APPENDIX D

ECONOMIC CONSIDERATIONS

GENERAL WASTE DISCHARGE REQUIREMENTS FOR COMPOSTING OPERATIONS - ECONOMIC CONSIDERATIONS

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SUMMARY

The proposed *General Waste Discharge Requirements for Composting Operations* (Order) will impose compliance costs on the compost industry that will increase the total cost of operations and decrease net returns. The proposed Order will require initial capital investments of approximately $25.2 million in retention ponds, monitoring wells, and drains. Annual investment costs will be about $2.2 million, and annual monitoring and maintenance will be an additional $1 million. Although these amounts seem large when expressed in relative terms or in units of production, the effect on compost operators will be manageable. The industry has 121 facilities subject to the proposed Order that processes about 7.8 million cubic yards of compost annually.

The proposed Order will impose annual cost increases on the order of one percent to seven percent, depending on the size of operation and ownership. Net revenue will decline by 2.5 percent to 18 percent. However, projected profit margins vary between eight percent and 40 percent and therefore, the economic viability of the operations will not be in jeopardy.

Analysis shows that compliance with the proposed Order is highly unlikely to divert green waste from compost operations to landfills. The difference between the landfill disposal cost and the total compost cost varies from $12.10/ton to $23.74/ton of green waste. Total compost costs would have to increase by at least 26 percent to approach landfill disposal costs.

INTRODUCTION

Two economic considerations are addressed in this analysis. The first is to determine the effect of imposing the proposed Order compliance costs on the economic viability of composting operations. The second is to project the possible shift in compost feedstocks to landfills as a result of the proposed Order's requirements.

ECONOMIC VIABILITY UNDER THE PROPOSED ORDER

The proposed Order categorizes compost operations into two tiers, Tier I and Tier II. Tier I are those operations processing less than 25,000 cubic yards of material onsite at any given time that includes all material received, processed and stored on the premises. Tier I must meet all siting criteria: minimum groundwater depth based on soil percolation rate; distance to nearest surface water (≥ 100 feet); and distance to nearest drinking water supply well (≥ 100 feet). Tier I feedstocks are limited to agricultural, green, paper, and vegetative food materials.

Tier II operations process more than 25,000 cubic yards onsite at any given time of solid food material, biosolids and manure in addition to Tier I materials. Tier II operations also must meet certain siting criteria: minimum distances to the nearest surface water (≥ 100 feet); and distance to nearest drinking water supply well (≥ 100 feet).

Compliance with the proposed Order will require Tier II operations to either (1) upgrade the operation surface pad to meet a hydraulic conductivity standard, or (2) perform groundwater protection monitoring (assumed to be groundwater monitoring); install a lined retention pond; monitor water quality in the retention pond; and submit annual reports. Tier I operations are not subject to the operations surface pad hydraulic conductivity standard; retention pond hydraulic conductivity standard; or the groundwater protection monitoring requirements.

Eight Tier II compost facility operators volunteered to provide cost and revenue data for this analysis. The facilities represent a broad spectrum of private, public, and partnered operations receiving 25,000 to 140,000 tons per year of multiple types of feedstocks, using a variety of composting techniques. For the purposes of confidentiality, survey participants will not be identified.

Cost of Processing Compost With and Without the Proposed Order

Survey cost results were compiled on the basis of cubic yards of compost produced and sold annually as shown in Table 1. The total annualized cost of producing a cubic yard of compost (referred to as the *Total Processing Cost*) for the surveyed facilities ranged from $19.19 to $30.99.

Table 1. Compost Facility Characteristics and Costs by Category

		Surveyed Processing Cost				Projected Compliance Cost				
Facility[1]	Compost Processed (cy/yr)	Operating Cost ($/cy)	Business Overhead Cost ($/cy)	Investment Overhead Cost ($/cy)	**Total Processing Cost ($/cy)**	Plant Pad Size (ac)	30 year Average Annual Precipitation[2] (in/yr)	Compliance Cost w/o Pad Installation ($/cy)	**Total Compost Cost ($/cy)**	**Change in Compost Cost** (%)
Pvt 1	25,000	$15.67	$5.89	$7.26	**$28.82**	15.8	22.36	$2.00	**$30.83**	**6.9%**
Pub 1	40,000	$16.86	$5.76	$8.36	**$30.99**	12.0	22.14	$1.06	**$32.04**	**3.4%**
Pvt 2	56,000	$13.01	$7.79	$6.76	**$27.56**	10.7	19.99	$0.67	**$28.23**	**2.4%**
Pvt 3	75,000	$10.65	$4.40	$4.14	**$19.19**	20.0	12.50	$0.55	**$19.74**	**2.8%**
Pub 2	100,000	$13.98	$12.09	$4.51	**$30.58**	18.0	38.39	$0.80	**$31.38**	**2.6%**
Pub 3	100,000	$16.04	$8.06	$3.91	**$28.01**	45.0	11.37	$0.66	**$28.67**	**2.4%**
Pvt 4	103,152	$8.91	$9.20	$6.32	**$24.44**	6.0	15.76	$0.26	**$24.70**	**1.1%**
Pub 4	137,016	$11.84	$11.23	$3.64	**$26.70**	72.0	6.63	$0.50	**$27.20**	**1.9%**

[1] Pvt indicates private ownership and Pub is a publically owned facility

[2] PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 3/1/2014.

The cost to produce compost, referred to as the "Surveyed Processing Cost" in Table 1, are principally a function of: (1) the size of the operation, (2) the business arrangement (private or public), and (3) the processing techniques employed. The major cost categories of operating costs, business overhead costs, and investment overhead costs are defined as follows:

Operating Costs – Includes receiving, grinding and screening, forming open windrows, turning windrows, separating fines, forming fines curing piles, and shipping. Costs of labor, equipment operating costs (i.e., energy and repairs), and interest on operating capital, are accounted for in this category.

Business Overhead Costs – Includes staff and management costs, equipment rental, outside services, materials and supplies, office expenses, insurance, taxes, permits, fees, and land costs.

Investment Overhead Costs – Includes the annualized cost of purchased buildings, equipment, and long term facility improvements.

The cost to comply with the proposed Order was estimated assuming the annual capital costs of (1) upgrading the operation's pad surface to meet the proposed Order's hydraulic conductivity standard, or (2) installing groundwater monitoring wells and monitoring; installing a retention pond meeting the hydraulic conductivity standard; and constructing drainage conveyance ditches. Annual monitoring of pond water and maintenance costs are also included. Annual compliance cost per cubic yard of compost processed was calculated for the two options using the following equations:

Option 1: Cost of Operations Surface Pad Installation

If the operator chooses to upgrade the pad surface to meet the required hydraulic conductivity standard, the following equation calculates compliance costs:

Annual Compliance Cost With Pad Installation ($/cubic yard) = Annual Pad Installation Cost ($/cubic yard) + Annual Retention Pond Installation Cost ($/cubic yard) + Annual Conveyance Drain Installation Cost ($/cubic yard) + Annual Retention Pond Monitoring Cost ($) +Annual Maintenance Cost ($)

Where: Annual Pad Installation Cost ($/cubic yard) = (Pad Installation Cost ($/acre) x Pad Size (acre) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Pad Installation Cost ($/acre) = $81,675[1]

Capital Recovery Factor[2] = 0.08718 = (Interest Rate x (1 + Interest Rate)$^{\text{Economic Life}}$) / ((1 + Interest Rate)$^{\text{Economic Life}}$ – 1)

Where: Interest Rate = 6.0%

Economic Life = 20 years

Annual Retention Pond Installation Cost ($/cubic yard) = (Pond Installation Cost ($/ac) x Pad Size (ac) x Pond to Pad Factor (in^{-1}) x Average Annual Precipitation (in) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Pond Installation Cost ($/acre) = $147,388[3]

Pond to Pad Factor (in^{-1}) = 0.00692 = ((Pad Size (ac) x ((Open Area (% of Pad) x Pad Runoff Coefficient) + (Material Area (% of Pad) x Material Runoff Coefficient)) x 43,560 (ft^2/acre) x 1/12 (ft/in)) / Pond Depth (in)) x (1/43,560 (acre/ft^3))

Where: Open Area (% exposed surface) = 50%

Pad Runoff Coefficient = 0.69[4]

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[1] Based on actual bids 2008 for lime/cement treated (12" thick), place AC roads, construction 200' x 200' concrete pad. Cost includes construction, design engineering, and construction oversight.

