air prior to venting. Typically a one to two month composting period is needed followed by a one to two month cure time.

Acreage Required: The ag-bag and the covered aerated static pile technologies can complete the compost process in less than half the time as conventional windrow technology. It is estimated that at least four to five acres would be necessary to compost the 20,000 plus annual tons of green material generated by the city.

Equipment Costs: A budgetary quote that was received from a vendor in June, 2007 listed that the aerated static pile equipment including cover system, automated controls, aeration equipment and biofilter hardware would be approximately $700,000. In addition, a loader, grinder and trommel screen would still be required for an estimated cost of $625,000 for a grand total equipment cost of $1,325,000.

Facilities Using This Technology: The Jepson Prairie Composting Facility in Vacaville and the Pacheco Pass facility near Gilroy use the Ag-bag technology for the composting of food scraps and yard trimmings.

Pros:  
- Ag-bag or aerated static piles utilize less acreage than windrows;  
- Can manage large amounts of organics through a faster composting process;  
- Can control moisture and oxygen content better;  
- Can filter the process air reducing particulates and odors; and
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- Can control excess heat in order to prevent fires.

Cons:
- Can cost more than a windrow system; and
- A paved or well compacted gravel foundation is required.

Stationary In-Vessel and Containerized In-Vessel Composting Systems

Stationary In-Vessel Composting Systems: A stationary in-vessel composting technology is the industries’ most technologically advanced and best controlled composting system. These vessels are typically constructed of concrete or stainless steel walls and ceilings. In-vessel systems can better mitigate strong odors associated with food scraps and control air flow and humidity in order to accelerate the composting process. The closed containers (vessels) exhaust the air emissions through biofilters in order to control odors. These vessels can typically be 15 to 20 feet wide and 30 to 90 feet long and contain perforated piping where air is forced through the feedstock to accelerate the composting process to three weeks with a secondary curing process of about 1 month. These stationary vessels are usually enclosed in prefabricated metal buildings that may also be needed to house the feedstock and final product. Incoming material is ground and fed into the vessels using an overhead loader conveyor system.

In-Vessel Facility Mariposa, CA

Vertical In-Vessel Composting System: Another form of in-vessel composting system has been proposed as an option to consider in the City’s Zero Waste Operational Plan. The vendor “VCU Technology” (VCU) has developed an in-vessel vertical composting system that processes organics in small to medium municipal and industrial applications. Composting takes place inside modular chambers that are typically 25 cubic meters in capacity and can have as many chambers as necessary. The process is continuous with waste being loaded into the top of the chamber and stabilized material removed from the bottom every day. The vertical orientation of the VCU processing chamber enhances a natural process, with aeration provided by natural convection forces and accelerated by a fan mounted on top of each chamber. Odor control is achieved by way of self-biofiltration and leachate is not produced.

VCU claims that operating costs will be low due to low energy and little maintenance and labor costs. The vertical design and smaller footprint may have advantages if land availability is an
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issue. With the vertical in-vessel system, feedstock is ground and fed into stage one of the process. The feedstock provides a matrix within the material and ensures that air can flow through the mass of the material, keeping it aerobic. All feeding of material into the system is done via fully enclosed computer controlled conveyors that move material from the shredder/mixer to stage one and again from stage one to stage two. Material remains in each stage for four days where it reaches temperatures in excess of 70 degrees Celsius. After 8 days, (4 days in each stage) the material is discharged into a skip and removed for maturation into finished compost. Integral temperature probes in the internal walls of the chambers record the temperature of the mass of the compost as it passes through the chamber and all this information is recorded in the central computer which controls the whole process. According to VCU, typical retention times to stabilize the feedstock vary between one to two weeks. Curing time is estimated at one month.

Containerized Composting System: The main difference between the containerized and stationary in-vessel composting systems is that containers are portable and can be moved and used outdoors. Composting in modular roll-off containers is flexible and easily expandable. Composting in roll-off containers allows flexibility in system design and operation. Usually these containerized systems can be used to compost from 1 to 100 tons per day.

Acreage: VCU proposed in the City’s Zero Waste Operational plan that a vertical feed in-vessel technology that would minimize the footprint of the facility to 2 to 3 acres and to 3 buildings totaling 60,000 square feet. Another in-vessel vendor Engineered Compost Systems “ECS” proposed that the City consider a stationary in-vessel composting system on a minimum 2 acre site because this system would provide the best odor control, process control, and has the smallest footprint compared to other composting technologies.

