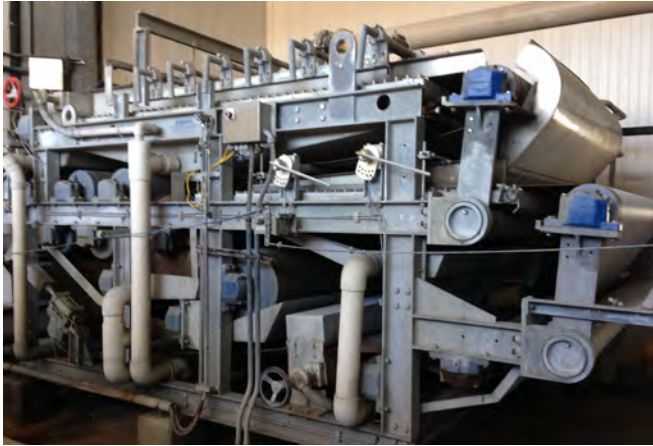




report

CITY OF FITCHBURG

Organics-to-Energy Feasibility Study Report

February 2016

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TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY	ES-1
TABLE OF CONTENTS	i
LIST OF FIGURES	ii
LIST OF TABLES	iii
LIST OF APPENDICES	iv
1.0 INTRODUCTION AND BACKGROUND	1-1
1.1 Introduction.....	1-1
1.2 Background	1-2
1.3 Project Goals.....	1-2
1.4 Preliminary Feasibility Study	1-3
2.0 DESCRIPTION OF PROJECT SITE AND VICINITY	2-1
2.1 General Description of Facility	2-1
2.2 Existing Treatment System Components	2-1
2.3 Site Vicinity.....	2-3
3.0 ENVIRONMENTAL AND PERMITTING REVIEW	3-1
3.1 Environmental Review.....	3-1
3.2 Permitting Review	3-3
4.0 IDENTIFICATION OF OFFSITE FEEDSTOCKS	4-1
4.1 Identification of Feedstocks.....	4-1
4.2 Modified Approach	4-2
4.3 Other Potential Organic Material Sources Not Considered for This Evaluation	4-4
4.4 Transportation of Substrates	4-5
5.0 BIO-PROCESS MODELING AND RESULTS	5-1
5.1 Digestion Model.....	5-1
5.2 Initial Run	5-2
5.3 Modification of Assumptions.....	5-2
5.4 Mass and Energy Balance	5-3
6.0 ANAEROBIC DIGESTER CONCEPTUAL DESIGN	6-1
6.1 Anaerobic Digestion Process for Energy Production	6-1
6.2 Biosolids Quality.....	6-4
6.3 Proposed Unit Processes.....	6-5
7.0 ELECTRICAL INTERCONNECTION & NET METERING.....	7-1
7.1 Existing Electrical Infrastructure	7-1
7.2 Proposed Interconnection Facilities	7-1
7.3 Net Metering.....	7-2
8.0 ENERGY PRODUCTION AND FINANCIAL ANALYSIS.....	8-1

8.1	Financial Analysis.....	8-1
8.2	Organic Waste Disposal Fees.....	8-2
8.3	Electrical Energy Production	8-3
8.4	Heat Energy Production	8-3
8.5	Renewable Energy Certificates	8-4
8.6	Alternative Energy Credits.....	8-4
8.7	Class A Biosolids.....	8-4
8.8	Opinion of Probable Costs	8-4
8.9	Economic Analysis	8-6
9.0	IDENTIFICATION OF PROJECT RISK FACTORS	9-1
9.1	Financial Risks	9-1
9.2	Public Compatibility	9-1
9.3	Feedstock Availability and Quality.....	9-2
9.4	Ability to Sell By-Products	9-2
9.5	Regulatory Risks	9-3
10.0	PROJECT OWNERSHIP & FINANCING OPTIONS	10-1
10.1	Ownership Options.....	10-1
10.2	Project Delivery Methods	10-2
11.0	CONCLUSIONS AND RECOMMENDATIONS	11-1
11.1	Technical Merits	11-1
11.2	Economic Merits.....	11-1
11.3	Recommendations	11-1
12.0	REFERENCES.....	12-1

LIST OF FIGURES

Figure 1.....	Site Location Map
Figure 2.....	Photo Location Map
Figure 3.....	Site Zoning Map
Figure 4.....	Environmental Receptors Map
Figure 5.....	Human Receptors Map
Figure 6.....	Waste Generators Map
Figure 7.....	Truck Routes to Site
Figure 8.....	Mass and Energy Balance
Figure 9.....	Conceptual Site Plan
Figure 10.....	Flow Schematic

LIST OF TABLES

Table 2-1.....	Existing Treatment System Components
Table 3-1.....	Mass GIS Screening Data Layers
Table 3-2.....	US EPA Emissions Standards for Stationary Digester Gas Engines
Table 4-1.....	Feedstock & Delivery Methods
Table 8-1.....	Feed Stock Delivery Rate
Table 8-2.....	Opinion of Probable Cost
Table 8-3.....	Economic Model Variable Input Parameters
Table 8-4.....	Economic Model Results

LIST OF APPENDICES

Appendix A.....	Figures
Appendix B.....	West Plant Utility Bills
Appendix C	Site Photos
Appendix D	Anaerobic Digestion Process Model
Appendix E.....	PELLC Electrical Interconnection Report and Cost Estimate
Appendix F	Economic Analysis
Appendix G	Public Participation Summary

LIST OF ABBREVIATIONS

ACEC	Area of Critical Environmental Concern
AEC	Alternative Energy Credits
AD	Anaerobic Digestion
AIR	Facilities with Air Operating Permits
APS	Alternative Portfolio Standard
ASTM	American Society for Testing and Materials
CEC	Massachusetts Clean Energy Center
CDD	Cooling Degree Days
CHP	Combined Heat and Power
CFM	Cubic Feet per Minute
CMR	Code of Massachusetts Regulation
CO	carbon monoxide
DCR	Department of Conservation and Recreation
DEP	Massachusetts Department of Environmental Protection
ENF	Environmental Notification Form
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
Ft.	feet
Gpd	Gallons per day
gpf	Gallons Per Foot
GWD	Facilities with Groundwater Discharge Permits
HDD	Heating Degree Days
HID	High Intensity Discharge
hp	horsepower
HPS	High Pressure Sodium
HRT	Hydraulic Retention Time
HV	Heating and Ventilation
HVAC	Heating, Ventilation, and Air Conditioning
HWR	Hazardous Waste Recyclers
kV	kilovolts
kW	kilowatt
kWh	kilowatt-hours
LQG	Large Quantity Generators of Hazardous Waste
LQGMA	Large Quantity Generator of MA-regulated Hazardous Waste
LQGRCA	Large Quantity Generator of EPA/RCRA-regulated Hazardous Waste)
LQTU	Large Quantity Toxic Users
MASS GIS	Massachusetts Office of Geographic and Environmental Information System
MEPA	Massachusetts Environmental Policy Act
MESA	Massachusetts Endangered Species Act

MMBtu	Million British Thermal Units
MW	Megawatts
MWh	Megawatt hour
mph	miles per hour
ms	meters per second
MW	megawatt
NOI	Notice of Intent
NOx	nitrogen oxides
NHESP	Natural Heritage and Endangered Species Plan
NPDES	National Pollution Discharge Elimination System
REC	Renewable Energy Certificate
RDA	Request for Determination of Applicability
rpm	revolutions per minute
SSO	Source Separated Organics
SWD	Facilities with Surface Water Discharge Permits
SWPPP	Stormwater Pollution Prevention Plan
TS	Total Solids
TSDF	Hazardous Waste Treatment, Storage and/or Disposal Facilities
USFWS	United State Fish and Wildlife Service
V	Volt
VFD	Variable Frequency Drive
VOC	volatile organic compounds
wtpd	wet tons per day
WWTF	Wastewater Treatment Facility

EXECUTIVE SUMMARY

Weston & Sampson, on behalf of the City of Fitchburg, has completed this Feasibility Study, which examines the technical and economic aspects of developing an anaerobic digestion project in the City of Fitchburg, MA. Based on the results of this study, we find that construction and operation of an AD facility at the existing Fitchburg West Plant site to be technically and economically feasible under a range of variable conditions. The economic feasibility was positive under a public ownership model which considered benefits (revenue) under current existing market estimates of disposal fees for likely organic feedstocks; a 25% decrease in disposal fees for likely available feedstocks, and; a scenarios which considered both a 25% decrease in disposal fees for likely available feedstocks and the risk the project is not eligible for net metering. The net present value of the scenarios evaluated ranged from \$500,000 to \$15.8M, with net cash flows of \$22M to \$58M. A summary of the economic models include:

Summary of Economic Model Results			
Description	Scenario 1	Scenario 2	Scenario 3
Preliminary Project Cost	\$23,700,000	\$23,700,000	\$23,700,000
Simple Payback, years	5.9	7.2	9.7
Internal Rate of Return ¹	15.2%	11.7%	7.3%
Net Present Value	\$15,800,000	\$8,700,000	\$500,000
20-Year Net Cash Flow	\$52,100,000	\$38,100,000	\$22,000,000
Benefit Cost Ratio	1.50	1.27	1.02

Scenario 1 - Equity, City-Owned, Designed and operated at current market rates

Scenario 2 - Equity, City-Owned, -25% decreases in disposal fees

Scenario 3 - Equity, City-Owned, -25% decreases in disposal, no net metering

1 - Unlevered rate of return, assumes no debt

We find it is technically feasible to repurpose the Fitchburg West Plant into a useful facility that would reduce the City's own residuals management and operational costs (which currently costs the City ~\$100,000 per year); provide a cost-effective alternative for other municipalities and industry to dispose of their wastewater residuals and organic materials, and; generate clean renewable energy that would produce revenue for the City. In general, a public ownership model cannot avail itself to tax incentives available to a privately-owned project. While there is also less financial risk to the City for a privately-owned project, there is also less reward. Based on the above, further project development appears warranted.

Recommended next steps include: developing a conceptual basis of design; conducting traffic, acoustical and odor control studies; conducting additional public outreach and involvement in project development; electrical interconnection design, and preliminary planning and permitting. Some of these steps, such as acoustical and odor control studies, could be completed as part of development of the project design. We also recommend the City of Fitchburg consider private ownership models, as a means to reduce risk and public cost. If private ownership is desired then it should issue a request for qualifications to solicit interest from prospective renewable energy project developers under Massachusetts General Law Chapter 25A, §11C. Private developers determined to be the best qualified could be asked to submit proposals to the City to design, construct and operate the facility for land lease, discounted disposal, power purchase or

net metering credit agreements or other forms of compensation which are in the best interest of the City as host of the project.

ACKNOWLEDGEMENTS

Weston & Sampson wishes to acknowledge the support and technical guidance provided by the many people who have invested time in this most valuable project. The completion of this report could not have been accomplished without support from the following people:

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The Massachusetts Department of Environmental Protection (MassDEP)
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Members of the Northeastern Solid Waste Industry
Various New England Wastewater Process Equipment Vendors

While the development of this report has taken many interesting turns and the original scope of study has been refined greatly, we feel that the final concept is a project worthy of serious consideration and, if constructed, has the potential to greatly benefit not only the City of Fitchburg, but the surrounding communities.

Thank you all for your part in helping Weston & Sampson in the development of this report. Your contributions are greatly appreciated.

1.0 INTRODUCTION AND BACKGROUND

1.1 Introduction

The City of Fitchburg owns and operates two wastewater treatment facilities (WWTF). The East Plant services the vast majority of the City's wastewater flows. The West Plant was constructed to service the City's industrial sector primarily consisting of paper mills. Both plants were originally built in 1975 in response to the Clean Water Act. Economic factors resulted in the diminished wastewater flows to the West Plant, to the point where it became more economical to pump wastewater from the West Plant to East Plant for primary treatment. The West Plant was modified in 2010 to process biosolids from the East Plant. This upgrade included construction of the dewatering room addition and sludge storage building. The dewatering facility included two 2-meter belt filter presses and conversion of two large welded steel tanks for sludge storage. Because the West Plant was a functioning WWTF, a large portion of the supporting infrastructure is already in place including access roads, utilities, and administrative offices; thus, making the site a desirable location based on the potential use of the existing infrastructure.

Anaerobic digestion is a series of processes in which microorganisms break down biodegradable material in the absence of oxygen. The process produces a methane and carbon dioxide-rich biogas suitable for energy production, or further processed as a natural gas; and a nutrient-rich digestate by-product that can be used as a liquid fertilizer, composted and used as a soil amendment, or de-watered and used as animal bedding. Typical substrates acceptable for wet-type anaerobic digesters are pre- and post-consumer food wastes, animal manures, fats/oils/grease, and most crops, crop wastes, and vegetation. In addition to the energy production estimate, additional byproducts such as heat, digestate, and compost are expected to add to the economics of the project.

The West Plant property is developed with access roads, an approximate 22,000 square feet building and supporting infrastructure. The north end of the site includes a water body resulting from a dam on the northernmost point on the site. The water body occupies approximately 10% of the parcel. The property and improvements at the site are owned by the City of Fitchburg. The site is partially developed, and areas not occupied by buildings, access roads or supporting infrastructure generally consist of cleared space with reasonable access to support development of small anaerobic digester(s). The plant was designed to treat up to 10.7 million gallons per day (MGD) of wastewater. It is anticipated that the digester equipment will be retrofitted into the existing property and the old and unused equipment could be removed and recycled where possible.

Currently the West Plant, which was originally constructed to provide treatment for the numerous paper mills in Fitchburg, is being used as a large pump station for industrial flows discharged by the two remaining operational paper mills. No treatment processes are currently active at this facility, and much of the process equipment has been decommissioned. The paper industry presence in Fitchburg has greatly diminished since the 1970's and it does not appear, with the advent of paper recycling and the Digital Age, that this industry will rebound in the Northeast. It is not expected that this facility will ever be re-commissioned as a City wastewater treatment facility.

1.2 Background

Since 1990, Massachusetts has established waste disposal bans on certain hazardous, recyclable, and compostable materials at solid waste facilities. Waste Bans are regulated under the Solid Waste Management Regulations by 310 CMR 19.000, 310 CMR 19.017 Waste Bans. The goals of the waste bans are to: promote reuse, waste reduction, or recycling; reduce the adverse impacts of solid waste management on the environment; conserve capacity at existing solid waste disposal facilities; minimize the need for construction of new solid waste disposal facilities; and support the recycling industry by ensuring that large volumes of material are available on a consistent basis.

Effective October 1, 2014, commercial organic material has been added to the list of banned materials. Banned commercial organic material is defined as food and vegetative material from businesses and institutions that dispose of one ton or more of that material per week. MassDEP estimates 1,700 entities may be subject to the ban. It is estimated that approximately 1,000 wet tons per day (wtpd) of Source Separated Organics (SSO) could be diverted from landfills and incinerators state-wide to recycling facilities such as farms for feeding livestock, anaerobic digestion or composting facilities.

It has been estimated, that food waste, compostable paper, and other organics represent 25% of the waste stream in Massachusetts. This group is the largest component of the waste stream behind recycling. The Massachusetts Solid Waste Master Plan (MassDEP, April 2013) set a specific objective to divert at least 35% of food waste from disposal by 2020, which would result in more than 350,000 tons per year of additional diversion activity from targeted business and institutional sectors. In order to accomplish this goal, the Plan proposes adoption of a number of strategies for increasing the diversion of organic material from the solid waste stream. The alternatives for handling the diverted organics include utilization of anaerobic digestion facilities for treating organics. This initiative is creating a new demand for use of existing digesters for co-digestion and encouraging the development of new organics digestion facilities.

Currently private-sector disposal companies and solid waste transporters direct approximately 100,000 tons per year of food wastes to organics processing facilities in Massachusetts. There are approximately two dozen such facilities currently operating. The typical processing facility is a small-scale composting facility. MassDEP estimates that approximately 400 businesses and institutions are currently diverting organic wastes. The typical waste generator is a supermarket, large restaurant, college or university, or food producer.

The organic waste ban, along with incentives for producing usable heat and electricity from renewable resources, producing a potentially valuable agricultural commodity in the form of compost and digestate, and the potential for savings on costly wastewater biosolids disposal, are some of the key economic factors which will influence the success of the project. Other key factors will include public acceptance and the ownership model selected by the City if a project were to proceed to development and operation.

1.3 Project Goals

In addition to the MassDEP's goal of diverting organics from the landfill stream, and the MassCEC's goal of developing affordable renewable energy projects, the City of Fitchburg has stated the following goals for this project:

1. Repurpose a major piece of the City's infrastructure, rather than have it fall into decay;

2. Work toward a net \$0 residuals management cost for the City wastewater facilities;
3. Reduce City's power purchase costs; and
4. Generate revenue.

While the City finds the possibility of an anaerobic digester (organics-to-energy) project attractive for the reasons reflected in their goals, they have been clear that they do not wish to take on operation of such a facility. Instead, they would like to approach this project as a design/build/operate (DBO) project, wherein an entity would provide a price to design, permit, construct and operate this facility for a specified period of time; after which the City would retain ownership of the infrastructure. If the City's goals for the project are met, the City would realize a net reduction in operating costs, thereby helping to insulate tax basis for residents and businesses in the City¹⁽¹³⁾.

1.4 Preliminary Feasibility Study

Weston & Sampson was contracted to prepare a Preliminary Feasibility Study in November 2012, where the objective of the study was to determine if there are any apparent fatal flaws associated with development of a source separated organics (SSO) handling facility at the site. It was stipulated that the SSO handling facility should not only be capable of receiving and handling source separated organics from the surrounding areas, but also to continue to handle and process the City's wastewater needs pursuant to current operating permits and practices. The factors evaluated as part of the Preliminary Feasibility Study included the following:

- Site Location
- Site Access and Market Considerations
- Regulatory and Zoning Requirements
- Site Electricity Use and Utilities
- Expansion Capabilities
- Project Risk Factors

1.4.1 Site Access and Market Considerations

The success of any organic waste receiving facility is dependent upon site location and site access from major highways and proximity to feedstock. As such, this preliminary effort must consider the location of the facility relative to organic waste generators and its proximity to major roads and highways. The site is located on Princeton Road, and is in close proximity to Route 2, Interstate 190, and Interstate 495. Interstate 190 provides a direct corridor to the Worcester area. Refer to the Locus map for further detail on the surrounding area. Princeton Road is a two lane road and contains an underpass to a railway bridge. The clearance height of the bridge is 13 feet-8 inches and is located on a curve in the road. While the height of the bridge and its proximity on the curve do not preclude use of this road by trucks serving the facility (industrial businesses already use the roadway on a regular basis), residents have expressed concerns about the poor visibility and safety at this location. Further traffic study would be required to determine if alternatives exist for mitigating or alleviating traffic safety issues associated with the

¹ Public comments, received at the March 31, 2015 Public Forum, have been addressed in this Report. Each comment, where addressed in the body of the report, has been identified with a superscript number which corresponds to the comment number, as listed in the April 2, 2015 Memorandum from the City of Fitchburg, which is also included in Appendix G of this Report.

fixed railroad bridge. This study could include seeking a definitive response from the owner of the railroad regarding what options and costs would be associated with improvements to the bridge; and approval of any proposed changes by the regional planning authority⁽²⁰⁾.

The DEP ban prohibiting the disposal of organic waste is a driving regulatory force behind the development of anaerobic digesters in Massachusetts. The Massachusetts DEP has set a goal of diverting an estimated 350,000 tons of organic material from disposal by the year 2020 by placing a ban on the disposal organics from large sources such as food processing plants and universities. The MassDEP ban on disposal of commercial organic wastes by businesses and institutions that dispose of one ton or more of these materials took effect on October 1, 2014. Organic diversion from landfills is expected to provide opportunities for anaerobic digestion, composting, and recycling facilities. In addition, proposed regulatory changes by MassDEP is expected to help overcome barriers to the siting and development of additional anaerobic digestion, composting and recycling facilities in Massachusetts.

Two primary feedstocks are anticipated for this Site; source separated organics and WWTF biosolids. These are discussed in greater detail in Section 4 of this report.

1.4.2 Regulatory and Zoning Requirements

The Site is owned by the City and zoned for Industrial Use. The Site is located adjacent to a mill conversion overlay district and former paper mill and nearby retail business district of the City. Based on our review of the local zoning by-laws, a Site Plan Review will be required. Below is a summary of permits based on our preliminary review of State and Local permitting requirements:

- Massachusetts Department of Environmental Protection (MassDEP) – A site assignment through the solid waste regulations (310 CMR 16.000) is likely not required. The digesters will have to be permitted as a change in operation of the WWTF pursuant to 314 CMR 12.00.
- Massachusetts Environmental Policy Act (MEPA) – The proposed project likely does not trigger any MEPA thresholds.
- Local Zoning – Industrial; Site Plan Review by the Planning Board per Section 181.9411 for modifications from existing use.
- Conservation Commission – The anticipated improvements are expected to be located within the bounds of the existing West Plant; therefore, will require minimal Conservation Commission review.
- Local Building – Building, Electric and other trades, as applicable.

1.4.3 Site Electricity Use and Site Utilities

The West Plant obtains both gas and electrical service from Unitil (Account 30000217-30000208). Current electricity demand at the site is on the order of 127 kW (November 2012) and the annual electricity usage at the West Plant is 554,000 kWh, based on the last 2011-2012 billing data, where the average cost of all the distribution-related charges was approximately \$0.092 kWh. Electricity was supplied by a third party at a rate of \$0.0792 per kWh through May 2014. The total budgeted cost for electrical service at the facility is approximately \$110,000 per year (as of 2011).

The gas usage at the facility was 29,500 therms over a 12 months period from 2011-2012. The cost of gas varies based on market conditions, seasonal adjustments (from \$0.4943 per Therm in summer months to \$0.8835 per Therm in winter months) and total budgeted cost for gas is on the order of \$50,000 per year, primarily for heating during winter months. The total budgeted cost for both gas and electric service at the facility is, therefore, on the order of \$160,000 per year, where the actual use of gas is directly dependent upon the number of heating degree days (as of 2011). It is anticipated that a properly sized anaerobic digester and combined heat & power (CHP) generator could offset the majority of the electric and gas usage and cost at the site. Appendix B contains copies of recent gas and electric utility bills for the West Plant.

The site is currently served by the Fitchburg city water system for domestic, process water and fire protection. Service capacity should be evaluated during the design phase of the final project. There is an existing (albeit antiquated) 500 kW diesel-fired backup generator on site with a 1,000-gallon underground storage tank. The generator was originally sized to handle electric loads in case of power outage and replacement should be considered based on updated design loads.

1.4.4 Potential Expansion Capabilities

The organic waste market is an immature and evolving market, sparked by the DEP and its regulatory changes as noted above. In this type of market, a number of uncertainties exist and we would suggest that the City approach the project in a phased approach, adding equipment and processing capacity as the feedstock supply increases. The Site is located on approximately 16.5 acres of land; approximately 60% of which is developed as buildings, paved roadways, and supporting WWTF infrastructure. A majority of the existing infrastructure is not being used at this time as flows to the West Plant have diminished and all flows are now pumped off-site for treatment at the East Plant. Where treatment equipment is no longer in use, there is room for expansion at the facility to accommodate the equipment needed for anaerobic digestion. In addition, the site is located adjacent to a rail line which could be used in the future to transport feedstock to the site, and compost from the site, as demands dictate, as there is little room on site for storage of any large volume of digestion products.

1.4.5 Public Participation and Community Compatibility

As part of this feasibility study, Weston & Sampson helped develop a community outreach plan, organized and hosted a series of public meetings and community outreach seminars designed to inform and educate the community of the project concept, discuss pros and cons and elicit compatibility concerns from the local community regarding the proposed development. Advanced advertising or posting (as required under public open meeting laws) were observed. The first meetings were intended to be informative in nature, where information about the process and proposed project was presented. Direct abutters and property owners within 1,000 feet of the Site were notified about the project concept in writing and invited to attend the first Community Forum meeting, which was also publicized in the local newspaper. A follow-up Community Forum was held prior to the release of the draft feasibility report, to update the public on the change of scope and to solicit community feedback and reactions about the project.

A Community Workshop was subsequently held in August 2015 to present an overview of project concepts, to allow for question and answers on the DRAFT feasibility study and formally close public comment period on the study phase. In summary, the community outreach program included:

Public Meeting	Venue	Date
City Planning Board Meeting	Fitchburg Municipal Offices Putnam Place 166 Boulder Drive	August 20, 2012
City Council Meeting	Memorial Middle School Library, 615 Rollstone Street	September 3, 2013
City Energy Commission Meeting	Fitchburg Municipal Offices Putnam Place, 166 Boulder Drive	September 12, 2013
Organics to Energy Community Forum No. 1	Memorial Middle School Library, 615 Rollstone Street	March 5, 2014
Organics to Energy Community Forum No. 2	Fitchburg State University Kent Recital Hall Conlon Fine Arts Building	March 31, 2015
Organic to Energy Community Workshop	Great Wolf Lodge 150 Great Wolf Drive	August 19, 2015

Public comments received during this forum were summarized in a Memorandum from the City of Fitchburg Department of Public Works, dated April 2, 2015. A copy of this Memorandum and Minutes from the Community Workshop, which provide written answers to project-related questions, are included in Appendix G, Public Participation Summary^(25, 26).

Based on input from the public, and from an understanding of the potential areas of concern for public compatibility, the feasibility study included preliminary review of potential nuisance conditions, such as odor and noise associated with operation of a source separated organic handling facility. The fact that the West Plant has been in operation as a WWTF since 1975 should minimize potential concerns, as the nature of the operation does not represent a drastic change from the past use, only a change in processes conducted at the site. Impacts due to odors and noise can be minimized if the facility is properly designed and operated. Increased vehicular traffic stood out as the strongest source of public concern, given the potential to exacerbate an existing intersection challenge.

It is recommended that additional traffic, acoustic, and odor control studies, be performed, as part of the next steps, or during development of the project design, and to develop a clear plan for public engagement to inform the local residents about the project and address public concerns. Community compatibility is discussed in greater detail in Section 9 of this report.

1.4.6 Financial Risk

The continued federal and state level support and incentives for renewable energy projects are important, particularly if a private developer is sought under a third-party facility ownership model and design-build-operate contract structure, which would seek to leverage tax incentives that a public entity cannot monetize. The size of the project and the value of excess heat and electrical energy under thermal alternative energy credit and net electrical metering credit agreements will also impact the financial performance of the proposed project.

An anaerobic digestion project will generate Massachusetts Class I renewable energy certificates (REC) for every MWh of electricity produced from the biogas. These certificates can be sold or traded in the New England Power Pool to meet Renewable Portfolio Standards. REC values are subject to a variety of market forces and can increase and decrease in value over time. The continued availability of grant funding; cost of organic disposal; and the quality of and markets for the digestate product are all significant factors that will impact the economic viability of the project.

Energy values should also be considered a risk factor, as volatile energy prices introduce uncertainty in the value of avoided energy costs or net metering credit rates. If the facility will generate more electricity than needed to satisfy onsite loads, then the continued availability of net metering under Unitil's caps could be important (see Section 7.3 for more information on net metering).

1.4.7 Preliminary Study Summary and Conclusions

Based on the preliminary feasibility study, the West Plant appears to be a suitable location for a small-scaled source separated organic handling and anaerobic digestion facility. The site may also be suitable for future expansion capabilities should adequate sources and the market conditions dictate. The site has the potential to utilize the rail line to import organics from the market. Additional studies are recommended to:

- Examine the feasibility of using the existing infrastructure to reduce capital costs;
- Review of organic waste streams to model and develop energy production estimates;
- Conduct market survey of applicable commodity pricing, including preliminary material handling and transportation cost data;
- Conduct additional traffic, acoustic, and odor control studies
- Identify potential SSO and obtain preliminary commitments from nearby sources; and
- Develop basis of design concept for the project.

Discussions of some of the above items are addressed in later sections of this report.

2.0 DESCRIPTION OF PROJECT SITE AND VICINITY

The City's West Plant is located off of Princeton Road in Fitchburg, Massachusetts. The West Plant property occupies approximately 16.5-acres of land and is bound to the east by a railroad line, followed by rural residential properties; to the south by Princeton Road; to the west by Princeton Road, a 125-acres former paper mill and electrical substation, and one residential house; and to the north by industrial use. The Site is located approximately 0.6 miles north of Route 2. The site is located adjacent to a mill conversion overlay district and former paper mill and nearby retail business district of the City. The general location of the Site is 42° 33' 36.97" North, 71° 50' 43.26" West. Please refer to Figure 1, Appendix A, for a Site Location Map illustrating the location of the West Plant with respect to local landmarks.

2.1 General Description of Facility

The West Plant was constructed in 1975 at a cost of \$13.0 million. The original treatment plant was designed to treat up to 15.3 million gallons of wastewater per day and consisted of two 130-foot diameter clarifiers, two 65-foot diameter backwash lagoons, flocculation and rapid mix tanks, carbon filtration system, process piping, roadways, lighting and associated infrastructure. Please refer to Figure 2, Appendix A, for a Photo Location Map. Photos of the facility are included in Appendix C.

The treatment process included pH adjustment, chemical coagulation/flocculation, primary clarification, and secondary filtration. Located in the main process building are twelve oxygen-enhanced carbon filters, three sludge storage tanks, belt filter presses, sludge loading facility, and various pumping and piping systems which connects all plant processes. Two wet wells are also located within the process building, one served as a "wet" well from which flows were pumped through the filters, and a clear well that holds filtered effluent prior to final discharge. The West Plant is currently functioning only as a pump station to convey wastewater collected at the site via force main to the City's East Plant for treatment.

2.2 Existing Treatment System Components

This section includes a general description of the major wastewater treatment system components which currently exist at the West Plant. As described above, the majority of the equipment at the West Plant is not being used for its original design purposes, due largely to the changing nature and volume of the wastewater which once flowed through the plant. These flows were historically dominated by effluent from nearby paper mills, which have scaled back or optimized operations over the years. Table 2-1 below provides a table summary of the existing infrastructure components of the West Plant:

Table 2-1 City of Fitchburg West Plant Existing Treatment System Components	
Component	Description
Municipal Influent Structure	Point at which all influent wastewater arrives by underground pipe at the West Plant on south end of site near the municipal clarifiers
Municipal Clarifiers	These are cylindrical concrete tank structures with conical bottom which are 30-feet in diameter and have a nine-foot side water depth. They have one foot thick reinforced concrete walls with 16-inch ductile iron influent and effluent piping.

Table 2-1 City of Fitchburg West Plant Existing Treatment System Components	
Component	Description
Wastewater Clarifiers	These are cylindrical concrete tank structures with conical bottom which are 130 feet in diameter and 17.5 feet deep. They have one-foot thick reinforced concrete walls with a variety of influent and effluent piping.
Flocculation Basin and Rapid Mix Tanks	Square concrete structure located between large wastewater clarifiers and backwash lagoons in central area of plant.
Backwash Lagoons	The two backwash lagoons are cylindrical concrete tank structures with conical bottom which are 65-feet in diameter and 12 feet deep. The volume of each backwash lagoon is approximately 39,819 cubic feet or 297,850 gallons. They have one foot thick reinforced concrete walls with 16-inch ductile iron influent and effluent piping.
Filter Building and Filter Gallery	Steel-framed three-story parallelogram building which houses the carbon filter gallery, carbon regeneration furnace, belt filter presses and office areas. The building was constructed around the 14 primary carbon filter vessels, which were fabricated on site before the building was erected around them.
Yard Piping	Variety of underground ductile iron pipe sizes (generally ranging from 4" to 24" in diameter) connecting major equipment from municipal influent structure, to clarifiers, to flocculation basins, to backwash lagoons, post aeration basin and sludge lagoons.
Post Aeration Basin	This is a large in ground cast in place structure at the west end of the filter building which was formerly used to boost dissolved oxygen levels in the plant effluent prior to discharge.
Sludge Lagoons	In ground structures formerly used for the storage of biological sludge resulting from the treatment of paper mill wastewater.
Ejector Vault	A below grade structure housing pumps for discharging all filter building side streams to the industrial effluent pump station, located between the clarifiers.
Wet Wells	Two 20-feet deep (operating depth) concrete wet wells (approximately 16 feet in diameter) located inside of the filter building
Process Piping	There is a variety of piping within the filter building connecting the carbon filter vessels and other treatment process equipment. There are a number of pumps and motors, ranging in size from 0.50 to 200 HP, which are currently not in use and falling into various stages of disrepair.
Clear Well	This is a large cast in place concrete tank beneath the filter building originally designed for effluent storage and disinfection.

Table 2-1 City of Fitchburg West Plant Existing Treatment System Components	
Component	Description
Carbon Regeneration Furnace	There is a gas-fired furnace that was installed in the filter building that was intended to be used to regenerate granular activated carbon by incineration on an as-needed basis as part of the original plant design.
Belt Filter Presses	Belt filter presses were added in 2010 as part of a dewatering system modification. There are two 2-meter belt filter presses in a dedicated dewatering room on the north wall of the filter building.
Shipping/ Receiving Station	This is a pre-engineered metal structure used to house two 30-yard roll off containers into which dewatered sludge cake is deposited for offsite disposal.
Existing Roadways	Existing 20-foot wide asphalt perimeter access road, sidewalks, landscaping, parking areas and stormwater management system.

Photographs of the West Plant site are included in Appendix C. It is expected that some of the existing equipment can be incorporated into the design and construction of an anaerobic digester at the site. It is our opinion that the majority of the process piping, vessels, pumps and motors inside of the filter building have only salvage value as scrap metal.

2.3 Site Vicinity

The Site is owned by the City and zoned for Industrial Use. The area adjacent to the north of the site is also zoned for Industrial Use; the area west of the site is zoned both in a Mill Conversion Overlay District and Industrial Use area; the area south of the site is considered a Priority Development Site Overlay District (and includes area that was once used as sludge drying beds as part of the West Plant wastewater treatment facility); the area east of the site is zoned Rural Residential where single family and multifamily housing exists within approximately 1,000 to 1,200 feet of the site, and; the area south of the site consists of more Industrial and Mill Conversion Overlay District. An operating paper mill, which currently recycles used paper products and may be a potential source of organic solids that could be utilized in the proposed anaerobic digestion (AD) process, is located approximately 800 to 1,000 feet west of the site. The quantity and quality of biosolids from the nearby paper mill are discussed further in Section 4. A portion of the City of Fitchburg Zoning Map with parcel boundaries depicting the subject site and nearby land uses is included as Figure 3, Appendix A.

3.0 ENVIRONMENTAL AND PERMITTING REVIEW

Weston & Sampson has performed a review of various area receptors to determine what, if any, impact an anaerobic digester project would have upon sensitive receptors near the Fitchburg West Plant. We have also reviewed the federal, state and local permits which may be required as part of a potential organics to energy facility at the site. The development of this project would involve installation of substantial new infrastructure for any of the alternatives being evaluated. In general, permits may be required whenever a proposed project affects certain environmentally sensitive resources, disturbs a specific amount of land and/or constructs new infrastructure subject to local building and zoning board reviews. A further detailed permitting review would need to be conducted during later stages of project implementation. This section provides a brief description of the environmental receptors and likely permits required for an anaerobic digestion project at the West Plant.

3.1 Environmental Review

The following section discusses the environmental and ecological characteristics at the site. A review of various area receptors was conducted to determine what, if any, impact this project would have upon sensitive receptors at the site. The result of this evaluation shows that development of an anaerobic digester is not expected to result in unacceptable negative impacts to wildlife or other sensitive receptors present at or near the site.

3.1.1 Environmental Evaluation and Analysis

Weston & Sampson gathered information regarding existing site conditions and habitats on the proposed site and analysis was conducted through review of site photographs, aerial photography, and scientific databases and literature. Data regarding rare species and critical habitats is compiled by the Massachusetts Office of Geographic and Environmental Information (Mass GIS) and organized as a number of Geographic Information System (GIS) data layers. These layers are represented as number of polygons drawn in conjunction with existing landscape features, and can be utilized to determine the spatial relationships between areas of environmental significance (e.g. wetlands) and a proposed project site. A table of the environmental GIS data layers used this analysis has been summarized below:

Table 3-1 Mass GIS Screening Data Layers		
Data Layers	Authority	Date of Update
Estimated Habitat of Rare Wildlife	NHESP	October 2008
Priority Habitats of Rare Species	NHESP	October 2008
Bio Map Core Habitat	NHESP	February 2011
Bio Map Critical Natural Habitat	NHESP	February 2011
NHESP Certified Vernal Pools	NHESP	January 2015
NHESP Potential Vernal Pools	NHESP	December 2000
Areas of Critical Environmental Concern	DCR	April 2009
DEP Wetlands (1:12,000)	MassDEP	January 2009
National Flood Hazard Layer	FEMA	November, 2014

Notes/Abbreviations:

NHESP: Natural Heritage and Endangered Species Program

MassDEP: Massachusetts Department of Environmental Protection

DCR: Massachusetts Department of Conservation and Recreation

FEMA: Federal Emergency Management Agency

The results of the environmental Mass GIS screening are included on Figure 4. GIS screening of the area shows that the project location is not located in an Area of Critical Environmental Concern (ACEC) or Protected Open Space. The proposed project location is also not located within an area of National Heritage & Endangered Species Program (NHESP) Estimated Habitats of Rare Wildlife. There are no certified or potential vernal pools in the project vicinity. There are two perennial streams on the eastern side of the property. If work is to occur within 200 feet of these streams, a Notice of Intent (NOI) may be required as discussed below. There are also DEP mapped wetlands on the project site. It is not anticipated that this project would include filling of wetlands. If work is to occur within 100 feet of wetlands, then a Request for Determination of Applicability (RDA) would be required. A portion of the site is also located within the 100-year flood zone. It is expected that this area can be avoided when planning the location of future project related infrastructure. These and other permitting requirements are discussed in further detail in the sections below.

3.1.2 Registered or Permitted Facilities

In addition to the environmental data layers mentioned above, a review of the existing registered or permitting facilities was conducted. The MassDEP maintains a database of major facilities is a statewide point dataset containing the location of a subset of facility types regulated by MassDEP's Bureau of Waste Prevention (BWP). The following "major" facility types have been included in this screening:

- Large Quantity Generators of Hazardous Waste (LQG)
- Large Quantity Generator of MA-regulated Hazardous Waste (LQG_MA)
- Large Quantity Generator of EPA/RCRA-regulated Hazardous Waste (LQG_RCRA)
- Large Quantity Toxic Users (LQTU)
- Hazardous Waste Recyclers (HWR)
- Hazardous Waste Treatment, Storage and/or Disposal Facilities (TSDF)
- Facilities with Air Operating Permits (AIR)
- Facilities with Groundwater Discharge Permits (GWD)
- Facilities with Surface Water Discharge Permits (SWD)

Based on review of this data set, there is one solid waste facility (inactive landfill) in the vicinity of the project site. The listed facility is located approximately 0.5 miles southwest of the site. The active Fitchburg Landfill is located approximately 1.5 miles south of the site. The location of the solid waste facilities, in addition to the nearby paper mills, is indicative of the industrial nature of this area of City of Fitchburg. The results of the screening are provided on Figure 5, Appendix A.

3.1.3 Proximity to Residents

The West Plant is located in an industrially-zoned area within the City of Fitchburg. The nearest residential properties are located approximately 1,025 feet northwest of the site. The process building on site is also approximately 1,400 feet from multifamily condominiums located off of Constitution Drive northeast of the Site. The closest residential areas south of the site are approximately 1,500 feet, across from the Can Am Machinery warehouse facilities, located along Princeton Road. The properties west of the site include Newark Paper Mill, followed by other industrial properties. The nearest western residential properties are approximately 4,500 feet west of the site, along Victoria Lane. From a traffic perspective, the site is located

approximately 0.5 miles north of Route 2, where trucks transporting materials to the site may pass six to eight residential properties.