[2] The Excel PMT function calculates the value which is defined as the payment for a loan based on constant payments and a constant interest rate.

[3] Assumes excavation, hauling, stockpiling, and finished grading (5' deep), installation of 60-mil HDPE membrane, and design, engineering and construction management.

[4] http://www.brighthubengineering.com/hydraulics-civil-engineering/93173-runoff-coefficients-for-use-in-rational-method-calculations/ Assumed disturbed area, 2 to 6% slope, Soil Group B with a coefficient of 0.68. However, 0.69 was inadvertently used in the calculations instead of 0.68.

Material Area (% covered surface) = 1 – Open Area

Material Runoff Coefficient = 0.14[5]

Average Annual Precipitation (in) = 30-Year Average Annual Precipitation (in)[6]

Annual Conveyance Drain Installation Cost ($/cubic yard) = (Conveyance Drain Installation Cost ($) x Capital Recovery Factor) / Compost Processed Annually (cubic yard)

Where: Conveyance Drain Installation Cost ($) = $10,000

Annual Retention Pond Monitoring Cost ($) = $3,962

Annual Maintenance Cost ($) = $3,500

Option 2: Cost of Groundwater Well Installation and Monitoring

If the operator chooses to monitor groundwater instead of upgrading the pad to the required hydraulic conductivity standard, the following equation calculates compliance costs:

Annual Compliance Cost Without Pad Installation ($/cubic yard) = Annual Retention Pond Installation Cost ($/cubic yard) + Annual Conveyance Drain Installation Cost ($/cubic yard) + Annual Groundwater/Retention Pond Monitoring Costs ($/cubic yard) + Annual Maintenance Cost ($/cubic yard) + Annual Groundwater Monitoring System Installation Cost ($/cubic yard)

Where: Annual Groundwater Monitoring System Installation Costs ($/cubic yard)[7] = ((If Pad Size ≥ 50 acres, then Cost of 5 Wells ($), If Pad Size < 50 acres, then Cost of 3 Wells ($)) x Capital Recovery Factor) / Compost Produced Annually (cubic yard)

Where: Installation Cost of 5 Wells ($) = $58,919

Installation Cost of 3 Wells ($) = $35,387

Annual Groundwater/Retention Pond Monitoring Costs ($/cubic yard)[8] = (If Pad Size ≥ 50 acres, then Annual Cost Monitoring 5 Wells ($), If Pad Size < 50 acres, then Annual Cost Monitoring 3 Wells ($)) / Compost Produced Annually (cubic yard)

Where: Annual Monitoring Costs for 5 Wells ($) = $16,667

Annual Monitoring Costs for 3 Wells ($) = $11,167

Surveyed Facilities' Costs by Category

Figure 1 graphs the costs of surveyed facilities presented in Table 1, and provides a visual comparison of cost categories by facility. The results assume that the operator chooses the lower cost (Option 2) of installing and monitoring groundwater rather than upgrading the operation's pad surface (Option 1).

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[5] Op. cit. Compost material is similar to forested areas with a slope 2 to 6% on Soil Group B.

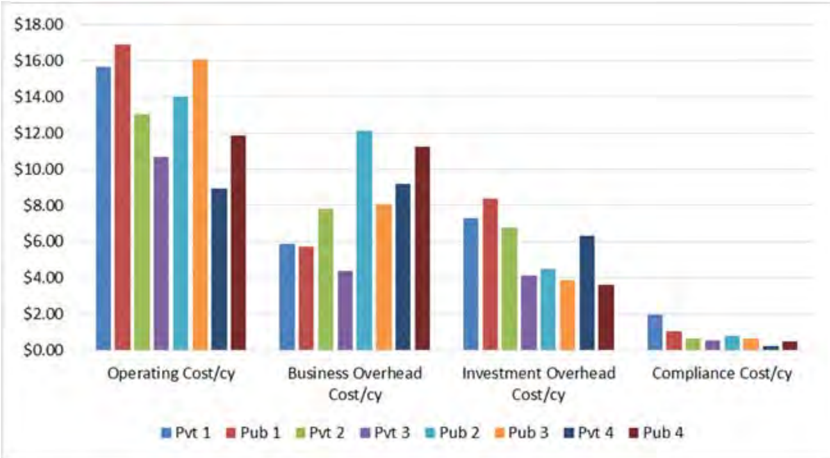
[6] PRISM Climate Group, Oregon State University, http://prism.oregonstate.edu, created 3/1/2014. 30-year average was closest available data to the 25-year annual required in proposed Order.

[7] Includes project management, planning, installation, sampling, and reporting for the first year.

[8] Includes annual sampling and reporting costs.

The facilities are arrayed by size so that the effect of economies of size on the cost of producing per cubic yard is shown. Operating costs, investment overhead costs and compliance cost decline as the amount of compost produced increases while business overhead cost increases. This is attributed to the larger facilities in the sample tending to lease or rent rather than purchasing selected capital equipment. Other differences may be attributed to the various processing technologies employed and ownership type.

Figure 1. Comparison of Surveyed Compost Facilities Cost Categories



Compliance costs assume the operator chooses the lessor cost option of monitoring groundwater rather than upgrading the operation's pad surface. Compliance costs are principally the installation of the retention pond, which is determined by pad size and 30-year average annual precipitation. Comparing pad size and precipitation for facilities Pvt 1 and Pvt 4 illustrates the variables' effects on compliance cost.

Facility Pvt 1 has a pad size of 15.8 acres, a 30-year average annual precipitation is 22.36 inches, and processes 25,000 cubic yards of compost annually. Using the pond to pad factor (0.00692in^{-1}), the pond installation cost of the single lined pond is $147,388 per acre. Therefore, facility Pvt 1 has a retention pond installation capital cost of $360,359. This capital cost is then annualized (assuming 6 percent interest rate over 20 years [0.0872]) and converted to a cost per cubic yard (by dividing the amount of compost produced annually), resulting in a cost of $1.26/cubic yard of compost produced. Adding in the cost of the drainage conveyance ($0.035/cubic yard); the compliance wells ($0.123/cubic yard); and retention pond monitoring and maintenance costs ($0.587/cubic yard), facility Pvt 1 has a total compliance cost of $2.00/cubic yard.

Much lower compliance costs were projected for facility Pvt 4. Facility Pvt 4 has a pad size of six acres, a 30-year average annual precipitation of 15.76 inches, and processes 103,152 cubic yards of compost annually. Therefore, facility Pvt 4 has a retention pond installation capital cost would be $96,457. Annualizing the cost and dividing by the amount of compost processed annually results in a cost of $0.082/cubic yard. Adding in the cost of the drainage conveyance ($0.008/cubic yard); the compliance wells ($0.030/cubic yard); and retention pond monitoring and maintenance costs ($0.142/cubic yard), facility Pvt 4 has a total compliance cost to $0.26/cubic yard, or approximately 13 percent of the compliance cost for facility Pvt 1.

Profit Margins With and Without the Proposed Order

The profit margin is one indication of the economic viability of an operation. Profit margins can be used to compare similar types of operations with respect to changes in operating costs to determine changes in economic viability.

The profit margin is calculated as follows:

$$\text{Profit Margin (\%)} = ((\text{Gross Revenue (\$)} - \text{Total Costs (\$)}) / \text{Gross Revenue (\$)}) \times 100$$

The profit margin is just one indicator of economic viability. Therefore, the rate of return on investment was also calculated and will be reported later in this report. Other measures of economic viability require knowledge of the operation's assets and debt situation, which are not addressed in this analysis.

Composting gross revenue is comprised of two major revenue sources. The first revenue source is termed "tipping fees", or the charge a facility requires for accepting feedstocks. The tipping fee is usually in units of gross tons. The second revenue source is from the sales of the finished product, typically on a bulk-wholesale cubic yard basis. Gross revenue, the revenue term used in the following text and tables, represents the sum of the two revenue sources.

Table 2 presents total costs, gross revenue, net revenue, profit margins, and rate of return on investment with and without compliance costs for the surveyed facilities. In this analysis, profits represent the economic returns that will be retained by the facility owner after all itemized expenses have been paid. Of the surveyed facilities, facility Pvt 3 had the largest profit margin, with a 41.8 percent profit margin (without compliance costs). Compliance costs for Pvt 3 was relatively low, at $.55 per cubic yard of compost sold, resulting in a profit margin with compliance costs of 40.2 percent, a reduction of 4.0 percent. Since the reduction in the profit margin is relatively low, it can be concluded that the proposed Order will not significantly affect the economic viability of Pvt 3.