Equipment Costs: A budgetary quote from ECS received in June, 2007 listed that the stationary in-vessel system that could accommodate 30,000 tons per year of mixed organics would cost approximately $8.9 million including the building cost. VCU has estimated equipment costs of approximately $4 million.

Facilities Using In-Vessel Technology: Mariposa County uses a stationary in-vessel system to compost their green material and MRF Fines that contain a large amount of food scrap. The system was designed to handle up to 50 tons per day. Several locations in Europe and Canada also employ this technology.

Pros:
- In-vessel composting technology utilizes less space than any other technology;
- Can manage large amounts of composting through a faster composting process;
- Can control moisture and oxygen content better;
- Can filter the process air reducing particulates and odors;
- Can control excess heat (fires);
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- These facilities are primarily designed for composting facilities with no significant buffer zones with neighbors and environmentally problematic feedstocks such as food scraps or biosolids.

Cons:
- In-vessel systems cost more than other systems;
- Usually have a higher ceiling for top loading vessels and may be problematic due to building height restrictions in some areas.

Compost, Conversion Technology and Palo Alto’s Sewage Treatment Plant

Currently, the Regional Water Quality Control Plant (RWQCP) incinerates raw sewage sludge. The $10 million investment made on these incinerators in 2000 will be paid off in 2024. It is anticipated that a major investment would be needed to rebuild the incinerators at that time.

Alternatively, a new technology, focused on energy recovery, could be selected, designed and implemented in that time frame. In order to insure that such an alternative can become a reality by then, the City is commencing a Master Planning process for the RWQCP in 2009. That process will take several years to complete. During that time, a detailed analysis of options will be conducted. One option is mixing sewage sludge with green waste to produce a compost. Another option is converting the biosolids to a fuel, possibly in combination with other organic wastes creating a compost feedstock material. RWQCP staff will also be participating in the Master Planning of other nearby sewage treatment plants. It could be that the most advantageous approach will be to construct a joint facility. This has been the case in the Los Angeles area where both composting and energy recovery facilities are further along. Economies of scale, availability of land, and the “not-in-my-backyard” phenomenon have driven these facilities to highly industrialized and semi-agricultural areas.

Most sewage treatment plants anaerobically digest raw sewage sludge rather than incinerate them. This typically means putting the sludge in a closed tank for 30-45 days in an oxygen-free environment where bacteria breakdown the material to methane gas and residual biosolids. The methane is typically burned in internal combustion engines to produce electricity and heat. In a small number of cases the residual biosolids are mixed with green waste to make compost. It is becoming more common to add other organics (such as restaurant grease and slaughtering waste) to the digestion tanks at sewage treatment plants. The compost facilities have not been located at the sewage treatment plants, but rather in semi-agricultural areas.

It would not be possible to combine RWQCP biosolids and green waste in the immediate future because the existing RWQCP technology is so focused on the incineration process. Considering this option as part of the RWQCP Master Planning Process beginning in 2009, appears doable and logical.

Energy recovery technology (conversion technology) is advancing rapidly. A number of ways (other than anaerobic digestion) of extracting the energy from sewage are in research and development phases. Currently, much of the available energy is lost during the aerobic oxidation process which virtually all sewage treatment plants employ. Someday it will likely be possible
to recover this energy, as well as the energy from the biosolids. The literature will be reviewed in the course of the Master Planning process to see if it appears that any more aggressive recovery process would likely be available in the 2015-2020 time frame. The literature on composting will also be reviewed to see if it would be possible to utilize any other RWQCP products besides digested biosolids in a composting operation. Staff's current belief is that anaerobic digesters would have to be installed at a cost of $20-30 million. Advances in technology may present other options.

In summary, combining a sewage product with a compost operation in Palo Alto should not be part of an initial composting evaluation plan but could be part of a subsequent planning phase as early as the 2015-2020 time frame.

**Non-Feasible Technologies:**

The following composting options were initially evaluated and found to be less feasible for a medium to large scale composting facility located in Palo Alto: rotating drum systems, vermicomposting, agitated beds and passive aerated static piles. In addition, emerging conversion technologies that utilize post-recycled organics for energy or fuel production have not been evaluated in depth because of the limited land available at the sites considered as part of this study.