3.1.4 Agency Consultation

Although the initial screening results indicate that the proposed project is not located within any critical or estimated habitat or ACEC, Federal and State agencies should be contacted to request information concerning endangered or threatened species and critical habitats within the project area. The City should contact the United States Fish and Wildlife Service (USFWS), New England Regional office, pursuant to Section 7 of the Endangered Species Act of 1973, to determine whether any federal listed species or habitats are present in the project area. In addition, the Massachusetts Natural Heritage and Endangered Species Program (NHESP) should be consulted for information regarding any state listed species and habitats.

The initial correspondence would constitute the beginning of the “informal” or “simple” review process as outlined by Section 7 of the Federal Endangered Species Act and the Massachusetts Endangered Species Act (321 CMR 10.0000). If, at the conclusion of these consultations, it is determined that no federal or state listed rare species are present or in close proximity to the proposed project site, then the informal or simple review process may be considered complete. Should the conclusion of these consultations reveal that the project site will likely disturb one or more listed species, then a more detailed biological assessment or order of conditions may be required.

3.2 **Permitting Review**

3.2.1 Wetlands

It is not expected that there will be any filling of wetlands as part of the proposed project. Depending on the exact location of construction activities, it is possible that construction could occur within 100 feet of wetlands. If this occurs, a Request for Determination of Applicability (RDA) will need to be filed with the local Conservation Commission. There are also two perennial streams on the eastern side of the site. If work is to occur within 200 feet of these streams, a Notice of Intent (NOI) and an alternatives analysis (explaining why the project couldn't be located at another site) will need to be filed with the local Conservation Commission. While not anticipated, if the project does involve disturbing more than 5,000 square feet of wetlands, then a US Army Corps of Engineers 404, MassDEP 401 Water Quality Certificate, and MEPA ENF would be required.

3.2.2 National Flood Insurance Rate Mapping (FIRM)

We have reviewed the FIRM mapping for the project location and found that a portion of the project site is located within the 100-year flood zone, as depicted on Figure 4, Appendix A. Proposed design and construction should incorporate flood protection, as appropriate. A more detailed review of flood zone impacts on the proposed project should be incorporated in the design phase of the project.

3.2.3 Stormwater

A Stormwater Pollution Prevention Plan (SWPPP) would be prepared and submitted to MassDEP during final design of the project. The SWPPP would identify a pollution prevention team, potential pollutant sources, stormwater management controls, monitoring requirements, record keeping, and reporting responsibilities. The SWPPP would also include a site map illustrating discharge locations, identifying receiving water bodies, and showing locations of materials exposed to precipitation. A project that disturbs an area greater than one acre would be regulated by EPA through a Construction Activities Permit. The site contractor would also be required to obtain a NPDES Permit before construction could begin. Local building permit plans should include stormwater protection measures as warranted by the proposed construction.

3.2.4 Air Quality Permitting

According to 310 CMR 4.10(2), installation of new biogas fired CHP engines would require Non-Major Comprehensive Plan Approval I from MassDEP. Therefore, a Non-Major Comprehensive Plan Approval application should be submitted for this project. The Non-Major Comprehensive Plan Approval application process can take up to six months. This application must include a Best Available Control Technology analysis, and a dispersion modeling demonstration. The U.S. EPA sets emission limits in 40 CFR 60 Subpart JJJJ, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines, shown in Table 3-2 below. All anaerobic digester-gas fired engines must comply with these limits for nitrogen oxides (NO_x), carbon monoxide (CO), and volatile organic compounds (VOC). The New Source Performance Standards (NSPS) requirements for new spark ignition-internal combustion engine (SI-ICE) burning digester gas are divided into two parts: 1) All digester gas engines (except lean burn engines greater than or equal to 500 hp but less than 1,350 hp); and 2) Lean burn engines greater than or equal to 500 hp but less than 1,350 hp. The intention is to design the project to meet the USEPA limits identified in Table 3-2⁽¹⁶⁾.

Table 3-2 US EPA Emissions Standards for Stationary Digester Gas Engines								
Engine Type and Fuel	Max. Engine Power (HP)	Manufacture Date	Emission Standards*					
			g/HP-hr			Ppmvd at 15% O ₂		
			NO _x	CO	VOC	NO _x	CO	VOC
Landfill/Digester Gas (Except Lean Burn 500≤HP≤1,350)	HP<500	7/1/2008	3.0	5.0	1.0	220	610	80
		1/1/2011	2.0	5.0	1.0	150	610	80
	HP≥500	7/1/2007	3.0	5.0	1.0	220	610	80
		7/1/2010	2.0	5.0	1.0	150	610	80
Landfill/Digester Gas Lean Burn	500≤HP≤1,350	1/1/2008	3.0	5.0	1.0	220	610	80
		7/2/2010	2.0	5.0	1.0	150	610	80

*Current standard: 71 Federal Register 39172, July 11, 2006

3.2.5 MassDEP

Acceptance of SSO at the proposed Fitchburg facility will require a written approval by MassDEP according to 314 CMR 12.00. It is anticipated that this approval would be received from MassDEP based on the known goals for the SSO initiative.

According to the solid waste regulations (310 CMR 16.00), a site assignment is only required for an area of land where solid waste uses can occur. The SSO materials handled at a wastewater treatment plant or at an exclusive organics processing facility are not considered a solid waste; therefore, we do not believe this project would require a solid waste site assignment.

3.2.6 Massachusetts Environmental Policy Act (MEPA)

MEPA regulations indicate that facilities that store, treat, or process over 50 tons of wet sludge per day may require a MEPA filing. The need for a MEPA filing should be determined based on the final design.

3.2.7 Natural Heritage and Endangered Species

The project site is not located within an area of critical or estimated habitat. A Massachusetts Endangered Species Act (MESA) Project Review Checklist should be filed with the Massachusetts Division of Fisheries and Wildlife. Based on a review of the information that was provided and the information that is currently contained in the database, it is likely that the NHESP will determine that this project, as currently proposed, will not result in a prohibited “take” of state-listed rare species.

3.2.8 Fitchburg Planning Board

The City of Fitchburg Planning Board should be consulted to confirm that there are no zoning requirements which would require approvals before this project could be constructed. As stated previously, there do not appear to be any zoning regulations which would prohibit the construction of an anaerobic digestion facility at the existing West Plant.

3.2.9 Local Building Permits

A local building and electric permit would need to be obtained prior to construction by the general contractor performing the work.

4.0 IDENTIFICATION OF OFFSITE FEEDSTOCKS

Feedstock composition is a major factor in determining biogas production rates and yield from an anaerobic digester, and subsequent power generation capabilities from this biogas. Developing an understanding of the quantity and quality of available substrate materials allows us to determine the size of the digestion facility and how much power can be generated from the biogas produced.

4.1 Identification of Feedstocks

Initially, two primary feedstocks were anticipated for this project: (1) source separated organics, and (2) wastewater treatment facility (WWTF) biosolids from the Fitchburg East Plant. Weston & Sampson reviewed a study by the Massachusetts Department of Environmental Protection (MassDEP) on identified large generators of food and organic wastes in Massachusetts to estimate volumes of potential feedstock, in order to develop the SSO feedstock quantity for this technical memorandum. The original source data can be found in the 2002 study for MassDEP by Draper/Lennon, Inc. entitled, "Identification, Characterization, and Mapping of Food Waste and Food Waste Generators in Massachusetts". The final report from this study is available online at:

<http://www.mass.gov/dep/about/priorities/foodwast.doc>

This report was again updated in Summer 2011 by the U.S. Environmental Protection Agency Region 1. Based on our review of the DEP data, the estimated source separated organics (SSO) within a 25-mile radius is in excess of 41,000 wet tons of material per year. In addition to the materials within the Fitchburg area in Massachusetts, the New Hampshire border is located approximately 10-miles north of the West Plant. We have included an overlay of these generation sites with a 25-mile radius around the City of Fitchburg as Figure 6. However, not all of this potential volume can be considered realistic for use at a digester facility in Fitchburg. In fact, the majority of this estimated volume is not considered for use at this project site.

To analyze the SSO generation estimates, Weston & Sampson sorted the DEP solid waste generator list in the following manner:

1. Remove all potential SSO sources from the table which are outside of the 25 mile radius, assuming that transportation costs for these materials will not be cost-competitive.
2. Organize this list in order from largest quantity generator to smallest quantity generator.

Weston & Sampson then began contacting the largest generators on the list, in order to determine whether or not the SSO generation assigned to them by the MassDEP was still valid, and available for consideration. What we found from our conversations with many of the generators, was as follows:

- Much of the SSO material has already been committed to local farms as animal feed.
- Much of the SSO materials have already been committed to composting for beneficial re-use.
- Many of the generators we contacted did not understand what organic wastes were, or that they were listed in the DEP Study.
- Many others were reluctant to discuss their organic waste materials with us at all.

- Generators who had already made commitments for organic waste disposal reported very low disposal costs, thus the economics of these established disposal methods were far more attractive than the transport and disposal costs anticipated for a large centralized digestion facility.

In addition, professional contacts we have and maintain within the solid waste industry noted that DEP published quantities appear to be high (however, they could not quantify how high). The solid waste industry suggests that most restaurants will not exceed threshold of >50 tons per year. Based on the lack of available information on SSO availability, we found that we needed to look elsewhere for possible substrate source information.

4.2 Modified Approach

Weston & Sampson reached out to several large commercial solid waste contractors, who serve the Central Massachusetts area. They all expressed interest in such a project, upon hearing the details of the facility and the project goals; however, all but one of them declined to offer waste load information, as they felt it would be “tipping their hand” when the time came to compete for a contract to design, build and operate this facility. One solid waste hauler agreed to provide information with the understanding that they remain anonymous in our report.

In addition to SSO materials, this commercial waste hauler we spoke with also dealt with regional municipal wastewater biosolids. They identified the disposal of municipal biosolids as a significant need in the Central Massachusetts area^(14,17). This sentiment was consistent with what we had heard from many of our municipal clients, who were formally hauling their liquid biosolids to the Fitchburg East Plant for incineration and ultimate disposal. The Fitchburg East Plant incinerator was decommissioned in 2012 due to anticipated increases in air permitting costs, and the need to completely rebuild the incinerator, which had exceeded its useful life by nearly a decade. Based on our discussions with this entity we have incorporated the following additional organic feedstocks into our technical memorandum for this project:

- Dewatered municipal wastewater biosolids from sources outside of the City of Fitchburg, and
- Wastewater biosolids, mainly starches from processing recycled paper, derived from the biological treatment of the paper mill effluent (local Newark Paper).

These feedstocks are quantified and described in more detail below. These feedstocks, in addition to the SSO materials (which the solid waste industry currently handles and could be made available) are the basis for this evaluation.

Based on the new organic loading information provided by our solid waste industry source, local needs, and City of Fitchburg goals, Weston & Sampson has identified the following four major substrates which will make up the feedstock to the proposed digester at Fitchburg. These four substrates are estimated to generate approximately 14,600 dry tons of digestible material, annually. The following feedstock and estimated quantities would be processed at the proposed Fitchburg West Plant anaerobic digester:

- Source Separated Organics - 100 dry tons per year,
- Municipal Biosolids from Prospective Solid Waste Management Company - 4,800 dry tons per year,

- Municipal Biosolids from former Fitchburg East Plant incinerator clients – approximately 4,650 dry tons per year, and
- Dewatered solids from Newark Paper Mill in Fitchburg – approximately 5,000 dry tons per year.

The City of Fitchburg historically accepted WWTF biosolids from approximately 42 surrounding communities before shutting down the incinerator in the summer of 2012. The City now only processes its own residuals at the East Plant, as well as septage from within Fitchburg. Biosolids processed at the Fitchburg East Plant are disposed of at the City of Fitchburg landfill, which is currently being contract-operated by Waste Management, Inc.

4.2.1 Source Separated Organics (SSO)

Source-Separated Organics (SSO) are defined as compostable or digestible materials that are segregated from the point of generation and collected separately from waste materials, to avoid any blending or contamination from the waste materials. SSO are expected to contribute about 2,000 wet tons per year to the Fitchburg digester project. The SSO will consist primarily of pre-consumer restaurant food waste (including fats, oil and grease) and grocery store wastes⁽²³⁾. This equates to 5.48 wet tons per calendar day and 7.69 wet tons per operating day (Monday through Friday). We expect this waste to be at about 4 to 5% total solids and have a chemical oxygen demand (COD) of approximately 100,000 mg/L. Our solid waste industry source, and prospective contributor, indicates that their food waste is both pre-consumer and post-consumer, but it has been decontaminated (no plastics or metals). This is estimated to contribute 100 dry tons per year.

4.2.2 Municipal Wastewater Biosolids (BIO1)

“Sewage Sludge” refers to the solids separated during the treatment of municipal wastewater. The definition includes domestic septage. “Biosolids” refers to treated sewage sludge that meets the EPA pollutant and pathogen requirements for land application and surface disposal. Estimates on municipal wastewater biosolids were received from the prospective solid waste management company. This substrate is estimated to contribute 20,000 wet tons per year, at an average solids concentration of 24% total solids. This equates to:

- 26,301 dry lbs. per day
- 78,839 gallons per calendar day at 4% total solids
- 110,375 gallons per operating day (assuming 5 days per week) at 4% total solids

These municipal biosolids are all dewatered and will be delivered to the site as such. They will need to be re-constituted to get it to the proper digester feed concentration of 4%. We will need to have facilities available to receive and blend these biosolids. An average of 76% Total Volatile Solids is expected in a quantity of 4,800 dry tons per year.

4.2.3 Municipal Biosolids (BIO2)

We have estimated the volume of municipal biosolids that can be expected from former City of Fitchburg municipal clients. The breakdown for the municipal biosolids from former Fitchburg clients is as follows:

- Raw Primary Sludge: 30% (by volume); 80% total volatile solids (TVS)
- Raw Waste Activated Sludge: 70% by volume; 65% TVS
- Total average liquid load: 33,050,000 gal./year at 3.8% total solids avg. and a combined TVS of 75%

While formerly dewatered and incinerated at the East Plant (Fitchburg), solids will most likely be hauled as a liquid to the proposed digestion facility. The total combined sludge volatile solids are 75% TVS by weight, as trucked to the site. This represents 42 local communities, who were former customers of Fitchburg's merchant sludge facility (before it closed in 2012). There is no overlap between the municipal wastewater biosolids and municipal biosolids. These are actually separate solids streams. This substrate is estimated at 4,658 dry tons per year.

4.2.4 Dewatered Solids From Newark Paper Mill (PMS)

The Newark Paper Mill is located west of the Fitchburg West Plant. Discussions with the mill have resulted in estimates of 1,200 wet tons per month, of dewatered solids that can be added to the estimate of available substrates. The residuals from the Newark Paper mill are generated by a biological wastewater treatment process producing an organic sludge from the degradation of starches and glue. These residuals are not typical of paper production facilities, and do not have a high clay content⁽¹⁾. These solids will be dewatered to 35% total solids before delivery and will need to be reconstituted. The solids are mainly dewatered starches, which have a high organic content from the pulping of recycled paper. An analysis performed on April 9, 2014 by the City of Fitchburg on this material yielded an average of 76% TVS. The estimated quantity of this material is 5,040 dry tons per year.

4.3 **Other Potential Organic Material Sources Not Considered for This Evaluation**

While Weston & Sampson has developed what we feel is a reasonable quantification of possible organic substrates for this project, there are no actual commitments guaranteeing that these materials will be available at the time that this facility is constructed (should it be found to be feasible). In light of this, we expanded the general area that a digestion facility in Fitchburg could service to see if there were other potential sources which could be tapped. Fitchburg is located a few miles from the New Hampshire border. While there is no published information for New Hampshire SSOs at this time; Keene State College, Franklin Pierce University, and the City of Manchester are all located within 30 miles of the City of Fitchburg, and could be expected to be large potential sources of SSOs, if the economics of disposal in Fitchburg were able to work. At this time we have not specifically included any organics from these potential sources.

We considered large municipalities, such as the City of Worcester which is located south of the 25-mile proposed service area, and found that there is currently one competing facility for their SSO materials. This facility is located in Rutland, Massachusetts and would likely bring direct market competition for SSO materials from the Worcester area. Both the West Plant and the

existing Rutland facility are approximately the same travel time from the City of Worcester. While the Rutland digester accepts SSO materials, it is our understanding that they have no plans to accept municipal wastewater biosolids. This reinforced our confidence that a digestion facility which could accept biosolids might have a higher level of feasibility. It should be noted that other disposal options which accept municipal wastewater residuals, could compete for these feedstocks if they have a lower disposal costs.

4.4 Transportation of Substrates

Transportation of the substrates will occur via tanker truck or open body dump truck as described below. Access to the site from major highways is not expected to be an issue. Three projected truck access routes are indicated on Figure 7, Appendix A. This figure includes potential truck routes from Route 13, Route 2 North, and Route 2 South. A table of the estimated feed stock and delivery methods is included below as Table 4-1.

It is anticipated that the source separated organics waste stream, which is the smallest portion of the proposed feed stock, would be delivered as slurry with a total solids content of approximately 4 to 5 percent. The slurry would be delivered via a liquid tanker truck, with an enclosed vessel, and it is estimated that one tanker truck per day would be processed at the facility.

The municipal biosolids from both the City's East Plant and from the prospective solid waste management companies would be received at the Fitchburg West Plant as a dewatered cake with an average solids concentration of approximately 24 percent. The solids would be trucked from their point of origin to the Fitchburg West facility via open body dump trucks at an estimated rate of eleven (11) trucks per day (assuming capacity of 7 wet tons per truck) that would be processed at the facility.

The municipal biosolids received from the former Fitchburg East Plant incinerator clients would be shipped to the facility as a liquid sludge with an average solids content of just under 4 percent. The biosolids would be delivered via a liquid tanker truck to an enclosed receiving area at an estimated rate of sixteen (16) trucks per day (assuming 8,000 gallon capacity) that would be processed at the facility.

The dewatered solids from the Newark Paper Mill would be received at the facility as a dewatered cake with an average solids concentration of approximately 35 percent. The solids would be trucked from the Newark Paper Mill to the Fitchburg West facility via open body dump trucks. It is estimated that six (6) trucks per day (assuming capacity of 10 wet tons per truck) would be processed at the facility.

In total, it is estimated that approximately seventeen (17) enclosed liquid tanker trucks and seventeen (17) open body dump trucks would enter and exit the facility each day via one of the three potential access routes (Route 2/Route 2A, Route 2/Route 31 or Route 13/Route 31). It is also estimated that the facility will be staffed by a team of three individuals who would generate approximately ten (10) trips in and out of the facility on a daily basis in small passenger vehicles. A summary of the anticipated feedstocks and delivery methods are provided in Table 4-1, below:

Table 4-1 Feedstock & Delivery Methods					
Feedstock	% Solids	Form	Quantity/Operating Day	Deliveries /Operating Day	Truck Type
Source Separated Organics (SSO)	4 - 5	Slurry	7.7 wet tons	1	Tanker Truck
Biosolids – Private Operator Source (BIO1)	24	Dewatered Cake	77 wet tons	11	Open Body Dump
Biosolids – Area Municipalities (BIO2)	3.8 average	Slurry	130,000 gallons	16	Tanker Truck
Newark Paper Mill Biosolids (PMS)	35	Dewatered Cake	56 wet tons	6	Open Body Dump

5.0 BIO-PROCESS MODELING AND RESULTS

Anaerobic digestion is a highly complex process which uses varying microorganisms to break down organic (in this case sewage sludge and SSO) materials. This digestion occurs through a large number of biological and chemical reactions, taking place at the same time, inducing many interactions between chemicals and microorganisms. A digester is a closed system, or reactor, where all chemical and biological components of the system participate in one or more reactions to maintain the equilibrium of this system. Each type of microorganism in a digester has a different anaerobic metabolism and is sensitive to its immediate environment. This environment is dependent upon the composition of the organic substrates introduced to the environment, or reactor vessel; therefore, the state of the biology depends on the composition of the substrates and how microorganisms themselves convert the given substrates. Significant research has been performed in the field of microbiology which defines the most critical processes for anaerobic digestion, allowing these processes to be modeled through computer simulation.

5.1 Digestion Model

For the purpose of this project, Weston & Sampson contracted with CH-Four Biogas, Inc. of Ottawa, Ontario, Canada. Genesys Biogas, Inc., the parent company of CH-Four, developed a highly successful anaerobic digestion process model which they felt would be necessary for the proper modeling and sizing of an anaerobic digestion facility. This process model is run using a program called "Aquasim" developed by Peter Reichert (Reichert, 1998). Aquasim is a computer program designed to identify and simulate aquatic systems as they occur in laboratories, technical operations and natural environments. These simulations serve as tools to improve the research, design, operation and optimization of anaerobic processes under specific conditions. Aquasim was developed to perform such analyses for artificial and natural aquatic systems. By defining compartment size and configuration along with the links between these various compartments in Aquasim, real-life situations can be simulated. Simulations produce data that suggest whether or not the operation of a desired system configuration is feasible, allowing for recommendations with regards to operational scenarios. CH-Four now owns this model, and has continued to develop and modify it, through experience on numerous anaerobic digestion projects, which they have developed throughout Canada and the United States. Please refer to Appendix D for additional details regarding this anaerobic digestion process model, and its use.

The Aquasim modeling software provides a reactor simulation, specific to the available feed substrates, which can generate the following information:

- Feedstock analysis and co-product predictability;
- Anaerobic digester size to accommodate feedstock volumes and flow patterns;
- Anticipated Biogas Production;
- System stability and indicator analysis;
- Operational recommendations;
- Process control optimization

Once this model has been established for a specific project, it can also be used to model the digestion system to predict the system's reaction to changes in substrate composition. This allows system operators to optimize the digester operation and balance substrate loadings for maximum biogas production; which, in the case of projects with a power generation component, is critical to maintaining a consistent power output. To date, biogas composition, biogas yields, pH, and levels of organic acids predicted by Aquasim have matched lab results quite closely.

5.2 Initial Run

As described in Section 4.0, Weston & Sampson has developed a list of target substrates (feedstocks) at the outset of this project. These specific substrates were:

- SSO materials from within the anticipated Fitchburg service area (800 to 1,000 dry tons/year)
- Fitchburg East Plant Biosolids (20,000 dry tons/year)

These specific materials were selected for evaluation based on the initial project goals of (1) diverting organic materials from the landfill waste stream in this area, and (2) providing the City of Fitchburg with a net zero cost for disposing of their East Plant biosolids (currently landfilled).

The process model was run using these substrates and their corresponding anticipated loadings. The model predicted the following based on these loadings:

- 2.64 MG required digester storage at a 30-day hydraulic retention time (HRT)
- 7,600 C.Y./day of biogas production with an approximate BTU value of 550 BTU/Cu. Ft.
- Power generation capacity of 630 kW.

Based on the construction modifications needed to adapt the Fitchburg West Plant for anaerobic digestion, and the value of the power produced, the return on investment was not favorable.

5.3 Modification of Assumptions

A review of the high energy SSO feedstock numbers generated by the MassDEP showed that many of the SSO materials generated by large quantity generators had already been committed to large animal farms (as animal feed), or to composting operations. Commitments had been made for these materials and the economics of these established disposal methods were far more attractive than the transport and disposal costs anticipated for a large centralized digestion facility.

Based on our discussions with a large commercial solid waste contractor, we modified our initial list of organic substrates to include the following materials:

- Outside dewatered municipal wastewater biosolids, and
- Wastewater biosolids from the biological treatment of paper mill effluent.

The substrates, quantified and described in detail in the previous chapter, are the current basis for this evaluation. Including these additional materials in the process model resulted in the following outputs:

- 2.4 MG required digester storage at a 20-day hydraulic retention time (HRT);
- 19,000 C.Y./day of biogas production with an approximate BTU value of 550 BTU/Cu. Ft.;
- Power generation capacity of 1.5 MW.

Through modeling of the modified feedstock inputs, we also identified the following process enhancements, which served to increase the efficiency of the proposed digestion system, and minimize the facility size. These process modifications were incorporated into the model in order to achieve the above output, and are as follows:

1. **Increase digester feed concentration to 8% total solids:** Our initial concept was to feed the anaerobic digestion system at 4% total solids. Increasing the feed concentration to 8% total solids dramatically reduces the amount of water being used and processed by the system. Reducing the amount of water results in a lower total heat load and reduced digester volume.
2. **Move pasteurization from post-digestion to pre-digestion:** Our initial concept for the digestion facility included pasteurization after digestion. Our modeling showed that total heat load requirements could be reduced if the substrates were pasteurized on their way to the digester. By doing this, we are able to direct all heat for the system to the pasteurization process and allow the anaerobic digester to operate using only residual heat from the pasteurization process. This both simplifies the system, and eliminates construction and long-term O&M costs related to digester heating facilities.
3. **Reduce digester HRT from 30 days to 20 days:** Our initial concept was to have a mesophilic digester with a standard HRT of 30 days, in order to completely break down suspended organic materials and maximize gas production. By placing pasteurization in front of the digesters, the pasteurized materials will enter the digester at a slightly higher temperature (107° F). While the mass of the digester will remain at 95° F, the temperature required for mesophilic bacteria to propagate, the added entrance heat coupled with complete mixing will allow us to provide complete digestion within a shorter time period. This reduces the digester volume requirements. Please note that we are dramatically increasing the load to the digesters, but the total volume is nearly the same as what we had modeled for our initial assumptions, which assumed a much smaller total organic loading.

5.4 Mass and Energy Balance

The technical goals of this project are to generate heat and electricity in the most efficient manner possible, while reducing the total volume of the organic materials processed and generating a stabilized (Class A) organic solid. This processing, through anaerobic digestion, produces a biogas which can be readily used as a fuel source. Heat and energy can be produced from this digester biogas using an internal combustion engine-driven electrical generator, from which heat is also recovered. This is referred to as a combined heat and power (CHP) system. In order to accomplish this, and to ensure that all process heat and power requirements have been accounted for, we have developed a “mass and energy balance”, or “material and energy balance”. By accounting for all materials entering and leaving a system, mass flows can be identified which might have been unknown, or difficult to measure without undertaking this exercise.

Mass balances are used widely in engineering and environmental analyses. This process is required for thorough design and analysis of wastewater treatment systems as well as specific unit processes, such as anaerobic digestion, where there are many input and output variables which need to be taken into consideration. Appendix D includes a description of the mass and energy balance based on the assumptions described above in Section 5.3. The following process parameters from Appendix D are summarized below:

1. Substrate loadings
2. Biogas production
3. Pasteurization heat requirements

4. Power and heat generated by the CHP units
5. Parasitic (system) power requirements
6. Waste heat produced
7. Net power for distribution

As noted above, this mass and energy balance “closes the loop” on this unit process by accounting for all process variables. By showing that we have considered all energy and mass inputs and outputs, and that they “balance”, we are confident that our modeling effort for the proposed anaerobic digestion system is complete.

The process model outputs, listed in Section 5.2 above, have been confirmed through this process and are the basis for digestion and power generation, equipment sizing and pricing; and, therefore the basis for our cost-feasibility analysis, presented later in this report.

A general mass flow diagram for an anaerobic digestion process is presented as Figure 8, Appendix A. The mass flow diagram would typically depict specific numerical information on the mass and energy balance for the project. A typical vendor who provides this proposed type of process equipment has indicated that the mass and energy balance for the proposed project has been completed and confirms the project, as proposed, to be functional. However, since the proposed process tends to be proprietary in nature, vendors have declined to provide the specific information on our proposed project.

6.0 ANAEROBIC DIGESTER CONCEPTUAL DESIGN

Before getting into a detailed description of the conceptual designs selected for this facility, it will be helpful to review what anaerobic digestion is, and how it applies to this project. Anaerobic digestion is recommended for this project for the following reasons:

1. **Volume reduction:** The “landfill ban” requires diversion of organic wastes from the landfill stream; therefore, they must be reduced in volume in order to be dealt with more efficiently. This volume reduction benefit can be applied to other organic materials identified for anaerobic digestion, thereby reducing the volume of these materials.
2. **Energy production:** Anaerobic digestion is a natural biologic process, which breaks down organic materials via conversion of these carbon rich materials to methane (biogas) which is an excellent fuel source. The methane can then be used as a source of energy for power generation.
3. **Recycling of materials:** Anaerobic digestion stabilizes organic materials to reduce potential vector attraction, eliminate odors, and reduce pathogens. Once an organic material has gone through the steps it is safe for use as a soil amendment or fertilizer. Note that the product must still have commercially desirable properties and meet a market demand for it to command any revenue.

The three step process above completes the “diversion” of these materials, allowing them to be completely recycled, giving us the full benefit of the energy they contain, conserving valuable landfill space, and reducing the need for incineration.

The following general discussion of the digestion process precedes the conceptual design of the facility, and is intended to give valuable background and insight to the reader as to necessity of each proposed unit process described later in this Section.

6.1 Anaerobic Digestion Process for Energy Production

The anaerobic digestion process in waste management has historically been used predominantly for treatment of residual sludge from wastewater treatment facilities to reduce the sludge mass requiring disposal. The process employs bacteria, which under anaerobic conditions (without oxygen), consume the organics in the sludge and convert the majority to gasses, predominantly methane and CO₂. The methane produced from wastewater sludge digestion has been used as fuel to heat the digesters and or to run gas fired generators to provide supplemental energy for operation of the treatment plant. The fuel value (i.e. gas production potential) of sewage sludge however is relatively modest in comparison to other organic materials due to the fact that the very processes used to treat the wastewater that produce the waste sludge (typically aerobic i.e. with oxygen) have already converted the raw waste and used some of the available energy in the process. Hence, it has not generally been seen as a significant source of commercial energy production.

However, with the ever increasing cost of energy the industry has looked for ways to enhance the energy production potential of the process through augmentation of the waste stream with higher energy value materials to boost the methane production potential. A variety of materials have been investigated and employed to varying degrees to do just this including other high organic content waste streams and even raw “non waste” organic products such as corn. Of

course some of the most economically promising sources are other high organic content waste streams such as recovered waste cooking fats, oils and greases, dairy wastes and other industrial wastes including organic solid wastes from the food processing industry and even source separated organic waste. The anaerobic digestion process provides multiple benefits including substantial reduction of the exiting waste stream residual mass to be disposed of, conversion of that mass to a more stable and environmentally friendly end product that can often be used as a soil amendment for agriculture, and a significant amount of energy.

All of these factors have resulted in an increasing number of facilities employing anaerobic digestion being built and operated around the world. As society's need for renewable energy and organic waste production increases, and with advances in the efficiency of the technology, the number of anaerobic digestion facilities is expected to increase significantly in the coming years. The advantage of the anaerobic digestion process is that it can process virtually any biodegradable material into methane when properly designed and operated.

The anaerobic digestion process is in its simplest terms a natural "decay" process. It is in fact a result of the natural metabolic "life cycle" process of a variety of naturally occurring microorganisms. It happens in nature all the time, in fact many of the microorganisms are present in the gut of animals (including humans) where they help with the digestion of food by converting complex organics into simpler byproducts that are more easily absorbed by the body. The decay of organic sediments at the bottom of lakes and streams and in swamps is affected through anaerobic digestion. This is in fact where "swamp gas" comes from, it is simply one of the byproducts of the process. Anaerobic digestion, like most metabolic processes, is a complex one but generally includes two primary steps. The first step is the conversion of complex organic molecules ultimately to largely CO₂, Acetic Acid and hydrogen. This is itself actually a multistep process biologically carried out by several groups of microorganisms producing various intermediate byproducts that are then converted to the identified end products. The second step is performed by a specific group of organisms known as methanogens. These microorganisms convert the acetic acid and hydrogen to methane gas, CO₂ and water. Other byproducts of anaerobic digestion, produced in lesser amounts, include hydrogen sulfide gas, inert solids, ammonia and others in even smaller amounts. Nutrients are concentrated in the reduced amount of residual inert solids, increasing their value as a soil amendment. Conversion of organic solids, by as much as 60% or more, can be achieved through anaerobic digestion, significantly reducing the volume of solids requiring disposal.

The goal of an anaerobic digestion facility is to optimize both the potential energy value of the feed materials and the efficiency of the anaerobic digestion process. The potential energy of the feedstock depends on both the inherent energy value it contains as well as the energy necessary to make it readily digestible by the microorganisms. Fats, oils and greases from food production and other high strength liquid waste, such as concentrated dairy and brewery wastes, are particularly high value because they require less processing than materials such as slaughter house waste and source separated organic wastes, which must first be processed typically into a slurry which requires additional processing steps including various levels of grinding and blending with other liquid wastes. Other moderate to high value wastes include wastewater treatment plant sludge, particularly "raw" or untreated solids settled from the influent wastewater, although waste sludge from aerobic processes is also a viable source as is domestic septic tank waste. With an adequate supply of sufficiently high energy content waste, anaerobic digestion can produce significant methane and subsequently useable energy. Homogenization and pasteurization can condition less degradable waste streams for improved degradability within the digester.

Maximizing conversion of the energy available in the waste to methane requires optimization of the digestion process itself. This requires an understanding of the environmental conditions under which the microorganisms performing that conversion function best. Critical considerations for efficient digestion are temperature, pH, mixing, active biomass population and reactor organics concentration.

1. **Temperature** - As noted earlier, the anaerobic digestion process is biologically a multistep process with various steps performed by different groups of microorganisms. The different groups of organisms have somewhat different temperature preferences the most significant being the methanogens. Some methanogens can perform well at temperatures between approximately 90 and 100 degrees Fahrenheit (referred to as mesophilic range) with the optimum being 95 degrees while other species function best at approximately 120 to 135 degrees Fahrenheit (the thermophilic range). There are more species of methanogens in the mesophilic range than there are in the thermophilic range. Furthermore the mesophilic species have proven to be more tolerant of variations in environmental conditions. Alternately, thermophilic digestion proceeds at a higher rate and as such produces gas faster than mesophilic digestion. The speed however comes at the price of the energy to keep the digester at the requisite temperature which is contrary to the primary purpose in this case, energy production. This and the inherent stability of the mesophilic process make it the preferred choice for anaerobic digestion facilities.
2. **pH** - pH is an important consideration in efficient anaerobic digestion. The methanogens tolerate only a relatively narrow range of pH. The first step in the process results in the production of CO₂ and acids, ultimately acetic acid, which the methane formers then convert to methane. The acid production would decrease the pH if not for the buffering capacity provided by the CO₂ produced. If the pH drops too low the methanogens will slow down and as pH drops further will shut down all together. Overproduction of acids and pH drop is typically a result of overfeeding of the reactor such that the first (faster) step produces acid faster than the methanogens can convert it to methane and CO₂. The pH increase slows the methanogens making the problem progressively worse and if not corrected in time will shut down the reactor. As such control of the feed rate based in part on monitoring of the pH is critical to maintaining reactor performance.
3. **Mixing** – Mixing of the reactor improves performance by increasing the contact between the microorganisms and the waste. Mixing in digesters can be provided in a number of ways, methods employed have included conventional rotary shaft style and linear motion shaft mixers, internal and external mounted “Pump and Nozzle” hydraulic mixing and pulsed compressed gas type systems. The various shaft style mixing systems include one or more cover mounted shaft drives with shafts equipped with one or more types of mixing blades mounted on the shaft extending through the cover into the reactor. Rotary shaft mixers as the name implies are effectively propellers mounted on a shaft that rotates providing the mixing energy. Linear motion mixers, as the name implies, employ a linear shaft motion. The drive is located on the cover and the blade equipped shaft penetrates the cover into the tank contents. The blade however is not a propeller but an open faced disk. The shaft moves up and down a short distance and the disc creates pulsation mixing the tank contents. Pumped hydraulic systems are rather simple, consisting of pumps that circulate the tank contents through one or more nozzles located in the tank directed so that they maximize the movement of the tank contents. The pumps are either submersibles internal to the tank or dry pumps external to the tank. These systems provide mixing both thorough circulation and the jet mixing effects of the

nozzles. The mixing energy for such systems can be quite high in comparison to others. The third type of system pulsed compressed gas mixing is considered a “non-mechanical” system in that there are no moving parts located in the reactor. Mixing is provided by a number of rising gas bubbles typically created by compressing some of the digester gas produced and injecting it into the reactor. There are several different proprietary mechanisms for release of the gas and creation of the pulse in the tank. This can be done by controlling the gas discharge to be intermittent or by fixed physical equipment mounted in the reactor itself. The gas mixing systems are among the lowest cost to operate and limit the potential for accumulation of debris (rags and fibers) that can occur with shaft type mixers.

4. **Active Biomass Population and Reactor Organics Concentrations** – Maintaining an adequate mass of microorganisms, appropriate feed rate of waste and time for the maximum level of digestion is also critical to the optimization of the process. This is controlled by the volume of the reactor relative to the feed rate and the solids retention time in the system. Typically, the solids retention time and hydraulic retention time in the digester are the same. Such systems are completely mixed, and as the feedstocks are fed into them, an equivalent volume of digestate is removed. To maximize hydraulic retention time, and increase digester efficiency, the solid and liquid phases of the tank contents must be separated and the solids returned to the tank while the liquid fraction is discarded. This can reduce the total reactor volume required to achieve a given level of digestion. This can be achieved in several ways but is typically performed by employing a “batch” operating mode, wherein feed to the reactor is periodically stopped and the contents allowed to settle. A portion of the liquid can then be decanted off the top of the reactor and then the process restarted again until full. This is more common for systems that are trying to maximize solids destruction and by nature result in a variable environment in the reactor. Anaerobic digestion systems typically do not employ this mode of operation. This can however also be achieved by recycling solids separated from the liquid external to the digester itself. The proposed system provides the ability to do this if desired.

The biogas, the valuable byproduct being produced, must be captured, stored, cleaned and then converted to energy. This requires a gas storage tank, gas scrubbing processes to remove contaminants (particularly hydrogen sulfide) that can cause corrosion, odors and undesirable emissions from the final step, which is conversion of the gas to electrical energy by gas fired engine generators. Such systems are typically provided as “package plants” that provide the gas scrubbing and engine generators. Gas storage is typically provided in variable volume storage containers or bladders. These provide for management of varying gas production and consumption rates in the engine generators.

From the “whole digestate,” the digested solids are separated from the liquid phase by conventional dewatering equipment. The liquid is then discharged to sewers for further treatment at a wastewater treatment facility and the solids can be applied to agricultural lands “as-is” or further processed to make more marketable soil amendments or fertilizers. If necessary, the solids can be landfilled or incinerated.

6.2 Biosolids Quality

A critical component of the landfill diversion program is the ultimate use of the organic materials that have been diverted. To be suitable for all agricultural, landscaping or home gardening applications, materials derived from sewage sludge must meet strict U.S. EPA guidelines

pertaining to pathogens, contaminants, and reduced vector attraction (e.g., flies). Through a combination of mesophilic anaerobic digestion and pasteurization, the facility would satisfy the pathogen and vector requirements. To ensure that the contaminant standards are met, it is anticipated that before any feedstock is accepted at the facility, it would need to be fully characterized through a toxicity characteristic leaching procedure (TCLP) and other appropriate testing, as part of the facility operations plan. Additional testing of the finished product will also be necessary.

