

# City of Davis Organics Processing Facility Feasibility Analysis



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# Section 1

## Executive Summary

The City of Davis hired the Clements Environmental team, including sub-contractors Sloan Vazquez McAfee and Diversion Strategies, to assess the feasibility of various organics processing scenarios for the diversion of organic waste from the landfill. These scenarios included:

1. Joining the County of Yolo's bioreactor project at the Central Landfill
2. Developing a new City-Sponsored Project
  - a. At the Old Landfill
  - b. At the Wastewater Treatment Plant (WWTP)
  - c. At a site adjacent to the University of California (UC) Davis Anaerobic Digestion (AD) plant
3. Contributing feedstock to a new UC Davis project adjacent to the university's AD plant

During the course of the study, Recology Services offered to purchase Davis Waste Removal. The Clements team provided input into the feasibility of the City committing its organic material to Recology and tasking them with handling these feedstocks in their regional organics system. This system includes most importantly the Jepson Prairie Organics composting operation near Vacaville.

### APPROACH

The Clements team gathered data by various methods and from numerous sources including:

1. Meetings with City staff and Davis Waste Removal
2. Meeting and discussions with UC Davis
3. Discussions with Yolo County
4. Meeting with the Yolo-Solano Air Quality Management District
5. In-depth discussions with Davis Waste Removal, and brief review of Recology and Waste Management's operations
6. Discussions with composting and AD technology providers
7. Team knowledge of the industry in general and the City of Davis region in particular
8. Team pro formas generated over decades of work with facilities and operations in the solid waste field
9. EPA, CalRecycle, and other databases

This information was then used to assess the feasibility, costs and benefits, of the selected organics diversion opportunities available to the City.

## FEEDSTOCKS

The feedstock study performed by Diversion Strategies reveals that the City collects about 48 tons per day (TPD) of organic material from customers, comprised of roughly two percent (2%) food waste with the remainder as green and wood waste. This is the first complete year of the City's organics collection program, and the team expects the percentage of food waste to increase to typical municipal organics program rates of five percent (5%) in the residential collection and ten percent (10%) in the commercial collection, and perhaps even more as the organics source separation programs mature. The study found that the source separated organic material was relatively free of contamination as compared to other cities with similar programs. This is a testament to both the effectiveness of the City's program design and education, and to the environmental ethic and performance of the residents of the City of Davis.

In addition, UC Davis also generates approximately 48 TPD of organics including food waste, green waste, digestate from their anaerobic digestion (AD) facility, and most of all, animal manure and bedding. The University has expressed interest in a joint project with the City and thus this material could be available as a feedstock.

## PRODUCTS MARKET ASSESSMENT

In order for any organics management system to be effective, there must be a market for the products the system generates. In the case of this study, the key products are compost and biogas. The latter can be used to generate electricity, to fuel Compressed Natural Gas (CNG) vehicles, or as renewable natural gas for injection in the utility gas pipeline. This study focused on the first two options as the quantities of biogas that could be generated were too low to make the more complex pipeline injection alternative feasible.

The results of the study found that there was a strong market for compost in the area with a value of roughly \$20 per ton. Likewise, biogas was found to be a valuable commodity as a generator of electricity to help power the WWTP; or even more when converted to CNG vehicle fuel.

## ALTERNATIVE PROJECT EVALUATIONS

The Clements team evaluated five options as summarized below and in detail in the body of the report.

### Joining the Yolo County Organics Project at the Central Landfill

The Clements team evaluated the feasibility of the City participating in the Yolo County Central Landfill's (YCCL) organic processing project. This option offers advantages in that the City would only be required to guarantee delivery of their organics to the County project at a specific, as yet undetermined, tipping fee. The disadvantage is primarily one of control in that the City may

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be wedded to the County and its project for decades into the future, and would not have the flexibility to change direction in programs or facilities as organics diversion progresses.

### City Project at the Old Landfill

Although the City's Old Landfill is a potential site for an organics facility, the team quickly eliminated this option from further analysis because:

- It is located relatively close to residential neighborhoods;
- The City is strongly considering other uses for the site that would take precedent over an organics project;
- City staff indicated that this site had little potential for development of an organics facility based on input from other City departments

### City Project at the WWTP

The City's WWTP is an excellent site for an organics processing facility. The City owns the land and there is a large acreage vacant and available. The site is remote from sensitive receptors such as residential areas, schools, and hospitals. There are certain synergies between an organics project and the WWTP operations and its by-products. Reclaimed water is available should an organics project, such as composting, require water for optimal processing conditions. Both the WWTP and an AD facility generate biogas that could be combined and make either power generation or conversion to CNG fuel more economical. In addition, the City would control much of the permitting and CEQA process.