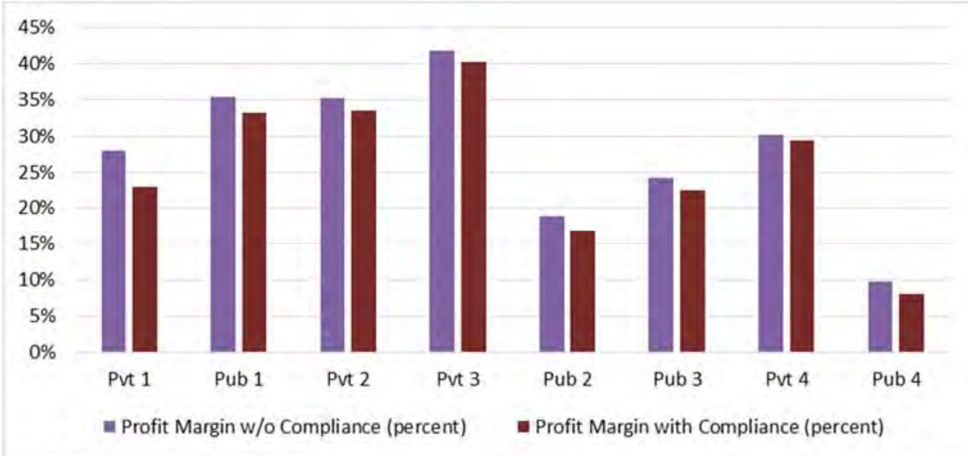
Table 2. Profit Margins

Facility	Total Cost w/o Compliance ($/cy)	Gross Revenue ($/cy)	Net Revenue w/o Compliance ($/cy)	**Profit Margin w/o Compliance (percent)**	Compliance Cost ($/cy)	Total Cost with Compliance ($/cy)	Net Revenue with Compliance ($/cy)	**Profit Margin with Compliance (percent)**	**Decline in Profit Margin (percent)**
Pvt 1	$28.82	$40.00	$11.18	**27.9%**	$2.00	$30.83	$9.17	**22.9%**	**17.9%**
Pub 1	$30.99	$48.00	$17.01	**35.4%**	$1.06	$32.04	$15.96	**33.2%**	**6.2%**
Pvt 2	$27.56	$42.50	$14.94	**35.2%**	$0.67	$28.23	$14.27	**33.6%**	**4.5%**
Pvt 3	$19.19	$33.00	$13.81	**41.8%**	$0.55	$19.74	$13.26	**40.2%**	**4.0%**
Pub 2	$30.58	$37.70	$7.12	**18.9%**	$0.80	$31.38	$6.32	**16.8%**	**11.2%**
Pub 3	$28.01	$37.00	$8.99	**24.3%**	$0.66	$28.67	$8.33	**22.5%**	**7.4%**
Pvt 4	$24.44	$35.00	$10.56	**30.2%**	$0.26	$24.70	$10.30	**29.4%**	**2.5%**
Pub 4	$26.70	$29.58	$2.87	**9.7%**	$0.50	$27.20	$2.37	**8.0%**	**17.4%**

Pub 4, the largest operation in the survey, has a 9.7 percent profit margin (without compliance costs), which is reduced to an eight percent profit margin when compliance costs are included. It should be noted that as wholly owned and operated by a public agency, profits are not the primary motivator for Pub 4. The objective of Pub 4 is to provide quality and cost-effective recycling services for the community at the lowest cost without negative financial returns. Pub 4 will provide composting services even if reasonable compliance costs increase the total cost of operation. Although the manager is charged with minimizing costs, the facility will not reduce operations due to a decline in net revenue.

Figure 2 presents a graphic comparison of facility profit margins with and without compliance costs. Pvt 1 is a privately owned, profit motivated company that will experience a decline of 17.9 percent in their profit margin. While a substantial decline in the profit margin, it leaves the operator with a 22.9 percent profit margin, which should not affect the economic viability of the facility.

Figure 2. Profit Margins With and Without Compliance Costs



The remaining five facilities will also experience reductions in net revenue, but should remain economically viable.

Four of the compost facilities are publicly owned or partnered with public entities. These operators have contractual obligations to provide compost services for the public and an additional objective to minimize costs. These operators will experience the most dramatic decline in projected profit margins, but are less vulnerable to economic hardship due to the participation of public partners. Four facilities are private operators with profit margins ranging from 22.9 to 40.2 percent after absorbing the compliance costs of the proposed Order and will remain economically viable.

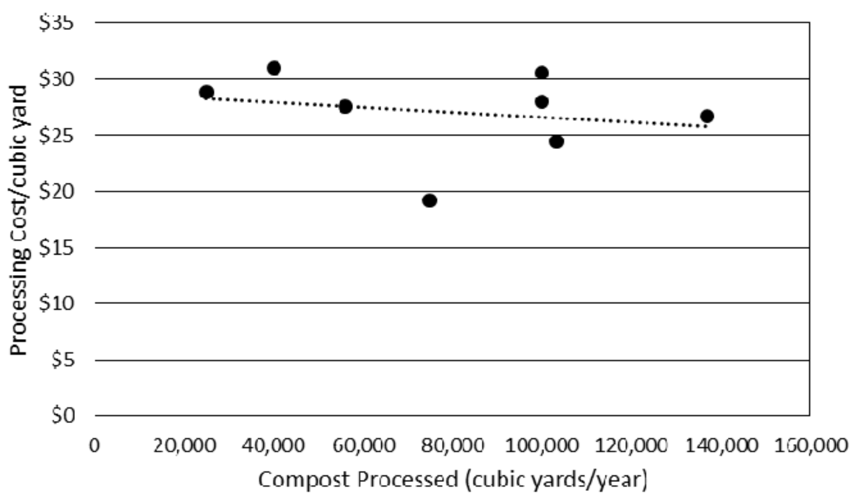
Profit Margins for California Compost Facilities

The data from the eight surveyed facilities were used to the estimate costs and revenues for the remaining 113 compost operations anticipated to be subject to the proposed Order. Facilities that are covered under existing waste discharge requirements; not currently operating; or exempted operations were not included in this analysis.

Processing Costs

Existing compost processing costs (without compliance costs added) for the surveyed facilities were plotted to obtain a trend line (Figure 3).

Figure 3. Existing Processing Costs and Total Annual Compost Processed



The trend line was estimated using the following regression model:

$y = \alpha + \beta x + \mu$

where: y is processing cost/cubic yard;

α is the intercept;

β is the slope of function;

x is the size of the facility in cubic yards processed annually; and

μ is the error term.

The estimated regression equation is:

Processing Cost ($/cubic yard) = $ 28.24 + (-$0.0000167 * Compost Processed Annually (cubic yard/year)

$R^2 = 0.018$

The R^2, or correlation of determination, indicates that proportion of the total variation of processing costs that is explained by the model. An R^2 of .018 is statistically insignificant but is consistent with the presence of economies of size. To improve the predicative properties of the model, a dummy variable was introduced to test the hypotheses that the type of ownership causes a structural change in processing costs. A dummy variable is a 0 or 1 numerical value, where a 0 represents a privately owned facility and a 1 represents a publically owned facility. The logic of this model is explained in the previous section on public and private ownership, and their differences in business objectives. The regression model now becomes:

$y = \alpha + \beta_1 x + \beta_2 p + \mu$

where: y is processing cost/cubic yard;

α is the intercept;

β_1 is the slope of function;

x is the size of the facility in cubic yards processed annually;

β_2 is the difference in the cost of processing for publically owned compost facilities;

p is 1 if the facility is publically owned, 0 otherwise; and

μ is the error term.

The estimated regression equation is:

Processing Cost ($/cubic yard) = $ 28.68 + (-$0.0000567 * Compost Processed Annually (cubic yard/year) + $5.74 for publically owned facilities.