6.3 Proposed Unit Processes

Weston & Sampson has prepared a conceptual design for a digestion facility to be constructed on the site of the existing Fitchburg West Plant. This conceptual design has been based on the revised organic loadings, discussed in Chapter 4.0, and the results of the digester modeling process discussed in Chapter 5.0. The following is a description of each individual unit process required to convert the raw organic substrates to a Class A biosolid product, while generating power for resale and reducing the volume of the waste materials processed. A conceptual site plan is included as Figure 9. A process schematic of this proposed process is included in Figure 10. Please refer to this Conceptual Site Plan and process schematic as you read this section for a complete understanding of the technical material presented.

6.3.1 Substrate Receiving

SSO materials, liquid municipal biosolids, dewatered municipal biosolids and dewatered biosolids generated by Newark Paper are expected to be delivered to the site by truck. To facilitate receiving of these materials, which vary in water content, we propose construction of a Tipping Building on the west end of the existing Filter Building. This structure is proposed to be a pre-engineered metal building which will have a large coil door on each end, allowing trucks to enter the building and offload their materials, while odors from the delivered materials are contained.

Liquid biosolids will be offloaded from tankers directly into a biosolids receiving tank via hose connection. Solid materials from municipalities and paper mills will be dumped into a live bottom bin in the floor of the Tipping Building. A screw conveyor would transport these materials into a second receiving tank, where filtrate from the digestate dewatering process will be used to reconstitute these materials to a total solids concentration of 8%. Source separated organics are expected to be delivered in liquid form, at a total solids concentration of 5%. The liquid SSO materials will be offloaded from the trucks via hose connection, similar to the procedure described above.

The west end of the existing Filter Building contains a series of large influent and effluent wet wells, originally used as part of the wastewater treatment process. Now that the West Plant has been decommissioned and no longer functions as a wastewater treatment facility, these wet wells are no longer in use. These structures, constructed within the existing Filter Building, will be repurposed to act as receiving tanks for the offsite substrates.

Typically, SSOs generated by food producers and wholesalers will be clean materials and will not contain contaminants such as foil, plastics, paper packaging, glass or wire. Our solid waste industry source has indicated that all materials that they could bring to this project will be included, and free of any contamination, which might adversely affect the digestion equipment or resale of the final product. For this reason, we have not included decontamination equipment

as part of this project. However, SSO screening and any decontamination equipment could be easily added at a future date if the plant's operators wish to pursue feedstocks such as off-spec packaged foods or front-of-house restaurant organics, which tend to contain more contaminants.

6.3.2 Inlet Receiving and Buffer Tank

Each substrate source will be stored onsite and processed accordingly to ensure an 8% Total Solids (TS) slurry in the buffer tank. As described earlier, bringing the solids to 8% before feeding the digestion process will ensure that pasteurization can take place without needing supplemental heating fuel. Prior to the buffer tank, substrates will need to be carefully reconstituted and blended, as described previously. This will be accomplished in steps between the individual receiving tanks (repurposed wet wells) and the proposed blending tank. The existing post aeration basin will be reconfigured to act as a large blend tank which will provide for equalization between the receiving tanks and the buffer tank. The blend tank will also ensure the proper solids concentration in the substrate feed to the buffer tank, as well as provide emergency storage for an emergency like contaminated substrates being delivered to the site. In this way, contamination can be controlled and dealt with without affecting the entire digestion process. The existing post-aeration basin will be modified as follows:

1. The main body of the vessel shall serve as the new blend tank.
2. A sectional aluminum cover will be installed on top of the tank.
3. The effluent launder for the existing tank will be reconfigured to act as a dry pit for the buffer tank feed pumps, which will allow for a flooded suction setup enabling this relatively thick material to be transferred effectively to the buffer tanks.

The buffer tank will be constructed of insulated, glass-lined bolted steel panels with a fixed aluminum cover. This tank, 660,000 gallons in capacity, is proposed for construction just south of the Filter Building, between the Filter Building and the existing backwash lagoons (no longer in use). This tank will provide 4 days Hydraulic Retention Time (HRT) for the substrates prior to the pasteurization process, allowing spikes in flow during the week to be equalized. The digestion process relies on a steady consistent feed rate, in order to be effective.

The buffer tank will be equipped with a jet mix type recirculation system (with a chopper pump) to maintain a homogenous mix of the multiple feed stocks.

6.3.3 Pasteurization System

Homogeneous flow from the buffer tank is pumped to the pasteurization plant, via positive displacement pumps, at a nominal rate of approximately 22 gpm. It is pumped directly to one of three pasteurization tanks. Pasteurization will be a batch process, taking place in three parallel tanks, each with a maximum batch volume of (nominally) 1,325 gal. At any one time, one tank is filling and being heated to 162°F, one tank is holding (batch hold for time temperature pathogen kill) and one tank is emptying. This approach allows a continuous feed in and a continuous feed out, while providing the one hour batch hold at 158°F required to meet the strictest U.S. EPA pathogen destruction requirements. This step is critical to the economic feasibility of this project.

The pasteurization equipment and feed pumps will be located inside the existing filter building, on the main floor. Please refer to the attached conceptual design drawing, Figure 9, Appendix

A. The welded steel and insulated pasteurization tanks are independently mixed via external pump recirculation with a dedicated mixing pump per vessel.

Heated, pasteurized slurry is pumped from the pasteurization plant to the anaerobic digester, via positive displacement pumps. These pumps are located adjacent to the pasteurization system, inside the Filter Building.

6.3.4 Anaerobic Digestion

Pasteurized slurry is pumped to the Anaerobic Digesters via cooling heat exchangers to bring the slurry to a digester feed temperature of approximately 107° F. Heat from the cooling heat exchanger will be captured from the slurry and used to help heat the incoming substrates from the Buffer Tank. There will be two digesters, each with a 1.2 million gallon capacity. We suggest sequential feeding between the two digesters, such that one pasteurized batch is fed to each digester in turn, in one hour intervals (i.e. each digester is fed once every 2 hours). Sequential feeding on a continual basis will produce the best result from this process.

As described in Section 6.1, anaerobic digestion converts organic material to biogas (methane and carbon dioxide) by the fermentation of organic material in the absence of oxygen. The minimum retention time of the digester is approximately 20 days. Biogas is collected within the roof space, which is connected to the biogas system.

As sequential feeding of the digesters is suggested, we would also suggest sequential sludge withdrawal from the digester, again every four hours to minimize short circuiting.

The proposed digesters will be insulated, glass-lined, bolted steel tanks, with a fixed cover. These tanks will be installed on the site of the existing Backwash Lagoons. While the digesters will be the same inside diameter as the existing Backwash Lagoons the existing lagoon structures are not suitable for adaptation to this process. In addition we anticipate that existing buried process piping between the backwash lagoons in the filter building is not suitable for reuse with the digestion system. The existing lagoon yard piping can be kept and abandoned in place. The lagoon structures will need to be demolished. The cost of this demolition is included in our anticipated project cost summary.

6.3.5 Gas Mixing

A sequential gas mixing system will draw biogas from the headspace of each individual digester, compress and recirculate the gas to the base of the digester using nine (9) mixing lines per tank. Each mixing line shall operate in turn, following a pattern designed to optimize digester blend time and minimize short circuiting. By mixing segments of the digester sequentially, the system can provide intensive localized mixing within digester zones with a low overall mixing energy. This serves to minimize compressor size and related power consumption.

All mixing lines can be individually isolated and flushed using either nitrogen gas or high pressure water for cleaning, as required. The digester gas mixing system is proposed for installation in a small pre-engineered metal building, constructed adjacent to the two proposed digesters.

6.3.6 Digester Cooling

As the pasteurization system feeds the digester at $> 158^{\circ}\text{F}$, the digesters will require cooling under normal operation, with a maximum cooling duty calculated as 191,250 BTU/h. Cooling will be accomplished by a single dedicated heat exchanger system per digester which incorporates a sludge recirculation pump to draw warm digested sludge from the tank and circulate it through the cooling heat exchanger and back to the digester. This equipment will also be located in the building which houses the gas mixing system.

Fresh feed from the pasteurization process will be introduced into the suction side of this recirculation pump in order to pre-dilute fresh feed and allow improved cooling efficiency. Cooling water will be supplied by a "cooling ring main" which will circulate potable water through a shell and tube heat exchanger acting as an interface with the site's final effluent supply. This cooling water will be provided from a plant water skid, to be located on the main floor of the existing Filter Building.

Each individual heat exchanger will be independently controlled to modulate the degree of cooling to control the digester temperature to $\pm 1.8^{\circ}\text{F}$ from the control point.

6.3.7 Digester Heating

In addition to being able to cool the digesters, the heat exchanger system is configured such that it can draw hot water from the boiler primary ring main to heat the digesters. This will be required during digester commissioning, when starting the process for the first time, and also as maintenance heat at times when there is low feed (i.e. when the hot sludge feed to the digesters is lower and hence heat input is lower). A boiler can be brought to the site temporarily for start-up heating needs, until the system is self-sufficient; or can be installed as a permanent standby in the existing filter building. For the purposes of this report, we have not included installation of a permanent gas fired boiler. A formal determination on this matter can be made during the final design phase of this project.

The system has been configured this way to give maximum control of the system allowing digester temperature to be maintained independently of feed rate and ambient temperature extremes. Hot water will be supplied by the heat exchangers via recovery loop from the CHP engines, capable of utilizing either natural gas or biogas as a heat source.

6.3.8 Digestate Dewatering

Digestate, the stabilized material produced by the digestion process, will be transferred via positive displacement pump to Post Digestion Storage. Post Digestion Storage will take place in the existing vertical steel tanks at the east end of the Filter Building. These tanks were previously used to store sludge prior to the dewatering process. These tanks will be retrofitted with a jet mixing system to keep the contents homogenous prior to dewatering. A positive dewatering feed pump system will transfer digestate from the post digestion storage tanks to the two existing 2-meter belt filter presses, located on the second floor of the Filter Building. These belt filter presses were added to the West Plant fairly recently, and have not exceeded their useful life. While these units are in fairly good condition, they have been sitting idle for several years and will require rehabilitation prior to operation.

Using these existing presses, and a new liquid polymer feed system, we anticipate digestate can be dewatered to approximately 22% to 24% total solids⁽²⁾. Dewatered digestate will be transferred to roll-off containers inside an existing Sludge Storage Building which was recently constructed north of the Filter Building using an existing conveyor system. The conveyor is a shaftless screw conveyor and will require rehabilitation prior to commencing operation of this facility, for the same reason as the belt filter presses. Class A dewatered product will be accumulated in two 30-yard roll-off containers inside the Sludge Storage Building. Once these containers are full, they will be hauled off site for a beneficial end use⁽²⁾. We anticipate an average of four trips per day of this material would be hauled off site. On site storage is not recommended⁽⁴⁾ due to the limited space at the facility.

Filtrate from the dewatering process will drain to the existing dewatering effluent pump station. We suggest replacement of the dewatering effluent pumps with equipment suitable to handle the filtrate load from the proposed process conversion. Filtrate will be discharged across the site through an existing force main, to the Industrial Effluent Pump Station, located between the existing wastewater clarifiers. Pumps in this structure currently transfer all industrial effluent from the West Plant to the Fitchburg sewer interceptor on Princeton Road. All wastewater collected or generated at the West Plant, now and in the future, will be treated at the Fitchburg East Plant. The East Plant has hydraulic capacity to accept the expected filtrate volume. Additional study would be required to determine if any additional phosphorus load to the East Plant would require pretreatment prior to discharge from the facility ⁽²⁷⁾. The additional study would be developed as part of a basis of design for the proposed digestion facility.

6.3.9 Biogas

An interconnecting piping system will connect the Buffer Tank, Pasteurization Tanks, and both digesters to a biogas storage facility, to be constructed between the Filter Building and Wastewater Clarifier No. 2 on the west side of the site. The Biogas Storage Facility will consist of a pad-mounted bladder with 52,000 ft³ of storage capacity at approximately 10" w.c. gas pressure. The storage facility will "float" (allow gas into and out of the bladder) on the gas system header similar to the way a water storage tank "floats" on a municipal water distribution system. Gas generated by the digester and other process vessels, will be used to feed two 0.75 MW containerized CHP units.

Gas safety equipment will be installed on all gas lines, and at all process structures to which these gas lines connect. The gas safety equipment, gas piping, and any required fire protection systems, would be designed and installed in accordance with NFPA 820. This is the National Fire Protection Code for facilities handling biogas. Also connected to the manifold will be two waste gas burners, or flares, which will have continuous sparking devices. Any gas not consumed by the CHP units (i.e. if the CHP units are off-line for maintenance) will be stored in the Biogas Storage Facility until it has reached maximum capacity. At that time, gas will be vented via specialized pressure relief system to one or both waste gas burners, depending upon the amount of gas being wasted. The flares will ignite the vented gas, eliminating odors and any danger of explosion of the discharged gas⁽¹⁵⁾.

6.3.10 Combined Heat and Power (CHP)

Two CHP units will be located on cast-in-place concrete pads at the east end of the Filter Building. Biogas will be fed to two internal combustion engines, which in turn drive two 0.75 MW generators. Power generated by the system could be used to existing and proposed building

loads (all of the electric loads related to existing operation and the proposed digestion system). Remaining power will be net metered for commercial distribution, providing a source of revenue to offset the construction and operating costs of this project. Please refer to Section 8 for an additional description of the power generation component of this project, and related equipment.

Heat generated by the CHP units will be collected in the form of hot water from the motor jackets and a heat exchanger on the generator exhaust. This water will be primarily used to supply heating for pasteurization. Typically, up to 2/3 of the energy produced by the CHP process is heat energy. In addition to heat supplied to the pasteurization process, some hot water will be used to heat the Filter Building, Gas Compressor Building, and ancillary facilities. Based on preliminary design assumptions, we anticipate that the heat produced by the CHP will be just enough to supply the facilities noted above. We do not expect that there would be sufficient heat produced to export off-site. Refer to Section 7 for further discussion of useful heat production.

6.3.11 Odor Control

It is recognized that odors from feed stock deliveries and the general digestion process would be of great concern to neighbors adjacent to the facility and along the trucking routes. As discussed above, approximately half of the truck traffic delivering feed stock to the site will be transported via enclosed tanker trucks. The enclosed nature of the tanker trucks will limit the potential for odor issues during transport. Once having arrived to the facility, the tanker trucks will be emptied using a liquid receiving station, which will allow for direct connections to the tanker trucks via a quick connect coupling system and transfer pumps. The enclosed nature of the receiving station and the tanker trucks provide limited potential for nuisance odors during transport and unloading operations.

Transportation of dewatered municipal biosolids to the Fitchburg West Plant is anticipated to be completed via open body dump trucks. As the dump body portion of the truck is open to the atmosphere, there is potential for odor generation during trucking, receiving and processing of dewatered solids. Odors from trucking operations, if present, could be mitigated by the use of oxidizing agents such as potassium permanganate introduced to the sludge at the point of origin. Once at the West Plant, the sludge receiving station and blending tankage will be completely enclosed within a building, thereby reducing nuisance odor potential. On-site odor generation could be further managed and limited during the receiving, handling and processing operations with the addition of on-site odor control measures.

Odor control provisions would be included as part of the facility design, and would include development of baseline air quality data⁽¹⁹⁾. Odorous air would be collected from non-pressurized tank headspaces as well as all process buildings via a negative air pressure ventilation system, similar to vapor recovery systems used in the petroleum industry. A wet chemical scrubber system could be used to spray a chemical solution mist into the odorous air stream, oxidizing sulfides and other odor causing constituents. A biofilter system could force air upward through a media which supports the growth of microorganisms which metabolize the odor forming compounds in the air. The exact type of system will be selected during the facility design phase. An allowance has been carried for odor control in the estimated construction budget for the project.

7.0 ELECTRICAL INTERCONNECTION & NET METERING

Weston & Sampson has conducted an initial review of the electrical interconnection requirements for the proposed CHP generator(s), as well as the net metering context for the project. This section provides a summary of the existing electrical infrastructure at the West Plant; a summary of the proposed interconnection arrangement for the new CHP generators; and a discussion of the potential net metering framework. To assist in this effort, Weston & Sampson retained the services of Power Engineers, LLC. A copy of the report from Power Engineers, LLC is included as Appendix E.

7.1 Existing Electrical Infrastructure

The West Plant is currently served by a 15 kV-class underground distribution service, fed from the overhead Unitil distribution feeder on Princeton Road. The facility receives primary voltage service through a 13.8 kV underground service which terminates at pad-mounted outdoor switchgear (circuit breaker and primary metering equipment) and a 3500 kVA transformer owned by Unitil. The electrical service to the facility is primary metered by Unitil.

From the secondary side of the transformer, a 4 kV class circuit serves load at the West Plant through 4 kV switchgear located in an electrical room in the Filter Building. The 4 kV switchgear has a single main breaker and three branch breakers that supply power to the facility through (a) a 4,160 Volt motor control center, (b) a 300 kVA, 480 Volt transformer, and (c) a 2,000 kVA, 480 Volt transformer. The existing 4 kV equipment is over 40 years old, and the main switchgear does not contain a spare breaker for additional connections.

Historically, consumption at the West Plant has averaged over 1.5 million kWh annually; however, due to reduced operations at the West Plant, the average annual load has been reduced to approximately 600,000 kWh, which includes pumping existing loads to the East Plant. Some consideration of the net metering design would be given to determine the most advantageous location and configuration of the interconnection. The base load at the West Plant would be increased by the new equipment required to run the AD. The two processes would likely be sub-metered for accounting purposes. The additional energy required to operate the AD process could be one of the net metered accounts. The rate that the AD process would pay for energy would be determined through negotiation between the developer and the City prior to construction. The value of the energy was assumed to be at the net metering credit rate for purpose of this study.

7.2 Proposed Interconnection Facilities

The proposed project includes the installation of 1.5 MW of generating capacity at the facility via two, 750 kW CHP generators. The generators would interconnect in parallel with the Unitil distribution service, in a “behind the meter” arrangement. Due to the age and condition of the 4kV equipment, it is recommended to interconnect the output of the generators to the 13.8 kV side of the primary transformer, between the transformer and the Unitil meter. Given the size of the existing service, and the historic loads and peak demands, it is likely that Unitil can readily accommodate the output from the proposed CHP generators without significant impact to the interconnection circuit.

The proposed interconnection facilities would include a new 480 V/2,500 A switchboard for the output from the generators; a 2,000 kVA pad-mounted transformer to step up the output voltage

from the generators (480V) to the interconnection voltage (13,800V); 15kV/600A pad-mounted switchgear with multifunction relays; a 15kV/200A lockable disconnect switch; and a new 15kV cable tapped to the 13.8 kV bus in the existing primary transformer.

The estimated cost for the proposed interconnection facilities is approximately \$450,000. This estimated cost includes installation of all of the required interconnection equipment, as well as an allowance for the cost of studies and interconnection equipment/upgrades that will be required by Until⁽¹³⁾. A detailed engineer's estimate of the interconnection costs is included with the report in Appendix E.

7.3 Net Metering

In order to maximize the value of the electricity generated by the CHP facility, the project should seek eligibility as a net metering facility under the State's net metering rules. As a net metered facility, the monthly generation from the CHP facility would offset retail kWh charges from Until associated with the continued operation of the West Plant, including the parasitic load from the digester facility. Net excess generation (on a monthly basis) would be exported to the grid and the exported kWh would be converted to utility credits with a value near the full retail rate of delivered electricity. These Until credits could be used by the City to offset Until charges at the City's other electricity accounts. Alternatively, the credits could be sold to a private party in Until's service territory⁽⁵⁾.

Net metering eligibility is available on a first come, first served basis and must be reserved online through the State's system of net metering assurance (MassACA). The net metering "caps", specific to each utility, limit the total amount of net metering capacity available in a given utility's service territory. Caps are established for public projects and private projects. Public projects are defined as those projects that are owned by public entities, or those projects that sell all of their output to one or more public entities.⁽⁵⁾

As of the date of this report, capacity available under Until's public cap was approximately 2.0 MW and the private cap was essentially filled (updates available at www.massaca.org). Given the proposed 1.5 MW capacity of the project, it is clear that the entire project may not be eligible under the existing private cap. It should be noted that certain provisions of the net metering regulations may allow for alternative net metering configurations, including the possible creation of two separate net metering facilities (one per CHP generator), or the interconnection of only one generator in a net metering configuration and the other connected behind the meter but not net metered. Depending on the final off-taker arrangement for the excess generation, it may also be beneficial to reduce the total generator size to ensure net metering eligibility. In any event, given the limited capacity under the Until public and private net metering caps, securing net metering eligibility as soon as possible is imperative to the success of the project.

The subject of net metering is under active discussion in the Massachusetts legislature as of this writing and its status should be monitored.

8.0 ENERGY PRODUCTION AND FINANCIAL ANALYSIS

This section provides an analysis of the various direct costs and revenue factors associated with the project, as well as estimates of indirect costs and benefits. This analysis is based on the development of a Class III net metering facility, which seeks to create the highest value for the electrical energy produced. Based on the conceptual design and anticipated feedstocks available for this project, it is estimated that an anaerobic digester could support a combined heat and power (CHP) generator with a rated capacity of 1.5 MW. For planning purposes, the capacity should be split using two 750 kW generators that are set up to run in parallel, to minimize downtime associated with regular and unscheduled maintenance. In addition, this would allow the project to be scaled up or down in phases⁽¹⁷⁾. The greatest value for the electrical energy generation would be to first use all the energy produced on site to operate the existing (and proposed) demands of the anaerobic digestion facility, and to net meter any excess energy to other City-owned accounts through virtual net metering. The heat energy produced by the CHP engine can likely be used to heat the West Plant during winter months, thereby reducing natural gas usage, and to heat the AD process. It is not clear at this point if nearby commercial/industrial facilities could make use of any excess heat beyond the needs of the plant as it is currently operated.

The follow analysis here considers the feasibility level estimates of probable cost ($\pm 25\%$), under public ownership as a capital project with estimates of quantity and market value of the commodities (electricity, heat, organic wastes) that the project will produce or consume. Where the project could be either publicly or privately owned, the basic financial model is used to determine if there is sufficient merit to warrant further development. In general, if the project is viable as a municipally owned facility, then it is likely that private development, led by a developer who would assume responsibility for final design, build and operation (DBO) of the facility, for profit and under an arrangement which had financial benefits that would accrue to the City as the host of the facility, is viable. The former involves significant resources and risk that the City may not have available and the latter allows the project to leverage allowable tax incentives that would not be available to the City as a public entity.

8.1 Financial Analysis

A financial analysis and model of the project concept is presented in this section. The model and analysis includes project costs and project benefits, and simple economic figures of merit in assessing if the project warrants further consideration. The more detailed financial model which considers time value of money, factors for general inflation and energy inflation, and treatment of tax incentives by a private developer are not considered here. The value of tax incentives passed on by a private developer to the City can only be determined by the private market, by way of a competitive, qualifications-based selection process. To understand the benefit to cost ratio, we have estimated the project has the following benefits and cost attributes:

Estimate of Potential Project Revenues & Sources (Benefits)

- Organic waste tipping fees the facility might collect for accepting AD feedstocks (SSO, Municipal Biosolids, or paper mill residuals from a nearby facility);
- Electrical energy (kWh) from the CHP engine and associated revenues or avoided costs through net metering;
- Useful heat energy from the CHP could be used to heat the West Plant and displace the fuel purchases used to heat the existing facility;
- Renewable Energy Certificates (RECs) from renewable electricity generation;

- Alternative Energy Certificates (AECs) from renewable thermal energy generation;
- Production of solid fertilizer/soil amendments from the AD digestate, and associated commodity revenues; and
- Grants, rebates and other incentives.

Estimate of Probable Project Costs (Costs)

- Design and permitting;
- Financing and transactional costs to procure and contract with 3rd party;
- Demolition of unused filter building process equipment;
- Build new building for SSO tipping floor;
- Renovate wetwell for SSO liquid storage;
- Install yard piping to and from filter building/new AD process equipment;
- Renovate existing belt filter presses and conveyor equipment;
- Installation of new AD process equipment including pasteurization skid;
- Install a new buffer tank;
- Install a new cover over existing aerobic post aeration basin;
- Odor control technology;
- Mechanical piping, pumping, and mixing equipment;
- Electrical interconnection; and
- Operate the AD facility.

The economic model includes sensitivity to key sources of project revenue; namely, the value of the disposal of the organic feedstocks and the value of the electricity produced by the process, given the risk of limited net metering cap space.

8.2 Organic Waste Disposal Fees

The facility would charge a unit rate fee for disposal of the organic feedstocks. The values of the disposal fees for the feedstocks are estimated in Table 8-1 as follows:

Table 8-1 Feed Stock Delivery Rate					
Feedstock	Quantity	Units	% of Load	Estimated Unit Fee Disposal (\$'s/unit)	Estimated Revenue (\$'s/year)
SSO	0.38	Dry Tons/Day	0.7%	\$60.00	\$7,000
BIO1	13.20	Dry Tons/Day	32.9%	\$279.00	\$1,344,000
BIO2	12.80	Dry Tons/Day	31.9%	\$279.00	\$1,303,000
PMS	13.80	Dry Tons/Day	34.5%	\$56.70	\$286,000
Total/Average	40.18	Dry Tons/Day	100.0%	N/A	\$2,940,000

All of the feedstocks are expected to be brought to the site by truck. The project would seek to create an incentive for the owner of each feedstock with an opportunity to have an alternative disposal option, presumably at a rate which is less than that which they are currently paying. The economic model uses a discount of 10% under current disposal practices^(11, 21).

Ideally, after the AD process is complete, the solid fraction of digestate would be pasteurized and result in a fertilizer or solid amendment product that could be used without restrictions in

agriculture, landscaping, or similar use. In this model, the product has to be trucked to another off-site facility that is permitted to store and stage the material prior to sale or distribution; therefore, the value of the material is offset by the cost of trucking and assigned a \$0 value with a \$0 cost of transport. Any remaining liquid fraction from the process would be pumped to the City's East Plant via existing force mains as currently configured. A private developer may work to alter the proposed plan to include additional capital expenditures which would be used to enhance the product's marketability and thereby generate a revenue stream from the solid and/or liquid fractions. This may alter the results of the financial analysis as presented for the project.

8.3 Electrical Energy Production

Based on the expected biogas production rates from the feedstocks anticipated for this project, the gas is expected to provide fuel sufficient for running a 1,500 kW combined heat and power generator at the site. Once the ratio of feedstocks added to the process and digestion times are stabilized, the generators are expected to run continuously at capacity factors ranging from 80-90%. Using an average capacity factor of 85% and nameplate rating of 1,500 kW, the gross electrical energy production is on the order of 11,169,000 kWh annually. Additional study, which would be carried out as part of the basis of design for the final proposed AD facility, would be required to estimate the additional electrical demand and loads of any new process equipment. The value of the electrical energy, based on a net metering credit rate of \$0.1387 kWh, would be on the order of \$1,549,140. Any energy used behind the meter could be valued at the full retail rate (currently \$0.1595/kWh). Depending on how the new facility is configured this could include the 554,000 kWh currently consumed by the West Plant for pumping.

The potential electricity cost savings to the City would be based on which ownership model was developed. If the City owned the facility, all of the attributes (electricity production, useful heat production, RECs, and AECs) would accrue to the City. If the project was developed by a third-party and City were an off-taker of the heat and energy, the benefit to the City would be in the form a discount to market prices that the City already pays for these commodities. The discount to market prices for heat (natural gas) and electricity (per kWh) could be on the order of 15%. Where the City currently pays approximately \$0.1595 kWh and \$1.00 per Therm, the value of the discount would be on the order or \$0.0239 per kWh and \$0.15 per Therm. Were the City the off-taker of 11,000,000 kWh under net metering at \$0.0239 per kWh and made use of heat energy displacing 29,500 Therms of natural gas at a savings of \$0.15 per Therm for purchases at the West Plant, the savings would be valued on the order of \$271,364 per year.

8.4 Heat Energy Production

Both the anaerobic digestion process and burning of the biogas in the reciprocating engine will produce excess heat. This heat can be used both to serve the AD process and excess heat can be used to offset the natural gas used to meet the heating needs of the existing facility. The process model using the feedstocks summarized in Table 8-1 it is anticipated to produce sufficient heat for the pasteurization process and facility heat. There is not likely to be sufficient excess heat for other nearby users of the excess heat, and therefore this model conservatively assumes that useful amount of excess heat is equal to the existing average natural gas use at the West Plant - in this case 29,500 Therms per year. The value of the heat energy, based on seasonal average natural gas fuel and delivery charges, is estimated at \$41,266 per year.

8.5 Renewable Energy Certificates

The project should be eligible for Class I Renewable Energy Certificates (RECs). Based on the alternative minimum compliance payments and current market values, we believe that Class I REC values of \$0.05 per kWh are approximate estimates for Year 1 through Year 10, and \$0.04 per kWh for the remainder of the useful life of the facility (20 years). Based on the expected production of electrical energy, the RECs are estimated to generate \$558,450 per year for the first 10 years and \$446,760 per year thereafter. Over 20 years, the RECs would accumulate estimated revenue of \$9,605,340.

8.6 Alternative Energy Credits

The project would be expected to qualify for Alternative Energy Credits (AECs) for the useful excess heat energy that is produced, if the product of the system has productive use (e.g., as fertilizer). Assuming that the only use for the excess heat would be to provide the equivalent heat energy used by the existing plant operations (pre-AD project conditions), the value of this displaced natural gas fuel is on the order of \$41,271, based on annual use of 29,500 therms. The value should fluctuate year to year, based on the actual number of heating degree days and actual heating demand. It is expected that a heat exchanger and required metering and monitoring would be installed and that the City would enter into a heat purchase contract with the facility operator, presumably at a discount over the cheapest alternative fuel source that it would ordinarily have at its disposal (natural gas). The cost of the alternative heating should also be subject to inflationary adjustment, which in this case is conservatively set at 0%.

8.7 Biosolids Product

The product of the AD process is estimated to generate 9,300 dry tons of biosolids per year. The end product generally has market value, depending upon the degree of processing and forms in which it is made available, shipped and sold; whether to the wholesale or retail markets. While an analysis of the marketability and refinement of the product is beyond the scope of this feasibility study, the goal would be to produce a product that has been sufficiently pasteurized so as to minimize any use restrictions, subject to testing, permitting and licensing requirements⁽³⁾.

As discussed, the economic model assumes the value of the material produced will be offset the by cost of transportation of the material to another site, resulting in a net \$0 value. This assumption is based on a suggestion by the waste hauling service industry.

8.8 Opinion of Probable Costs

The planning level opinion of project cost is approximately \$23,700,000. The probable costs include: design and permitting; demolition of unused filter building process equipment; construction of new building for SSO tipping floor; renovation of existing wetwell for SSO liquid storage and processing equipment (belt filter presses); ancillary piping; electrical interconnection and ongoing operation of the facility once constructed. The planning level opinion of probable cost is given in Table 8-2 below:

Table 8-2
Opinion of Probable Cost

Description	Quantity	Unit	Unit Cost	Extended Cost
Wetwell Demolition	1	LS	\$100,000	\$100,000
Wetwell Divider Wall Construction	1	LS	\$50,000	\$50,000
Mechanical Demolition Filter Building	1	LS	\$750,000	\$750,000
Mechanical Demolition - Scrap Value	1	LS	(\$250,000)	(\$250,000)
Existing Backwash Lagoon Demolition	1	LS	\$500,000	\$500,000
Existing Belt Filter Press Rehabilitation	2	EA	\$75,000	\$150,000
Existing Sludge Conveyor Rehabilitation	1	LS	\$20,000	\$20,000
Dewatering Pump Station Retrofit	1	LS	\$150,000	\$150,000
Abandon Existing Municipal Clarifiers	1	LS	\$150,000	\$150,000
Cover for Exist. Post Aeration Tank (Reuse as Blend Tank)	1	LS	\$500,000	\$500,000
Anaerobic Digester Tanks (1.2 MG each)	2	EA	\$1,000,000	\$2,000,000
Buffer Tank (0.66 MG)	1	EA	\$500,000	\$500,000
Pasteurization Skid	1	EA	\$1,200,000	\$1,200,000
BioGas Storage System	1	EA	\$1,000,000	\$1,000,000
Digester Sequential Gas Mixer System	2	EA	\$100,000	\$200,000
Receiving Tank Mix System	1	LS	\$50,000	\$50,000
Blend Tank Mix System	1	LS	\$50,000	\$50,000
Buffer Tank Jet Mix System	1	LS	\$50,000	\$50,000
Post Digestion Storage Mix System	1	LS	\$50,000	\$50,000
Liquid Biosolids Mix System	1	LS	\$50,000	\$50,000
Transfer Pump Syst. (Buffer to Pasteurization.)	2	EA	\$10,000	\$20,000
Dewatering Feed Pump System	3	EA	\$10,000	\$30,000
Biogas Booster Pump	2	EA	\$50,000	\$100,000
Transfer Pump (SSO to Buffer)	2	EA	\$10,000	\$20,000
BioSolids Conveyance (Blend to Buffer)	1	LS	\$250,000	\$250,000
Transfer Pump (Liq. BioSolids to Blend)	2	EA	\$10,000	\$20,000
Liquid BioSolids Receiving Station	1	LS	\$25,000	\$25,000
Dewatered BioSolids Receiving Station	1	LS	\$100,000	\$100,000
CHP Generator/Control Equipment	1	LS	\$4,500,000	\$4,500,000
Gas Handling Equipment Allowance	1	LS	\$500,000	\$500,000
Electrical Interconnection	1	LS	\$386,000	\$386,000
Odor Control Allowance	1	LS	\$600,000	\$600,000

Table 8-2 Opinion of Probable Cost				
Description	Quantity	Unit	Unit Cost	Extended Cost
Tipping Bldg./Found. Allowance	1	LS	\$750,000	\$750,000
Digestate Pump/Compress. Bldg./Found Allowance	1	LS	\$500,000	\$500,000
Yard Piping Allowance	1	LS	\$1,000,000	\$1,000,000
Mechanical Piping/Valve Allowance	1	LS	\$1,000,000	\$1,000,000
On-site Electrical Work Allowance	1	LS	\$500,000	\$500,000
Digester Electrical Room Allowance	1	LS	\$150,000	\$150,000
Site Work Allowance	1	LS	\$500,000	\$500,000
Subtotal				\$18,221,000
Design/Permitting (10%)	0.10			\$1,822,000
Contingencies (25%)	0.25			\$4,555,000
Subtotal				\$24,598,000
Estimated Maximum MassCEC Grant (OTE D-C)				\$400,000
Estimated Maximum MassDEP Grant (SMRP)				\$500,000
Net Project Cost				\$23,698,000

Grant funding (subject to change), currently available through the MassCEC's Organics-to-Energy for Design and Construction currently top out at \$400,000 and MassDEP's Sustainable Materials Recovery Program (SMRP) Municipal Grants could add an additional \$500,000 toward construction of the proposed AD project if found eligible for maximum amounts to reduce the capital cost of the project. Additional funding options include low rate loans through the State Revolving Fund for Clean Water capital improvements.

8.9 Economic Analysis

In evaluating the economic merits of any project, it is useful to use simple economic figures of merit, including simple payback, internal rate of return, net present value, cash flow, and benefit to cost ratio. In order to perform an economic analysis for the alternatives presented, the benefits and costs of the project were evaluated. A project cost of \$23,700,000 was used that includes design, permitting, capital costs, interconnection, etc. Benefits of the project include the value of offset retail energy purchases (electric and heating), net metering credits, the sale of RECs and AECs, and disposal fees collected for accepting the four identified organic waste streams. A nominal residual value of 10% of the net capital cost of the equipment was also included.

The value of the avoided cost was calculated based on the sum of the estimated value of default service, distribution, transmission and transition kilowatt-hour charges. The cost and benefits are estimated over a 20 year useful life of the project and are then factored into a simple economic model (discounted cash flows) to arrive at a net present value and present value benefits and costs using a conservative discount rate of 7% to reflect the relative risk of the project. For this study, we have modeled three scenarios:

- Scenario 1:** Base case projecting anticipated volumes of feedstock at current estimated market values;
- Scenario 2:** Considers decreasing market value of disposal by 25%, and
- Scenario 3:** Considers 25% decrease in disposal fees and no net metering availability due to risk of net metering capacity.

Table 8-3 below provides a summary of the economic model assumptions of the three scenarios:

Table 8-3 Economic Model Variable Input Parameters			
Description	Scenario 1	Scenario 2	Scenario 3
CHP Nameplate (kW)	1,500	1,500	1,500
Gross Capacity Factor	85.0%	85.0%	85.0%
Net Annual Energy Production (kWh)	11,169,000	11,169,000	11,169,000
Annual Facility Use (kWh/yr)	554,000	554,000	554,000
Useful Heat Energy, (kWh/yr)	864,557	864,557	864,557
Retail Offset (kWh)	\$0.1387	\$0.1387	\$0.1387
Net Metering Credit (kWh)	\$0.1387	\$0.1387	\$0.0500
REC value Y1-Y10 (kWh)	\$0.0500	\$0.0500	\$0.0500
REC value Y10-Y20 (kWh)	\$0.0250	\$0.0250	\$0.0250
AEC value Y1-Y10 (kWh)	\$0.0210	\$0.0210	\$0.0210
AEC value Y10-Y20 (kWh)	\$0.0210	\$0.0210	\$0.0210
SSO Tipping Fees, 5.5 Dry Tons per day	\$60.00	\$45.00	\$45.00
BIO1 - Private Operator Source, 13.2 Dry Tons per day	\$279.00	\$209.25	\$209.25
BIO2 - Municipal Sources, 12.8 Dry Tons per day	\$279.00	\$209.25	\$209.25
PMS - Newark Paper Mill Biosolids, 13.8 Dry Tons per day	\$56.70	\$42.53	\$42.53
O&M (\$/kW)	\$400.00	\$400.00	\$400.00
Project Term, Years	20	20	20
Financing	100% Equity	100% Equity	100% Equity
Energy Inflation	0.0%	0.0%	0.0%
General Inflation	0.0%	0.0%	0.0%
Discount Rate	7.0%	7.0%	7.0%

Solids are typically described in units of dry tons, a unit of measurement which accounts for the total weight of dry solids in a material, excluding water content.

An industry-standard economic metric for a renewable energy project is to examine the net present value (NPV). The NPV can be defined as the present value of the initial investment, plus all future cash flows. For an anaerobic digester, cash flows are evaluated over the useful life of the equipment, in this case 20 years, but sometimes 25 to 30 years, depending upon the manufacturer and care taken during the maintenance of the equipment.

Another useful measure is a time-adjusted benefit-cost ratio (BCR). The BCR is the present value of cash inflows divided by the present value of cash outflow. An investment which has a BCR which is greater than 1.00 predicates a positive return on the investment and anything less than 1.00 costs more than the benefit of the investment. A project with a BCR of 1.00 is considered breakeven.

The Internal Rate of Return (IRR) is also used to judge the economic merits of an investment. If the IRR exceeds the opportunity cost of capital, the investment is attractive. If the IRR equals the cost of capital, the investment is marginal. The IRR is a capital budgeting metric typically used by private firms to decide whether they should make investments. It is an indicator of the efficiency or quality of an investment, as opposed to net present value (NPV), which indicates value or magnitude. The IRR is the annualized effective compounded return rate which can be earned on the invested capital (i.e.: the yield on the investment). A project is a good investment proposition if its IRR is greater than the rate of return that could be earned by alternate investments of equal risk (investing in other projects, buying bonds, even putting the money in a bank account). In general, if the IRR is greater than the project's cost of capital, or hurdle rate, the project would add value for the project developer. Formally, the IRR of an investment is equal to the discount rate at which the investment's NPV equals zero. Please note, the IRR and simple payback is not an applicable figure of merit where the project is developed with a term loan.