**4 – Potential Facility Locations**

**Potential Facility Locations:**

Staff was asked to evaluate sites in Palo Alto where composting could be permitted and accomplished. Generally waste processing facilities such as composting facilities are better suited for remote areas with a large amount of land and large buffer zones (at least 1,000 feet) between neighbors due to environmental impacts such as dust, odors, vectors, noise and traffic. Most of the regional composting facilities have large sites and are rural or located in large buffer zones including the Pacheco Pass facility-18 acres, Z Best - 77 acres and Newby Island - 18 acres. The four potential sites within the City limits that are evaluated below are between 2 and 7.5 (plus) acres and have buffer zones between 100 and 1,000 feet from the nearest neighbors.

**State and County Permitting:**

**Solid Waste Facility Permit (SWFP):**

In order to develop and operate a new composting facility that would accommodate all of the City's green material as well as additional possible feedstock such as food scrap or compostable paper, an application for a full solid waste facility permit would need to be filed with the local enforcement agency (Santa Clara County Department of Environmental Health) as described in Title 27 of the California Code of Regulations (CCR). The application would include as at a minimum:
Compost Facility Feasibility Report For the City of Palo Alto

- A completed application form
- Report of Facility Information
- An odor impact minimalization plan
- CEQA Information
- Conformance finding information.
- Owner operator certification

If the application is complete and addresses all of the regulatory requirements, then the County with the concurrence from the California Integrated Waste Management Board could grant the City a composting facility permit.

CEQA Requirements:

For CEQA, it is expected that a full EIR would be required for each of these sites with the possible exception of the current composting facility site (landfill). It is possible that a mitigated negative declaration would be required for a new facility at the landfill if the City were allowed to operate under it’s current composting facility permit.

Non Disposal Facility Element:

Any new composting site would need to conform to the Santa Clara County’s non-disposal facility element (NDFE) plan. Before a new composting facility can be permitted and developed a new composting facility would need to be proposed to the County’s Planning section and the facility could be added to the plan. The City’s existing composting facility would also need to be removed from the NDFE (unless the landfill option is used).

Waste Discharge Requirements

In addition to the SWFP, the San Francisco Bay Regional Waster Quality Control Board (RWQCB) would probably require a permit known as Waste Discharge Requirements (WDRs) if the composting facility were an outdoor facility where material is processed, composted or stored. If a new composting facility were outdoors, then it is likely that the RWQCB would require the construction of retention basins to contain all of the storm water runoff, thereby requiring a large amount of land and cost.

Air Permit Issues

Currently, there is no separate permit issued by the Air District for composting facilities. In the future, Assembly Bill 32 (Global Warming Bill) may require more stringent regulations, permits or even prohibitions for certain uncontained composting operations. In-vessel composting technology would be better suited for any possible more stringent air requirements.

Four Sites for Consideration

Four potential composting facility locations are evaluated below. These four locations are currently undeveloped with the exception of the landfill and were proposed in the City Council’s
colleague's memorandum dated August 6, 2007. Because of the close proximity to neighbors, a large building is recommended for the sites except for the landfill and would be useful to contain problematic waste such as food scraps and to contain and filter the air through the use of a biofilter. Providing some processing within a building could also reduce fugitive dust during the processing of the feedstock materials.
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Site Location #1 the Current Landfill Site:

Due to the abundance of land on the landfill, a conventional windrow, ag-bag or covered aerated static pile would be the simplest and less costly technologies to use at this location.

Advantages:
- Large amount of semi-flat land;
- Easiest to permit. May be able to revise the current permit instead of applying for a new permit, thereby perhaps reducing CEQA from an EIR to a mitigated negative declaration, and eliminating the need to update the County’s NDFE (to site a new composting facility); and
- Further away from neighbors than the other three sites (reducing nuisances or environmental impacts).
- Could operate the least costly method of composting “conventional windrow technology”.

Disadvantages:
- Dedicated Parkland (need vote to approve use changes);
- Need to change the Comprehensive Plan Land Use designation from Public Park to Major Institution Special Facility;
- Highly visible location;
- Use conflicts with the Baylands Masterplan;
Site Location #2 Land in the vicinity of the RWQCP:

The area within the WQCP property at the southwest corner contains between two to three acres available for development. A composting facility located here would need to have a small footprint. Therefore a stationary in-vessel system would be the most feasible technology.