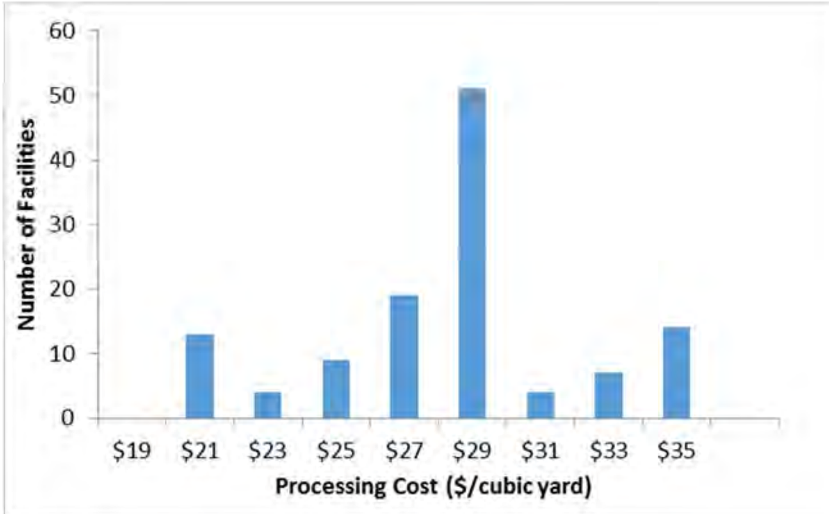
$R^2 = 0.58$

The R^2 indicates that 58 percent of the variation in the facility cost of processing is explained by the regression model.

The t statistic (coefficient divided by the standard error) of β_1 is 1.76, which is significant at the 90% confidence level. The t statistic of β_2 is 2.54, which is significant at the 95% confidence level. This set of regression coefficients was used to predict compost costs for the 113 statewide facilities subject to the proposed Order.

The frequency of compost processing costs for the 121 statewide facilities is presented in Figure 4.

Figure 4. Processing Cost



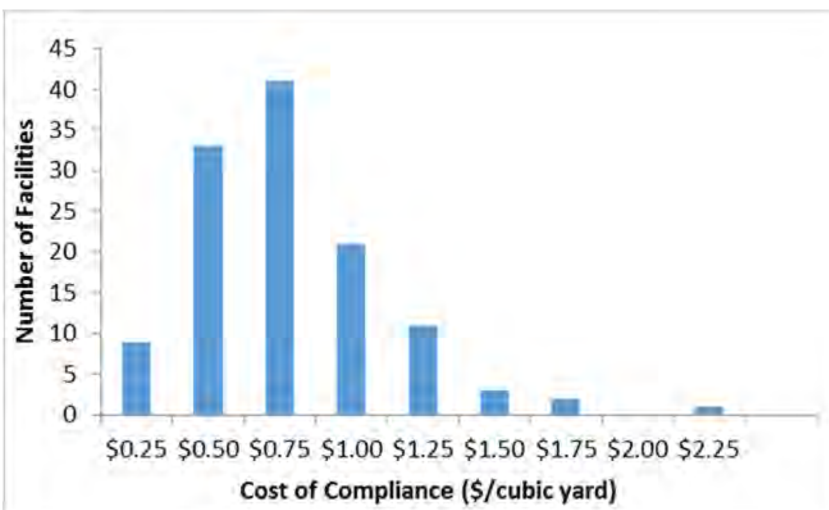
The minimum facility processing cost is $19.19/cubic yard and the maximum is $34.08/cubic yard. The mean is $27.20/cubic yard and the median is $27.66/cubic yard.

Compliance Costs

121 California compost operations are subject to the provisions of the proposed Order. CalRecycle's Solid Waste Information System (SWIS) facility database[9] provides collected data on the quantity of compost processed, and the size of each facility. As stated above, total compost costs for each facility is the total of processing costs plus compliance costs.

Figure 5 plots the frequency of compliance costs ($/cubic yard) for the 121 facilities. As previously stated, compliance cost is primarily determined by the pad size, and the average annual precipitation.

Figure 5. Compliance Costs



The minimum facility compliance cost is $.09/cubic yard and the maximum is $2.00/cubic yard. The mean is $0.66/cubic yard and the median is $0.59/cubic yard.

[9] http://www.calrecycle.ca.gov/swfacilities/Directory/

The location of the 121 compost facilities, their compliance costs, and 30-year average annual precipitation is shown in Figure 6. As previously stated, a high correlation exists between higher rainfall areas and higher compliance costs, which is prevalent in Northern California.

Compliance costs per unit of compost processed is a function of the size of the operation and the amount of compost processed annually. Facilities with lower compliance costs are generally located in the San Joaquin Valley and Southern California, and process larger amounts of compost annually. Plotting compliance costs and the amount of compost processed annually indicates the influence of the economies of size (Figure 7). The nonlinear Excel trendline indicates that costs decline as size increases, but most economies of size are achieved by the 50,000 cubic yard/year level. The deviations from the trendline can be attributed to distortions of pad size relative to facility size and average annual precipitation.

Figure 6. Compost Facilities and Compliance Cost

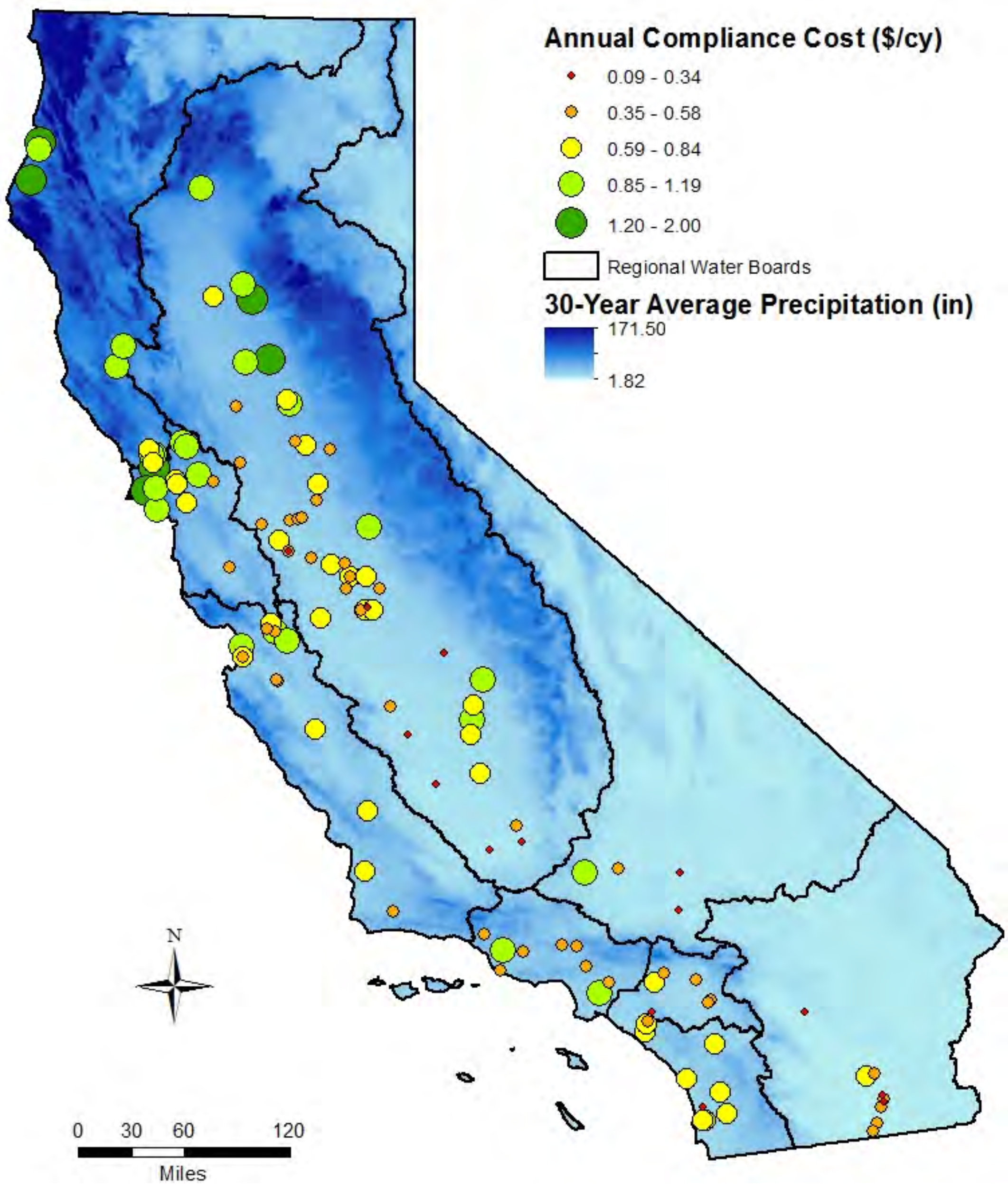
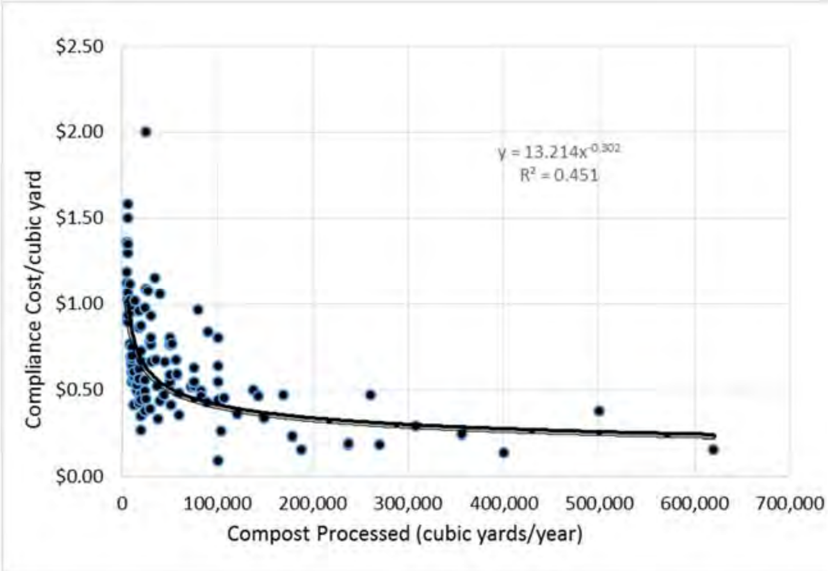