For the purpose of this model, general inflation and energy inflation rates are assumed to be zero. Normally, general inflation rates, which might range from 0 to 3.5% per year, could be applied to project costs, consumables and labor to account for increased costs over time. Energy inflation rates, which might average from 1 to 4% per year, could be applied to value of useful heat and electricity produced, and the fees for disposal that the project would produce and offer; however, small changes to these rates can have significant impacts to the overall figures of merit; therefore, they are set at 0% for this feasibility level study. Further, the financial analysis would cease to be simple if complex inflationary figures are introduced into the analysis. Pension costs of municipal employees associated with the proposed facility were not specifically factored into the financial analysis as part of this assessment. The cost model may need to be revised, depending on the type of procurement method selected for this project^(7, 24). Under a public-private partnership model in which operations are provided by the private partner, staffing of the AD facility would not add any new employees to the City of Fitchburg payrolls.

Project cash flow is based upon the project benefits minus project costs. Cumulative revenue from electrical power sales, net metering credits, sale of RECs and AECs and disposal fees collected for tipping of organic waste streams that serve as feedstock, monetizing of tax credits should be appreciably greater than project costs. Project costs are expected to include design and permitting, capital costs required to construct the facility, finance costs, O&M, insurance, taxes, land lease payments, discounts given to host for net metering credits, power, heat and disposal fees, and startup costs, including soft cost for all of the required contractual transactions. The economic model is based on a minimum design life of 20 years, where all of the construction occurs in the first year. The facility would need to be evaluated and upgraded at the end of 20 years⁽¹⁰⁾.

Table 8-4
Summary of Economic Model Results

Description	Scenario 1	Scenario 2	Scenario 3
Preliminary Project Cost	\$23,700,000	\$23,700,000	\$23,700,000
Simple Payback, years	5.9	7.2	9.7
Internal Rate of Return	15.2%	11.7%	7.3%
Net Present Value	\$15,800,000	\$8,700,000	\$500,000
20-Year Net Cash Flow	\$52,100,000	\$38,100,000	\$22,000,000
Benefit Cost Ratio	1.50	1.27	1.02

The economic performance improves when factoring in grant funding from MassCEC and MassDEP, which could provide up to \$900,000, if eligible for maximum. Other economic factors which impact the project economics are the project cost, discount rate (cost of capital) and inflation factors (both general and fuel-related energy costs). The economic performance erodes as the discount rate and general inflation rise. The economic modeling herein assumes that the project will be paid for with 100% equity (cash). Simple payback estimates, as the name implies, do not consider inflation and is based on the first full year of net revenue divided by the project cost. The cost estimates do not include the cost of decommissioning. In this case, these figures are assumed to be of equal value and therefore would have a net zero impact on the analysis.

Based on the above, development of a large-scale (1.5 MW) AD project appears economically viable and further development is warranted. The simple payback, NPV, IRR, cash flow and BCR, from the perspective of a developer, suggest that the project is worth pursuing. If the City leases the site to a private developer, then the combination of lease payments and other benefits (discounted energy costs, disposal fees, etc.) should be sufficient for the City to make it worthwhile to pursue the project. The benefits to the City become a cost to the private developer under the third-party ownership model. From the City's perspective, the financial benefits are expected to be significantly less than the base numbers presented above. The analysis is sensitive to market fluctuations in the value of several important commodities, many of which have historically fluctuated rather significantly year to year; however, the overall benefit to cost ratio is appreciably positive and considered attractive for development. Year over year cash flow for the economic model scenarios are included in Appendix F^(8, 21, 24).

9.0 IDENTIFICATION OF PROJECT RISK FACTORS

The risk factors considered for this study include: financial risks, public opposition, changes in waste stream, and ability to sell biosolids. Each of the factors is discussed below.

9.1 Financial Risks

There are several economic risk factors that could impact the expected financial performance of the proposed project, beyond availability of net metering discussed in Section 7. One such risk is the cost of energy. As the cost of energy decreases, the anaerobic digester project becomes less financially attractive. According to the Green Communities Act of 2008, life cycle cost calculations “shall assume the cost of fossil fuels and electricity will increase at the rate of 3.0% per year about the estimated rate of inflation or at a rate determined by the department of energy resources.” As discussed Section 8, we applied a more conservative energy escalation rate of 0% per year in the simple financial model. These assumptions result in more conservative (lower) rates of return for the scenarios evaluated.

Another financial risk is that the project will not attract prospective bidders because of the projected economics. Each developer will have a minimum profit margin on which they will make a decision to bid on the project. If they do not estimate with confidence that they can achieve this margin, then they will not bid on the project. Many factors will go into this decision including capital cost, operating costs, revenue generation, etc.

Related to this is the availability and cost of private capital to fund construction of the facility. Market conditions and relative availability of other high yielding investments can drive up the cost (through interest rates) of obtaining private capital to fund construction. A positive current economic outlook can be indicative of a need to assume a higher cost for capital, as other competitive investments are available.

9.2 Community Compatibility

It is important to ensure that the project will not impose unacceptable odor, traffic, or noise impacts on neighborhood residents, and that questions and concerns from these stakeholders are elicited and addressed. Maintaining meaningful and effective public participation throughout the planning process can help facilitate accurate public understanding of the project and its likely impacts, and engage the public in implementing effective mitigation solutions wherever possible.

9.2.1 Odor Issues

It is recognized that odors from the various feed stock deliveries and the general digestion process will be of great concern to neighbors adjacent to the facility and along the trucking routes. Impacts due to odors can be minimized if the facility is properly designed and operated. Odor control concerns and mitigation measures are previously discussed in greater detail in Section 6.3.11^(12, 18).

9.2.2 Traffic Issues

Traffic issues associated with this project included the number of vehicles and the ability of traffic to effectively enter and exit the site. As mentioned in Section 4, it is estimated that approximately seventeen (17) enclosed liquid tanker trucks and seventeen (17) open body dump trucks would enter and exit the facility each day via one of the three potential access routes (Route 2/Route 2A, Route 2/Route 31 or Route 13/Route 31). It is also estimated that the

facility will be staffed by a team of six to 10 individuals (average of three on site at any one time) who would generate approximately ten (10) trips in and out of the facility on a daily basis⁽⁶⁾. This estimate should be communicated to the public to address any concerns about traffic issues for the proposed project^(12,18). The entrance to the West Plant from Princeton Road is over a one lane access driveway that passes underneath a railroad bridge. If two vehicles are trying to enter and exit the facility at the same time, one vehicle must stop and wait for the other to pass. The one lane entrance prohibits two cars from passing at the same time. We recommend that a traffic study is conducted in order to generate some options for mitigating these traffic issues.

9.2.3 Noise Issues

There are existing standards referenced in the Fitchburg City Code, Part II General Legislation; Chapter 132: Peace and Good Order; Article VI Noise Control. Further, the MassDEP limits noise to 10 dBA above background levels at the property line or nearest sensitive receptor (residents, nursing homes, etc.) which are near a new stationary noise source. A baseline acoustical study should be undertaken during the design phase of the project to determine existing background sound levels. This information can then be used to model the impact of the proposed equipment. It is assumed that potential stationary sources of noise, such as mechanical rotating equipment, idling trucks and internal combustion engines, are concerns which can be mitigated through proper design and construction. We recommend that sounds be properly identified and engineered to ensure they are not a nuisance. Sound attenuation design for the proposed facility should consider a target maximum increase which is significantly lower than a 10 dBA increase above background at the property line or nearest sensitive receptor.

9.3 Feedstock Availability and Quality

Another project risk factor is that a change in the quantity and quality of the feedstocks could occur. A change in feedstocks could upset an established biological process and result in downtime for the system; added operational costs; loss of power generation revenue and other adverse cost impacts such as increased cost of characterization and disposal of the substrates. These particular risk factors could be mitigated through contract terms and mandatory quality assurance monitoring and testing.

Competition from other nearby Digestion/Composting operations, could limit the tipping fees charged by this facility at the front end. If Digestion facility tipping costs had to be lowered to be competitive with an alternate facility, it would adversely impact the economics for this project through a reduction in revenue.

The possible closure of Newark Paper could have a major negative impact on this facility⁽¹¹⁾. As modeled, Newark Paper would supply approximately 25% of the total organics load. Should Newark Paper shut down, the organic load to the plant, and thereby power generation, would be significantly reduced. Revenue from the sale of power and tipping fees charged for the solids would be lost. Having said this, however, it should be noted that other substrate sources may come and go, depending on local economics. It is likely that there will be other sources of organics that could be used, once this facility has been constructed.

9.4 Ability to Sell Digestate Products

The physical product from the anaerobic digestion process is expected to meet regulatory requirements for sale and distribution as a fertilizer or soil amendment. Although this type of material does have a market value, the price at which it could be sold would have a bearing on

the total project economics. We are currently anticipating a net \$0 cost for the ultimate disposition of the product. We are assuming, for the purpose of this evaluation, that revenues from the sale of this product will offset the cost of transportation. Should the sale price of this material drop, the result could be a net cost for transportation to the market.

9.5 Regulatory Risks

Municipal wastewater biosolids have been well regulated and typically do not vary in quality. The likelihood that the Federal EPA or the Commonwealth of Massachusetts will impose stricter regulations on the beneficial use of these materials is unknown, but believed to be relatively small. In addition, the MassDEP has gone to great lengths to modify its regulations to promote the development and use AD facilities⁽⁹⁾.

10.0 PROJECT OWNERSHIP & FINANCING OPTIONS

This section discusses the project ownership options for the project including City (Municipal) ownership and third party ownership. It also discusses some of the risks associated with each option. Project delivery methods are also discussed. Project delivery would depend on which ownership and financing structure is ultimately chosen for the project.

10.1 Ownership Options

As part of its evaluation of the project, the City must consider project ownership and financing alternatives. The major alternatives include:

- City ownership and financing
- Third party ownership and financing

City Ownership and Financing - Notwithstanding any of the risks and challenges in procuring, designing, and constructing the project (addressed in the next section), the size of the project alone, with an estimated capital cost of ~\$25 million, is a significant impediment to City ownership. Financing a project of this magnitude alone could severely limit the City's borrowing capacity for other worthy projects, including infrastructure improvements and other capital needs that may be of higher priority to the City and its taxpayers. The City could seek to add this project to the intended use plan for the State's Revolving Fund (SRF) for planned infrastructure and improvement projects. As the project owner the City would generally take on all of the accordant ownership risks. One such risk would be the long-term financial viability of the project as the City would rely on consistent, long term revenue streams and avoided costs from the project to pay off the debt it had incurred to build the project. Given that the revenue and avoided cost benefits of the project are each subject to dynamic market forces beyond the City's control, these financial viability concerns cannot be lightly dismissed.

Another significant ownership risk to the City would be the obligation to provide long term operations of the facility and management of its commercial components including contracting for feedstock on beneficial terms; managing the sale or cost-effective disposal of digestion by-products; contracting for the sale of excess electricity generation; trading the renewable energy certificates generated by the project; and providing operations, monitoring, repair and maintenance of the facility. Managing these responsibilities would require the City to budget for the operational costs of the facility, and to hire staff with the requisite experience and expertise to manage what would essentially be a municipal franchise. The City could mitigate some of its ownership risks and personnel obligations by contracting some or all of the operations and management of the facility to a third party, but as a necessary trade-off in this arrangement the City's ability to repay the debt would be diminished.

Third Party Ownership and Financing - would involve a much simpler and lower risk arrangement from the City's perspective, wherein a private entity would contract with the City to finance, own and operate the facility under a long term lease agreement. Under the lease agreement, the City would receive a rent payment or host fee, which might for example be linked to the quantity of feedstocks delivered to the facility. To the extent that the City was willing to obligate itself via long-term contract to the delivery of feedstock to the facility at a contracted disposal rate, or to the purchase of excess electricity generated by the facility under a net metering arrangement, the City could accrue benefits beyond the lease payment, such as savings on its wastewater biosolids disposal costs and savings on its City-wide electricity costs.

There are a number of commercial entities that may be willing to enter a third party arrangement with the City for financing, owning and operating the facility. Interested parties may include integrated solid waste management companies; waste to energy companies; energy development companies; private equity firms with renewable energy asset portfolios, and others with the requisite experience and interest. It should be noted that the facility is eligible for potentially significant tax incentives at the federal level under the IRS Investment Tax Credit (ITC) program, and certain capital costs could benefit from accelerated depreciation treatment under the Modified Accelerated Cost-Recovery System (MACRS) program. There may be other applicable tax incentives at the state level as well. Private capital is thus incentivized to finance and own assets like the proposed facility, and public capital is disadvantaged in comparison. The impact of the tax benefits on ownership (public vs. private) of renewable energy facilities can be seen by surveying the landscape of renewable energy projects, where the vast majority of projects nationwide are privately owned and financed.

10.2 Project Delivery Methods

The choice of project delivery method would be dictated initially by the ownership and financing structure. If the City elected to finance and own the project, the most likely project delivery method would be design-bid-build. This delivery method is essentially mandated under state law for public buildings or public works. Under the design-bid-build delivery method, the City would procure the services of a design engineer to design the proposed facility, secure the necessary permits and entitlements for the facility, and prepare construction documents for bidding. Once the City had secured the necessary funding for construction, by issuing municipal bonds or similar, the City would competitively bid the construction of the facility to qualified contractors.

Upon completion of construction, facility operations could be either by the City or by a contracted vendor, as described in the previous section.

Under the third party financing and ownership structure, the most likely project delivery method, and one that is typical in the energy project sector, is design/build/operate. In this scenario, the project owner and developer would likely contract with a qualified EPC contractor (Engineer-Procure-Construct) who would be responsible for the turnkey design and construction of the project, and who would likely provide contracted operations and performance/process guarantees for a defined term to protect the City from technical risks. The developer would secure the necessary equity and debt to construct the project and provide ongoing operation and maintenance.

The City's procurement responsibilities in this scenario would be more limited than above, and would involve the competitive solicitation of an entity to finance, own and operate the facility under a lease and potentially other contractual agreements with the City (e.g. for disposal of WWTF biosolids, or purchase of net metering credits). The City would need to prepare a comprehensive RFP to identify the site and any development constraints; to demonstrate the technical feasibility of the project; to articulate the specific terms the City would require; and to identify any benefits the City would be willing to offer (purchase of excess electricity via net metering, etc.). Once a developer/owner/operator was procured, the City would be responsible for managing and enforcing the provisions of the third-party contract including throughout the development and construction period, and over the long term operating period of the facility.

Under any project procurement scenario, the City should seek the advice of legal counsel to ensure that the procurement is conducted in accordance with the applicable Massachusetts procurement law.

11.0 CONCLUSIONS AND RECOMMENDATIONS

Weston & Sampson, on behalf of the City of Fitchburg, has conducted a feasibility study regarding the development of an AD project at the City's West Plant. The project included a review of the technical and economic aspects of a project which would involve construction of a 1.5 MW CHP system that utilizes biogas from locally sourced organic feedstocks thereby generating electricity, heat and useful digestate products.

11.1 Technical Merits

The use of the West Plant offers reuse of existing industrial infrastructure which is characteristically similar in nature to the original construction in the early 1970's. The existing features such as buildings, roads, and electrical service and other equipment at the site would be supplemented with additional capital equipment and restoration work which would accommodate the project concept.

11.2 Economic Merits

The cost of the project development is on the order of \$23,700,000. The facility would process an estimated 40.1 dry tons per day of separated organics, biosolids and paper mill sludge from nearby sources, where disposal fees would be collected for the feedstock as an alternative form of disposal over current practices. Revenue from disposal fees is estimated to be on the order \$3,000,000 per year. The process would create a methane based biogas that would run a reciprocating engine, driving an electrical generator that would be considered a Class III net metering facility. The annual gross electrical generation is estimated to be 11,169 MWh. The electrical generation would produce Class I Renewable Energy Certificates. Any useful heat energy would also be eligible for Alternative Energy Certificates. The annual value of electrical generation, heat energy, RECs and AECs is on the order of \$2,000,000 per year. With an estimated annual operating cost of just under \$1M, the project would have a simple payback of 5.7 years. The NPV of the project is estimated to be \$17M (at a discount rate of 7%), with a 20-year net cash flow of \$54M, IRR of 15.8% and BCR of 1.53. Sensitivity analysis which examined a 25% decline in market value for feedstock disposal and no eligibility for net metering credits (wholesale electric rates) for electricity production suggests the project would still be positive.

11.3 Recommendations

Based on the results of this study, we find that construction and operation of an AD facility at the existing Fitchburg West Plant site to be technically and economically feasible under a range of variable conditions. The economic feasibility was positive under a public ownership model which considered benefits (revenue) under current existing market estimates of disposal fees for likely organic feedstocks; a 25% decrease in disposal fees for likely available feedstocks, and; a scenarios analysis which considered both a 25% decrease in disposal fees for likely available feedstocks and the risk that net metering is no longer available by the time the facility is ready to interconnect.

We find it is technically feasible to repurpose the Fitchburg West Plant into a useful facility that could reduce the City's own residuals management and operational costs; provide a cost-effective alternative for other municipalities and industry to dispose of their wastewater residuals and organic materials, and; generate clean renewable energy that would produce revenue for the City. In general, a public ownership model cannot avail itself to tax incentives available to

private developer, favoring a private ownership model with reduced public risk. Based on the above, further project development appears warranted.

Recommended next steps include: developing a conceptual basis of design; conducting additional public outreach and involvement in project development; electrical interconnection design, and preliminary planning and permitting^(12,20). Additional studies related to traffic, acoustical and odor control issues could be completed during the project design phase. We recommend the City of Fitchburg consider private ownership models, as a means to reduce risk and public cost. If private ownership is desired then it should issue a request for qualifications to solicit interest from prospective renewable energy project developers under Massachusetts General Law Chapter 25A, §11C. Private developers, determined to be the best qualified, could be asked to submit proposals to the City to design, construct and operate under a long term lease of the facility, discounted disposal fees, power purchase or net metering credit agreement or other forms of compensation which are determined to be in the best interest of the City as host of the project.

In order for the City to gain the greatest benefit from the current incentive programs, the construction of the facility should be underway (greater than 5% of construction cost incurred) before December 31, 2016, unless federal tax incentives are extended by Congress⁽²²⁾.

12.0 REFERENCES

Fitchburg City Code, Part II General Legislation; Chapter 132: Peace and Good Order; Article VI Noise Control

Massachusetts 2010-2020 Solid Waste Master Plan, Pathway to Zero Waste, (April 2013), Massachusetts Department of Environmental Protection, Executive Office of Energy and Environmental Affairs

Preliminary Feasibility Study, City of Fitchburg West Plant, November 2012, Weston & Sampson Engineers, Inc., Peabody, MA.

Reichert, Peter, (September 1998), Computer Program for the Identification and Simulation of Aquatic Systems (Aquasim), Swiss Federal Institute for Environmental, Science and Technology (EAWAG), CH - 8600 Dubendorf, Switzerland, ISBN: 3-906484-16-5

40 CFR 60 Subpart JJJJ, Standards of Performance for Stationary Spark Ignition Internal Combustion Engines, 71 Federal Register 39172, <http://www.ecfr.gov>

APPENDIX A

Figures

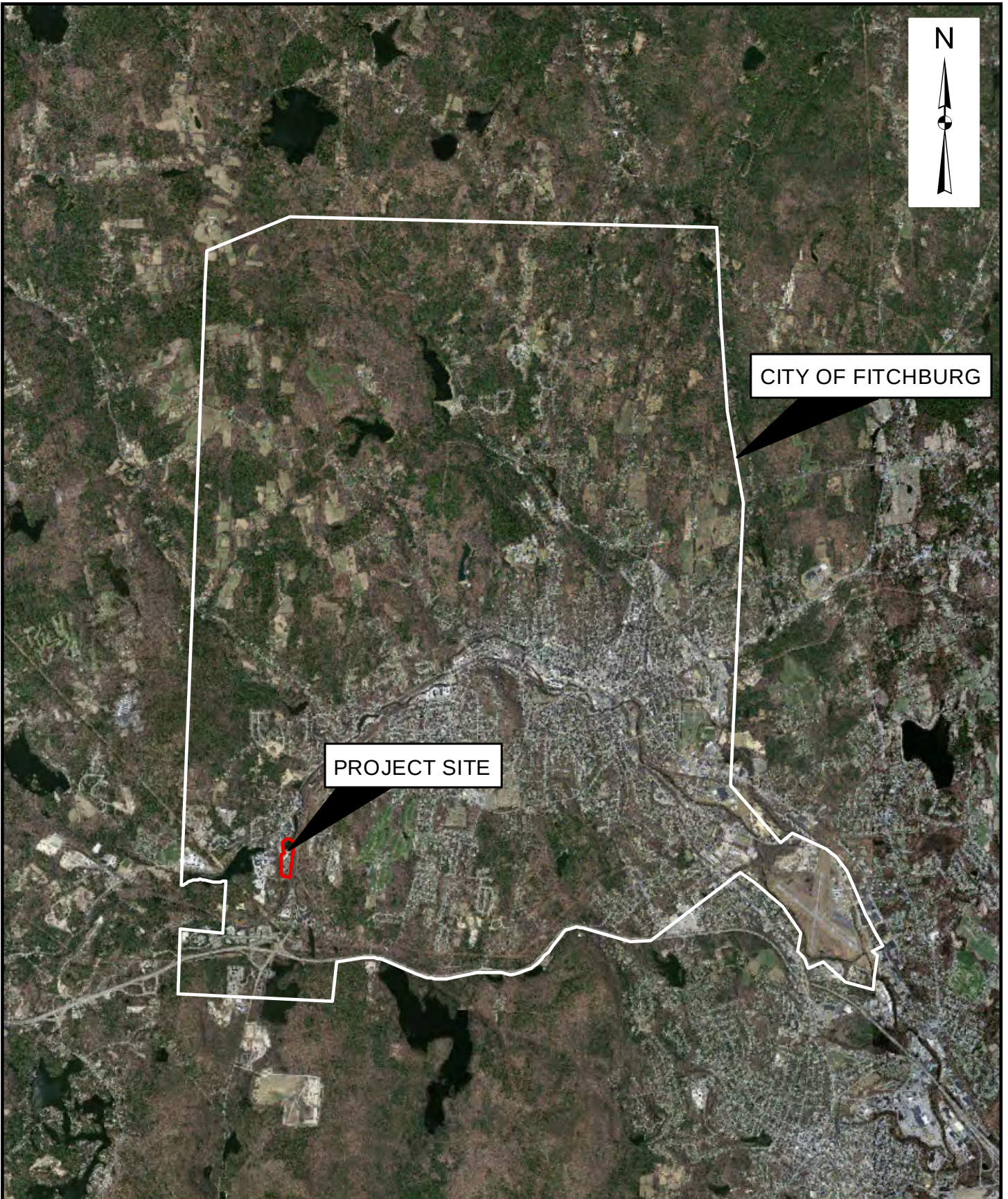
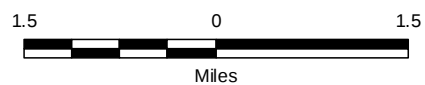
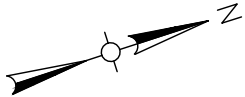
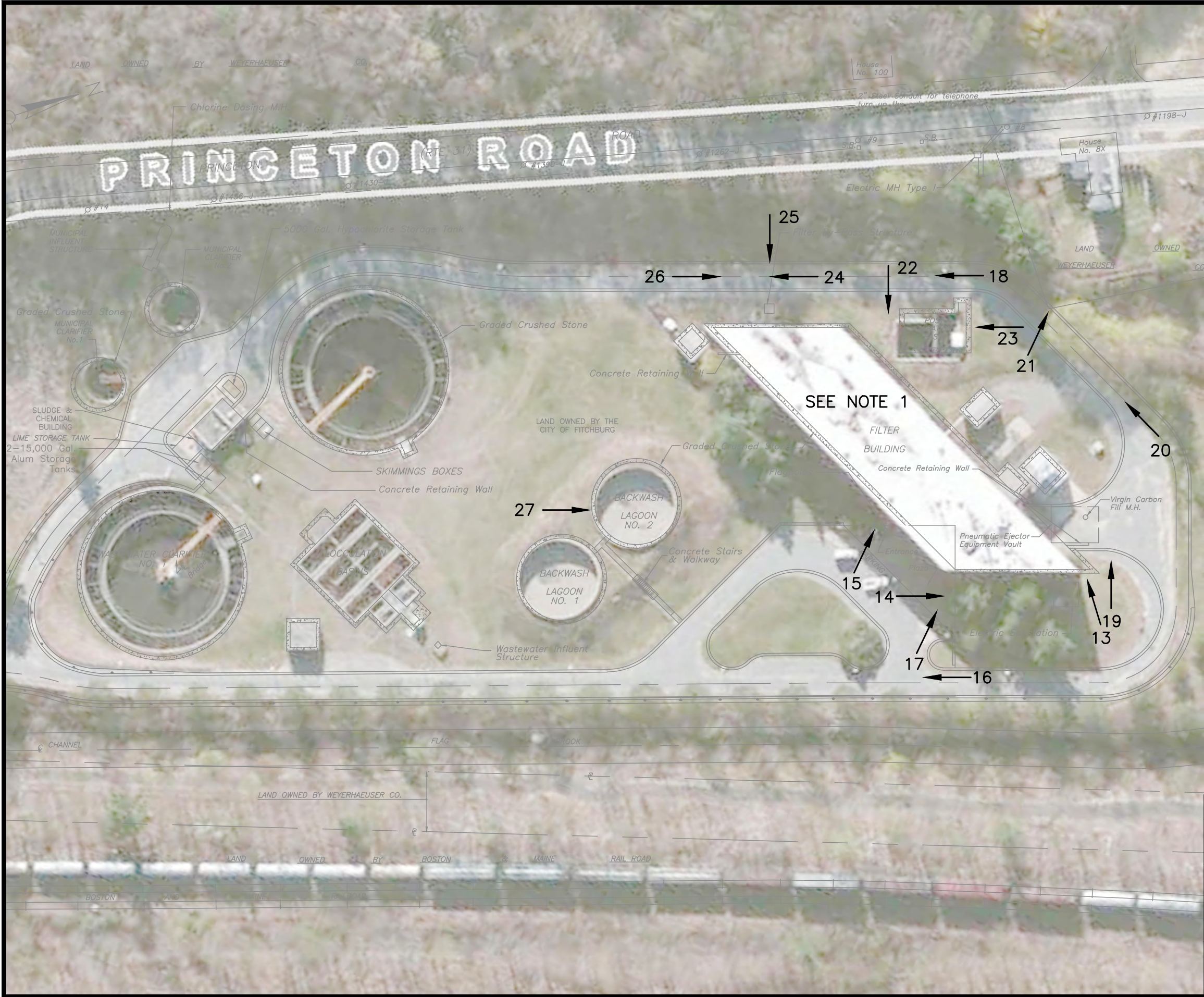


FIGURE 1
CITY OF FITCHBURG MASSACHUSETTS
FITCHBURG ORGANICS-TO-ENERGY PROJECT
SITE LOCATION MAP





KEY:

← 17 DIRECTION AND PHOTO NUMBER

NOTES:

1. SEE PHOTOS 1–12 FOR INSIDE PHOTOS.
2. SITE PLAN DIGITIZED FROM CAMP DRESSER & McKEE’S “WASTEWATER TREATMENT FACILITY – WEST PLANT” PLAN SET, DATED JUNE 1971. ADDITIONAL BUILDINGS WERE INCORPORATED BASED ON AERIAL PHOTOGRAPHY.
3. ALL DIMENSIONS AND LOCATIONS ARE APPROXIMATE.

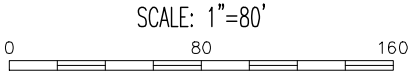


FIGURE 2

CITY OF FITCHBURG, MASSACHUSETTS
ORGANICS TO ENERGY PROJECT

PHOTO LOCAITON MAP

DESIGNED BY: MAS	CHECKED BY: KMN	DATE: February 2015
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Weston&Sampson®

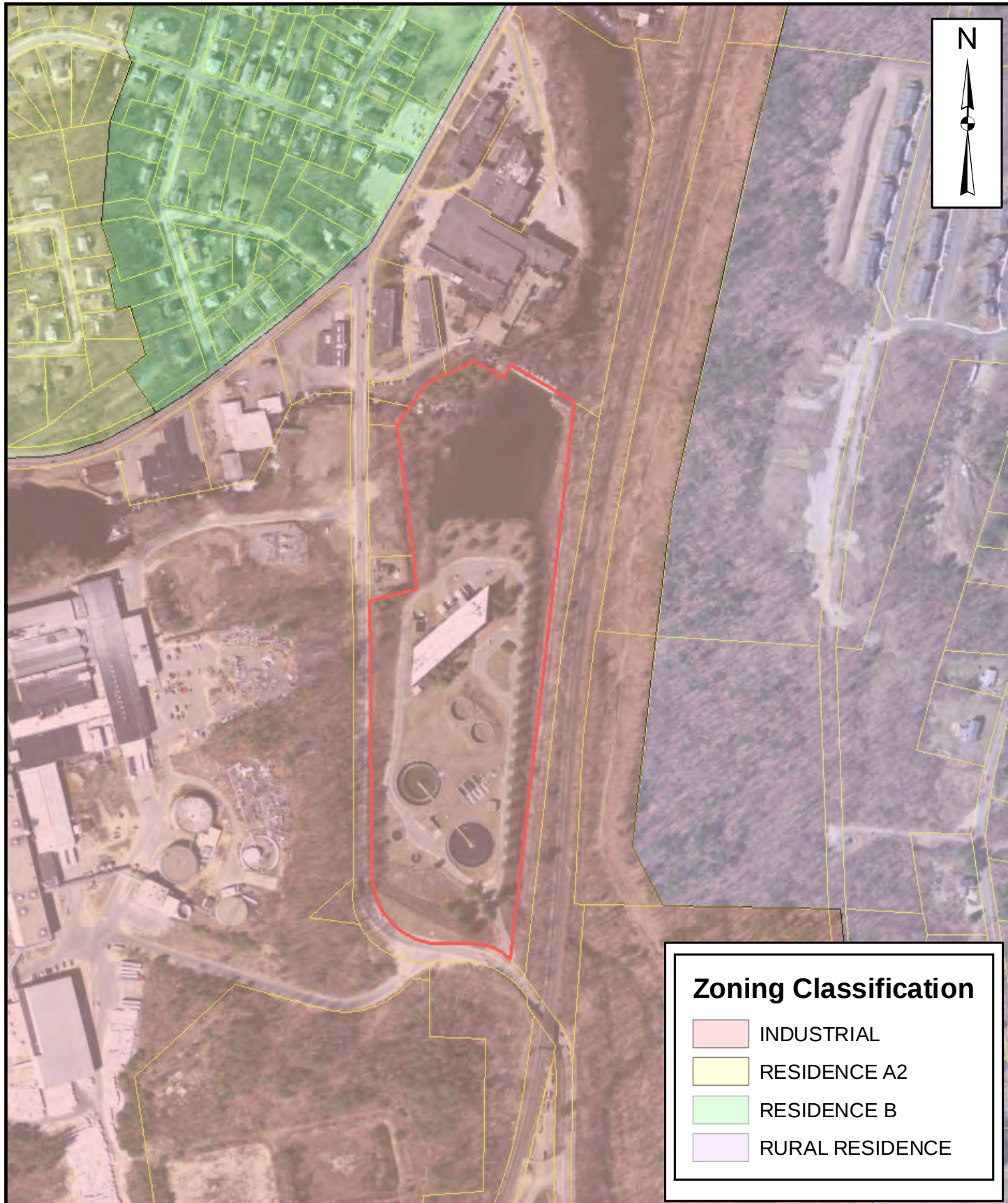


FIGURE 3
CITY OF FITCHBURG, MASSACHUSETTS
FITCHBURG ORGANICS-TO-ENERGY PROJECT

ZONING MAP



- | | |
|--|---|
|  Parcel |  NHESP Priority Habitats of Rare Species |
|  MA Towns |  NHESP Estimated Habitats of Rare Wildlife |
|  Perennial Stream |  ACECs |
|  Intermittent Stream |  DEP Wetlands |
|  Pond, Lake, Ocean |  100-Year Flood Zone |
|  Reservoir | |
|  BioMap2 Core Habitat | |
|  BioMap2 Critical Natural Landscape | |
|  NHESP Certified Vernal Pools | |
|  Potential Vernal Pools | |

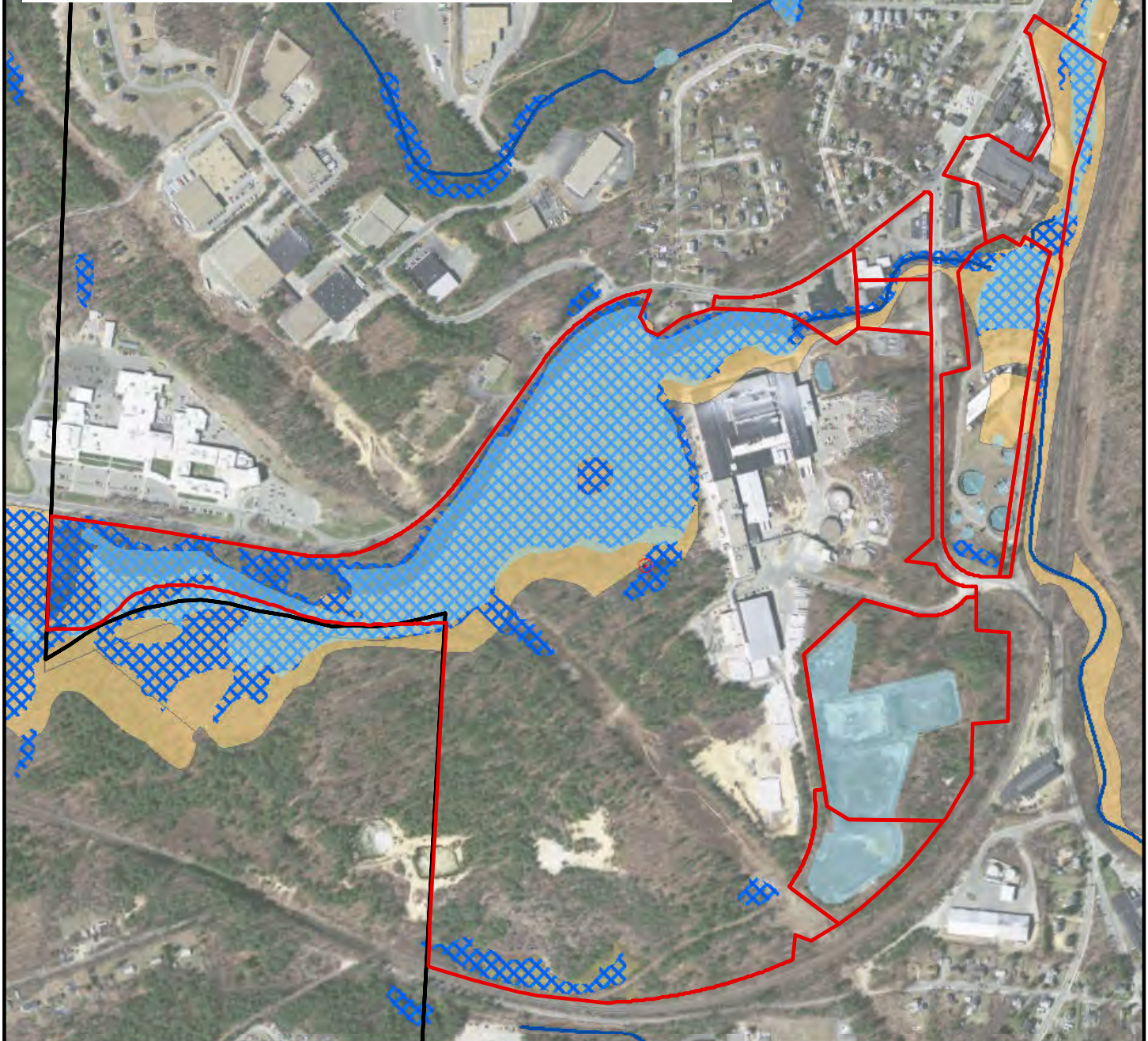
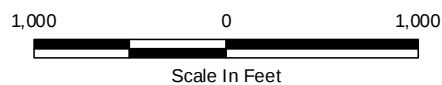


FIGURE 4
CITY OF FITCHBURG, MASSACHUSETTS
FITCHBURG ORGANICS TO ENERGY PROJECT
ENVIRONMENTAL RESOURCES MAP



Path: T:\Water\W\FHGIS - Constraints Mapping\Fitchburg\Anaerobic digester\Figure 2 - Human Receptor.mxd User: ShimickD Saved: 5/7/2015 11:27:24 AM Opened: 5/7/2015 11:28:00 AM