Advantages:
- Not highly visible, does not interfere with airport flight path;
- No change needed to Zoning/Land Use: PF(D) / Major Institution Special Facility;
- Not dedicated parkland.

Disadvantages:
- Small area, not much room for processing, staging or curing material;
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- Would restrict future master planning options for the WQCP;
- Close to neighbors (businesses).
- Difficult to permit.
- Enclosed in-vessel system is more costly than the conventional windrow, ag-bag or aerated static pile technologies. and
- Part of the area is presumed to be wetlands.

Site Location #3 Unused Portion of the Palo Alto Airport:

Almost four acres would be available at the airport bordering Embarcadero Road. A stationary in-vessel process would be recommended at this location. The airport’s ALUP (Airport Land Use Plan (1982)) is currently being updated and discussions with the Santa Clara County’s Planner revealed that the draft revised ALUP could support the development of a fully enclosed facility on this area if noise and safety concerns are addressed.

Advantages:
- No change needed to Zoning/Land Use: PF(D) / Major Institution Special Facility
- Not dedicated parkland
- 3.9 acres may be large enough for in-vessel stationary technology.

Disadvantages:
- Potentially not aesthetically compatible with the Baylands gateway;
- Existing airport land use plan does not allow new structures. Final draft of new airport land use plan could allow structures if concerns addressed;
- Located 100% within the Airport turning safety zone may need approval from the FAA;
- Highly visible location.
- Not much buffer zone between other offices or maintenance facilities.
- Difficult to permit.
- Enclosed in-vessel system is more costly than the conventional windrow, ag-bag or aerated static pile technologies.
Site Location #4 Los Altos Treatment Plant:

Staff anticipates that 6.5 to 9 acres may be available at the LATP for development for all of the City’s uses. Some of the initial proposed uses at the LATP have been a new animal services center, a utility storage area, and a recycling center/HHW drop-off location. Utilizing four acres for a composting facility would require a stationary in-vessel composting. This site will be annexed into the City of Palo Alto in the near future.

Advantages:
- No change needed to Zoning/Land Use: PF(D) / Major Institution Special Facility.
- Large amount of land currently undeveloped.

Disadvantages:
- The potential issues are most related to whether there is enough room for all the desired uses for this site (the uses for the site are currently under discussion).
- Close neighbors with no off site buffer zones (businesses, including a large child care facility, bordering on three sides).
- Difficult to permit.
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- Timing – LATP will need to undergo cleanup and wetlands remediation and may not be available before the existing facility must close.
- Enclosed in-vessel system is more costly than the conventional windrow, ag-bag or aerated static pile technologies.

Site Location #4 LATP
5 – Environmental and Economic Impacts

Summary:

The least expensive option ($41 per ton) for composting the City’s green material is to transport the material directly to SMArT to be ground and transported to a regional composting facility. The City’s current conventional windrow technology system is estimated to cost $54 per ton if land rent of $100,000 per acre to the general fund is applied (7.5 acres). In-vessel technology is more expensive due to the large amount of capital necessary for development of the infrastructure.

Product Volumes and Estimated Value:

Average finished compost sales revenues of approximately $175,000 per year can be expected based on an average of 21,000 tons of green material accepted for composting each year. In addition, if other feedstocks are added such as food scrap, compostable paper and untreated wood, then it may be feasible to collect another 12,000 to 18,000 tons of feedstock annually depending on the capture rates. According to staff’s survey of regional composting facilities, food scrap compost generally sells at half the price of the cleaner green material compost. If the City were to permit and add these additional organics to the composting operations, Staff estimates that another $115,000 per year in sales of final product could be realized.

Green House Gas Emissions

Staff has estimated that an additional 1,100 metric tons of carbon dioxide would be emitted through increased vehicle emissions when (or if) the City’s composting facility closes in the near future. The additional emissions were calculated with the assumptions that all of the City’s green materials would need to be hauled to nearby transfer stations (for example SMArT) then ground and hauled to regional composting facilities in the South County. It should be noted that the City’s entire vehicle fleet emits a total of 1,900 metric tons of carbon dioxide per year. Other air pollutants would also be emitted including Nitrogen Oxides, carbon monoxide and particulate matter.