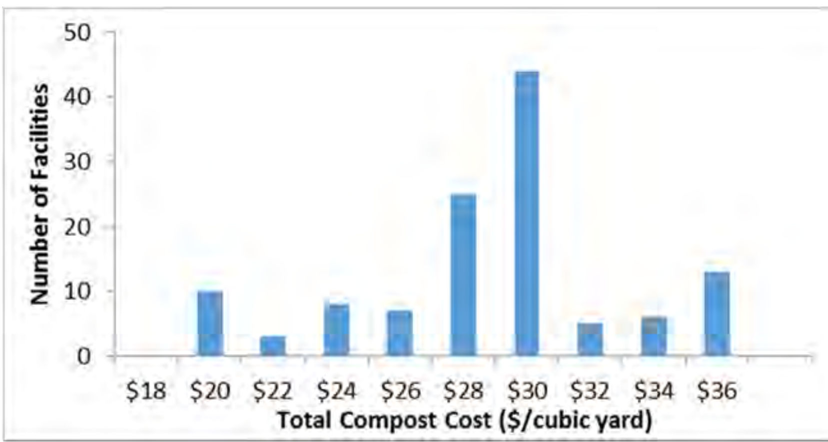
Figure 7. Compliance Cost and Size of Compost Facility



Total Compost Cost

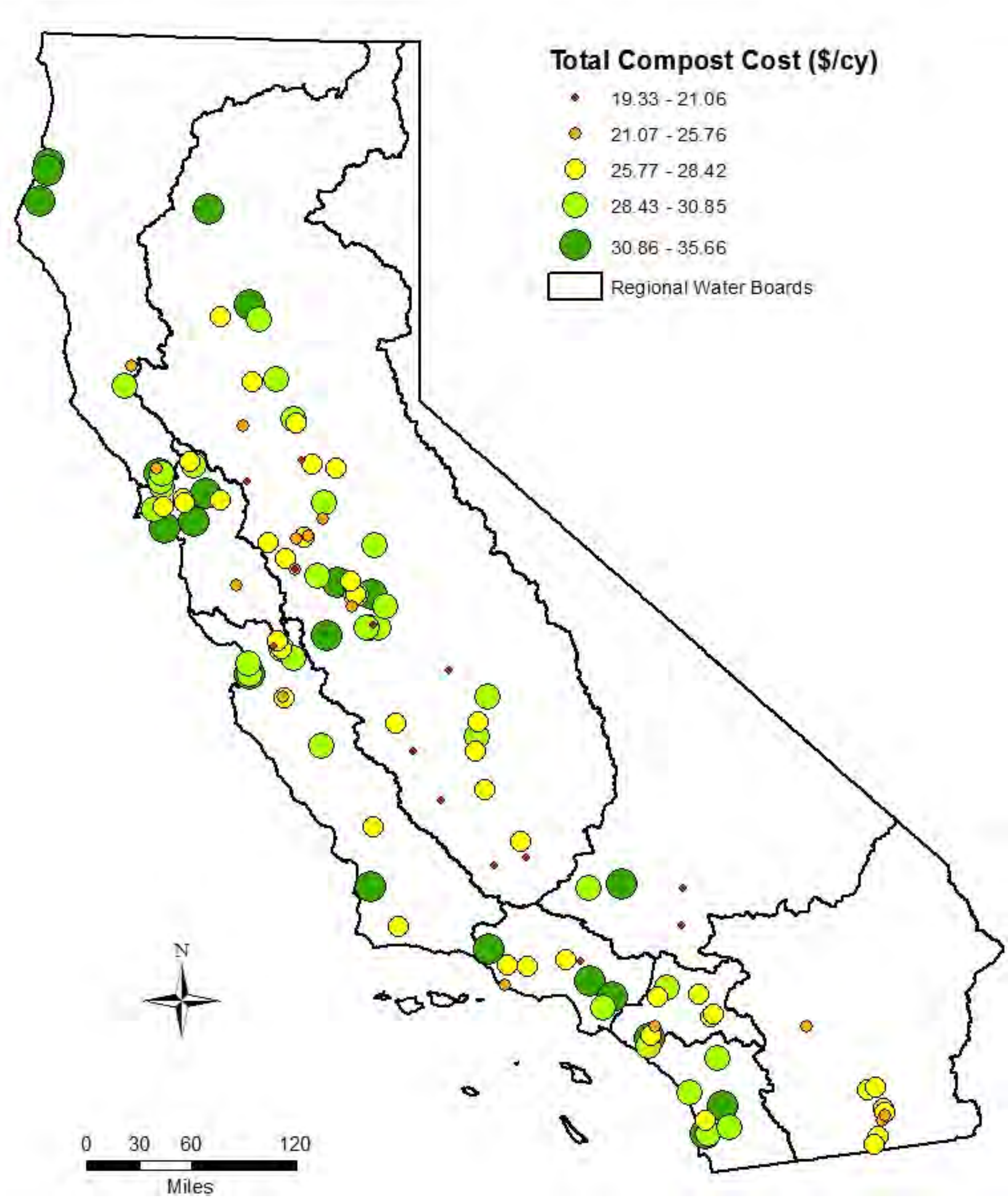
The total compost cost per cubic yard for each facility is the sum of the total processing cost and the annual compliance cost. The frequency of the facility total compost costs ($/cubic yard) for the 121 compost operations is presented in Figure 8.

Figure 8. Total Compost Cost



The estimated minimum facility total cost is $19.33/cubic yard and the maximum is $35.66 cubic yard. The mean is $27.85/cubic yard and the median is $28.28/cubic yard. Seventy of the 121 facilities fall into the $26/cubic yard to $30/cubic yard cost category. Twenty five of the 32 publically owned or operated facilities had total compost costs exceeding $29.79/cubic yard. Many of the low cost facility are located in the south central valley and southern California (Figure 9).

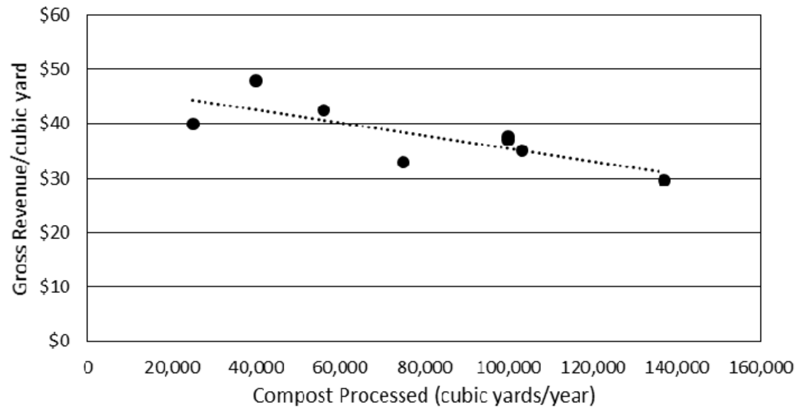
Figure 9. Compost Facilities and Total Compost Costs



Gross Revenue

Net revenue and profit margins were calculated for the 121 compost operations. First, gross revenue was projected using regression analysis. A plot of the compost gross revenue for the surveyed facilities and a linear trendline is presented in Figure 10.