For this study, the Clements team evaluated two basic scenarios: a composting facility; or an AD facility co-located with a composting facility. For the latter, a composting operation is integral to the operation of the AD facility to handle the AD digestate and supernatant. The general types of technologies evaluated as best suited for this application were as follows:

#### *Composting*

- Covered Static Pile (12 inch compost cover)
- Covered Aerated Static Pile (CASP) (membrane cover)

#### *Anaerobic Digestion (AD)*

- High Solids Discontinuous / Batch-Flow Type
- High Solids Continuous / Plug-Flow Type

#### *Biogas Use*

- Power Production
- CNG Fuel

For purposes of this study, the team combined Covered Static Pile Composting, the Discontinuous/Batch Flow AD, and biogas power production as the less sophisticated and less expensive scenario; and the Covered Aerated Static Pile composting, the Continuous/Plug Flow AD, and the CNG production as the more sophisticated, higher performing, and expensive option. In this way, the range of project possibilities was covered, without having to analyze every possible combination of composting, AD, and biogas utilization technologies, which was beyond the scope of this work.

### City Project at UC Davis

UC Davis has expressed interested in hosting a City-operated composting project adjacent to the university's AD facility. Since the team assessed the feasibility of an identical composting operation at the City's WWTP, the same technology design, costs, and revenues were applied to this project.

The two key differences between a composting project at the City's WWTP and at UC Davis are: 1) UC Davis would be the lead agency during the CEQA and land use permitting process; and 2) the City would most likely be required to pay to lease the UC Davis property.

Alternatively, the City could commit its organic material to a university owned and operated composting project at the same location. This would alleviate the City from having to pay for and develop its own project, but would severely limit the City's flexibility moving forward as its feedstock would likely have to be committed for years to the university's project.

### Recology Services

Recology Services has offered to purchase Davis Waste Removal, both its business and all its assets. The City is currently vetting this proposal; it is unclear whether the purchase will occur or not. If it does, Recology has local organics infrastructure that could receive the City of Davis material. The Jepson Prairie Organics (JPO) facility in Vacaville, only 19 miles from the City of Davis, is within direct haul distance. This site is permitted for composting and could process the City's material, although this would require Recology to free up capacity the composting operation is near permitted limits. Alternatively, Recology could transfer material from JPO to a larger facility in Vernalis.

This may well be the least expensive option for the City depending on the pricing Recology offers. However, it is one which also provides little control moving into the future in relation to new technology options and price control.

## Project Economics

The team used data from current composting and AD operations, and recent grant applications to populate the Sloan/Vazquez/McAfee pro forma for each of the options for City-developed projects. We also utilized data from the City on labor rates, power pricing, and other factors. It should be emphasized that this is a “concept level” analysis and is not meant as a definitive cost evaluation. It does offer a general comparison of costs and revenues between composting and AD scenarios, and provides a yardstick with which to compare future organics projects with existing costs, and other options, such as a proposal from Recology.

The table below provides a summary of per ton costs for the four options of a City-developed project at the WWTP (A through D), and at the UC Davis site (E and F).

	NO.	TECHNOLOGY	TYPE	PRODUCTS	\$ / TON
City WWTP	A	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost	\$19.69
	B	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost	\$44.20
	C	AD with Composting	Discontinuous / Batch-Flow (AD-D) + Covered Static Pile	Power Production + Compost	\$70.31
	D	AD with Composting	Continuous / Plug-Flow (AD-C) + CASP	CNG fuel + Compost	\$119.25
UC Davis	E	Stand Alone Composting	Covered Static Pile (12-inch compost cover)	Compost	\$19.69
	F	Stand Alone Composting	Covered Aerated Static Pile (CASP) (membrane cover)	Compost	\$44.20

Refer to *Section 7, Project Economics* of this report for details of the economic analysis, and **Appendix D** for copies of the pro forma output.

As shown, the options vary significantly in bottom line cost from roughly \$20/ton for basic composting to \$120/ton for a more advanced project including both AD, composting, and CNG production.

## Section 2

# Introduction and Background

The purpose of this *Organics Processing Facility Feasibility Analysis* was to provide an analysis of the current and potential future options for organic waste diversion for the City of Davis (City). Specifically, the Clements Environmental team was to determine the feasibility of a City-owned and/or operated organics processing facility at two possible locations, a County-owned and operated facility at the Yolo County Central Landfill (YCCL), and a possible joint project with University of California Davis (UCD).

The following aspects were evaluated:

- Feedstocks
- Products Markets
- Site Features
- Technology Evaluation and Concept Layout
- Environmental Regulatory Requirements
- Capital, Operation & Maintenance, and Equipment Costs
- Policy Considerations

The City identified a need for this analysis based on current and future State of California policies and current organics processing projects moving forward in Yolo County.