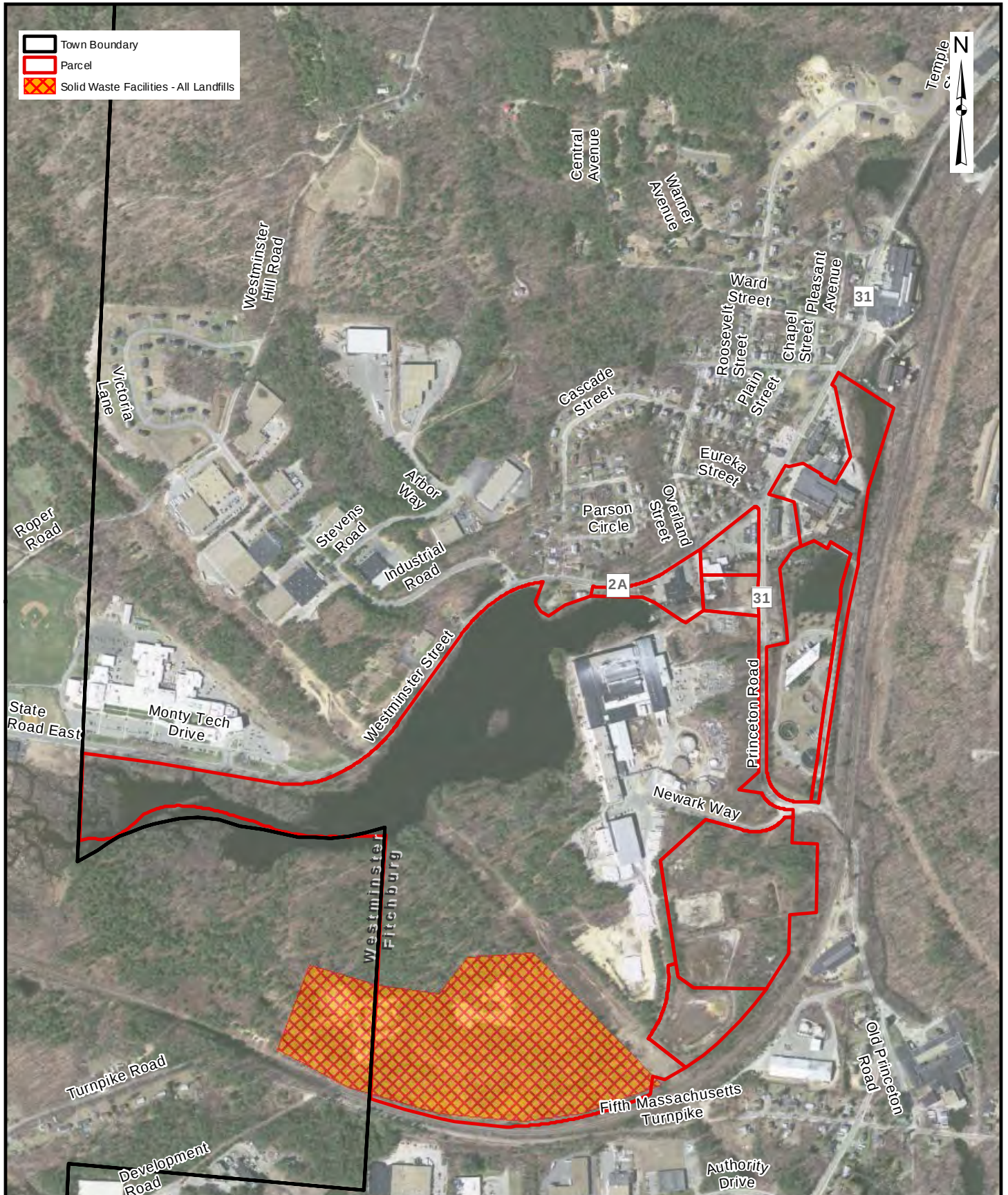
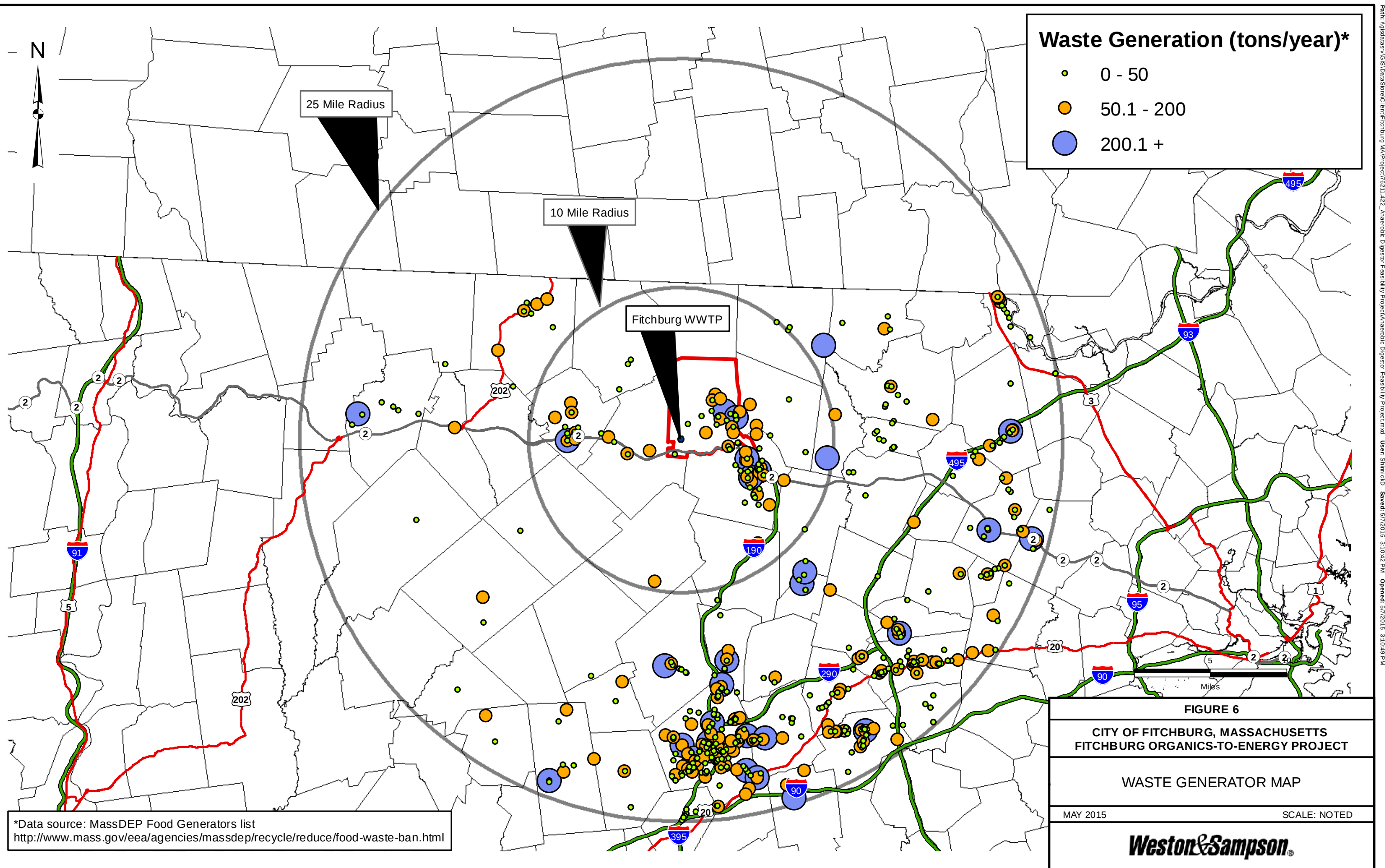
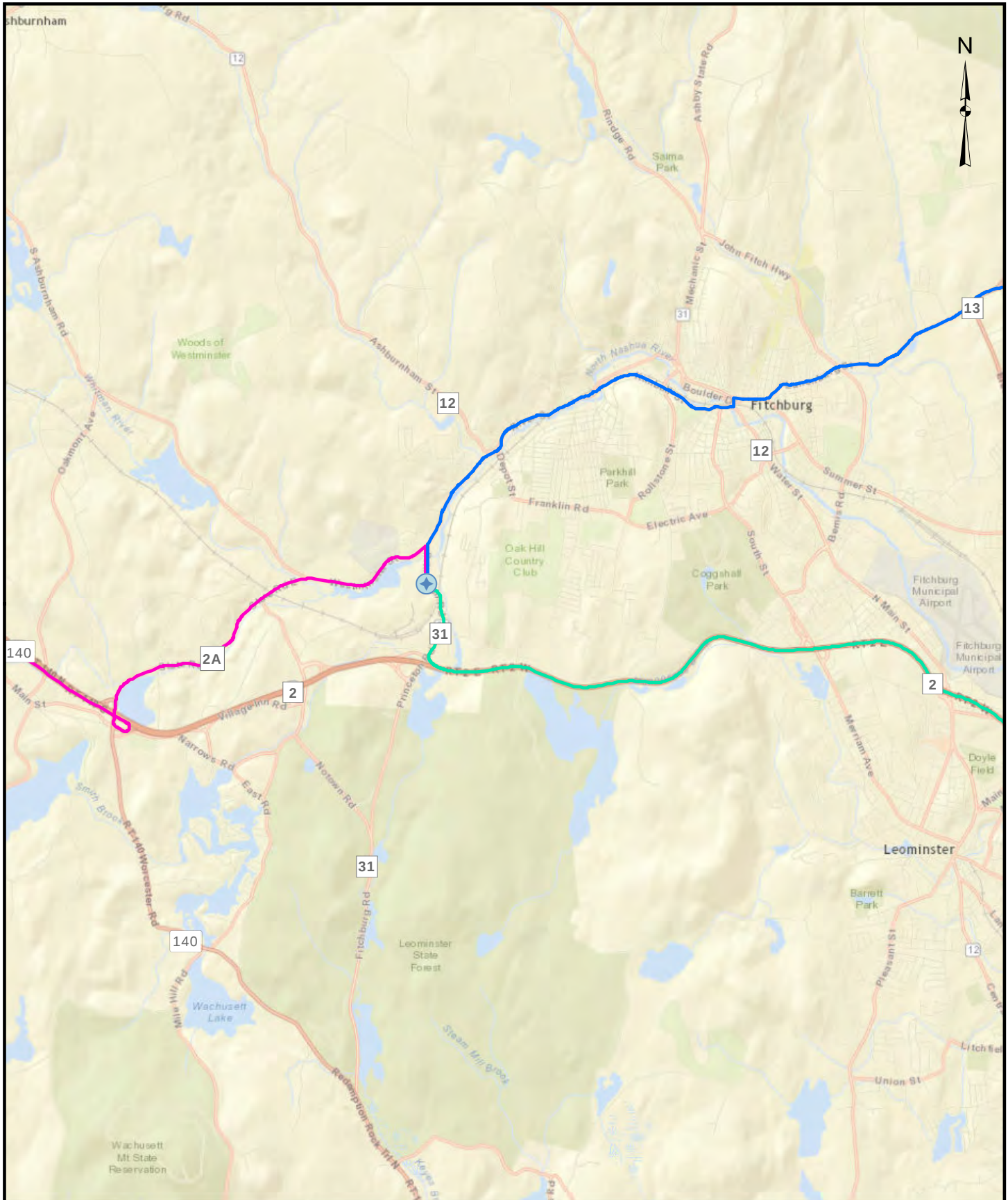


FIGURE 2
Fitchburg, MA
Anaerobic Digester Project
Nearby Licensed or Registered Facilities

840 0 840
Scale in Feet

Weston & Sampson





Legend

Site 230 Princeton Rd
Fitchburg, MA 01420

Route 1

From Rte. 13

Route 2

From Rte. 2 N Exit 28

Route 3

From Rte. 2 S Exit 25

FIGURE 7
CITY OF FITCHBURG, MASSACHUSETTS
FITCHBURG ORGANICS TO ENERGY PROJECT
POTENTIAL TRUCK ROUTES TO SITE

8,000 0 8,000
Scale In Feet

Weston & Sampson

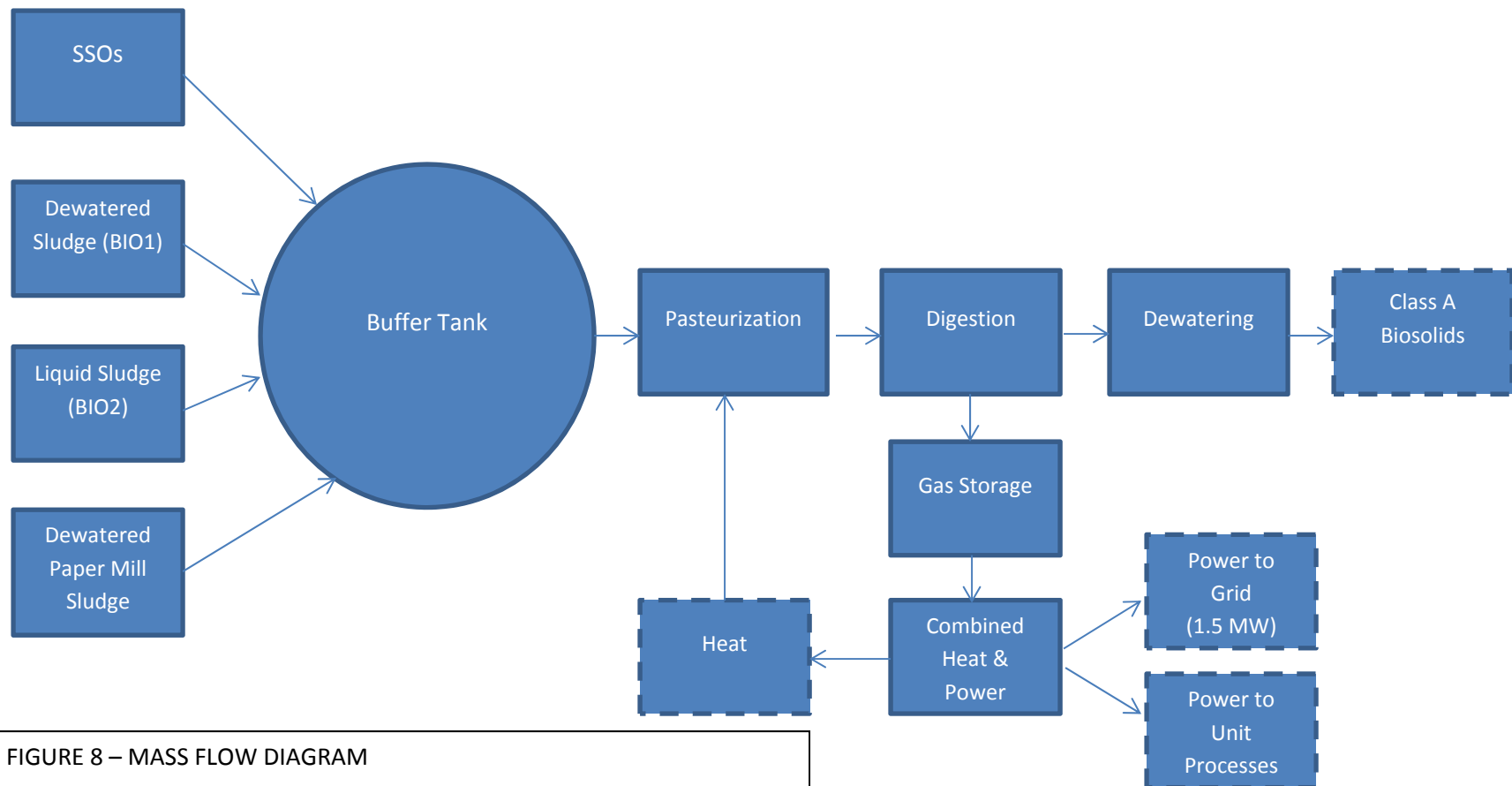
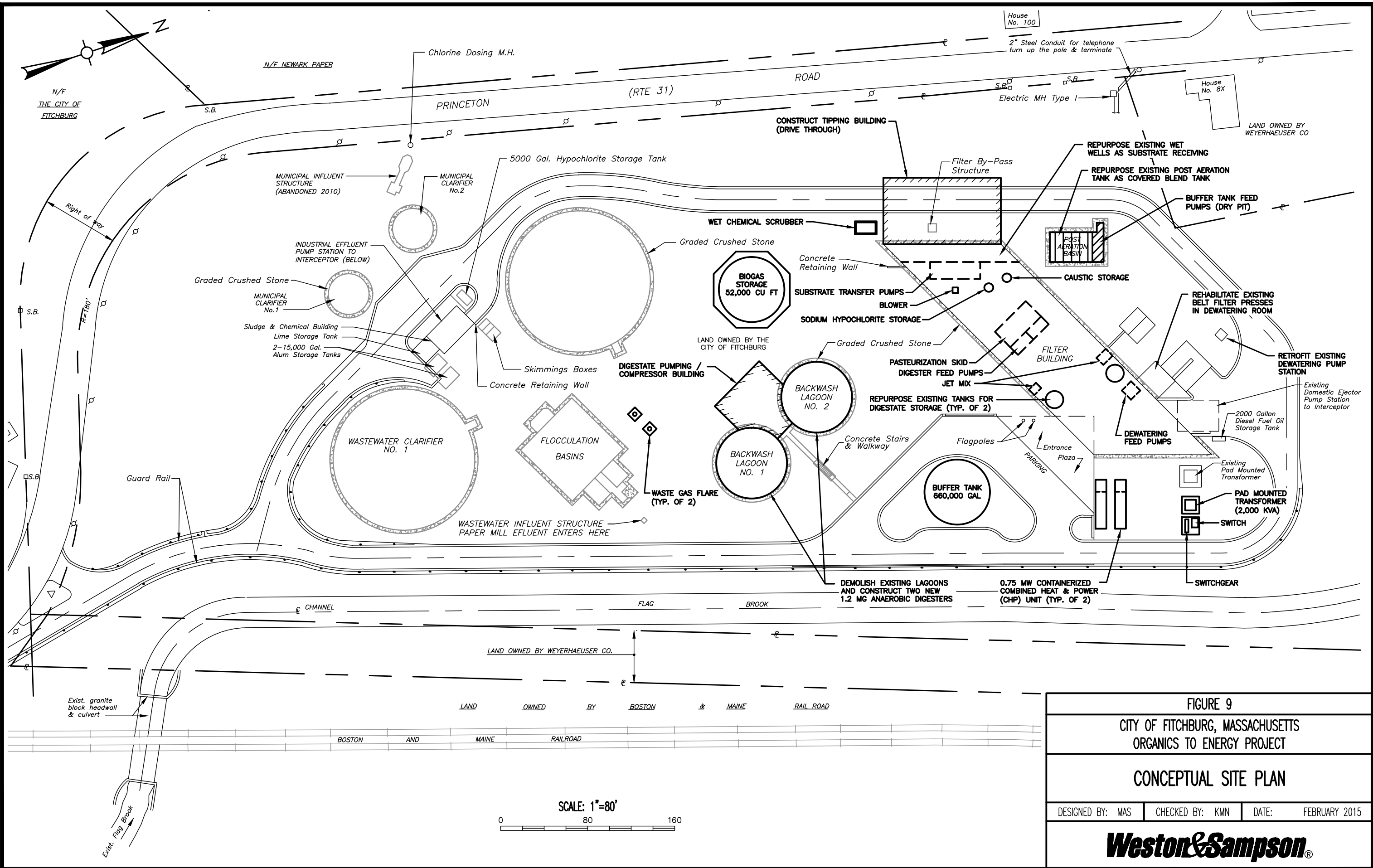


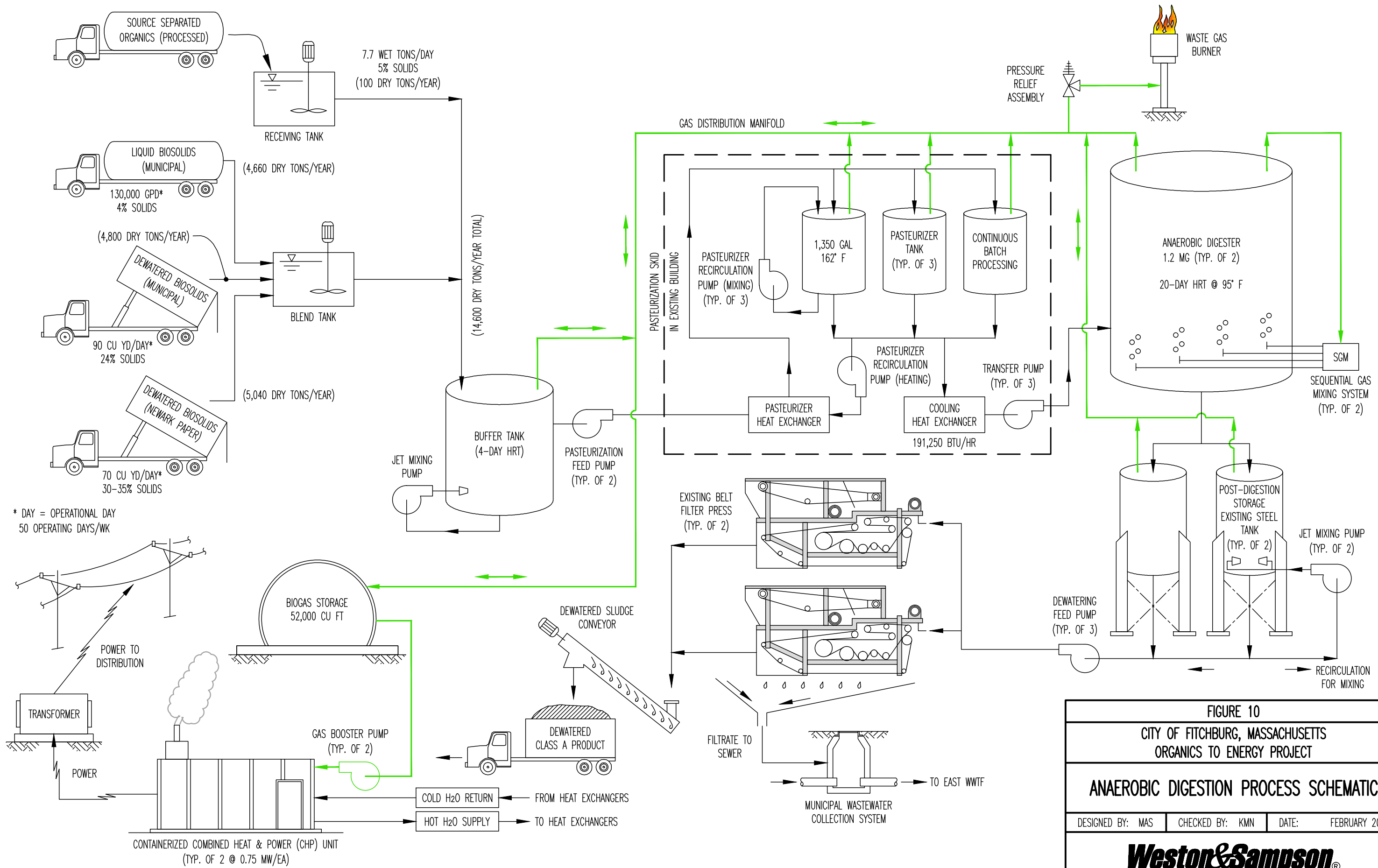
FIGURE 8 – MASS FLOW DIAGRAM

Figure 8 is included and presented as a general Mass Flow Diagram for an anaerobic digestion process. The Mass Flow Diagram would typically depict specific numerical information on the Mass and Energy Balance for the project. A typical vendor who provides this proposed type of process equipment has indicated that the Mass and Energy Balance for the proposed project has been completed and confirms the project as proposed to be functional. However, since the proposed process tends to be proprietary in nature, vendors have declined to provide the specific information on our proposed project.



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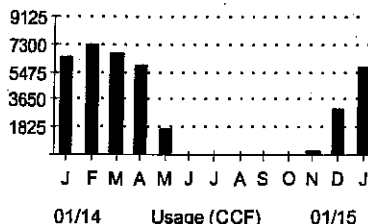
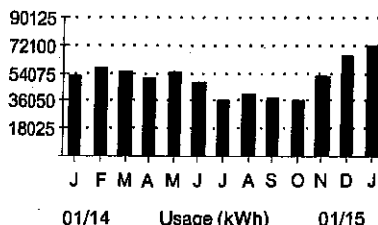
O:\Fitchburg MA\Anaerobic Digester\CADD\Design\Flow Schematic.dwg

APPENDIX B

West Plant Utility Bills

AMOUNT DUE \$9,567.25

ACCOUNT NUMBER 3000217-3000208 BILL DATE 1/08/15 PLEASE PAY BY 3/04/15 NEXT METER READING DATE 2/04/15



MESSAGES

Effective 1/01/15, electric rates will decrease by \$0.01768 per kWh due to decreases in reconciling rate components included in the delivery charge. The demand rate will decrease by \$2.56 per kW. Basic Service customers will see bill decreases ranging from 9.7% to 11.8%.

compared to the prior month, depending upon rate class and usage.

Jan 1, a Net Metering Recovery Surcharge of \$0.00136 per kWh will be included in the distribution charge for billing purposes. This change approved by the M.D.P.U recovers the cost for net metering credits paid to customers with on-site generation facilities.

Jan 1, a Net Metering Recovery Surcharge of \$0.00114 per kWh

230 PRINCETON RD, FITCHBURG

WEST

Page 1 of 2

AT A GLANCE

AMOUNT OF LAST BILL	\$7,666.73	TOTAL CURRENT CHARGES	\$9,567.25
PAYMENT - THANK YOU 01/05/15	(\$7,666.73)	PLEASE PAY AMOUNT	\$9,567.25
YTD BUDGET AMOUNT	\$0.00	YTD ACTUAL AMOUNT	\$0.00

METER NUMBER	METER PREVIOUS	METER READING PRESENT	METER CONSTANT	METERED USAGE	NUMBER OF DAYS	METERED DEMAND	RATE CODE
150641	263	293	2400	72000.00 kWh	32		G2
150641					32	124.50 kW	G2
MA0025	12408	12978	10.00	5700.00 CCF	32		G42

LAST BILL AMOUNT
BALANCE FORWARD

\$7,666.73
\$0.00

ELECTRIC SERVICE DISTRIBUTION

PERIOD 12/05/14 - 01/06/15

CUSTOMER CHG				10.00
DEMAND CHG	120.76 kW	x	\$8.57999	1,036.12
ENERGY CHG	69840.00 kWh	x	\$0.03432	2,397.38
ENERGY CONSERVATION CHG	69840.00 kWh	x	\$0.00250	174.60
RENEWABLE ENERGY CHG	69840.00 kWh	x	\$0.00050	34.92
TRANSFORMER CREDIT	120.76 kW	x	(\$0.17000)	(20.53)
TRANSITION				
DEMAND CHG	120.76 kW	x	\$2.15998	260.84
ENERGY CHG	69840.00 kWh	x	\$0.00962	672.12
TRANSMISSION				
DEMAND CHG	120.76 kW	x		0.00
ENERGY CHG	69840.00 kWh	x	\$0.02074	1,448.99
Total Current EL Charges				\$6,014.44

ELECTRIC SUPPLIER SERVICE SUPPLIER SERVICES

PERIOD 12/05/14 - 01/06/15

DIRECT ENERGY BUSINESS				
ENERGY CHARGES	69840.00 kWh	x	0.00	0.00
Total Current SS Charges				\$0.00

GAS SERVICE

PERIOD 12/05/14 - 01/06/15

METERED USAGE	5700.00 CCF x 1.0290 = 5865.30 THERMS			
DELIVERY CHARGES				
CUSTOMER CHARGE				120.00

West Gas 3513.87
Elec 6053.38
7567.25

TO AVOID INTEREST CHARGES OF .8200% PER MONTH, EFFECTIVE 2/01/14 TOTAL CURRENT BILL \$9,567.25
PAYMENT MUST BE RECEIVED BY 5 PM ON 3/04/15 TOTAL AMOUNT DUE \$9,567.25

Questions about your bill? Visit www.unitil.com or call: (888) 301-7700. More information on reverse.

PLEASE PAY UPON RECEIPT AND BY DATE LISTED BELOW.

PAYMENT INFO

RECEIVED JAN 1 2 2015

000529 000001687



WEST WASTEWATER
CITY HALL
166 BOULDER DR
FITCHBURG MA 01420-3168



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ACCOUNT NUMBER

3000217-3000208

AMOUNT DUE	PLEASE PAY BY	AMOUNT PAID
\$9,567.25	3/04/15	

UNITIL
P.O. BOX 981010
BOSTON, MA 02298-1010



80030002170030002080009567256

AMOUNT DUE \$9,567.25

ACCOUNT NUMBER 3000217-3000208 BILL DATE 1/08/15 PLEASE PAY BY 3/04/15 NEXT METER READING DATE 2/04/15

230 PRINCETON RD, FITCHBURG

WEST

Page 2 of 2

AT A GLANCE

AMOUNT OF LAST BILL	\$7,666.73	TOTAL CURRENT CHARGES	\$9,567.25
PAYMENT - THANK YOU 01/05/15 (\$7,666.73)		PLEASE PAY AMOUNT	\$9,567.25
YTD BUDGET AMOUNT	\$0.00	YTD ACTUAL AMOUNT	\$0.00

DISTRIBUTION CHG-FIRST	500.00	Therms	x	\$0.3303	165.15
DISTRIBUTION CHG-NEXT	5365.30	Therms	x	\$0.4249	2,279.72
DISTRIBUTION ADJUSTMENT	5865.30	Therms	x	\$0.1618	949.00
Total Current GA Charges					\$3,513.87

GAS SUPPLIER SERVICE PERIOD 12/05/14 - 01/06/15

SUPPLIER CHARGES				
GA DIRECT ENERGY MARKET				
SUPPLIER CHARGE	5865.30	Therms	x	0.00
Total Current GS Charges				\$0.00

OUTDOOR LIGHT PERIOD 12/05/14 - 01/06/15

CURRENT CHARGES OUTDOOR				38.94
Total Current OL Charges				\$38.94

OL SUPPLIER SERVICE PERIOD 12/05/14 - 01/06/15

CURRENT CHARGES SUPPLIE				0.00
Total Current SO Charges				\$0.00

MESSAGES

Effective 1/01/15, electric rates will decrease by \$0.01768 per kWh due to decreases in reconciling rate components included in the delivery charge. The demand rate will decrease by \$2.56 per kW. Basic Service customers will see bill decreases ranging from 9.7% to 11.8%.

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Jan 1, a Net Metering Recovery Surcharge of \$0.00114 per kWh

TO AVOID INTEREST CHARGES OF .8200% PER MONTH, EFFECTIVE 2/01/14, TOTAL CURRENT BILL \$9,567.25
PAYMENT MUST BE RECEIVED BY 3 PM ON 3/04/15 TOTAL AMOUNT DUE \$9,567.25

Questions about your bill? Visit www.unitil.com or call: (888) 301-7700. More information on reverse.

PLEASE PAY UPON RECEIPT AND BY DATE LISTED BELOW.

PAYMENT INFO

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ACCOUNT NUMBER

3000217-3000208

AMOUNT DUE	PLEASE PAY BY	AMOUNT PAID
\$9,567.25	3/04/15	



UNITIL
P.O. BOX 981010
BOSTON, MA 02298-1010



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APPENDIX C

Site Photos



Photo 1: Klampress® belt filter press (1 of 2)
3/6/2014



Photo 2: Klampress® belt filter press (2 of 2)
3/6/2014



Photo 3: Gorbel® 1-ton overhead crane over belt filter presses
3/6/2014

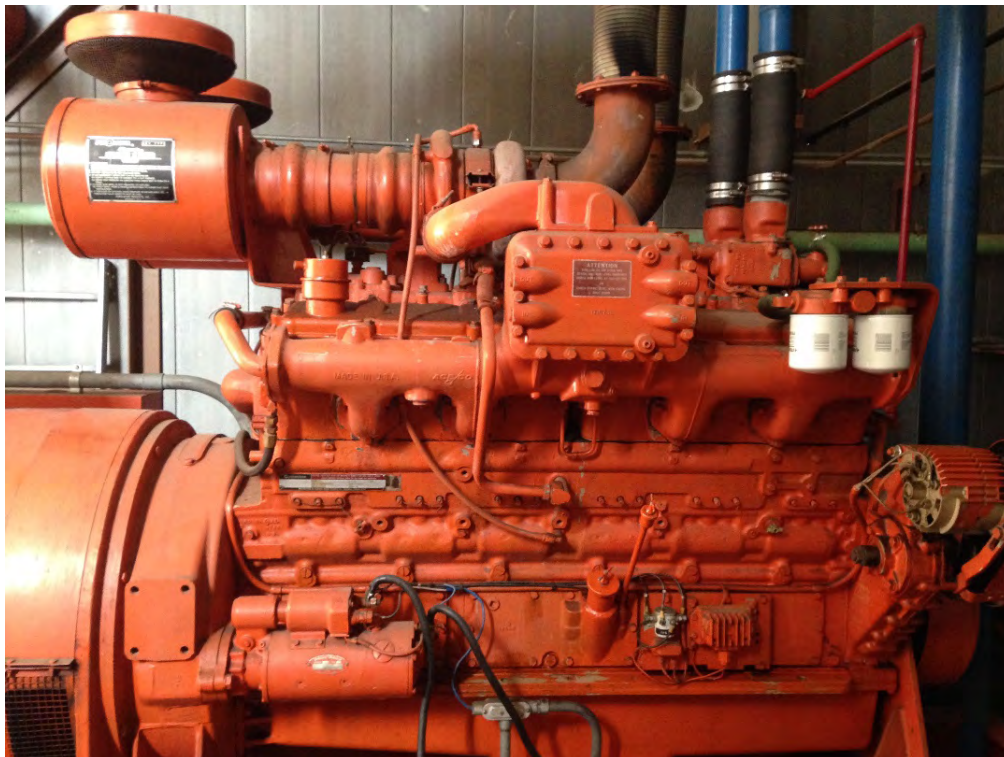


Photo 4: Cummins 400 kW diesel standby electric room of filter building
3/6/2014



Photo 5: Main motor control center in electrical room of filter building
3/6/2014



Photo 6: Steel sludge storage tank (typical 1 of 3)
3/6/2014



Photo 7: Steel carbon storage vessel (typical 1 of 12)
3/6/2014



Photo 8: Filter gallery
3/6/2014



Photo 9: Filter pump, note corrosion and poor condition
3/6/2014

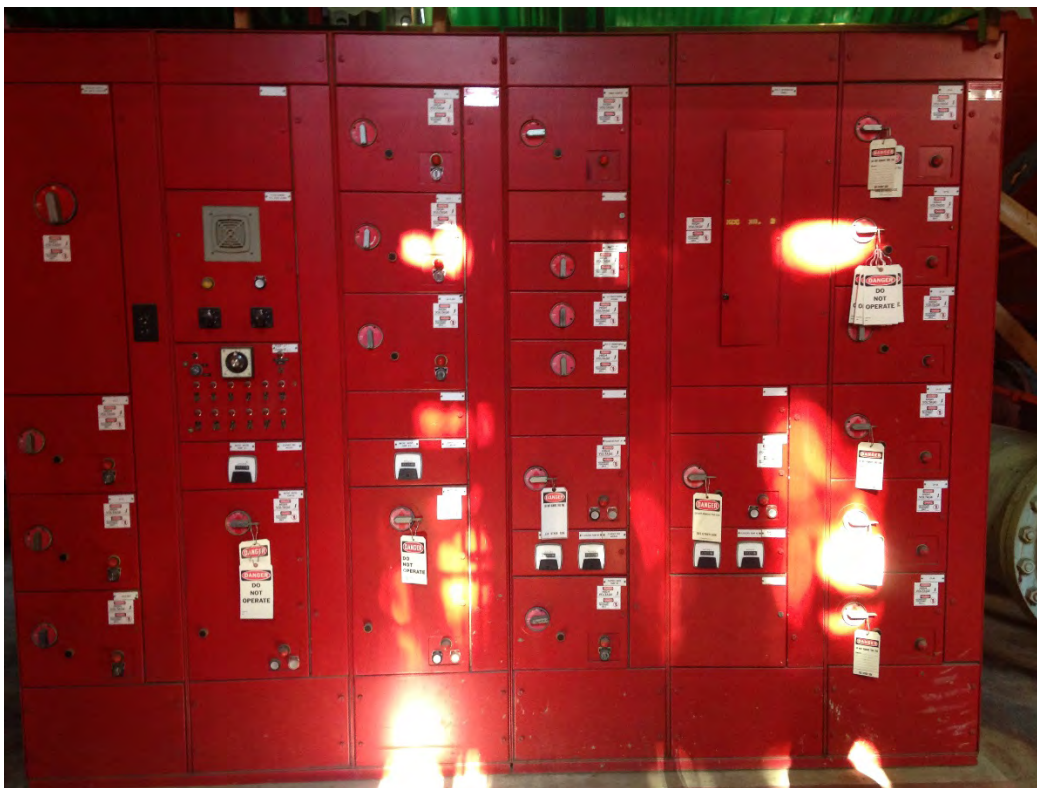


Photo 10: Motor control center located on west end of filter building
3/6/2014



Photo 11: Filter gallery
3/6/2014



Photo 12: Vertical turbine pumps over wet wells on west end of filter building
3/6/2014



Photo 13: Filter building, facing west. Note transformer and 1,000 gallon AST
3/6/2014



Photo 14: East entry of filter building, facing north
3/6/2014



Photo 15: Front of filter building, facing northwest
3/6/2014



Photo 16: Existing access road, facing south
3/6/2014



Photo 17: Filter building, facing northwest
3/6/2014



Photo 18: Filter building, facing northwest
3/6/2014



Photo 19: Filter building, facing north. Note existing conveyor and hopper garage
3/6/2014



Photo 20: Existing access road, facing west-southwest
3/6/2014



Photo 21: Existing gas line, facing north

3/6/2014



Photo 22: Rear of filter building, facing east-southeast

3/6/2014



Photo 23: Post-aeration basin and effluent structure, facing south
3/6/2014



Photo 24: Existing access road, facing south
3/6/2014



Photo 25: Filter bypass structure, facing east
3/6/2014



Photo 56: Existing Access Road, facing north
3/6/2014



Photo 27: Existing backwash lagoon, facing north

3/6/2014

APPENDIX D

Anaerobic Digester Process Model



Simulating the Biological and Chemical Processes of Anaerobic Digestion

February 2012

Marcel Stadelmann¹; Benjamin Strehler¹; Cigdem Eskicioglu²; Kevin J. Kennedy²

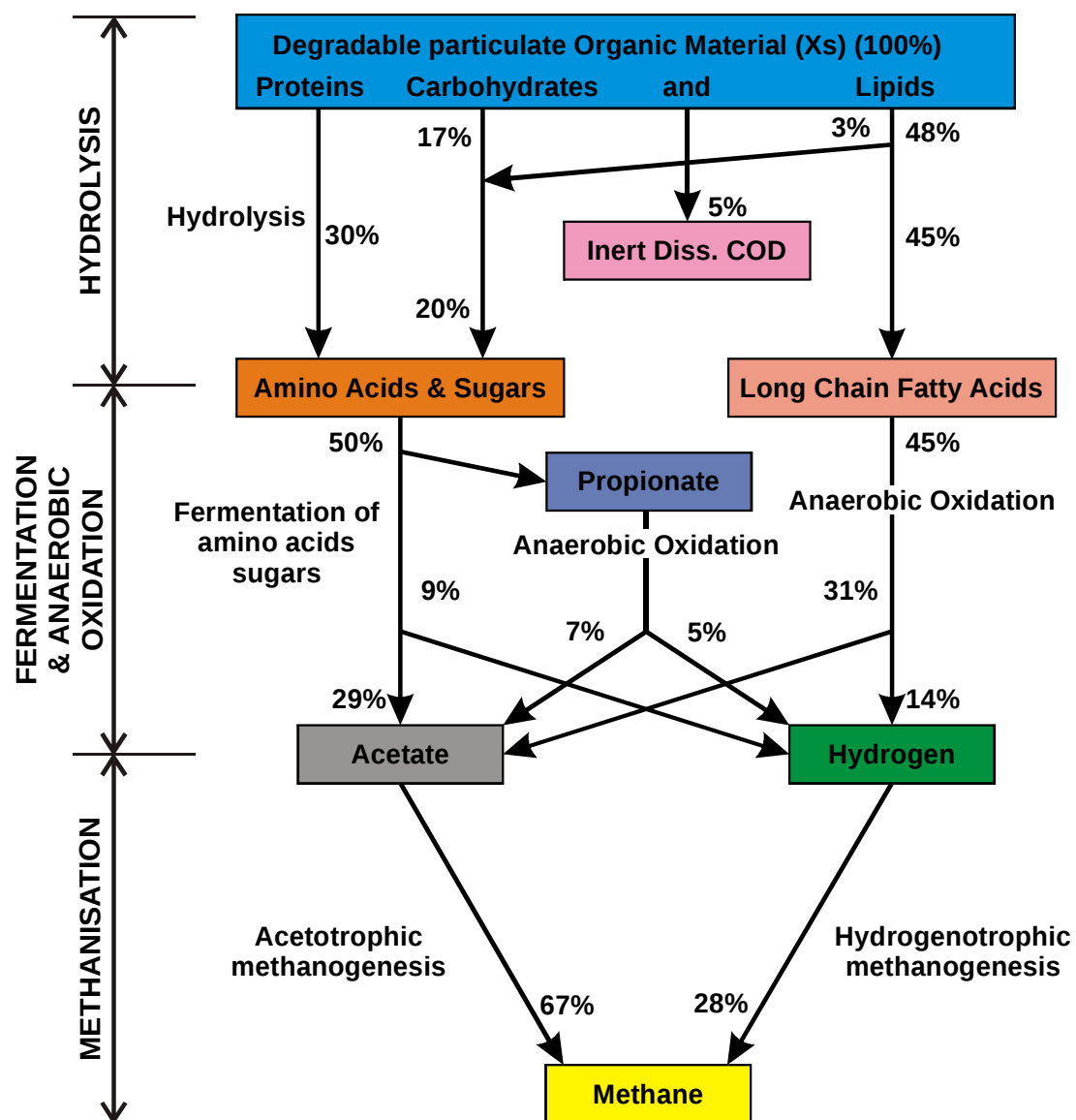
¹Genesys Biogas Inc., Ottawa, ON; ²University of Ottawa, Ottawa, ON

Background

Anaerobic digestion is a highly complex process containing an immeasurable quantity of biological and chemical reactions. These processes all take place at the same time, inducing many interactions between chemicals and microorganisms.