Figure 10. Gross Revenue and Quantity of Compost Processed Annually



A linear regression analysis estimates the following relationship:

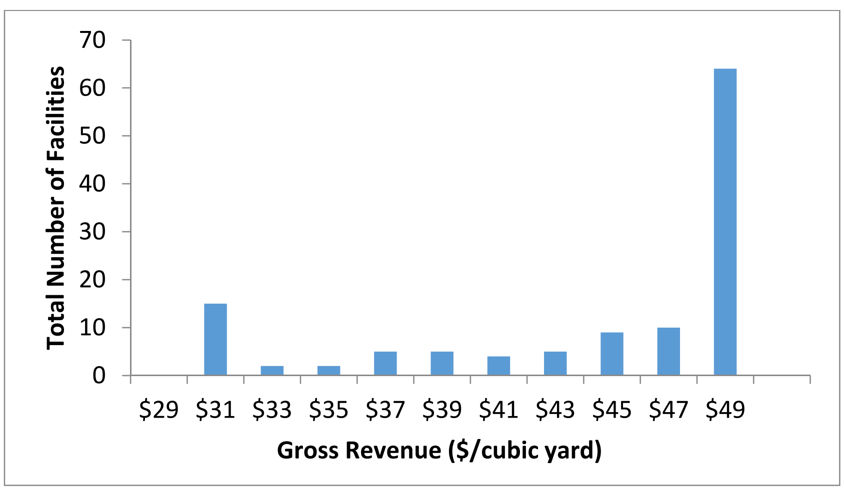
Gross Revenue ($/cubic yard) = $51.63 + (-$0.000161 * Compost Processed (tons/year)

$R^2 = .74$

The t statistic for the slope variable is 3.8 which is significant at the 95% confidence level.

The gross revenue was calculated for the 121 compost facilities subject to the proposed Order. The frequency of the facility gross revenue is presented in Figure 11. The minimum gross revenue is $29.58/cubic yard and the maximum is $48.00/cubic yard. The mean is $43.27/cubic yard and the median is $47.60/cubic yard.

Figure 11. Gross Revenue

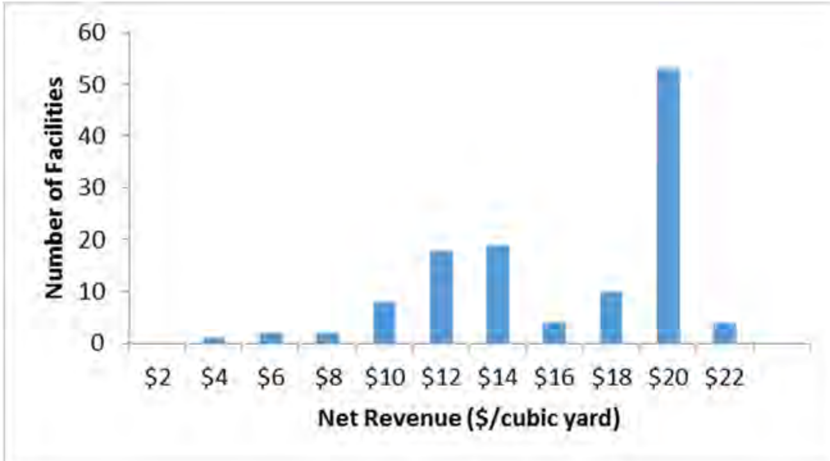


Due to the considerable slope of the regression equation, gross revenue was constrained to the upper and lower values ($48.00 and $29.58) of the sample data. This accounts for the high frequency (64) of Tier I and small Tier II facilities that fall into the $47/cubic yard - $49/cubic yard category. This is also exhibited in the number of facilities in the $29.00/cubic yard - $31.00/cubic yard category.

Net Revenue

Net revenue was calculated by subtracting total processing cost from gross revenue for each of the 121 compost facilities. The frequency of the facility net revenue is presented in Figure 12.

Figure 12. Net Revenue

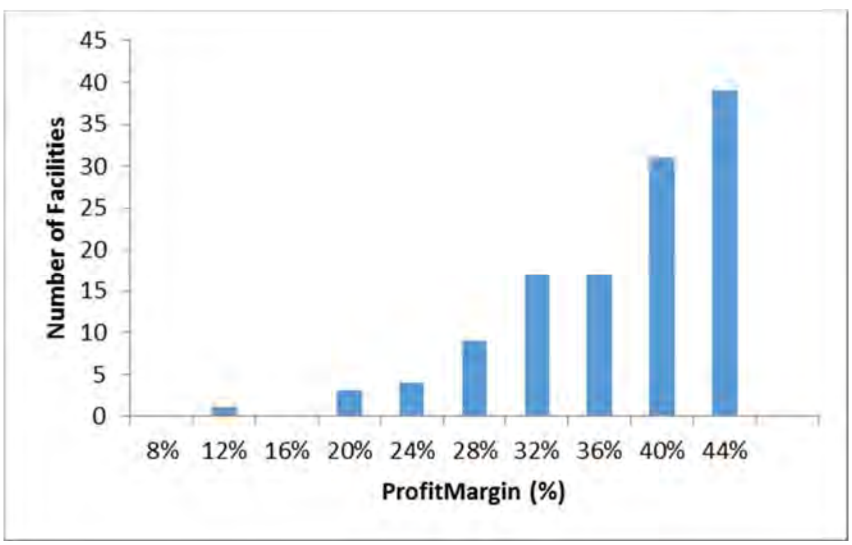


The minimum net revenue is $2.43/cubic yard and the maximum is $20.19/cubic yard. The mean is $15.42/cubic yard and the median is $17.17/cubic yard. As the regression equations indicate, both gross revenue and total costs decline as the quantity of compost processed increases but revenue declines faster than costs. While the lower net revenue per cubic yard seem small, total net revenue for a facility should be adequate to maintain economic viability due to the larger amount of compost processed. For example, the facility with the lowest net revenue ($2.43/cubic yard)[10] had a total net revenue of $402,000.

Profit Margins

Profit margins were calculated for the 121 compost facilities by subtracting total costs from gross revenue and dividing by gross revenue. The frequency of the facility profit margins is presented in Figure 13.