Cost Comparisons:

A cost comparison between the export of compostable wastes to regional facilities and the development and usage of a City owned facility is presented in Table 3 below. The costs itemized below were either developed from a vendor budgetary estimate, taken from actual City operations cost reports or presented in the Zero Waste Operational Plan, June 2007. These estimates are preliminary and conceptual in nature and are provided solely for the purposes of relative comparisons between the alternatives. They are not intended as final cost estimates for budgetary or financing actions and should not be utilized for those purposes. Costs will change depending on final design, conditions of permitting and approval, and actual year of construction.
## Compost Facility Feasibility Report For the City of Palo Alto

**Table 3 Cost Comparisons (in 2008 dollars)**

<table>
<thead>
<tr>
<th>Notes</th>
<th>Item</th>
<th>Windrows Green Material</th>
<th>S MaRT Green Material</th>
<th>In Vessel Green Material</th>
<th>In Vessel With Other Organics</th>
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<tbody>
<tr>
<td>1</td>
<td>Initial Capital Costs</td>
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<td>Annualized Capital Costs</td>
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<td>3</td>
<td>Transportation $7.50/ton</td>
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<td>$131,000</td>
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<td>4</td>
<td>Tip Fees Paid by City @$3 per ton</td>
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<td>$575,000</td>
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<tr>
<td>5</td>
<td>Operating Costs</td>
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<td>Included above</td>
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<td>6</td>
<td>Land Rent ($100,000 per acre per year)</td>
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<td>7</td>
<td>Revenue Offset From Sale of Finished Product</td>
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<td>$0</td>
<td>&lt;$175,000&gt;</td>
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<tr>
<td>8</td>
<td>Total</td>
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<td>9</td>
<td>Cost per ton</td>
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<tr>
<td>10</td>
<td>Cost per ton not including land rent</td>
<td>$17.86/ton</td>
<td>$41/ton</td>
<td>$109/ton</td>
<td>$72/ton</td>
</tr>
</tbody>
</table>

**Notes:**

1) Initial capital estimates for an in-vessel facility is based on a vendor budgetary quote $8.9 million (for building costs and equipment) plus a 20% contingency (1.78 million) to cover ancillary site development costs for a facility capable of processing all of the City's organics. The in-vessel option for green material only is reduced by 33% because of less vessels, smaller building size, and no additional mixing or processing equipment for other organics.

2) Annualized capital costs based on 4.3% interest, 20 year term.

3) Transportation cost per ton to S MaRT is based on 18 mile round trip at an estimated speed of 50 mph, vehicle capacity of 7 tons per load at $85.70 per hour.

4) S MaRT tip fee estimate for receipt of unprocessed green material provided by Sunnyvale staff.

5) Operating cost for Windrow system based on average cost from the last four years. In vessel cost estimates are based on the Zero Waste Plan estimates including labor, maintenance and fuel and also includes 50% of facilities/equipment maintenance, equipment replacement costs, utilities, general administration/legal/acct., overhead, insurance and operating cost contingency.

6) Approximate land rent amount paid to the general fund.

7) Revenue Offset for the windrow facility is based on the average amount of revenue from the sale of finished compost (from accepting 21,000 tons of green material) the last two years. In-vessel (all organics option) was estimated based on 14,000 tons of food scrap and other organics diverted to an in-vessel facility in the City. Pricing for food scrap finished compost is approximately ½ the price of clean green compost and it is assumed that food scrap would need to be bulked with some of the green material at the site devaluing the price that the City could sell the finished product.

9) Cost per ton based on 21,000 tons per year of green material for the windrow and in-vessel green material options. The cost per ton for the S MaRT option is based on 17,430 tons (83% of the 21,000 tons of green material that the City controls). In-vessel with other organics based on 21,000 tons + 14,000 = 35,000 tons of all organics,

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City of Palo Alto Public Works Department 4/17/2008
Impact on Byxbee Park
The most significant impact of maintaining a composting facility in Byxbee Park is the visual impact of the operation. It would be a continuation of the current highly visible operation that exists today. The piles mounds of compost are clearly visible from East Bayshore Road, Highway 101, and West Bayshore Road.

Other impacts include dust, litter, vectors and odor. During screening operations, dust generated is sometimes mistaken for smoke from a fire. Litter mixed in with green waste can be blown from the operation area and onto the public park area. Litter mixed in with green waste also attracts vectors such as flies and rodents. On days when wind blows from the east, the composting operation can produce a noticeable and distinctive earthy odor on East and West Bayshore Roads.