An anaerobic digester is essentially a bioreactor containing several kinds of microorganisms, supplied through the introduction of sewage sludge or manure. Each microorganism has a different anaerobic metabolism and is sensitive to diverse chemical conditions. Consequently, the state of the biology depends on the composition of the substrates and how microorganisms themselves convert the given substrates. An abundance of nutrients and optimal environmental conditions result in the growing and reproduction of microorganisms, which in turn allows for a high conversion rate of substrates. However, if this conversion of substrates results in a lack of nutrients or an increased concentration of a critical chemical, some microorganisms will starve or be inhibited. Therefore, a bioreactor is seen as a closed system where all components, whether chemical or biological, participate in one or more reactions to maintain system equilibrium.

In the fields of microbiology and environmental engineering, significant laboratory research is performed to define the most important processes (Graphic 1). These processes can be replicated by computer simulation.



Graphic 1 : Anaerobic Digestion Processes

Why mathematical simulation?

As a result of relatively low energy prices in Canada, Biogas project developers were forced to use high strength feedstock in order to achieve adequate energy production, ultimately pushing biogas systems to their limits. Consequently, some equilibriums in the digestion process are shifted to a critical level that could endanger the methanization process or even the operation of the entire biogas plant. Predicting these cases of system decline or failure is essential for project financing. Traditionally, predicting either relies on time-consuming and expensive lab-tests.

To reduce costs and time, Genesys Biogas Inc. developed a mathematical model to simulate the anaerobic digestion process in order to predict the biogas yield and stability of the entire digestion process. The model is based on the Anaerobic Digestion Model No.1 (ADM1) of the IWA task group and the simulation is done with a program known as Aquasim. Genesys Biogas Inc. further developed ADM1 with several processes and adjustments concerning high strength substrates.

So far, biogas composition, biogas yields, pH, and levels of organic acids predicted by Aquasim have matched lab results quite closely. Aquasim further allows the identification of ammonia inhibition as a cause for increasing acetate concentration in the lab test.

Reliability of the Anaerobic Digestion Model

The extended ADM was compared to different laboratory results to determine the accuracy of the computer modelling.

BMP Tests

The energy content of a substrate is usually determined by a laboratory batch digestion study, known as a Biochemical Methane Potential test (BMP). Genesys Biogas Inc. simulated BMP tests of two different high strength substrates:

- Substrate 1, a by-product from a milk processing plant.
- Substrate 2, a by-product of a down-stream process in the Bioethanol production.

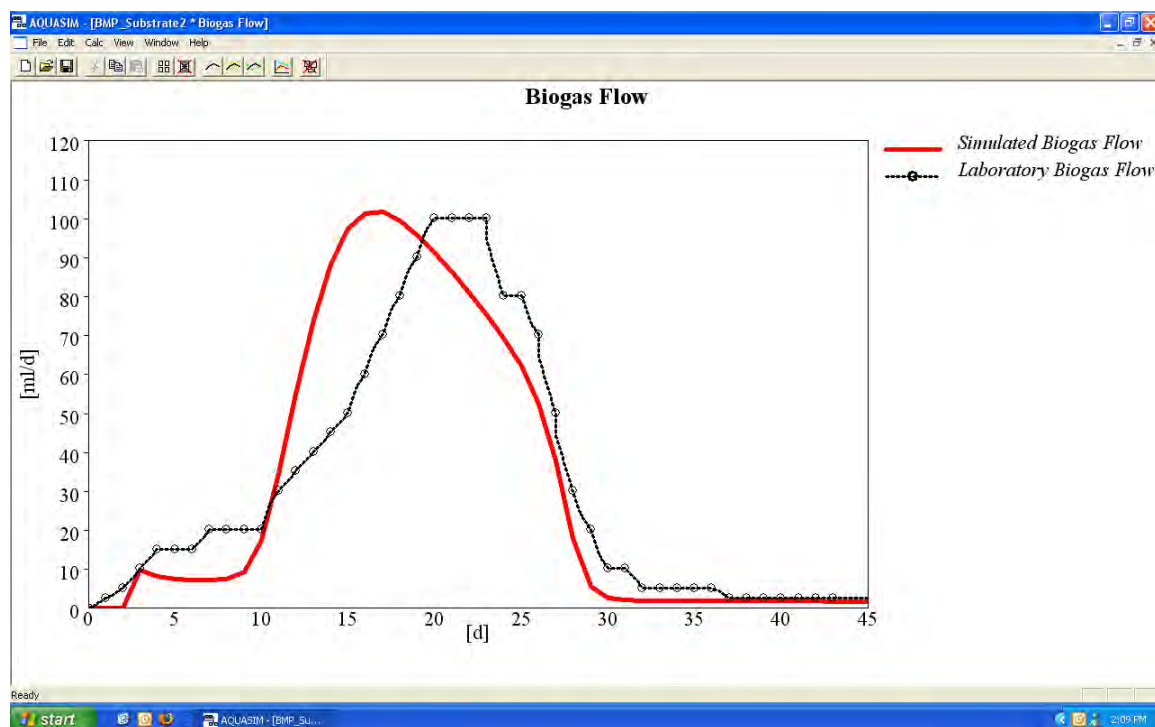


Chart 1: Simulated biogas production compared to measured biogas production in the laboratory for the BMP test of substrate 1.

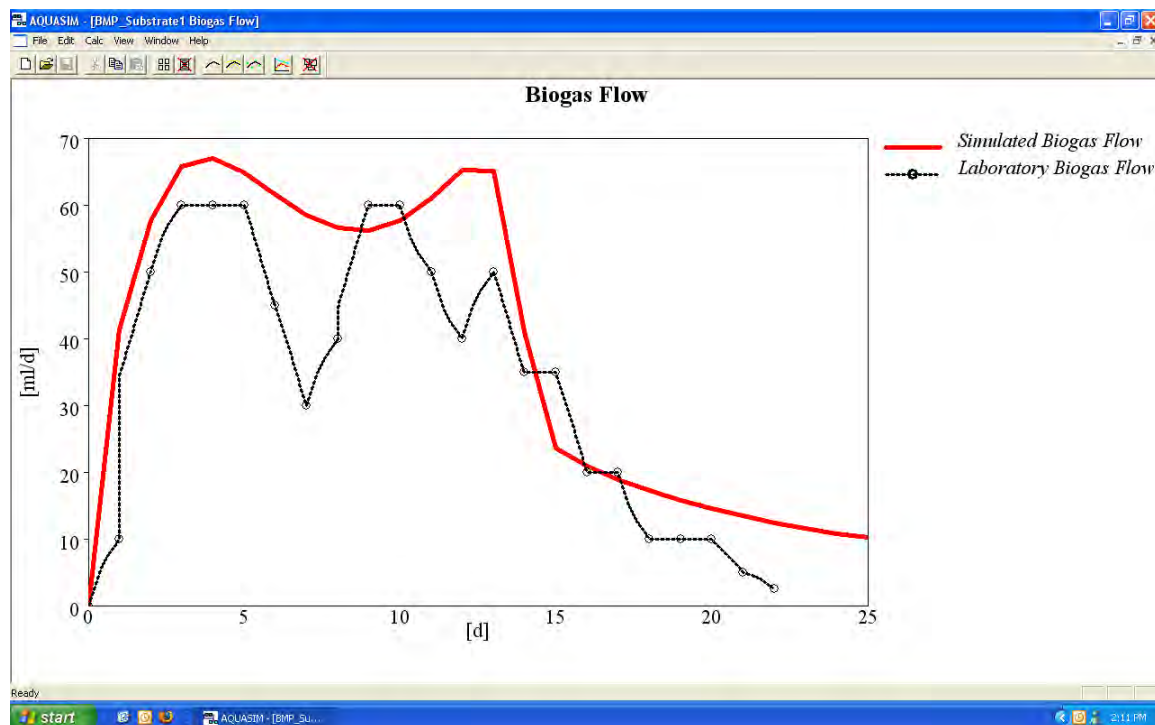


Chart 2: Simulated biogas production compared to measured biogas production in the laboratory for the BMP test of substrate 2.

Semi-Continuous Flow Digestion Study

The model was used to simulate a semi-continuous flow study of a Bioethanol by-product over 45 days.

Prediction of levels of organic acids, biogas yield and pH are compared to lab results.

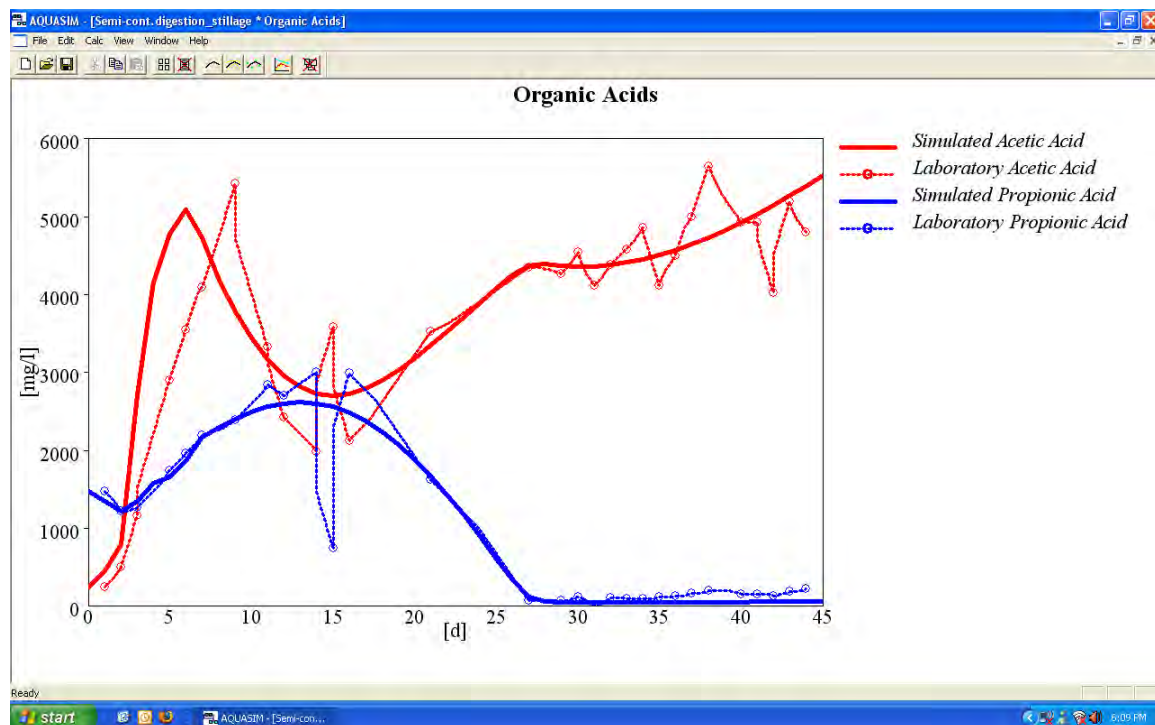


Chart 3: Simulated concentration of acetic acid and propionic acid compared to measured concentrations in the laboratory for the 4L semi-continuous flow reactor over 45 days.

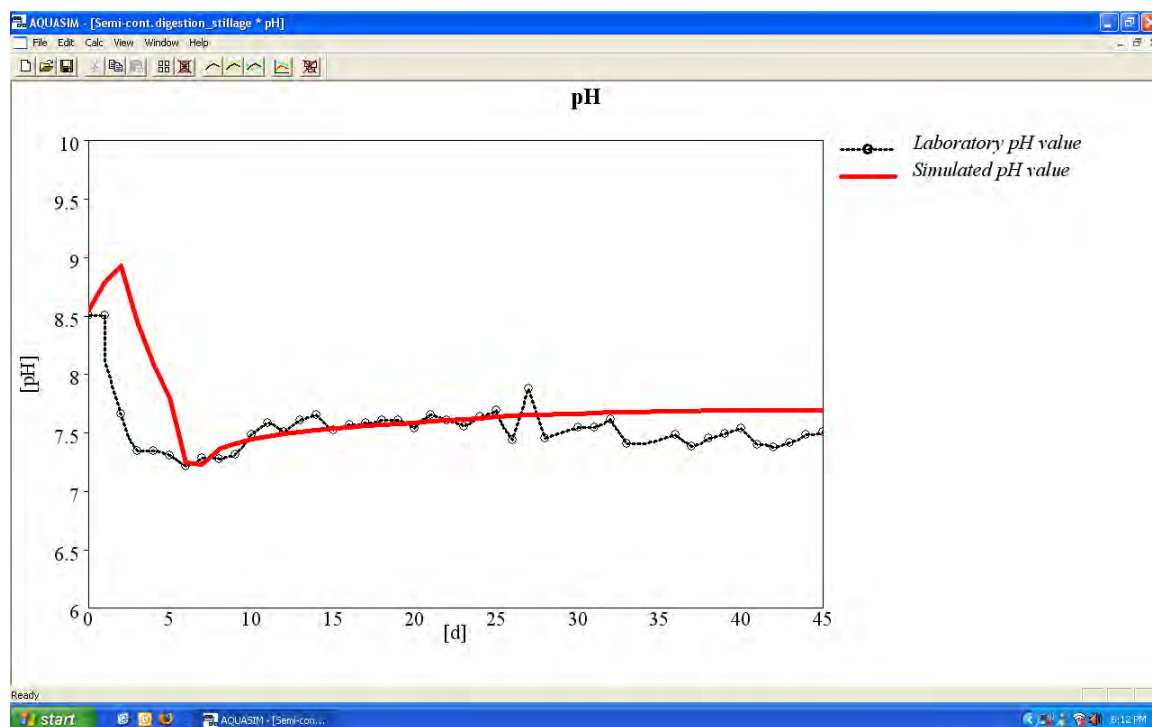


Chart 4: Simulated pH values compared to measured pH in the laboratory for the 4L semi-continuous flow reactor over 45 days.

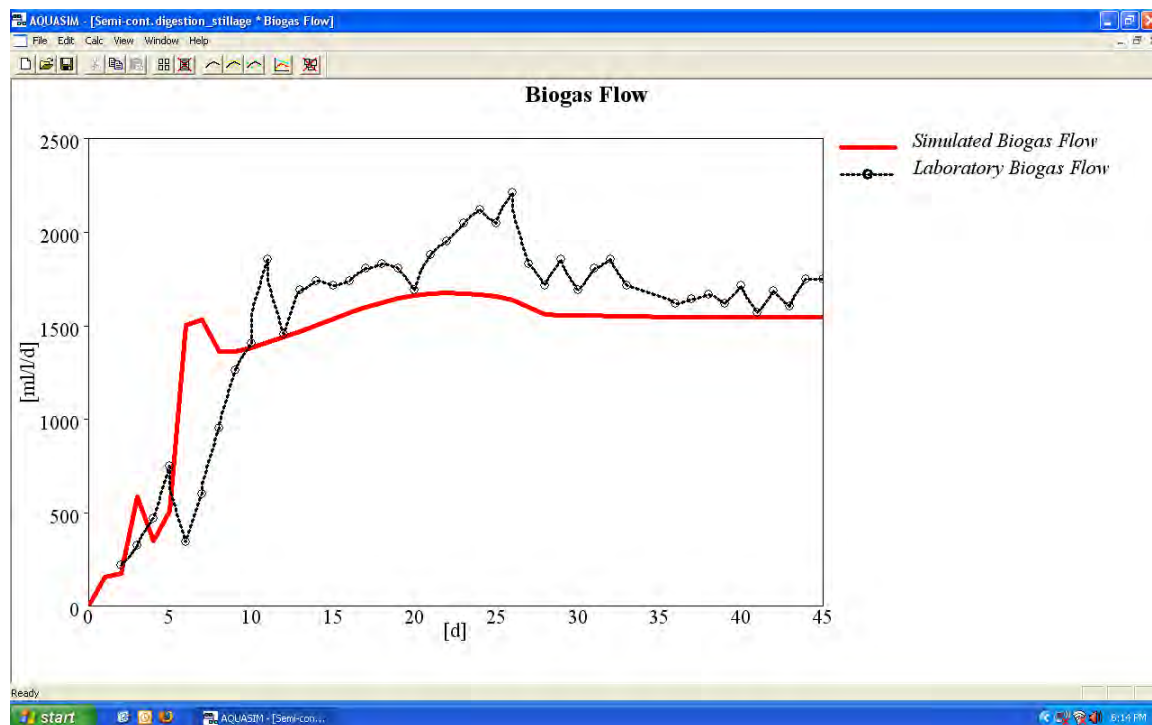


Chart 5: Simulated the biogas flow compared to measured biogas flow in the laboratory for the 4L semi-continuous flow reactor over 45 days.

Monitoring study of Fepro Farm's Biogas plant

Fepro Farm's biogas plant has operated on dairy manure for several years. The process is under steady state conditions.

Based on the available data from the laboratory, values of organic acids and pH were compared to the simulation by Aquasim.

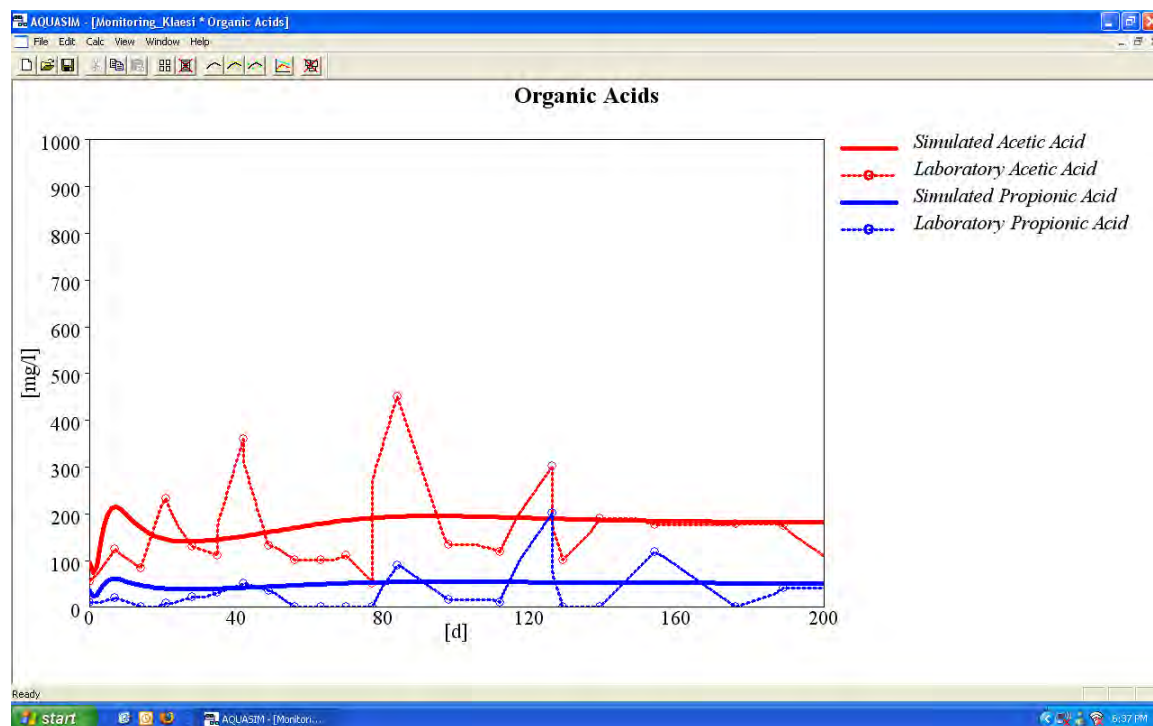


Chart 6: Simulated concentration of acetic acid and propionic acid compared to measured concentration in the laboratory for the Fepro Farm's biogas plant over 200 days.

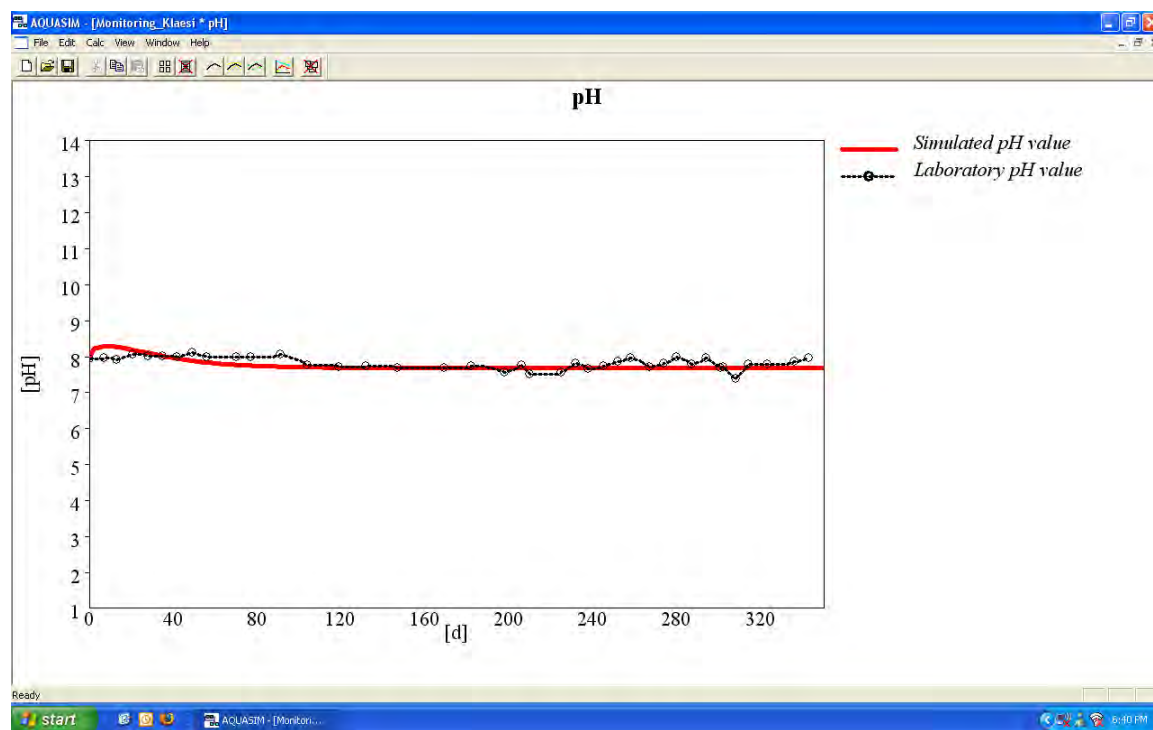


Chart 7: Simulated pH values compared to measured pH in the laboratory for the Fepro Farm's biogas plant over 340 days.

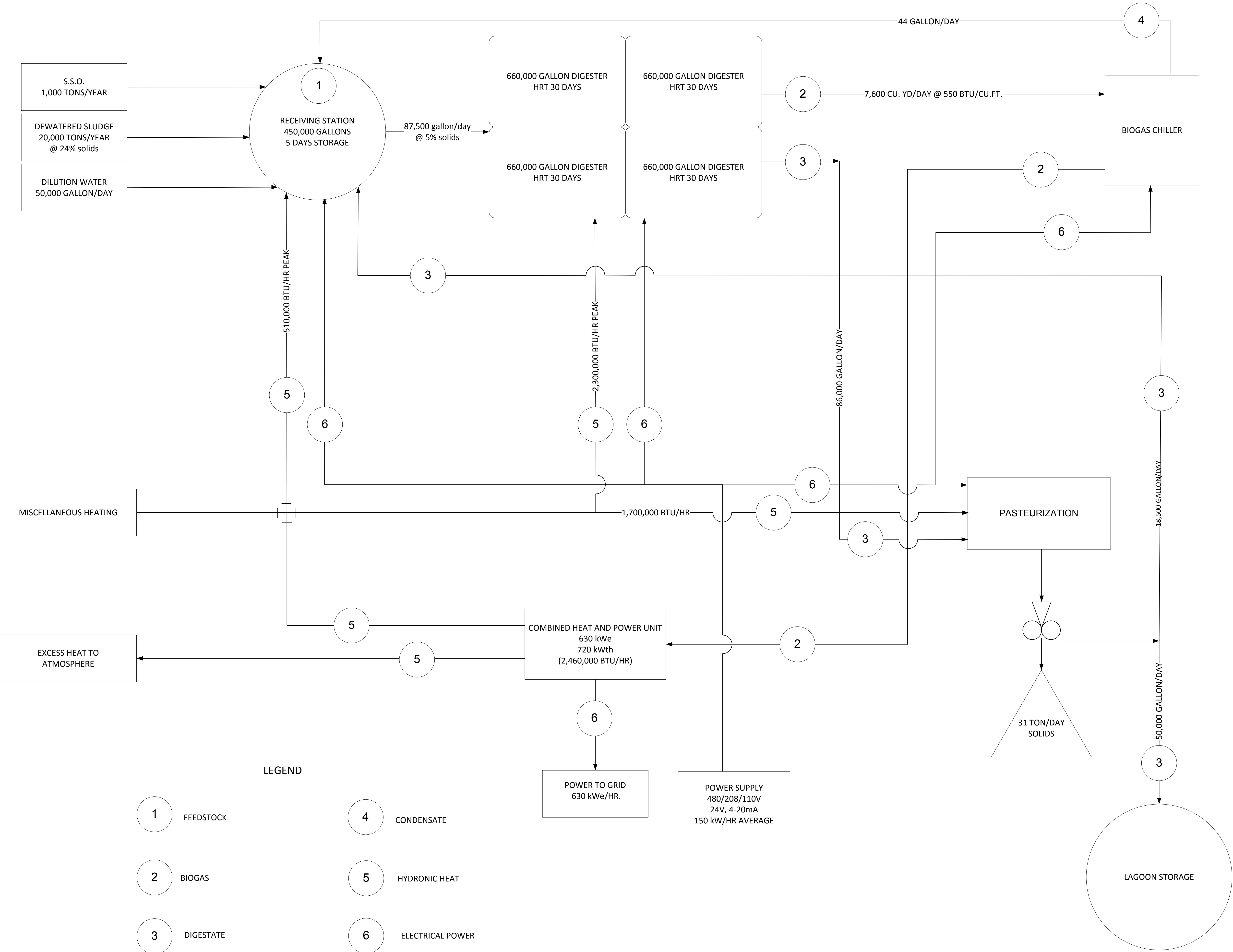
Discussion / Outlook

The modelling of the biological and chemical processes during anaerobic digestion creates a new opportunity to predict the potential and limits of high strength substrates. The enhanced model developed by Genesys Biogas Inc. produces an accurate description of the properties of potential biogas system substrates. This tool provides the opportunity to choose the most useful substrates in your area without time-consuming lab tests. Consequently, it reduces evaluation cost during project planning.

The main benefits for our clients are:

- Evaluation of new substrates with unknown behaviour
- Reduced cost for substrate evaluation
- Time benefit with few or no lab tests
- Process stability verification
- Prediction of critical components
- Establishment of operational safety margins
- Predicting steady state conditions including biogas yields of industrial organic by-products and its interactions with other substrates present
- Performance optimization of existing digesters
- Yield analysis and substrates behaviour of complex interactions in a digester
- Early warning systems for critical digester feed rates and problematic substrates
- Optimizing digester feeding regime, optimizing substrate blending in single stage and multiple stage digestion

Due to the immense number of biological and chemical processes within an anaerobic digester, this enhanced model has a great deal of potential for continued development. As a result, Genesys Biogas Inc. continues to refine the model in order to increase the accuracy of simulation and the diversity of its application.



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1	2014-04-03		JKB
No.	DATE	REVISION	DRAWN
WESTON AND SAMPSON			
MASS FLOW DIAGRAM			
Job#	14C02 - FITCHBURG	Scale:	NTS
Design:	JKB	Checked:	CA
CHFOUR BIOGAS Your Organic Energy Potential Realized. 1390 Prince of Wales Drive, Suite 102, Ottawa, ON K2C 3N6 Tel: 613-224-8308 www.chfour.ca			
APRIL 2, 2014		G 3	

APPENDIX E

PELLC Electrical Interconnection Report and Cost Estimate

POWER ENGINEERS, LLC

Electrical Engineering, Power, Lighting, Technical Studies and Utility Consulting

37 Fox Den Road
Kingston, MA 02364-2150
(508) 612-0382 Phone
(781) 936-8641 Fax
Dave@PowerEngineersLLC.com

**Mr. Stephen Wiehe
Weston & Sampson Engineers
5 Centennial Drive
Peabody, MA 01960**

February 3, 2015

Via Email

**Subject: Report
Electrical Evaluations for DG Feasibility Study
Fitchburg WWTF West Plant (Organics to Energy)**

Dear Steve,

Power Engineers, LLC has completed a preliminary electrical evaluation of the proposed site for the new organics to energy project at the above-named location. Attached please find our detailed report, which can be used as the electrical interconnection section in your DG Feasibility Study.

Also attached is a budgetary cost estimate for interconnection equipment and known utility cost expenses. The estimate includes a planning level budgetary cost estimate for the proposed electrical interconnection from the utility point to the secondary circuit breaker disconnect at the generators. The cost of the generators is not included.

A proposed one-line diagram of the existing facility service entrance and the new generator interconnection is attached for your review and use. The drawing and report are based on using 2 x 750kW generators. Photographs were taken during our 3/2014 site visit.

If you have any questions, or require additional information, please feel free to give me a call.

Sincerely,



David J. Colombo, P.E.
Principal

1.0 Engineering and Interconnection Requirements **West Fitchburg WWTP – Combined Heat & Power (CHP) Project**

1.0.0 Existing Electrical Infrastructure

The existing facility is supplied power from a 13.8kV Unitil distribution line located on Princeton Road (Route 31) in Fitchburg. A three-phase riser is located on the roadway just west of the facility, and a single underground ductbank with one set of 15kV, #1/0Awg primary cable goes from the pole to the outdoor 13.8kV switchgear on site. The existing outdoor switchgear (see Photo#1 below) has two (2) bays, one for a 15kV class circuit breaker, and one for the Unitil primary metering. Next to the 15kV switchgear bays is a 2500/2800/3500kVA transformer, with a 13.8kV primary voltage, and a 4160/2400V secondary voltage. From the outdoor switchgear transformer 4160V side, an underground feeder goes into the adjacent Filter Building to the 4kV switchgear.



Photograph #1 – Outdoor 13.8kV Switchgear and Transformer

The indoor 4kV switchgear has a single main breaker and 3 branch breakers. The branch 4kV breakers feed the 4160V MCC, a 300kVA transformer that supplied 480V MCC#4 and a 2000kVA transformer that supplies the 2000A, 480V switchgear in the main electrical room. The indoor 4kV switchgear is shown in Photograph #2 below.

The 2000A, 480V switchboard has breaker positions for MCC#1 (800A), MCC#2 (400A), MCC#3 (600A) and a 200A feeder to the Emergency Panel, also located in the same room. The 2000A switchboard is shown in Photograph #3 below. The Emergency Panel connects to an existing 400kW/500kVA standby generator.



Photograph #2 – Indoor 4.16kV Switchgear and Transformer



Photograph #3 – Indoor 480V, 2000A Switchboard

The attached one-line diagram E-1 illustrates the existing on-site main electrical system. From the MCC's and other panels, the various loads on site are supplied power. Note that there are no spare breakers in the existing 4kV switchgear.

Existing electricity usage on site from 2005 to the present has been reviewed. The facility has consumed a high of 1,920,000 kWh annually during 2008. This has declined in recent years to just over 600,000 kWh annually. Average demand on site over the last full year's data was approx. 74kW, and a peak recorded demand of 98kW.

1.0.1 Electrical Interconnection Plan

A number of alternative for electrical interconnection plans of the proposed generator were analyzed. The preferred alternative is detailed on the attached one-line diagram and proposed electrical site plan.

Given the age (44 years) of the existing 4kV switchgear inside of the building electrical room, and the lack of spare breakers, a direct interconnection to the 13.8kV equipment on site is recommended. There also be less voltage drop and greater efficiency to interconnect directly to 13.8kV as opposed to 4160V.

The proposed electrical interconnection is to interconnect the new 1.5MW generator directly to Unitil 13.8kV distribution system. The new generator will be two (2) Jenbacher Type 3, 750kW units each. Output is assumed to be at 480V three-phase which is typical for units of this size. A new switchboard would be needed with circuit breakers to protect the generators and their cabling. Upstream of the switchboard would be a 2000kVA transformer to step-up the proposed 480V generator output to 13.8kV for interconnection.

Upstream of the transformer would be the 13.8kV interconnection equipment. It is recommended to tap the existing 13.8kV switchgear on site at the primary metering to allow the new generation to offset the existing WWTP electrical load and have excess generation flow to the grid. Directly after the tap of the existing 13.8kV switchgear, a disconnect switch would be required to be the DG disconnect, accessible and lockable by the local utility per current utility tariffs and DPU requirements. A padmount air-insulated 15kV class, 200A three-phase disconnect with visible and lockable blades would be recommended.

Between the DG disconnect and the 2000kVA generator step up (GSU) transformer would be the DG interconnection interrupting device. This could be a padmount vacuum fault interrupting (VFI) switchgear unit with a utility-grade protective relay. This relay is required by the utility to provide over and under voltage and frequency protection of the DG.

15kV underground cable would interconnect the existing switchgear, new padmount disconnect and new padmount VFI switchgear and then to the primary side of the new generator transformer. All of these pieces of equipment could be located on the lawn area between the existing switchgear and the generators, which are understood to be containerized and located no more than 500 feet from this point.

The point of interconnection will be to the existing Unitil 13.8kV distribution circuit adjacent at the existing switchgear and primary metering.

For a generator rated up to 1500 kW, the current carrying requirement of the 13.8kV power cable circuit will be less than 100 amperes and can be accommodated by three, single conductor, 15 kV class, #1/0 AWG, aluminum cables. New 15kV class cables should be installed in an underground conduit for physical protection rather than being directly buried.

It is anticipated that Unitil will require a 15kV switching device that can be used to automatically disconnect the generator from the Unitil 13.8kV distribution system. Therefore, the interconnection plan includes a 15kV padmounted vacuum fault interrupter (VFI) switch.

The 15kV switch will be capable of normal switching and fault current interruption. The 15kV switch will automatically open upon a signal from protective relays that are required by Unitil for interconnection to their distribution circuit. The protective relays sense abnormal 13.8kV circuit conditions that require the generators to be disconnected from the rest of the 13.8kV circuit. The protective relays that Unitil will likely require include over/under voltage relays, over/under frequency relays, and overcurrent relays, along with zero-sequence ground overvoltage.

The interconnection plan also includes a 13.8kV, three pole, gang-operated, disconnect switch for the manual disconnection and visible isolation of the generator from the Unitil 13.8kV distribution system. Unitil operations personnel will need access to manually open and padlock this disconnect switch in the open position to guarantee that the generator will not energize their 13.8kV distribution circuit while they are working on it or when they otherwise deem it necessary. This manual disconnect would sit next to the padmount vacuum switch.

1.0.2 Electrical Interconnection Details

1.0.2.1 - Unitil Interconnection Requirements

Unitil has specific standards and requirements for the interconnection of distributed generation such as the proposed generator project. The interconnection requirements address electrical system protection, revenue metering, operation, and the configuration of the primary interconnection equipment. Unitil will review the proposed design of the electrical interconnection facilities and will perform analyses to determine the impact of the proposed generation on their electrical distribution system.

Based on the results of Unitil's analysis, certain modifications may be needed within the Unitil distribution system and/or to the interconnection facilities.

1.0.2.2 - Electrical Interconnection Equipment Details

The technical details of the major power system components associated with the electrical interconnection of the generator are described in this section.

1.0.2.2.1 Generator Step-up and Step-down Transformers

The generator step-up and step-down transformers are described by specifying the transformer voltage rating (primary and secondary), power rating (kilovolt-amperes or kVA), winding configuration (primary and secondary), and construction type. For all transformers they shall be three phase, padmount type, oil-filled, self-cooled transformers.

The primary voltage rating of the transformers shall be consistent with the nominal voltage of the Unitil distribution supply circuit to the School which is 13.8kV phase-to-phase for all three phase transformers. To allow flexibility for local voltage deviations that may exist on the Unitil distribution system or within the 13.8kV interconnection circuitry, the transformer primary winding shall be equipped with five (5) fixed taps to change the primary voltage rating +/- 5% from nominal voltage in 2-½ % increments. For the generator step-up transformer, the secondary voltage rating shall be consistent with the generator voltage which is typically in the range of 480 volts.

The three phase power rating of the generator step-up transformer (expressed in kVA) shall be consistent with the generator power rating (expressed in kW) and increased for the allowable generator power factor. Two (2) 750 kW generator operating at a 80% lagging power factor requires a padmount transformer with a minimum continuous rating of 1875 kVA. A 2000kVA transformer would be the next largest standard size.

1.0.2.2.2 - Interconnection Circuit 15kV Class Cables

The generator interconnection require the use of 15kV class interconnection circuit cables. A three phase interconnection circuit of approximately 500 feet is required from the generator step-up transformer to the point of interconnection to the Unitil 13.8kV system at the existing location.

The power cables shall be specified for 15kV class insulation and consist of three, single conductor cables with either aluminum or copper conductors. For a generator power ratings of up to 1500 kW, the size of the power cables shall be a minimum of #1/0 AWG Aluminum. This is typically the smallest size primary cable installed by utilities.

The power cables from the generator step-up transformer to the 13.8kV interconnection point shall be installed in underground conduit. The conduit shall be Schedule 40 PVC that is encased in concrete. At least one (1) additional conduit for communications and control of the generator should also be included in the conduit system.

1.0.2.2.3 - 15kV Padmount Switch

The 15kV switch specified for generator interconnection shall be a three phase device that is capable of interrupting normal generator current and the maximum available fault current as simultaneously contributed by the Unitil distribution system and the generator. A standard interrupting rating for the 15kV switch is 12,000 amperes of symmetrical fault current at a nominal operating voltage of 15kV. The 15kV switch shall be rated for a normal continuous current carrying rating of 200 amperes which is sufficient for this application.

The 15kV Switch could be installed on a new fiberglass or concrete pad within close proximity to the existing Unitil 13.8kV switchgear.

1.0.2.2.4 - Main 13.8kV Disconnect Switch

The main 13.8kV disconnect switch specified for generator interconnection shall be a manually operated, three pole, switch. The switch shall be rated 200 amperes continuous current with a momentary rating of 25,000 amperes. The main 13.8kV disconnect switch provides a visible open point between the generator and the Unitil 13.8kV supply circuit. The operating handle of the main 13.8kV disconnect switch shall be capable of being padlocked by Unitil's lock in the open position. The position of the disconnect switch blades shall be capable of being visually observed to allow positive determination of the electrical connection between the generator and the rest of the 13.8kV system. The 13.8kV disconnect switch may be part of the padmount vacuum switch or a separate free-standing air-insulated switch in its own padmounted enclosure. The main 13.8kV disconnect switch must be accessible to Unitil personnel at all times.