Figure 13. Profit Margins



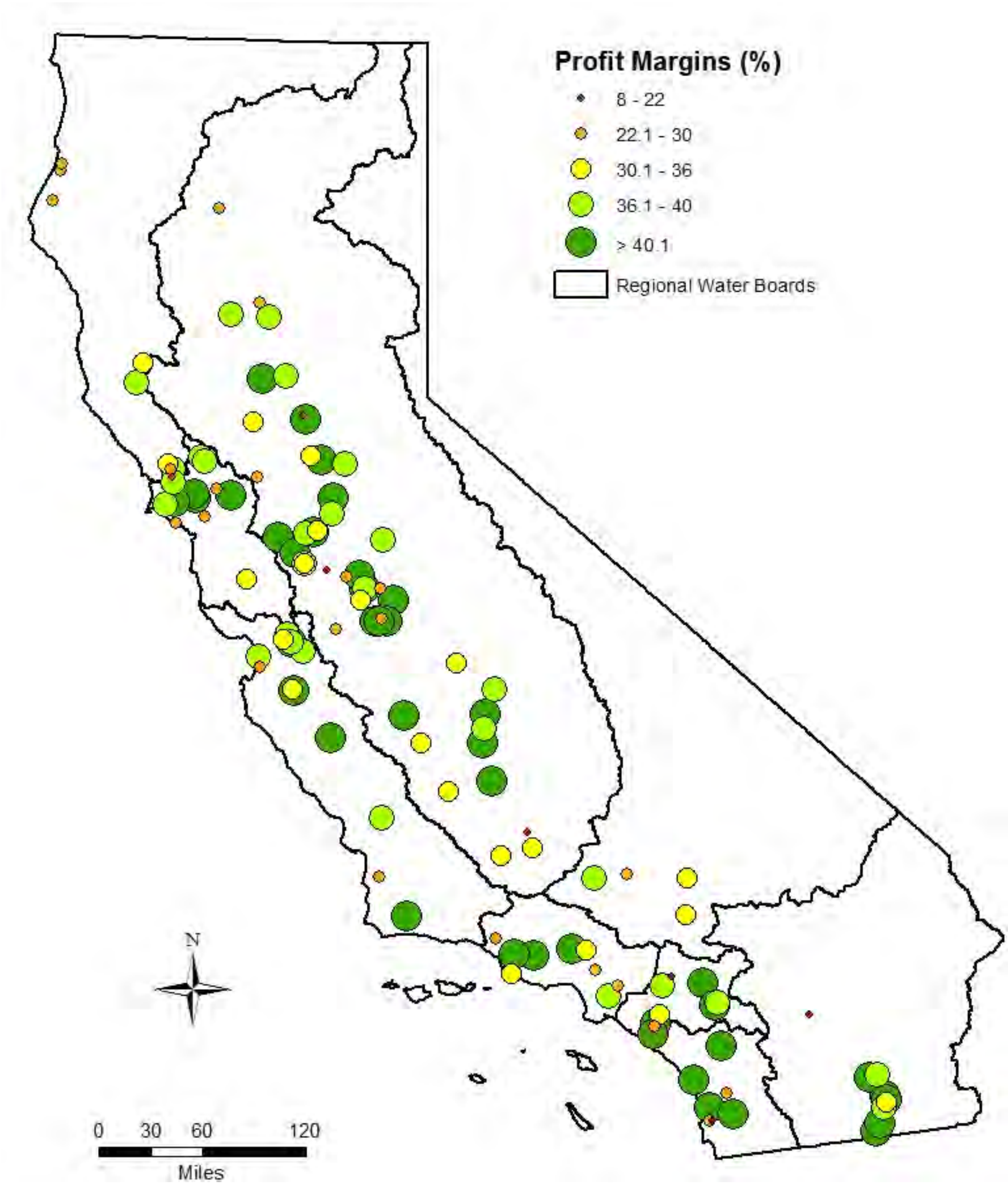
The minimum profit margin is 8.2 percent and the maximum 42.1 percent. The mean is 35.2 percent and the median is 38.5 percent.

The calculated profit margins indicate that the imposition of the proposed Order will not adversely affect the economic viability of California compost facilities. Lower profit margins (less than 18 percent) are experienced by larger, publically owned facilities (where profit margins are less significant on the

[10] Included in the $2 -$4 range of Figure 12.

continued running of the operation) located in the San Joaquin Valley and southern desert regions (Figure 14).

Figure 14. Compost Facilities and Profit Margins



FEEDSTOCK DISPOSAL DESTINATION – COMPOST OR LANDFILL

The second objective of this analysis is to project the possible shift of compost feedstocks from composting operations to landfills as the result of the proposed Order. To project the change in feedstock destination, compost costs of the surveyed landfill disposal facilities were compared to the regional cost of landfill disposal.

Landfill Disposal Alternatives

Landfill disposal costs estimated by HF&H Consultants and Cascadia Consulting Group were used in this comparison.[11] The per-ton disposal costs were gathered through a survey of disposal rates for municipal and high-volume customers. Where appropriate, these disposal rates were weighted to include the costs of transfer station and transport operations. Disposal rates include all government fees and taxes. Landfill disposal costs were calculated for seven regions (Figure 15). The per ton disposal costs for each region, and the counties comprising each region, are listed in Table 3.

Table 3. Landfill Disposal Costs by Region

Region	Counties	Landfill Disposal Costs ($/ton)
Northern California A (Urban Counties)	Marin, Sonoma, Solano, Sacramento, Contra Costa, Alameda, San Francisco, San Joaquin, San Mateo, Santa Clara, Santa Cruz, and Stanislaus	$43.48
Northern California A (Rural Counties)	Napa, Yolo, and San Benito	$49.88
Northern California B (Urban Counties)	Placer, Merced, Monterey, Butte, Fresno, and Tulare	$57.22
Northern California B (Rural Counties)	Alpine, Amador, Calaveras, Colusa, Del Norte, El Dorado, Glenn, Humboldt, Lake, Lassen, Madera, Mariposa, Mendocino, Modoc, Nevada, Plumas, Shasta, Sierra, Siskiyou, Sutter, Tehama, Trinity, Tuolumne and Yuba	$46.59
Southern California A (Urban Counties)	Los Angeles, Orange, Riverside, San Bernardino, San Diego, and Ventura	$42.19
Southern California B (Urban Counties)	Imperial, Kern, San Luis Obispo, and Santa Barbara	$41.43
Southern California B (Rural Counties)	Inyo, Mono, and Kings	$49.53
California Average		$43.48

Source: "Cost Study on Commercial Recycling". Contractor's Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011.

[11] "Cost Study on Commercial Recycling". Contractor's Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011. 625 pages.

Figure 15. Definition of Regions

Source: "Cost Study on Commercial Recycling". Contractor's Report produced under contract by HF&H Consultants, Cascadia Consulting Group for Department of Resources Recycling and Recovery, State of California. January 2011. 625 pages.

Survey Compost Facilities Landfill – Compost Cost Margins

Compost feedstocks would probably be diverted from composting facilities to landfill sites if the compost tipping fees exceeded landfill tipping fees. Current compost feedstock tipping fees were not reported in the CalRecycle database therefore this comparison cannot be made. However, tipping fees were collected from the surveyed operators and they are reported in Table 4. As observed in the surveyed facilities data, tipping fees generally approximate the total cost of compost processing, and sales, represent net profit. As a result, the total cost of processing compost was assumed to approximate compost tipping fees and compared with the landfill disposal cost.

Tipping fee cost margins were calculated to easily compare the landfill and compost tipping fees. A cost margin is defined as the difference between the alternative landfill disposal cost and the total compost cost divided by the landfill disposal cost. The cost margin represents the percent increase in the compost tipping fee that would equal the landfill tipping fee. Landfill-compost cost margins for the surveyed facilities range between 27.8 and 54.6 percent (Table 4). This means that the total compost cost with compliance costs would have to increase by 27.8 percent to equal the landfill disposal cost. The high cost margins indicate that the imposition of the proposed Order compliance costs will not shift feedstock from compost sites to landfills.

Table 4. Total Compost Costs, Landfill Disposal Costs, and Cost Margin by Facility

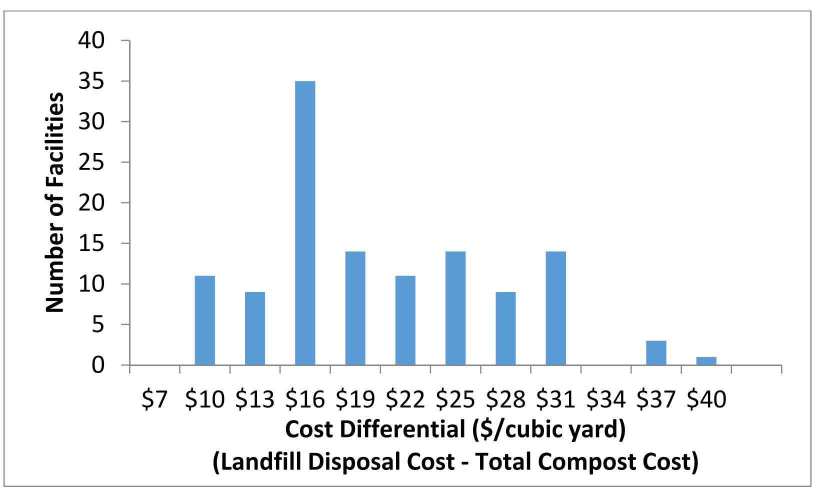
Facility	Total Cost ($/cy)	Gross Revenue ($/cy)	Compost Tipping Fee ($/t)	Landfill Disposal Cost ($/ton)	Cost Difference ($/ton)	Cost Margin[1] (percent)
Pub 1	$32.04	$48.00	$40.00	$49.48	$17.44	35.2%
Pub 4	$27.20	$29.58	$28.00	$49.53	$22.33	45.1%
Pvt 1	$30.83	$40.00	$30.00	$46.59	$15.76	33.8%
Pvt 4	$24.70	$35.00	$30.00	$42.19	$17.49	41.5%
Pvt 2	$28.23	$42.50	$30.00	$43.48	$15.25	35.1%
Pub 2	$31.38	$37.70	$30.00	$43.48	$12.10	27.8%
Pvt 3	$19.74	$33.00	$21.00	$43.48	$23.74	54.6%
Pub 3	$28.67	$37.00	$30.00	$42.19	$13.52	32.0%

[1] Cost Difference / Landfill Disposal Cost.