The City implemented a mandatory City-wide organics program in July 2016. Over the past year, the City has diverted 14,946 tons of organics. These organics include mixed green and food waste, construction and demolition debris wood drop boxes, street sweepings, and loose green waste piles. Of this waste, roughly 45% is from the organics cart collection (i.e. mixed green and food waste). The City is unique in that it has no large industrial businesses, nor does the City provide waste services to the nearby University of California, Davis. The City's largest organic waste producers are its grocery stores (i.e. Nugget Markets, Safeway, and Savemart) which have adopted individual organic waste policies and programs and, at the time of this study, did not participate in the City's organics collection.

Three major legislative mandates affect the City's organic waste: AB 341, AB 1826, and SB 1383. AB 341 sets a statewide mandate to reduce, recycle, or compost 75% of waste generated by 2020. AB 1826, which came into effect April 1, 2016, requires businesses and multifamily dwellings of certain size to divert their organic waste from the landfill. SB 1383 specifically identifies organic waste diversion targets to reduce statewide greenhouse gas emissions to 1990 levels; CalRecycle plans to adopt formal regulations by 2019 to take effect in 2022.

Only one permitted composting facility is located within Yolo County; Northern Recycling in Zamora. Currently, all of the City-generated organics are processed at this composting facility. The City's contracted hauler (Davis Waste Removal) currently collects and delivers all organics to the Yolo County Central Landfill (YCCL), where the organics are either preprocessed and transferred, or transferred directly to Zamora for composting. YCCL has developed a partnership with Northern Recycling to move the composting operation in Zamora to YCCL. In addition, YCCL is currently permitting and constructing anaerobic bioreactor digestion cells and a liquid and food waste processing system at the landfill. Per the Yolo County's Waste Advisory Committee meeting in October 2017, YCCL anticipates the anaerobic bioreactor cells to be operational by Fall 2018, with the composting component operational in Fall 2019.



## Section 3

# Approach

The Clements team performed the following tasks for this analysis:

- Feedstock Study
- Products Market Assessment
- Site Assessments
- Technology Evaluation and Concept Layouts
- Environmental Regulatory Requirements
- Capital, Operation & Maintenance (O&M), and Equipment Costs
- Policy Considerations

In the course of this project, the Clements team met with representatives of the City of Davis, Davis Waste Removal, University of California Davis, and the Yolo Solano Air Quality Management District. Representatives from Yolo County were contacted via telephone.

### Feedstock Study

Clements team member, Diversion Strategies (DS), conducted a review of the City's current waste collection routes, schedule, and organics programs; evaluated the City's organic feedstock tonnage and waste composition; and performed an assessment of potential organic feedstocks from the nearby municipalities' of Winters, West Sacramento, Woodland, and Unincorporated Yolo County. From this information, the team was able to identify the organics feedstock quantity and quality generally available for a City organics processing facility.

### Products Markets Assessment

Diversion Strategies (DS) identified and described local and State finished compost standards applicable to this project. The team then identified potential uses for all organic products including compost and biogas. DS outlined the feasibility of marketing and distributing each end product, and identified potential outlets, uses, and pricing. In addition, the economics of utilizing the biogas for power generation and transportation fuel were evaluated.

### Site Assessments

The Clements team conducted thorough location analyses for the two sites identified by the City as potential areas for an organics processing facility. This included evaluating the sites' land availability, proximity to sensitive receptors, zoning and permitting, utility availability, and future potential uses. In addition, Clements conducted a comprehensive review of the Yolo County

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Central Landfill's (YCCL) organics project including proposed operations, project status, and tip fees.

## Technology Evaluation & Concept Layout

The Clements team identified the most applicable organics processing technologies and evaluated access, land, and operational requirements. The latter included power, labor, and equipment considerations. The potential processing technologies were sized based on the City's and UC Davis's actual feedstock types and quantities. Concept site layouts were prepared depicting key functions and space requirements.

## Environmental Regulatory Requirements

Several regulatory bodies govern organics processing facilities in California including: CalRecycle, the Yolo-Solano Air Quality Management District, the State Water Resources Control Board, and the Central Valley Regional Water Quality Control Board. The Clements team has decades of experience permitting solid waste, organics and recycling facilities, and used their expertise to provide the potential impacts of regulations on the project options. Several regulatory requirements were considered in this feasibility analysis, including, but not limited to, California Environmental Quality Act (CEQA), Best Available Control Technology (BACT), National Pollutant Discharge Elimination System (NPDES) Waste Discharge Requirements (WDR), the Industrial General Permit (IGP), and Compostable Materials Handling Facilities State Minimum Standards.

## Capital, O&M, and Equipment Costs

As part of the Clements team, Sloan Vazquez McAfee (SVM) used the conceptual project design and their proprietary pro formas to identify annual and per ton project costs based on capital and operation requirements and product revenues.

## Policy Considerations

The Clements team evaluated the advantages and disadvantages of the City's participation in each option from a policy perspective. Key among these policy issues is the balance between the effort, cost and risk of developing the City's own projects; and the loss of control and flexibility that comes with participation in a project by either Yolo County or UC Davis.