1.0.2.2.5 - Protective Relay Scheme

The required protective relays for the selected generator interconnection option will be specified by Unitil based on the results of their system impact study. Based on a review of the Unitil Interconnection Requirements, it is anticipated that the protective relay scheme for the interconnection of the generator will include over/under frequency relays, over/under voltage relays, and overcurrent relays. All relays shall monitor all three phases and the overcurrent protection should include ground

overcurrent relaying. Upon sensing conditions that exceed allowable operating limits, the protective relay scheme shall send a trip signal to the appropriate tripping devices to open and disconnect the generator from the rest of the distribution system.

Note that since the facility has an existing standby generator, some control wiring may be needed to prevent the new 750kW CHP generators from running during any condition where the existing 400kW standby generator is needed to prevent running these generators in parallel.

1.0.3 Revenue Metering Modifications

The proposed interconnection would make use of the existing current and potential transformers and existing primary revenue meter in the existing switchgear. The meter itself may need to be replaced for a bi-directional meter to measure excess power returned to the grid.

END OF SECTION

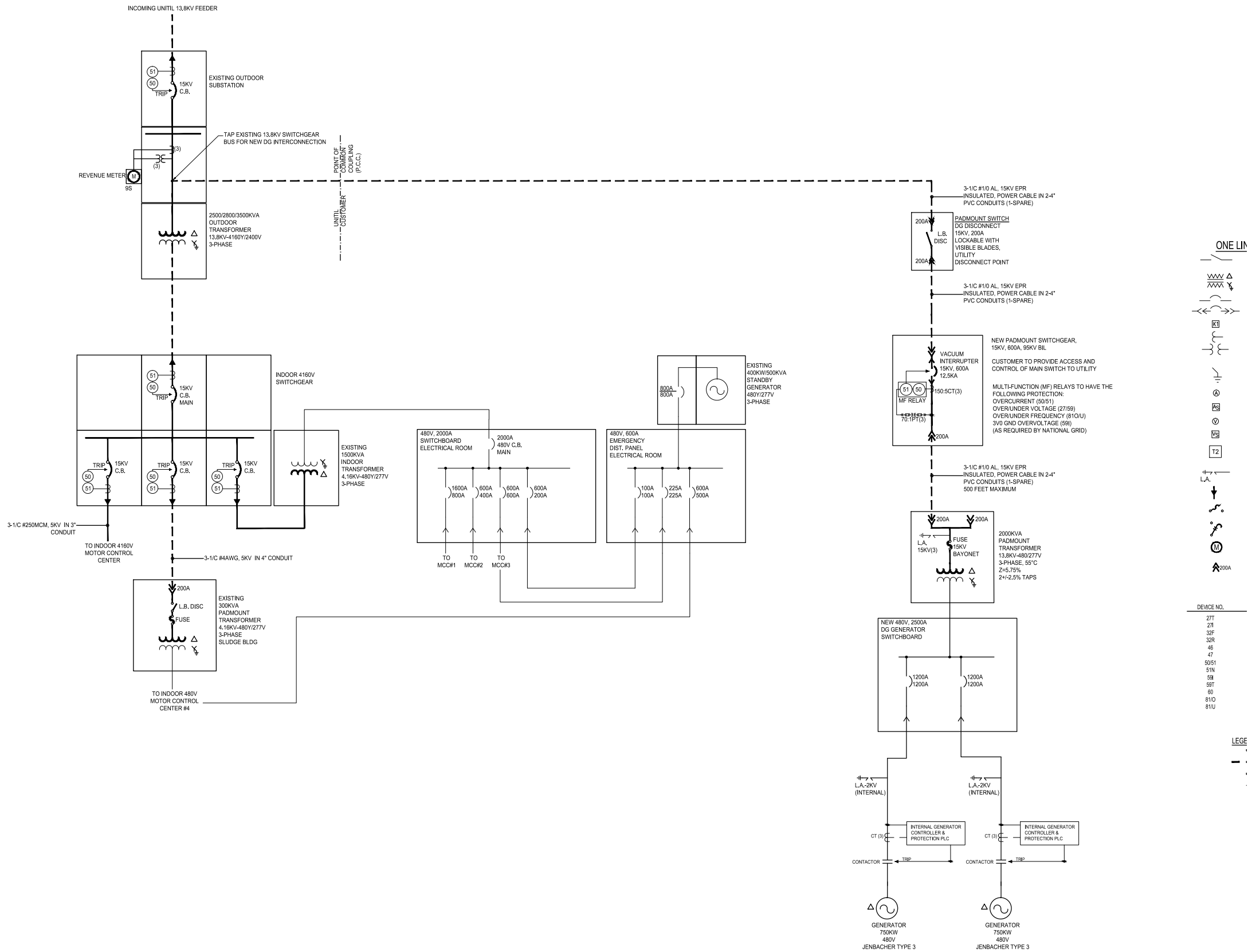
**WEST FITCHBURG WWTF
1.5MW DG GENERATOR PROJECT**

**PROPOSED ELECTRICAL INTERCONNECTION
MATERIALS AND CONSTRUCTION COST ESTIMATE**

Item Description	Quantity	Units	Unit Cost	Total Cost
Excavation, Backfill and Compaction for Primary Cable Ductbank (2-4")	750	Feet	\$ 45.00	\$ 33,750.00
Additional excavation & backfill for 2-2" communications conduits	750	Feet	\$ 25.00	\$ 18,750.00
Installation of Primary and Communications Conduits	1,500	Feet	\$ 11.00	\$ 16,500.00
Concrete Encasement of conduits	750	Feet	\$ 20.00	\$ 15,000.00
Installation of Primary Cable	750	Feet	\$ 35.00	\$ 26,250.00
Concrete Pad for New Padmount Transformer	1	Ea	\$ 2,500.00	\$ 2,500.00
Grounding of Transformer	1	Ea	\$ 1,000.00	\$ 1,000.00
Concrete Pad for New Padmount Switches	2	Ea	\$ 2,500.00	\$ 5,000.00
Grounding of Switch & Meter Pads	2	Ea	\$ 1,000.00	\$ 2,000.00
Installation of Secondary Conduits to Generator Switchboard 8-4" w/2-2" Comm	50	Feet	\$ 125.00	\$ 6,250.00
Installation of Secondary Cable to PV System, 7 sets 3W-600MCM	50	Feet	\$ 238.00	\$ 11,900.00
New Distribution Panel for Aux Equipment	1	Lot	\$ 10,000.00	\$ 10,000.00
Installation of New Electric Manholes	1	Ea	\$ 7,000.00	\$ 7,000.00
Installation of New Communication Handholes (10"x18"x20")	2	Ea	\$ 900.00	\$ 1,800.00
Padmount Transformers 1 x 2000kVA each installed	1	Ea	\$ 25,000.00	\$ 25,000.00
Padmount Primary Disconnect Switch installed	1	Ea	\$ 20,000.00	\$ 20,000.00
Padmount Primary VFI Switchgear with Relay Cabinet installed	1	Ea	\$ 75,000.00	\$ 75,000.00
Tap of Existing 13.8kV Switchgear	1	Lot	\$ 2,500.00	\$ 2,500.00
Site Restoration - Loaming and Seeding (Manhole / Trench area only)	1	Lot	\$ 3,000.00	\$ 3,000.00
SUBTOTAL - CONSTRUCTION			\$	283,200.00
Contractor Markup, Insurance, Permits, etc.	10%	of subtotal	\$	28,320.00
Additional Electrical Equipment and Testing (Control Wiring, Cable Terminations, Start-up, etc.)	10%	of subtotal	\$	28,320.00
Estimated Utility Backcharges (studies, new meter, design, etc.)			\$	75,000.00
Contingency	10%	of subtotal	\$	28,320.00
TOTAL ESTIMATE			\$	443,160.00

NOTES:

1. Cost Estimate is budgetary for planning purposes and does not include permitting, legal, financing and other costs beyond those listed above.
2. Cost Estimate does not include communication cable, as type is unknown at this time.
3. Cost Estimate is for interconnection and does not include Generators or Gen Controls
4. An interconnection to 2 - 750kW generators is assumed.



REVISIONS			REVISIONS		
No.	DATE	DESCRIPTION	No.	DATE	DESCRIPTION
0	2/3/2015	ISSUED FOR REVIEW AND APPROVAL			

PROJ. MANAGER:	
CHIEF DESIGNER:	
REVIEWED BY:	DATE

SEAL

SCALE:	
HORIZ.: NONE	
VERT.:	
DATUM:	
HORIZ.:	
VERT.:	
GRAPHIC SCALE	

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Electrical Engineering, Power, Lighting,
Technical Studies and Utility Consulting

WEST FITCHBURG
DISTRIBUTED GENERATION
PROPOSED 1.5MW

FITCHBURG

APPENDIX F

Economic Analysis

City of Fitchburg
Organics to Energy Feasibility

Table 8-1 Feed Stock Delivery Rates					
Feedstock	Quantity	Units	% of Load	Estimated Unit Fee Disposal (\$'s/unit)	Estimated Revenue (\$'s/year)
SSO	0.3	Dry Tons/Day	0.70%	\$60.00	\$7,000
BIO1	13.2	Dry Tons/Day	32.90%	\$279.00	\$1,344,000
BIO2	12.8	Dry Tons/Day	31.90%	\$279.00	\$1,303,000
PMS	13.8	Dry Tons/Day	34.50%	\$56.70	\$286,000
Total/Average	40.1	Dry Tons/Day	100.00%	N/A	\$2,940,000

City of Fitchburg
Organics to Energy Feasibility

Table 8-2 Opinion of Probable Cost				
Description	Qty	Unit	Unit Cost	Extended Cost
Wetwell Demolition	1	LS	\$100,000	\$100,000
Wetwell Divider Wall Construction	1	LS	\$50,000	\$50,000
Mechanical Demolition Filter Building	1	LS	\$750,000	\$750,000
Mechanical Demolition - Scrap Value	1	LS	(\$250,000)	(\$250,000)
Existing Backwash Lagoon Demolition	1	LS	\$500,000	\$500,000
Existing Belt Filter Press Rehabilitation	2	EA	\$75,000	\$150,000
Existing Sludge Conveyor Rehabilitation	1	LS	\$20,000	\$20,000
Dewatering Pump Station Retrofit	1	LS	\$150,000	\$150,000
Abandon Existing Municipal Clarifiers	1	LS	\$150,000	\$150,000
Cover for Exist. Post Aeration Tank (Reuse as Blend Tank)	1	LS	\$500,000	\$500,000
Anaerobic Digester Tanks (1.2 MG each)	2	EA	\$1,000,000	\$2,000,000
Buffer Tank (0.66 MG)	1	EA	\$500,000	\$500,000
Pasteurization Skid	1	EA	\$1,200,000	\$1,200,000
BioGas Storage System	1	EA	\$1,000,000	\$1,000,000
Digester Sequential Gas Mixer System	2	EA	\$100,000	\$200,000
Receiving Tank Mix System	1	LS	\$50,000	\$50,000
Blend Tank Mix System	1	LS	\$50,000	\$50,000
Buffer Tank Jet Mix System	1	LS	\$50,000	\$50,000
Post Digestion Storage Mix System	1	LS	\$50,000	\$50,000
Liquid Biosolids Mix System	1	LS	\$50,000	\$50,000
Transfer Pump Syst. (Buffer to Pasteurization.)	2	EA	\$10,000	\$20,000
Dewatering Feed Pump System	3	EA	\$10,000	\$30,000
Biogas Booster Pump	2	EA	\$50,000	\$100,000
Transfer Pump (SSO to Buffer)	2	EA	\$10,000	\$20,000
BioSolids Conveyance (Blend to Buffer)	1	LS	\$250,000	\$250,000
Transfer Pump (Liq. BioSolids to Blend)	2	EA	\$10,000	\$20,000
Liquid BioSolids Receiving Station	1	LS	\$25,000	\$25,000
Dewatered BioSolids Receiving Station	1	LS	\$100,000	\$100,000
CHP Generator/Control Equipment	1	LS	\$4,500,000	\$4,500,000
Gas Handling Equipment Allowance	1	LS	\$500,000	\$500,000
Electrical Interconnection	1	LS	\$386,000	\$386,000
Odor Control Allowance	1	LS	\$600,000	\$600,000
Tipping Bldg./Found. Allowance	1	LS	\$750,000	\$750,000
Digestate Pump/Compress. Bldg/Found Allowance	1	LS	\$500,000	\$500,000
Yard Piping Allowance	1	LS	\$1,000,000	\$1,000,000
Mechanical Piping/Valve Allowance	1	LS	\$1,000,000	\$1,000,000
On-site Electrical Work Allowance	1	LS	\$500,000	\$500,000
Digester Electrical Room Allowance	1	LS	\$150,000	\$150,000
Site Work Allowance	1	LS	\$500,000	\$500,000
Subtotal				\$18,221,000
Design/Permitting (10%)	0.10			\$1,822,000
Contingencies (25%)	0.25			\$4,555,000
Subtotal				\$24,598,000
Estimated MassCEC Grant (OTE D-C)				\$400,000
Estimated MassDEP Grant (SMRP)				\$500,000
Net Project Cost				\$23,698,000

City of Fitchburg
Organics to Energy Feasibility

Table 8-3 Summary of Economic Model Variable Inputs			
Description	Scenario 1	Scenario 2	Scenario 3
CHP Nameplate (kW)	1,500	1,500	1,500
Capacity Factor	85.0%	85.0%	85.0%
Gross Annual Energy Production (kWh)	11,169,000	11,169,000	11,169,000
Annual Facility Use (kWh/yr)	554,000	554,000	554,000
Useful Heat Energy, (kWh/yr)	864,557	864,557	864,557
Retail Offset (kWh)	0.1387	0.1387	0.1387
Net Metering Credit (kWh)	0.1387	0.1387	0.0500
REC value Y1-Y10 (kWh)	0.0500	0.0500	0.0500
REC value Y10-Y20 (kWh)	0.0250	0.0250	0.0250
AEC value Y1-Y10 (kWh)	0.0210	0.0210	0.0210
AEC value Y10-Y20 (kWh)	0.0210	0.0210	0.0210
SSO Tipping Fees, Dry Tons	\$ 60.00	\$ 45.00	45.0000
BIO1 - Private Operator Source, Dry Tons	\$ 279.00	\$ 209.25	209.2500
BIO2 - Municipal Sources, Dry Tons	\$ 279.00	\$ 209.25	209.2500
PMS - Newark Paper Mill Biosolids, Dry Tons	\$ 56.70	\$ 42.53	42.5250
O&M (\$/kW)	\$ 400.00	\$ 400.00	\$ 400.00
Project Term, Years	20	20	20
Financing	Equity	Equity	Equity
Energy Inflation	0.0%	0.0%	0.0%
General Inflation	0.0%	0.0%	0.0%
Discount Rate	7.0%	7.0%	7.0%

Scenario 1 - Equity, City-Owned, Designed and Operated

Scenario 2 - Equity, City-Owned, -25% in Disposal Fees

Scenario 3 - Equity, City-Owned, -25% in Disposal, No Net Metering

Organics to Energy Feasibility Study
Fitchburg, MA

5/2/2015

CHP Model	Jenbacher Type 3
CHP Nameplate (kW)	1,500 (2 at 750 kW)
Capacity Factor	85.0%
Gross Annual Energy Production (kWh)	11,169,000
Annual Facility Use (kWh/yr)	554,000
Useful Heat Energy, (kWh/yr)	864,557 8%
Retail Offset (kWh)	\$ 0.1387
Net Metering Credit (kWh)	\$ 0.1387
REC value Y1-Y10 (kWh)	\$ 0.0500
REC value Y10-Y20 (kWh)	\$ 0.0250
AEC value Y1-Y10 (kWh)	\$ 0.0210
AEC value Y10-Y20 (kWh)	\$ 0.0210
SSO Tipping Fees, Dry Tons	\$ 60.00
BIO1 - Private Operator Source, Dry Tons	\$ 279.00
BIO2 - Municipal Sources, Dry Tons	\$ 279.00
PMS - Newark Paper Mill Biosolids, Dry Tons	\$ 56.70
O&M (\$/kW)	\$ 400.00
Net Present Value	\$15,795,128
Net Cash Flow	\$52,054,561
Present Value Benefit	\$47,657,613
Present Value Cost	\$31,862,485
Benefit Cost Ratio	1.50

Scenario 1 - Equity, City-Owned, Designed and Operated			
Project Term	20 years		
Financing	Equity		
Energy Inflation	0.0%		
General Inflation	0.0%		
Discount Rate	7.0% Based on Risk		
Finance Rate	0.0% SRF, If applicable		
Project Cost	\$23,698,000		
Simple Payback	5.89 years		
IRR	15.22%		
Residual Value	10%		
Cost of Energy	\$0.1745 kWh		
Average Rate	0.30 SSO Dry Tons/Day		
Average Rate	13.20 BIO1 Dry Tons/Day		
Average Rate	12.80 BIO2 Dry Tons/Day		
Average Rate	13.80 PMS Dry Tons/Day		
Total, Dry tons per day	40.10 Dry Tons/Day		
Class A Biosolid (Digestate)	9,300 Class A BIO Dry Tons/Year		
Useful Heat, Therm	\$1.3990		
Property Tax Rate	\$21.60 per \$1,000		

Existing Electric Use and Cost Basis			
Electric Demand:	127 kW		
Annual Use:	554,000 kWh		
Account No. Unitil	30000217-30000208		
	Estimated Use	Service Rate	Total/Yr
	Customer Charge	1.00000	8.23000 \$ 98.76
	Distribution Demand, kW	127.00000	7.65000 \$ 11,658.60
	Energy Charge, kWh	554,000	0.03440 \$ 19,057.60
	Energy Conservation, kWh	554,000	0.00250 \$ 1,385.00
	Renewable Energy, kWh	554,000	0.00050 \$ 277.00
	Transformer Credit, kW	127.00000	\$ (0.14) \$ (17.78)
	Transition Demand, kW	127.00000	2.74000 \$ 347.98
	Transition Energy, kWh	554,000	0.00940 \$ 5,207.60
	Transmission Demand, kW	127.00000	0.29000 \$ 36.83
	Transmission Energy, kWh	554,000	0.01572 \$ 8,708.88
	Energy Supply, kWh	554,000	0.07920 \$ 43,876.80
	Total	554,000	0.16361 \$ 90,637.27
	1 therm = 29.307 kWh		
	29,500 Therms of gas used for normal plant heat		
	864,557 kWh equivalent		

Project concept assumes construction will require one year before system is operational and processing at 100% capacity.

Useful heat energy is existing heating base load in Therms converted to kWh equivalent.

Project Cash Flow Analysis		Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Benefits		Total	(Construct)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)
Value of Retail Offset, kWh		\$1,460,167	\$0	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851
Value of Exported Electricity, kWh		\$25,179,969	\$0	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262	\$1,325,262
Value of RECs, kWh		\$8,097,525	\$0	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450
Value of AECs, kWh		\$344,958	\$0	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156
Value of Useful Heat Energy		\$784,142	\$0	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271
SSO Dry Tons/Day		\$124,830	\$0	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570	\$6,570
BIO1 Dry Tons/Day		\$25,540,218	\$0	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222	\$1,344,222
BIO2 Dry Tons/Day		\$24,766,272	\$0	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488	\$1,303,488
PMS Dry Tons/Day		\$5,426,360	\$0	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598	\$285,598
Residual Value		\$2,369,800	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$2,369,800
Benefit Subtotal		\$94,094,241	\$0	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,959,867	\$4,680,642	\$4,680,642	\$4,680,642	\$4,680,642	\$4,680,642	\$4,680,642	\$4,680,642	\$4,680,642	\$7,050,442

Costs		Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Capital		\$23,698,000	\$23,698,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Interest		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
O&M		\$11,400,000	\$0	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000
Insurance		\$3,791,680	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584
Incidental Trucking and Hauling		\$600,000	\$0	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Legal and Administrative Costs		\$1,400,000	\$500,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Testing, Licensing, QA-QC		\$1,100,000	\$150,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Other		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cost Subtotal		\$41,989,680	\$24,537,584	\$939,584	\$939,584	\$939,584	\$939,584	\$939,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584
Net		\$52,104,561	(\$24,537,584)	\$4,020,283	\$4,020,283	\$4,020,283	\$4,020,283	\$4,020,283	\$4,045,283	\$4,045,283	\$4,045,283	\$4,045,283	\$4,045,283	\$3,766,058	\$3,766,058	\$3,766,058	\$3,766,058	\$3,766,058	\$3,766,058	\$3,766,058	\$3,766,058	\$6,135,858
Cumulative			(\$24,537,584)	(\$20,517,301)	(\$16,497,019)	(\$12,476,736)	(\$8,456,454)	(\$4,436,171)	(\$390,888)	\$3,654,394	\$7,699,677	\$11,744,960	\$15,790,242	\$19,556,300	\$23,322,357	\$27,088,415	\$30,854,473	\$34,620,530	\$38,386,588	\$42,152,646	\$45,918,703	\$52,054,561

Organics to Energy Feasibility Study
Fitchburg, MA

5/2/2015

CHP Model	Jenbacher Type 3	
CHP Nameplate (kW)	1,500	(2 at 750 kW)
Capacity Factor	85.0%	
Gross Annual Energy Production (kWh)	11,169,000	
Annual Facility Use (kWh/yr)	554,000	
Useful Heat Energy, (kWh/yr)	864,557	8%
Retail Offset (kWh)	\$ 0.1387	
Net Metering Credit (kWh)	\$ 0.1387	
REC value Y1-Y10 (kWh)	\$ 0.0500	
REC value Y10-Y20 (kWh)	\$ 0.0250	
AEC value Y1-Y10 (kWh)	\$ 0.0210	
AEC value Y10-Y20 (kWh)	\$ 0.0210	
SSO Tipping Fees, Dry Tons	\$ 45.00	
BIO1 - Private Operator Source, Dry Tons	\$ 209.25	
BIO2 - Municipal Sources, Dry Tons	\$ 209.25	
PMS - Newark Paper Mill Biosolids, Dry Tons	\$ 42.53	
O&M (\$/kW)	\$ 400.00	
Net Present Value	\$8,695,739	
Net Cash Flow	\$38,090,141	
Present Value Benefit	\$40,558,224	
Present Value Cost	\$31,862,485	
Benefit Cost Ratio	1.27	

Scenario 2 - Equity, City-Owned, -25% in Disposal Fees		
Project Term	20 years	
Financing	Equity	
Energy Inflation	0.0%	
General Inflation	0.0%	
Discount Rate	7.0% Based on Risk	
Finance Rate	0.0% SRF, If applicable	
Project Cost	\$23,698,000	
Simple Payback	7.21 years	
IRR	11.70%	
Residual Value	10%	
Cost of Energy	\$0.1745 kWh	
Average Rate	0.30	SSO Dry Tons/Day
Average Rate	13.20	BIO1 Dry Tons/Day
Average Rate	12.80	BIO2 Dry Tons/Day
Average Rate	13.80	PMS Dry Tons/Day
Total, Dry tons per day	40.10	Dry Tons/Day
Class A Biosolid (Digestate)	9,300	Class A BIO Dry Tons/Year
Useful Heat, Therm	\$1.3990	
Property Tax Rate	\$21.60 per \$1,000	

Existing Electric Use and Cost Basis			
Electric Demand:		127 kW	
Annual Use:		554,000 kWh	
Account No.	Unitil	30000217-30000208	
		Estimated Use	Service Rate Total/Yr
	Customer Charge	1.00000	8.23000 \$ 98.76
	Distribution Demand, kW	127.00000	7.65000 \$ 11,658.60
	Energy Charge, kWh	554,000	0.03440 \$ 19,057.60
	Energy Conservation, kWh	554,000	0.00250 \$ 1,385.00
	Renewable Energy, kWh	554,000	0.00050 \$ 277.00
	Transformer Credit, kW	127.00000	\$(0.14) \$ (17.78)
	Transition Demand, kW	127.00000	2.74000 \$ 347.98
	Transition Energy, kWh	554,000	0.00940 \$ 5,207.60
	Transmission Demand, kW	127.00000	0.29000 \$ 36.83
0.7%	Transmission Energy, kWh	554,000	0.01572 \$ 8,708.88
32.9%	Energy Supply, kWh	554,000	0.07920 \$ 43,876.80
31.9%	Total	554,000	0.16361 \$ 90,637.27
34.4%			
100.0%			
	Estimated Value of Retail Offset		0.16361 Unitil
	Estimated Value of Net Metering Credit		0.13872 Unitil
	Estimated Wholesale Electric Supply		0.05000
	1 therm = 29.307 kWh		
	29,500 Therms of gas used for normal plant heat		
	864,557 kWh equivalent		

Project concept assumes construction will require one year before system is operational and processing at 100% capacity.

Useful heat energy is existing heating base load in Therms converted to kWh equivalent.

[illegible]

Costs	Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Capital	\$23,698,000	\$23,698,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Interest	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
O&M	\$11,400,000	\$0	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000
Insurance	\$3,791,680	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584
Incidental Trucking and Hauling	\$600,000	\$0	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Legal and Administrative Costs	\$1,400,000	\$500,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Testing, Licensing, QA-QC	\$1,100,000	\$150,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Other	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cost Subtotal	\$41,989,680	\$24,537,584	\$939,584	\$939,584	\$939,584	\$939,584	\$939,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584
Net	\$38,140,141	(\$24,537,584)	\$3,285,313	\$3,285,313	\$3,285,313	\$3,285,313	\$3,285,313	\$3,310,313	\$3,310,313	\$3,310,313	\$3,310,313	\$3,310,313	\$3,031,088	\$3,031,088	\$3,031,088	\$3,031,088	\$3,031,088	\$3,031,088	\$3,031,088	\$3,031,088	\$5,400,888
Cumulative		(\$24,537,584)	(\$21,252,271)	(\$17,966,958)	(\$14,681,645)	(\$11,396,331)	(\$8,111,018)	(\$4,800,705)	(\$1,490,392)	\$1,819,921	\$5,130,234	\$8,440,547	\$11,471,636	\$14,502,724	\$17,533,812	\$20,564,900	\$23,595,988	\$26,627,076	\$29,658,164	\$32,689,253	\$38,090,141

Organics to Energy Feasibility Study
Fitchburg, MA

5/2/2015

CHP Model		Jenbacher Type 3	Scenario 3 - Equity, City-Owned, -25% in Disposal, No Net Metering		Existing Electric Use and Cost Basis	
CHP Nameplate (kW)		1,500 (2 at 750 kW)	Project Term		Electric Demand: 127 kW	
Capacity Factor		85.0%	20 years		Annual Use: 554,000 kWh	
Gross Annual Energy Production (kWh)		11,169,000	Financing		Account No. Unitil 30000217-30000208	
Annual Facility Use (kWh/yr)		554,000	Equity		Estimated Use Service Rate Total/Yr	
Useful Heat Energy, (kWh/yr)		864,557 8%	Energy Inflation 0.0%		Customer Charge 1.00000 8.23000 \$ 98.76	
Retail Offset (kWh)		\$ 0.1387	General Inflation 0.0%		Distribution Demand, kW 127.00000 7.65000 \$ 11,658.60	
Net Metering Credit (kWh)		\$ 0.0500	Discount Rate 7.0% Based on Risk		Energy Charge, kWh 554,000 0.03440 \$ 19,057.60	
REC value Y1-Y10 (kWh)		\$ 0.0500	Finance Rate 0.0% SRF, If applicable		Energy Conservation, kWh 554,000 0.00250 \$ 1,385.00	
REC value Y10-Y20 (kWh)		\$ 0.0250	Project Cost \$23,698,000		Renewable Energy, kWh 554,000 0.00050 \$ 277.00	
AEC value Y1-Y10 (kWh)		\$ 0.0210	Simple Payback 9.72 years		Transformer Credit, kW 127.00000 \$ (0.14) \$ (17.78)	
AEC value Y10-Y20 (kWh)		\$ 0.0210	IRR 7.29%		Transition Demand, kW 127.00000 2.74000 \$ 347.98	
SSO Tipping Fees, Dry Tons		\$ 45.00	Residual Value 10%		Transition Energy, kWh 554,000 0.00940 \$ 5,207.60	
BIO1 - Private Operator Source, Dry Tons		\$ 209.25	Cost of Energy \$0.1745 kWh		Transmission Demand, kW 127.00000 0.29000 \$ 36.83	
BIO2 - Municipal Sources, Dry Tons		\$ 209.25	Average Rate 0.30 SSO Dry Tons/Day		Transmission Energy, kWh 554,000 0.01572 \$ 8,708.88	
PMS - Newark Paper Mill Biosolids, Dry Tons		\$ 42.53	Average Rate 13.20 BIO1 Dry Tons/Day		Energy Supply, kWh 554,000 0.07920 \$ 43,876.80	
O&M (\$/kW)		\$ 400.00	Average Rate 12.80 BIO2 Dry Tons/Day		Total 554,000 0.16361 \$ 90,637.27	
Net Present Value		\$508,532	Average Rate 13.80 PMS Dry Tons/Day			
Net Cash Flow		\$21,985,997	Total, Dry tons per day 40.10 Dry Tons/Day		100.0%	
Present Value Benefit		\$32,371,017	Class A Biosolid (Digestate) 9,300 Class A BIO Dry Tons/Year		Estimated Value of Retail Offset 0.16361 Unitil	
Present Value Cost		\$31,862,485	Useful Heat, Therm \$1.3990		Estimated Value of Net Metering Credit 0.13872 Unitil	
Benefit Cost Ratio		1.02	Property Tax Rate \$21.60 per \$1,000		Estimated Wholesale Electric Supply 0.05000	
					1 therm = 29.307 kWh	
					29,500 Therms of gas used for normal plant heat	
					864,557 kWh equivalent	

Project concept assumes construction will require one year before system is operational and processing at 100% capacity.

Useful heat energy is existing heating base load in Therms converted to kWh equivalent.

Project Cash Flow Analysis		Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Benefits		Total	(Construct)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)	(Operate)
Value of Retail Offset, kWh		\$1,460,167	\$0	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851	\$76,851
Value of Exported Electricity, kWh		\$9,075,825	\$0	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675	\$477,675
Value of RECs, kWh		\$8,097,525	\$0	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450	\$558,450
Value of AECs, kWh		\$344,958	\$0	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156	\$18,156
Value of Useful Heat Energy		\$784,142	\$0	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271	\$41,271
SSO Dry Tons/Day		\$93,623	\$0	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928	\$4,928
BIO1 Dry Tons/Day		\$19,155,164	\$0	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167	\$1,008,167
BIO2 Dry Tons/Day		\$18,574,704	\$0	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616	\$977,616
PMS Dry Tons/Day		\$4,069,770	\$0	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198	\$214,198
Residual Value		\$2,369,800	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$2,369,800
Benefit Subtotal		\$64,025,677	\$0	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,377,311	\$3,098,086	\$3,098,086	\$3,098,086	\$3,098,086	\$3,098,086	\$3,098,086	\$3,098,086	\$3,098,086	\$5,467,886

Costs		Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Capital		\$23,698,000	\$23,698,000	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Interest		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
O&M		\$11,400,000	\$0	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000	\$600,000
Insurance		\$3,791,680	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584	\$189,584
Incidental Trucking and Hauling		\$600,000	\$0	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000	\$25,000
Legal and Administrative Costs		\$1,400,000	\$500,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Testing, Licensing, QA-QC		\$1,100,000	\$150,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000	\$50,000
Other		\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0
Cost Subtotal		\$41,989,680	\$24,537,584	\$939,584	\$939,584	\$939,584	\$939,584	\$939,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584	\$914,584
Net		\$22,035,997	(\$24,537,584)	\$2,437,727	\$2,437,727	\$2,437,727	\$2,437,727	\$2,437,727	\$2,462,727	\$2,462,727	\$2,462,727	\$2,462,727	\$2,462,727	\$2,183,502	\$2,183,502	\$2,183,502	\$2,183,502	\$2,183,502	\$2,183,502	\$2,183,502	\$2,183,502	\$4,553,302
Cumulative			(\$24,537,584)	(\$22,099,857)	(\$19,662,131)	(\$17,224,404)	(\$14,786,678)	(\$12,348,951)	(\$9,886,224)	(\$7,423,498)	(\$4,960,771)	(\$2,498,044)	(\$35,318)	\$2,148,184	\$4,331,685	\$6,515,187	\$8,698,689	\$10,882,190	\$13,065,692	\$15,249,194	\$17,432,695	\$21,985,997

City of Fitchburg
Organics to Energy Feasibility

Table 8-4 Summary of Economic Model Results			
Description	Scenario 1	Scenario 2	Scenario 3
Preliminary Opinion of Probable Cost	\$ 23,700,000	\$ 23,700,000	\$ 23,700,000
Simple Payback, years	5.9	7.2	9.7
Internal Rate of Return	15.2%	11.7%	7.3%
Net Present Value	\$ 15,800,000	\$ 8,700,000	\$ 500,000
20-Year Net Cash Flow	\$ 52,100,000	\$ 38,100,000	\$ 22,000,000
Benefit Cost Ratio	1.50	1.27	1.02

Scenario 1 - Equity, City-Owned, Designed and operated at current market rates

Scenario 2 - Equity, City-Owned, -25% decrease in disposal fees

Scenario 3 - Equity, City-Owned, -25% decrease in disposal, no net metering

APPENDIX G

Public Participation Summary

City of Fitchburg
Organics to Energy Feasibility Study
Community Engagement Summary

In an effort to reach out to the local community, the City of Fitchburg informed the residents and general public of the purpose and intent of the Organic to Energy feasibility study through a series of public meetings. The early meetings dates were used primarily to simply announce some basic facts; including the fact that the city had applied and was awarded a grant to undertake the OTE feasibility study and introduce the basic concept of the Anaerobic Digestion process; discuss some of the regulatory and economic drivers; review of the State's general plan to reduce organics loads going to landfill through the organics waste ban; introduce the financial incentives for renewable energy projects as they relate to potential benefits for City. The meetings where the OTE concept was introduced and discussed in a public forum included:

Meeting	Venue	Date
City Planning Board Meeting	Fitchburg Municipal Offices Putnam Place, 166 Boulder Drive,	August 20, 2012 6:00 pm
City Council Meeting	Memorial Middle School Library, 615 Rollstone Street	September 3, 2013 7:30 pm
City Energy Commission Meeting	Fitchburg Municipal Offices Putnam Place, 166 Boulder Drive, F	September 12, 2013 6:00 pm
Organics to Energy Community Forum	Memorial Middle School Library, 615 Rollstone Street	March 5, 2014

Direct abutters and property owners within 1,000 feet of the Site were notified about the project concept in writing and invited to attend the Community Forum meeting. The written notification, mailed by the Planning Department, included a description of the project concept and schedule for planned Community Forum meetings, with the time, date and location of the meeting. During the meetings, participants were invited to provide feedback and reaction about the idea of project.

The Notice about the Community Forum invited parties to bring questions and concerns so that the City can consider the concerns and to judge the level of support or opposition as part of the feasibility study. Notice of all Meeting and agendas were also posted on the City of Fitchburg's official web site:
http://fitchburgma.gov/government/public_meeting/.

Advanced advertising or posting as required under public open meeting laws were observed. The Community Forum was also publicized in the local newspaper approximately prior to the schedule forum, to help ensure the public had knowledge and opportunity to attend.

Weston & Sampson participated in each of the meetings in a technical consulting capacity with information materials designed to help inform and educate the community of the project concept, discuss pros and cons and establish consensus for local support of the proposed development. Discussions include the potential benefits and risks associated implementation of the technology, with a focus on costs, benefits, as well as the potential for adverse conditions, such as odors, noise and increased vehicular traffic at the West Plant if the project were to be developed.

Community Opinion

The feedback from the public and citizen members of the various City boards generally had a positive attitude and embraced the idea of developing an OTE at the West Plant in the City of Fitchburg. The positive opinions which suggested support of the project included “green” aspects of using otherwise wasted organic materials to generate both heat and electricity. The potential for economic incentives (both from potential revenue from sale of beneficial byproducts, net metering credits and sale of RECs or AECs) or from savings from the alternative to costly disposal of biosolids were appealing to the people at the meetings.

For the amount of support, there was also an equal amount of concern about the potential negative attributes of the project. The concerns that were stated most often were increased vehicular traffic and potential for odors emanating from project. If these concerns were properly identified, studied and mitigated, it is our opinion that residents and businesses in Fitchburg would support an OTE project at the West Plant. The project proponents would have to demonstrate that levels of vehicular traffic would not increase dramatically and that odors could be controlled. One concern that was raised that the project would not likely be able to address, is desire by some to have the railroad bridge near the site enlarged or widened.

Continued Community Engagement

Follow-up meetings are recommended if the project is to advance from feasibility to design stage. These community meetings and workshops should be scheduled and held to communicate which direction the project development is headed as they are decided and to aid in the decision making process, where the community should continue to have a voice and opinion and to continue to invite the exchanges of ideas, concerns and engineering alternatives that could help minimize any potential negative impacts that an OTE project could have on the local community.

**City of Fitchburg
Organics to Energy Feasibility Study
Community Engagement Plan**

In an effort to reach out to the City of Fitchburg community and inform the residents of the purpose and intent of the Organic to Energy feasibility study which is underway, the project concept will be introduced at a series of public meetings. The early meeting dates will be used primarily to simply announce some basic facts; such as the MassCEC grant award for the study and the basic concept of the AD process; regulatory and economic drivers; general plan to reduce organics loads going to landfill (organics ban); financial incentives for renewable energy projects as they relate to potential benefits for City.

In addition, direct abutters and property owners within 1,000 feet of the Site will be notified about the potential project in writing. The notification will contain a description of the project concept and schedule for planned Community Forum meetings, with time, date and location, to conveying information and solicit feedback and reaction about the project. The following is a list of planned meetings where the project concept will be introduced:

City Council Meetings: City Council meetings are scheduled to begin at 7:30 pm in the Memorial Middle School Library, 615 Rollstone Street, Fitchburg, MA

July 16, 2013
September 3, 2013
October 1, 2013

Planning Board Meetings: The Planning Board generally meets on the Third Tuesday of the month at 6pm in the Conference Room of the Fitchburg Municipal Offices at Putnam Place, 166 Boulder Drive, Fitchburg, MA

August 21, 2013
September 17, 2013

Energy Commission Meetings: Fitchburg Energy Commission meetings are on the second and fourth Thursday of each month at 6:00 p.m. in the Conference Room, Fitchburg Municipal Offices, 166 Boulder Drive, Fitchburg, MA

July 11, 2013
August 8, 2013
September 26, 2013

Community Forums: A series of community forums, open to the public, will be held for abutting land owners, property owners within 1,000 feet of the project Site, and interested parties, to review the details of the project concept and solicit feedback from the community. The Notice will invite parties to bring questions and concerns so that the City can consider the concerns and judge the level of support or opposition as part of the feasibility study. A second, follow-up meeting may also be held and with interested parties notified through mail, if warranted by turnout, concern or interest.

Anaerobic Digestion 101 Date 1 – Late August 2013 (TBA)
Anaerobic Digestion 201 Date 2 – Late September 2013 (TBA)

Notice of all Meeting and agendas will be posted on the City of Fitchburg's official web site: http://fitchburgma.gov/government/public_meeting/. Advanced advertising or posting as required under public open meeting laws will be observed. Community Forums will also be publicized in local newspaper approximately seven to 10 days prior to the schedule forum, then again two to three days prior to each forum.

Weston & Sampson will participate in a technical consulting capacity at each of the public meetings, and prepare information materials as appropriate, to help inform and educate the community of the project concept, discuss pros and cons and establish consensus for local support of the proposed development. The discussion will include the potential benefits and risks associated implementation of the technology, focusing on costs, benefits, as well as the potential for odors, noise, increased traffic and other concerns (vector control, concerns for contamination).