California Landfill and Compost Operation Cost Differential

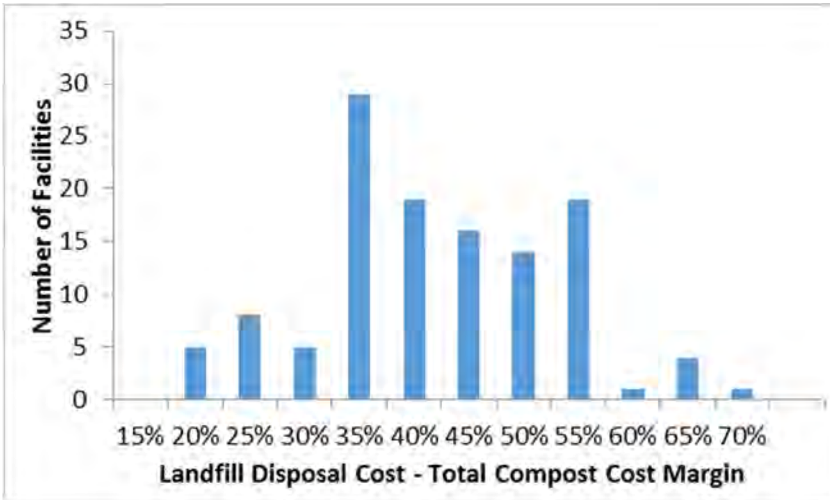
Comparing the total compost cost to the landfill disposal cost determines the possibility of compost feedstock being diverted to landfills. The frequency of the cost differential between the landfill cost and the total compost cost is presented in Figure 15.

Figure 15. Landfill Disposal Cost and Total Compost Cost Differential



The minimum cost differential is $7.04 per cubic yard and the maximum is $37.74 per cubic yard. The mean is $18.91 per cubic yard and the median is $17.34 per cubic yard. The results of this comparison indicate that compost feedstocks will not be diverted to landfills as a result of the proposed Order. The frequency of cost margins for the 121 California compost facilities is depicted in Figure 16.

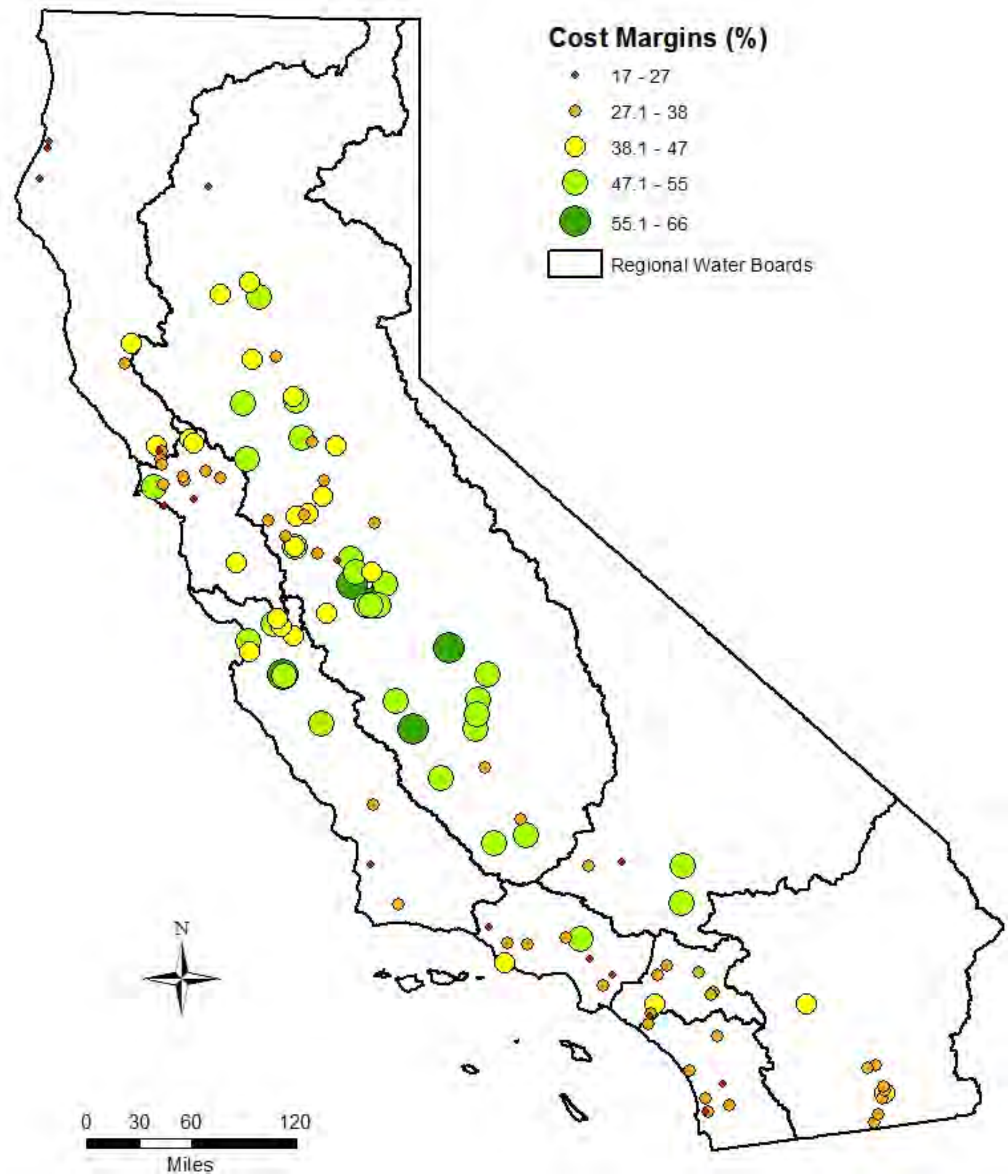
Figure 16. Landfill - Compost Cost Margins



The minimum cost margin is 17.0% and the maximum is 66.0%. The mean is 39.6% and the median is 38.3%. As stated above, the cost margins calculated here include the costs of compliance with the proposed Order.

Facilities located in the southern coastal region have the lowest cost margins and the lowest landfill disposal costs (Figure 17). Since the lowest cost margins estimated was 17.0%, there is very little possibility that compost feedstock will ever be diverted to landfills as a result of adopting the proposed Order.

Figure 17. Compost Facilities and Landfill - Compost Cost Margins



CONCLUSIONS

This report provides the results of an economic analysis of California compost operations. The objectives of the analysis were to (1) determine the economic viability of compost operations to absorb the financial costs of implementing the provisions of the proposed Order to protect groundwater, and (2) determine if compost feedstock might be diverted to landfills as a result of the proposed Order.

Specifically the proposed Order would require compost facilities to modify their operational pad to meet a permeability standard, and to install a pond to catch and store precipitation runoff. In lieu of upgrading the pad, operators can opt to install groundwater monitoring wells to determine if a groundwater threat is present. Since the latter option is the least cost option, it is assumed operators will install the groundwater monitoring system instead of upgrading the pad to meet the permeability standard.

Detailed compost processing costs and revenues were obtained from eight compost facilities located throughout California. The facilities vary in ownership structure, size and the type of technology employed. Compliance costs were combined with the surveyed costs and revenues to determine economic viability. The results of the surveyed operations were extended to the 121 California permitted compost operations that will be subject to the proposed Order. Imposition of the proposed Order will increase facility composting costs by 1.1 percent to 6.9 percent. This increase will not threaten the economic viability of compost operations subject to the proposed Order.

Compost tipping fees were compared to landfill tipping fees to determine the possibility of compost feedstocks being diverted to landfills as a result of the proposed Order. Compost tipping fees approximate the cost of processing. Compliance cost were added to the cost of compost processing to derive the projected, post-proposed Order, tipping fee. The projected tipping fee was then compared to the landfill tipping fee to determine if compost feedstock would be diverted to landfills. The difference between the projected compost tipping fees and landfill tipping fees ranged from $12.10 to $23.27 per ton of feedstock. This comparison can also be expressed as a cost margin. A cost margin is the percent change that compost costs would have to increase to equal the landfill disposal cost. The cost margin ranges from 27.8% to 54.6%. The compost tipping fee includes the projected cost of compliance, therefore, the imposition of the proposed Order will not cause a diversion of compost feedstocks to landfills.

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