PUBLIC MEETING

Where: Memorial Middle School
615 Rollstone Road

When: Wednesday, February 5, 2014

Time 6:30 PM

Topic: Conversion of West Fitchburg Wastewater Plant
Anaerobic Digestion Facility

The Fitchburg Wastewater Department will be holding a public meeting on Wednesday, February 5, 2014 at 6:30 PM at the Memorial Middle School library.

The purpose of the meeting is to provide residents information on a proposed Anaerobic Digestion facility to be located at the West Fitchburg Wastewater Treatment plant site. City officials and consultants will explain the details of the project including what Anaerobic Digestion is, how it works, benefits to the City and potential issues associated with the project.

The public is encouraged to attend to learn about the project and provide feedback and voice concerns they may have.



CITY OF FITCHBURG
PLANNING BOARD
301 BROAD STREET
FITCHBURG, MASSACHUSETTS 01420

(978) 829-1891
PHONE

(978) 345-9687
FAX

Planning Board Meeting Agenda

MEETING DATE: Tuesday, August 20, 2013
MEETING TIME: 6:00 p.m.
MEETING PLACE: **Fitchburg Municipal Offices, 166 Boulder Drive
First Floor - Conference Room**

- I. CALL MEETING TO ORDER
- II. MINUTES
- III. COMMUNICATIONS
- IV. APPROVAL NOT REQUIRED PLANS
- V. MINOR SITE PLAN REVIEW
 - New 4,000 sq. ft. hangar, Fitchburg Pilots Assoc., 567 Crawford St.
- VI. PUBLIC HEARINGS
 - (1) Proposed Rezoning - Change West side of Water St. from Wanoosnoc Rd. to Leominster City Line from Residence B to Central Business District
 - (2) Special Permit - Anés, 45-47 Jackson Ave. - converting two-family to single-family
- VII. OTHER BUSINESS
 - Concept plan - Cumberland Farms, John Fitch Hwy. (next to #285)
 - Informal - amending "Arden Mills" project to finish off Bldg. #1
 - Weston & Sampson, "Organics to Energy" anaerobic digestion project, West WWTP, Princeton Rd.
 - Bond reduction request - South Street Crossing subdivision
 - Project updates
- VIII. ADJOURN (*Planning Board will adjourn meeting by 10:00 p.m.*)



Fitchburg Municipal Offices
166 Boulder Drive
FITCHBURG, MA 01420
TELEPHONE: 978-829-1801
FAX: 978-345-9553
EMAIL: FitchburgEnergy@gmail.com

FITCHBURG ENERGY COMMISSION

The Fitchburg Energy Commission will have a meeting on Thursday, September 12, 2013 at 6:00PM in the Conference Room at Fitchburg Municipal Offices, 166 Boulder Drive.

Agenda

I. Introductions

- a. Attendance
- b. Approval of the minutes
- c. Constituent Concerns

II. Old Business

- a. Report on Green Communities Act webinar
- b. Report on meeting with regional Coordinator on Green Communities

III. New Business

- a. Presentation by Joseph A. Jordan, Deputy Commissioner, on the Anaerobic Digestion Process
- b. Proposed Letter to Superintendent Ravenelle for request on updates concerning the schools green energy goals.
- c. Discuss Saco, ME's energy policy as a model for Fitchburg

IV. Adjournment

The next regular meeting is scheduled for October 10, 2013 at 6:00PM.

REGULAR COUNCIL MEETING

SEPTEMBER 3, 2013

City of Fitchburg City Council Meeting
Memorial Middle School Library
615 Rollstone Street, Fitchburg, MA

The Council Meets at 7:30 o'clock p.m.

September 3, 2013

- I Public Forum**
- II Report of Committee on Records**
- III Communications from Her Honor the Mayor**

**V. COMMUNICATIONS AND REPORTS FROM
HEADS OF DEPARTMENTS**

VI. SPECIAL PRESENTATION

Joseph A. Jordan, DPW Deputy Commissioner for Wastewater
Organics to Energy Feasibility Study

VII. ANNUAL REPORT

- 208-13. ANNUAL REPORT: Fitchburg Redevelopment Authority for
the years ending December 31, 2011 and 2012.

VIII. REPORTS OF COMMITTEES

Board of Health:

- 029-13. Councillor Thibault-Munoz, to request the addition to
the existing City Code ch. 181 Zoning sec. 181.313
Table of Principle Use Regulation subsection B., as
outlined in the enclosed Petition. (Raising and
keeping of poultry of six (6) or less for use by
residents of the premises with a parcel of five acres
or less)
(Not be Granted)

IX. RECESSED HEARINGS

- 029-13. Councillor Thibault-Munoz, to request the addition to
the existing City Code ch. 181 Zoning sec. 181.313
Table of Principle Use Regulation subsection B., as
outlined in the enclosed Petition. (Raising and
keeping of poultry of six (6) or less for use by
residents of the premises with a parcel of five acres
or less)
- 163-13. Councillor Joel Kaddy, to rezone Water Street on the
West side from Wanoosnoc Road to the Leominster Line
to Commercial Business District.

X. ORDERS

- 198-13. LOAN ORDER: Appopr. \$1,100,000 to pay the cost of purchasing various items of departmental equipment as listed in the enclosed Loan Order, and to authorize the Mayor to borrow said amount under and pursuant to Chapter 44, Section 7 (9) of the General Laws.
(Final reading) (Roll Call Vote)
- 209-13. ORDER: That the City of Fitchburg accepts the gift of Rescue Air Bags, fair market value of \$2,370, from Rydemore Heavy Duty Truck Parts, for the purposes of said gift.
- 210-13. ORDER: Appopr. \$128,000, same to be credited to BUILDING CAPITAL-DEPARTMENTAL EQUIPMENT and charged against CITY PROPERTY SOLD.
- 211-13. ORDER: That the City of Fitchburg hereby approves the expenditure of funds from the FEMA, Emergency Management Performance Grant-FY14, in the approximate amount of \$14,030, for the purposes of said grant.
- 212-13. ORDER: That the City of Fitchburg approves the expenditure of funds from the Federal Department of Justice for the Police FY14 Local JAG Award-LLEBG 17 Grant, in the approximate amount of \$25,413, for the purposes of said grant.
- 213-13. ORDER: That the City of Fitchburg hereby approves the expenditure of funds from the CHNA-9 (Community Health Network Area) Mini-grant, in the approximate amount of \$1,670, for the purposes of said grant.

XI. PETITIONS

- 214-13. Douglas Farwell, Fitchburg Plumbing Supply, to request The City of Fitchburg to declare parcel of property Map 56, Lot 28, Lot A, at 0 Main St., Surplus and Sell.
(City Property Committee)
- 215-13. Duane W. Winter, to request the City Release, Remove, and/or Abandon the Right of Way Easement held by the City of Fitchburg at lot 7, Davis Rd., Westminster, MA as outlined in the enclosed Petition.
(City Property Committee)
- 216-13. Joseph A. Jordan, DPW Deputy Commissioner for Wastewater, to declare the vehicles listed in the petition as scrap property.
(City Property Committee)

- 217-13. Ronald Varney, to request that all petitions submitted be acted upon within 6 months unless held up for legal reasons.
(Council as a Whole Committee)
- 218-13. Ronald Varney, to charge the businesses on John Fitch Highway the same rate as the residential. Charge a lower rate until we repair the road and solve the flooding problem.
(Finance Committee)
- 219-13. Councillor David Clark, to investigate and find remedy at the intersection of Cross and Milk Street. Currently large trucks are having a difficult time turning onto Cross Street from Milk Street.
(Public Safety Committee)
- 220-13. Councillor David Clark, to investigate and find remedy to a "line of sight" issue at the intersection of Valley and Canton Streets.
(Public Safety Committee)
- 221-13. Ronald Varney, to request FSU solve student parking problem and end student parking at Coolidge Park, as outlined in the enclosed petition.
(Public Safety Committee)
- 222-13. Ronald Varney, to eliminate the purchase of Police Department Pickup Trucks with snow plows.
(Public Safety Committee)
- 223-13. Ronald Varney, to have FSU put trash barrels at all the parking lots and crosswalks.
(Public Works Committee)
- 224-13. Councillor David Clark, to investigate and find remedy to water runoff problem in the area of 15 Bourque Terrace.
(Public Works Committee)
- 225-13. Councillor Joseph and Michael Ellia, to remove dying pine trees (5), around 79 Jerry St.
(Public Works Committee)
- 226-13. Ronald Varney, to repave Summer St., Water St., Myrtle Ave., Clinton St., Highland Ave. and Rindge Rd.
(Public Works Committee)
- 227-13. Ronald Varney, to notify residents living nearby a large construction work area, including work with boulders or explosives, and to ensure OSHA and EPA rules are being followed at these worksites.
(Public Works Committee)

SPECIAL PRESENTATION

City of Fitchburg
Organics to Energy Feasibility Study

Project Description

A feasibility study will be conducted to evaluate the potential for developing an organics to energy project at the City-owned West Wastewater Treatment Facility (West Plant). A phased approach to the study is intended to focus on the technical feasibility and economic viability for the development of an anaerobic digester at the West Plant, which will seek to convert sewage sludge, source separated organics (SSO) or other feed stocks, into to heat, electricity, and compost, fertilizers, soil amendments or other marketable byproducts.

What is Anaerobic Digestion?

Anaerobic digestion is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen. One of the end products is biogas, which is combusted to generate electricity and heat. A range of anaerobic digestion technologies are converting livestock manure, municipal wastewater solids, food waste, high strength industrial wastewater and residuals, fats, oils and grease (FOG), and various other organic waste streams into biogas, 24 hours a day, 7 days a week. Separated digested solids can be composted, utilized for dairy bedding, directly applied to cropland or converted into other products. Nutrients in the liquid stream are used in agriculture as fertilizer.

Background Information

- The City's West Plant is located at 230 Princeton Road. It is situated on approximately 16.5 acres of City-Owned land.
- The facility is currently serving as a pump station to convey wastewater generated at two paper mills to the East WWTF, located approximately 7 miles east of the West plant.
- Because the West Plant is a WWTF, a large portion of the supporting infrastructure is already in place including access roads, utilities, and administrative offices; thus making the site a desirable location.
- It is anticipated that the digester equipment will be retrofitted into the existing property.

Project Benefits

- The project will include the re-use of an underused developed property (West plant).
- The project would create additional jobs for the area
- Diverting FOG from wastewater to anaerobic digesters prevents combined sewer overflows, which protects water quality and saves money.
- This project will not only serve to produce a form of renewable energy, but will help this region to meet the State's new organics diversion goals, while extending the life of the landfill.
- The City's municipal solid waste landfill, is nearing the end of its design life in terms of capacity. Wastewater treatment plant sludge generated at the City's East plant can be treated through the digesters, rather than disposed of at the landfill.
- The City may also be able to accept surrounding communities' wastewater sludge, thereby obtaining additional tipping fee.
- Income for the City of Fitchburg could be gained from the processing of waste (tipping fees), sale of organic fertilizer and other by-products, Class I Renewable Energy Certificates (RECs) and net metering credits for excess power.
- This project may also be eligible for tax credits under certain ownership models being considered.

Project Risk Factors

- Public Perception - Nuisance conditions, such as odor and noise
- Financial Risk

FITCHBURG CITY CLERK
2013 AUG 27 P 3:15

ANNUAL REPORT

FITCHBURG REDEVELOPMENT
AUTHORITY

FINANCIAL STATEMENTS
AND SUPPLEMENTARY INFORMATION
WITH INDEPENDENT AUDITOR'S REPORT

FOR THE YEARS ENDED
DECEMBER 31, 2012 AND 2011

FITCHBURG REDEVELOPMENT AUTHORITY

<u>TABLE OF CONTENTS</u>	<u>PAGE</u>
Independent Auditor's Report	1-2
Financial Statements	
Statements of Financial Position	3
Statements of Activities	4
Statements of Cash Flows	5
Notes to Financial Statements	6-11
Supplementary Information	
Schedule of Actual Project Costs	12
Independent Auditor's Report on Internal Control over Financial Reporting and on Compliance and other Matters based on an Audit of Financial Statements Performed in Accordance With Government Auditing Standards	13-14

MARK S. MUELLER
CERTIFIED PUBLIC ACCOUNTANT

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(978) 833-9990
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INDEPENDENT AUDITOR'S REPORT

To the Board of Directors
Fitchburg Redevelopment Authority
Fitchburg, MA 01420

Report on the Financial Statements

We have audited the accompanying financial statements of Fitchburg Redevelopment Authority (a political subdivision), which comprise the statements of financial position as of December 31, 2012 and 2011 and the related statements of activities and cash flows for the years then ended, and the related notes to the financial statements.

Management's Responsibility for the Financial Statements

Management is responsible for the preparation and fair presentation of these financial statements in accordance with accounting principles generally accepted in the United States of America; this includes the design, implementation, and maintenance of internal control relevant to the preparation and fair presentation of financial statements that are free from material misstatement, whether due to fraud or error.

Auditor's Responsibility

Our responsibility is to express an opinion on these financial statements based on our audit. We conducted our audit in accordance with auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards*, issued by the Comptroller General of the United States. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the financial statements. The procedures selected depend on the auditor's judgment, including the assessment of the risks of material misstatement of the financial statements, whether due to fraud or error. In making those risk assessments, the auditor considers internal control relevant to the entity's preparation and fair presentation of the financial statements in order to design audit procedures that are appropriate in the circumstances, but not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. Accordingly, we express no such opinion. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of significant accounting estimates made by management, as well as evaluation of the overall presentation of the financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above present fairly, in all material respects, the financial position of Fitchburg Redevelopment Authority as of December 31, 2012 and 2011, and the changes in its net assets and its cash flows for the years then ended in accordance with accounting principles general accepted in the United States of America.

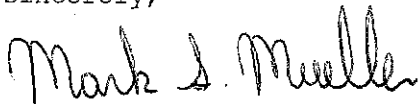
Other Matters

Our audit was conducted for the purpose of forming an opinion on the financial statements as a whole. The schedule of actual project costs on page 12 is presented for purposes of additional analysis and is not a required part of the financial statements. Such information is the responsibility of management and was derived from and relates directly to the underlying accounting and other records used to prepare the financial statements. The information has been subjected to the auditing procedures applied in the audit of the financial statements and certain additional procedures, including comparing and reconciling such information directly to the underlying accounting and other records used to prepare the financial statements or to the financial statements themselves, and other additional procedures in accordance with auditing standards generally accepted in the United States of America. In our opinion, the information is fairly stated in all material respects in relation to the financial statements as a whole.

Other Reporting Required by Government Auditing Standards

In accordance with *Government Auditing Standards*, we have also issued our report dated June 4, 2013, on our consideration of Fitchburg Redevelopment Authority's internal control over financial reporting and on our test of its compliance with certain provisions of laws, regulations, contracts, and grant agreements and other matters. The purpose of that report is to describe the scope of our testing of internal control over financial reporting and compliance and the results of that testing, and not to provide an opinion on internal control over financial reporting or on compliance. That report is an integral part of an audit performed in accordance with *Government Auditing Standards* in considering Fitchburg Redevelopment Authority's internal control over financial reporting and compliance.

Sincerely,



Mark S. Mueller
Certified Public Accountant
June 4, 2013

FITCHBURG REDEVELOPMENT AUTHORITY

STATEMENTS OF FINANCIAL POSITION

DECEMBER 31,

ASSETS

	<u>2012</u>	<u>2011</u>
<u>Current Assets</u>		
Cash and Cash Equivalents	\$ 1,689,956	\$ 1,656,678
Accounts and Grants Receivable - Net	424,511	446,453
Prepaid Expenses	46,583	42,426
Note Receivable MART - Current Portion	53,333	53,333
Total Current Assets	<u>2,214,383</u>	<u>2,198,890</u>
<u>Property and Equipment - Net</u>	<u>15,078,961</u>	<u>15,306,815</u>
<u>Other Assets</u>		
Property Held for Development	768,075	768,075
Note Receivable MART - Net of Current Portion	690,001	743,334
Total Other Assets	<u>1,458,076</u>	<u>1,511,409</u>
<u>Total Assets</u>	<u>\$ 18,751,420</u>	<u>\$ 19,017,114</u>

LIABILITIES AND NET ASSETS

<u>Current Liabilities</u>		
Accounts Payable	\$ 103,917	\$ 67,460
Accrued Expenses	82,855	81,773
Accrued Payroll	3,200	3,801
Payroll Taxes Payable	1,759	5,628
Accrued Compensated Absences	10,325	17,435
Accrued Interest Payable	52,700	67,737
Current Portion of Long-Term Debt	836,045	783,176
Current Portion of Deferred Gain on Installment Sale	<u>13,978</u>	<u>13,978</u>
Total Current Liabilities	<u>1,104,779</u>	<u>1,040,988</u>
<u>Other Liabilities</u>		
Long-Term Debt - Net of Current Portion	1,562,297	2,606,031
Deferred Gain on Installment Sale - Net of Current Portion	181,715	195,693
Security Deposits	87,447	93,855
Total Other Liabilities	<u>1,831,459</u>	<u>2,895,579</u>
<u>Total Liabilities</u>	<u>2,936,238</u>	<u>3,936,567</u>
<u>Net Assets</u>		
Unrestricted	<u>15,815,182</u>	<u>15,080,547</u>
<u>Total Liabilities and Net Assets</u>	<u>\$ 18,751,420</u>	<u>\$ 19,017,114</u>

(The Accompanying Notes are an Integral Part of these Financial Statements)

FITCHBURG REDEVELOPMENT AUTHORITY

STATEMENTS OF ACTIVITIES

FOR THE YEARS ENDED

DECEMBER 31,

	<u>2012</u>	<u>2011</u>
<u>Revenues</u>		
Grant Revenue	\$ 672,551	\$ 693,635
Real Estate Rentals	1,777,481	1,703,646
Installment Sale - MART	13,978	13,978
Interest Income	11,394	14,560
Miscellaneous Income	7,445	-
Total Revenues	<u>2,482,849</u>	<u>2,425,819</u>
<u>Expenses</u>		
Salaries	160,242	200,363
Payroll Taxes and Employee Benefits	73,390	69,741
Total Salaries and Related Expenses	<u>233,632</u>	<u>270,104</u>
Utilities	542,491	541,668
Interest Expense	147,475	192,906
Depreciation	356,372	350,822
Repairs and Maintenance	111,661	151,275
Environmental Investigation Services	8,731	32,800
Insurance	61,407	57,156
Legal and Professional Fees	21,438	1,066
Accounting and Audit	10,250	10,500
Property Taxes	140,580	135,224
Security Services	65,430	55,410
Bank Charges	7,091	8,542
Advertising	1,848	702
Dues and Subscriptions	1,055	956
Office Expense	4,559	3,483
Travel and Entertainment	1,294	3,109
Main Street Housing Program	25,000	25,000
Bad Debt Expense	7,900	-
Total Expenses	<u>1,748,214</u>	<u>1,840,723</u>
Change in Net Assets	734,635	585,096
Net Assets, Unrestricted, Beginning of Year	<u>15,080,547</u>	<u>14,495,451</u>
Net Assets, Unrestricted, End of Year	<u>\$ 15,815,182</u>	<u>\$ 15,080,547</u>

(The Accompanying Notes are an Integral Part of these Financial Statements)

FITCHBURG REDEVELOPMENT AUTHORITY

STATEMENTS OF CASH FLOWS

FOR THE YEARS ENDED

DECEMBER 31,

	<u>2012</u>	<u>2011</u>
Cash Flows from Operating Activities:		
Change in Net Assets	\$ 734,635	\$ 585,096
Adjustments to Reconcile Change in Net Assets to Net Cash Provided by Operating Activities:		
Depreciation	356,372	350,822
Changes in Operating Assets and Liabilities (Increase) Decrease in:		
Accounts and Grants Receivable	21,942	(14,359)
Prepaid Expenses	(4,157)	(8,128)
Property Held for Development	-	(12,942)
Increase (Decrease) in:		
Accounts Payable	36,457	(12,707)
Accrued Expenses	1,082	1,171
Accrued Payroll	(601)	828
Payroll Taxes Payable	(3,869)	19
Accrued Compensated Absences	(7,110)	1,805
Accrued Interest Payable	(15,037)	(13,775)
Security Deposits	(6,408)	(17,834)
Due to Riverfront Park	-	(5,587)
Deferred Gain on Installment Sale	(13,978)	(13,978)
Net Cash Provided by Operating Activities	<u>1,099,328</u>	<u>840,431</u>
Cash Flows from Investing Activities:		
Purchase of Property and Equipment	(128,518)	(34,516)
Repayment of Note - MART	53,333	53,333
Net Cash (Used) Provided by Investing Activities	<u>(75,185)</u>	<u>18,817</u>
Cash Flows from Financing Activities:		
Repayments of Long-Term Debt	(990,865)	(742,868)
Net Cash Used by Financing Activities	<u>(990,865)</u>	<u>(742,868)</u>
Net Increase in Cash	33,278	116,380
Cash and Cash Equivalents, Beginning of Year	<u>1,656,678</u>	<u>1,540,298</u>
Cash and Cash Equivalents, End of Year	<u>\$ 1,689,956</u>	<u>\$ 1,656,678</u>

SUPPLEMENTAL CASH FLOW INFORMATION

Cash Paid for Interest	<u>\$ 162,512</u>	<u>\$ 206,681</u>
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(The Accompanying Notes are an Integral Part of these Financial Statements)

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

1. SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES

a) Nature of Activities

Organization

The Fitchburg Redevelopment Authority (FRA) was established on January 21, 1964, as part of the City of Fitchburg, Massachusetts to engage in urban renewal and development. On September 23, 1964, the FRA commenced the independent management of its funds under Massachusetts General Law 121B.

Putnam Place

During 1999 the FRA acquired the building and land located on Boulder Drive, from General Electric Co., with the intent of converting the property to rentable office and manufacturing space, under the City of Fitchburg's Urban Renewal and Development plan. Putnam Place commenced operations during 2000.

b) Basis of Presentation

The accompanying financial statements have been prepared on the accrual basis of accounting in accordance with accounting principles generally accepted in the United States of America. Net assets and revenues, expenses, gains and losses are classified based on the existence or absence of donor imposed restrictions. Accordingly, net assets of the organization and changes therein are classified and reported as follows:

Unrestricted Net Assets - Net assets that are not subject to donor-imposed stipulations.

Temporarily Restricted Net Assets - Net assets subject to donor-imposed stipulations that may or will be met, either by actions of the FRA and/or the passage of time. When a restriction expires, temporarily restricted net assets are reclassified to unrestricted net assets and reported in the statement of activities as net assets released from restrictions. There were no temporarily restricted net assets for the years ending December 31, 2012 and 2011.

Permanently Restricted Net Assets - Net assets subject to donor-imposed stipulations that they be maintained permanently by the FRA. Generally, the donors of these assets permit the FRA to use all or part of the income earned on any related investments for general or specific purposes. There were no permanently restricted net assets for the years ending December 31, 2012 and 2011.

c) Cash and Cash Equivalents

Cash and cash equivalents consist primarily of demand deposit accounts and certificates of deposit with maturities of 3 months or less. Cash and cash equivalents are stated at cost which approximates market value.

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CON'T)

d) Advertising

Advertising costs are charged to operations when incurred.

e) Accounts Receivable

Trade accounts receivable are stated at the amount the FRA expects to collect. The FRA maintains allowances for doubtful accounts for estimated losses resulting from the inability of its tenants to make required payments. Management considers the following factors when determining the collectability of specific tenant's accounts: tenant's credit-worthiness, past transaction history with the tenants, current economic industry trends and changes in tenant's payment terms. If the financial condition of the FRA's tenants were to deteriorate, adversely affecting their ability to make payments, additional allowances would be required. Based on management's assessment, the FRA provides for estimated uncollectible amounts through a charge to earnings and a credit to a valuation allowance. Balances that remain outstanding after the FRA has used reasonable collection efforts are written off through a charge to the valuation allowance and a credit to accounts receivable.

f) Property and Equipment and Depreciation

Property and equipment additions are recorded at cost. Depreciation is computed using the straight-line method over the following estimated useful lives:

Building and Improvements	10 - 50 Years
Furniture and Fixtures	3 - 7 Years
Equipment	5 - 7 Years

g) Estimates

The preparation of financial statements in conformity with accounting principals generally accepted in the United States of America requires management to make estimates and assumptions that affect certain reported amounts and disclosures. Accordingly, actual results could differ from those estimates.

h) Income Taxes

FRA is exempt from federal and state income taxes under section 501(c)(1) of the Internal Revenue Code, except on income derived from unrelated business activities.

On January 1, 2010, the FRA adopted the provisions of FASB ASC-740-10, *Accounting for Uncertainty in Income Taxes*. FASB ASC-740-10 requires that a tax position be recognized or derecognized based on a 'more-likely-than-not' threshold. This applies to positions taken or expected to be taken in a tax return. The implementation of FASB ASC-740-10 had no impact on the FRA's statement of financial position or statement of activities. The FRA does not believe its financial statements include (or reflect) any uncertain tax positions.

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

SUMMARY OF SIGNIFICANT ACCOUNTING POLICIES (CON'T)

i) Concentrations of Credit Risk

Financial instruments that potentially subject the FRA to concentrations of credit risk consist principally of cash and certificates of deposit. The FRA maintains its cash in bank deposit accounts, the balances of which, at times may exceed federally insured limits. Accounts are guaranteed by the Federal Deposit Insurance Corporation (FDIC) up to \$250,000. At December 31, 2012 and 2011, the FRA had approximately \$913,000 and \$803,000 respectively in excess of FDIC insured limits. The FRA has not experienced any losses in such accounts.

- j) Certain amounts in prior periods presented have been reclassified to conform to the current financial statement presentation. These reclassifications have no effect on previously reported net income.

2. ACCOUNTS AND GRANTS RECEIVABLE

Accounts and grants receivable consist of the following:

	<u>2012</u>	<u>2011</u>
Due from the State of Massachusetts	\$ 329,653	\$ 329,653
Accounts Receivable Putnam Place	<u>100,358</u>	<u>140,571</u>
	430,011	470,224
Less: Allowance for Doubtful Accounts	<u>(5,500)</u>	<u>(23,771)</u>
	<u>\$ 424,511</u>	<u>\$ 446,453</u>

3. NOTE RECEIVABLE - MART

The FRA entered into an agreement with the Montachusett Regional Transit Authority (MART) dated May 23, 2003 to transfer ownership of property held by FRA for redevelopment. The agreement states that the MART will pay The FRA \$1,050,000 over a 21-year period commencing June 2006. At December 31, 2012 and 2011, amounts due to FRA under the agreement are \$743,334 and \$796,667 respectively.

Installment receivables will be collected as follows:

Year ending December 31:

2013	\$ 53,333
2014	53,333
2015	53,333
2016	53,333
2017	53,333
Thereafter	<u>476,669</u>
	<u>\$ 743,334</u>

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

4. LAND, BUILDINGS AND EQUIPMENT

Land, buildings and equipment consist of the following:

	<u>2012</u>	<u>2011</u>
Land	\$ 672,612	\$ 672,612
Buildings and Improvements	17,156,233	17,034,465
Equipment	15,945	15,945
Computer Software	10,000	10,000
Construction in Progress	15,120	8,370
	<u>17,869,910</u>	<u>17,741,392</u>
Less: Accumulated Depreciation	<u>(2,790,949)</u>	<u>(2,434,577)</u>
	<u>\$15,078,961</u>	<u>\$15,306,815</u>

Depreciation expense amounted to \$356,372 and \$350,822 for the years ending December 31, 2012 and 2011, respectively.

5. PROPERTY HELD FOR DEVELOPMENT

FRA acquired the following properties for further development:

	<u>2012</u>	<u>2011</u>
Authority Drive	\$ 3,000	\$ 3,000
College Area (North Street and Snow Street)	<u>765,075</u>	<u>765,075</u>
	<u>\$ 768,075</u>	<u>\$ 768,075</u>

6. LONG-TERM DEBT

Long-term debt consists of the following:

	<u>2012</u>	<u>2011</u>
Note payable to bank, in monthly installments Of \$13,995 including interest 5.25% through June 2015. Secured by leases and rents.	\$ 217,947	\$ 566,812
Note payable to the Mass Development Authority, non-interest bearing.	40,395	40,395
Mortgage note payable to the City of Fitchburg. Pass-thru HUD Section 108 loan, variable annual installments, including interest at a variable rate (approximately 4.7%) through July, 2015, secured by land, building, leases and rents.	<u>2,140,000</u>	<u>2,782,000</u>
	<u>2,398,342</u>	<u>3,389,207</u>
Less: Current maturities	<u>(836,045)</u>	<u>(783,176)</u>
Long-term debt	<u>\$ 1,562,297</u>	<u>\$ 2,606,031</u>

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

LONG-TERM DEBT (CON'T)

Maturities of long-term debt are as follows:

<u>Year ending December 31,</u>	
2013	\$ 836,045
2014	770,902
2015	751,000
2016	<u>40,395</u>
	<u>\$ 2,398,342</u>

7. OPERATING LEASES (AS LESSOR)

The FRA enters into rental agreements with numerous tenants consisting of various lease terms to rent office space and manufacturing facilities located at Putnam Place.

Future minimum rental payments to be received are as follows:

<u>Year ending December 31,</u>	
2013	\$ 1,031,544
2014	1,020,973
2015	1,023,796
2016	846,655
2017	782,598
Thereafter	<u>2,378,111</u>
	<u>\$ 7,083,677</u>

8. PENSION PLAN

Plan Description

The Fitchburg Redevelopment Authority contributes to the Fitchburg Retirement System (FRS), a cost sharing multi-employer defined benefit pension plan administered by the Fitchburg Retirement System. FRS provides retirement and disability benefits, annual cost-of-living adjustments, and death benefits to plan members and beneficiaries. Chapter 32 of general laws of Massachusetts assigns the authority to establish and amend benefit provisions to the FRS retirement board. FRS issues a publicly available financial report that includes financial statements and required supplementary information for FRS. That report may be obtained by writing to Fitchburg Retirement System, 718 Main Street, Fitchburg, MA 01420.

Funding Policy

Plan members are required to contribute 9.0% of their annual salary up to \$30,000 and 11.0% on any salary in excess of \$30,000. The Fitchburg Redevelopment Authority is required to contribute at an actuarially determined amount. The contribution requirements of plan members and the Fitchburg Redevelopment Authority are established and may be amended by the FRS Board of Trustees. The Fitchburg Redevelopment Authority's contribution to the FRS for the years ending December 31, 2012, 2011 and 2010 were \$57,404, \$52,806, and \$29,910 respectively. Amounts are equal to the required contributions for those years.

FITCHBURG REDEVELOPMENT AUTHORITY

NOTES TO THE FINANCIAL STATEMENTS

FOR THE YEARS ENDED

DECEMBER 31, 2012 AND 2011

9. CONTINGENCIES

Economic Development Administration

As a condition of the award of two grants from the United States Department of Commerce, Economic Development Administration (EDA), totaling \$2,000,000, the FRA must hold title to the Putnam Place property for a minimum of fifteen years, or risk repayment of the EDA grants. This agreement was confirmed by a vote of the FRA board of directors in June, 2006 and evidenced by the recording of a mortgage on said property.

Sick Time

Sick time can be accrued up to maximum of 334 days, but if an employee terminates employment for any reason other than retirement or death the accrued balance is forfeited. In the event of retirement or death the cash benefit received would be \$30 per accrued day to a maximum benefit of \$10,000 per employee.

Main Street Housing Program

Fitchburg Redevelopment Authority has an agreement with Twin Cities Community Development Corporation whereas Twin Cities Community Development Corporation will develop 23 market-rate housing units located at 470 Main Street, Fitchburg. Fitchburg Redevelopment Authority will then award a grant of \$5,000 per unit for a total of \$115,000 to the developer for developing the units. As of December 31, 2012, Fitchburg Redevelopment Authority has paid \$100,000 of the grant awarded.

10. RELATED PARTY TRANSACTIONS

Included in long-term debt is a note to the City of Fitchburg (see footnote 6 for details of the note).

11. EVALUATION OF SUBSEQUENT EVENTS

The FRA has evaluated subsequent events through June 4, 2013, the date which the financial statements were available to be issued.

SUPPLEMENTARY INFORMATION

FITCHBURG REDEVELOPEMENT AUTHORITY

SCHEDULE OF ACTUAL PROJECT COSTS

URBAN REVITALIZATION DEVELOPMENT

FOR THE YEAR ENDED DECEMBER 31, 2012

	<u>From Inception through 12/31/11</u>	<u>Fiscal Year 2012</u>	<u>From Inception through 12/31/12</u>
Revenues			
Mass Urban Renewal	\$ 8,033,754	\$ 659,306	\$ 8,693,060
Sale of Real Estate	1,518,457	-	1,518,457
Other Grants	1,284,619	13,245	1,297,864
Interest Income	247,975	11,394	259,369
Miscellaneous	162,834	-	162,834
Total Revenues	<u>11,247,639</u>	<u>683,945</u>	<u>11,931,584</u>
Expenditures			
Professional Services:			
Other	295,478	-	295,478
Design and Site Planning	260,794	-	260,794
Appraisals	224,637	-	224,637
Environmental			
Investigative Services	661,606	8,731	670,337
Consulting	82,438	-	82,438
Project Inspection/Audit	5,274	-	5,274
Acquisition, Construction, and Improvement Costs	4,166,359	-	4,166,359
Interest and Bond Fees	2,205,442	128,405	2,333,847
Marketing	291,265	-	291,265
Legal	444,482	3,130	447,612
Relocation	216,237	-	216,237
Utilities	556,874	13,949	570,823
Real Estate Taxes	253,725	26,050	279,775
Repairs and Maintenance	157,938	4,460	162,398
Depreciation	331,623	37,419	369,042
Advertising	56,510	-	56,510
Office Expense	37,939	-	37,939
Salaries and Wages	238,572	52,207	290,779
Miscellaneous	26,997	-	26,997
Loan Program	105,000	25,000	130,000
Insurance	55,638	11,197	66,835
Travel and Entertainment	8,906	1,294	10,200
Accounting	794	-	794
Total Expenditures	<u>10,684,528</u>	<u>311,842</u>	<u>10,996,370</u>
Net Income	<u>\$ 563,111</u>	<u>\$ 372,103</u>	<u>\$ 935,214</u>

MARK S. MUELLER
CERTIFIED PUBLIC ACCOUNTANT

23 Mill Street, Suite 2 - Leominster, Massachusetts 01453
(978) 833-9990
Fax (978) 840-0394

**INDEPENDENT AUDITOR'S REPORT ON INTERNAL CONTROL OVER FINANCIAL REPORTING AND
ON COMPLIANCE AND OTHER MATTERS BASED ON AN AUDIT OF FINANCIAL STATEMENTS
PERFORMED IN ACCORDANCE WITH GOVERNMENT AUDITING STANDARDS**

To the Board of Directors of
Fitchburg Redevelopment Authority

We have audited, in accordance with the auditing standards generally accepted in the United States of America and the standards applicable to financial audits contained in *Government Auditing Standards* issued by the Comptroller General of the United States, the financial statements of Fitchburg Development Authority (a political subdivision), which comprise the statements of financial position as of December 31, 2012 and 2011, and the related statements of activities, and cash flows for the years then ended, and the related notes to the financial statements, and have issued our report thereon dated June 4, 2013.

Internal Control over Financial Reporting

In planning and performing our audit of the financial statements, we considered Fitchburg Redevelopment Authority's internal control over financial reporting (internal control) to determine the audit procedures that are appropriate in the circumstances for the purpose of expressing our opinion on the financial statements, but not for the purpose of expressing an opinion on the effectiveness of Fitchburg Redevelopment Authority's internal control. Accordingly, we do not express an opinion on the effectiveness of the Organization's internal control.

A *deficiency in internal control* exists when the design or operation of a control does not allow management or employees, in the normal course of performing their assigned functions, to prevent, or detect and correct, misstatements on a timely basis. A *material weakness* is a deficiency, or a combination of deficiencies, in internal control, such that there is a reasonable possibility that a material misstatement of the entity's financial statements will not be prevented, or detected and corrected on a timely basis. A *significant deficiency* is a deficiency, or a combination of deficiencies, in internal control that is less severe than a material weakness, yet important enough to merit attention by those charged with governance.

Our consideration of internal control was for the limited purpose described in the first paragraph of this section and was not designed to identify all deficiencies in internal control that might be material weaknesses or significant deficiencies. Given these limitations, during our audit we did not identify any deficiencies in internal control that we consider to be material weaknesses. However, material weaknesses may exist that have not been identified.

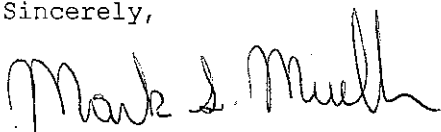
Compliance and Other Matters

As part of obtaining reasonable assurance about whether Fitchburg Redevelopment Authority's financial statements are free from material misstatement, we performed tests of its compliance with certain provisions of laws, regulations, contracts, and grant agreements, noncompliance with which could have a direct and material effect on the determination of financial statement amounts. However, providing an opinion on compliance with those provisions was not an objective of our audit, and accordingly, we do not express such an opinion. The results of our tests disclosed no instances of noncompliance or other matters that are required to be reported under *Government Auditing Standards*.

Purpose of this Report

The purpose of this report is solely to describe the scope of our testing of internal control and compliance and the results of that testing, and not to provide an opinion on the effectiveness of the organization's internal control or on compliance. This report is integral part of an audit performed in accordance with *Government Auditing Standards* in considering the organization's internal control and compliance. Accordingly, this communication is not suitable for any other purpose.

Sincerely,



Mark S. Mueller
Certified Public Accountant
June 4, 2013

REPORTS FROM COMMITTEES



Office of the

Board of Health

City Hall

Fitchburg, Massachusetts 01420

978-829-1870

FITCHBURG CITY CLERK

2013 AUG 27 A 10:15

MEMORANDUM

To: Honorable City Councilors

From: Stephen D. Curry,
Director of Public Health

cc: Mayor Lisa A. Wong
Ian J. Murray, BOH Chair
Sandra J. Knipe, BSN, Member
Daria M. Karos, M.D., Member

Date: August 26, 2013

Re: Petition #029-13 (Raising and keeping of Poultry)

Please be advised at a regular meeting held on Friday August 23rd 2013, at 8AM in the Conference Room located at 166 Boulder Drive, the Board of Health unanimously voted (2-0, one member absent-Dr. Karos) to not allow the above mentioned proposed petition as it is currently written.

RECESSED HEARINGS

REPORT

The Committee on
Planning Board, City Council Public
Hearing April 2, 2013

to which was referred this petition recom-
mend that the petition be granted, be given
leave to withdraw.

In City Council

Report Read and Accepted

Clerk

No. 029 - 2013

PETITION

of

Councillor Thibault-Munoz

to

Request the addition to the existing
City Code Ch. 181 Zoning sec. 181.313
Table of Principle use Regulations
subsection B. as outlined in the enclosed
petition (raising and keeping of poultry
of six (6) or less for use by residents
of the premises with a parcel of five
acres or less)

In City Council

February 5, 2012

Referred to Committee on

Planning Board, City Council Public
Hearing, April 2, 2013

Anna M. Farrell

Clerk

TO THE HONORABLE CITY
COUNCIL OF THE CITY OF
FITCHBURG

Ladies and Gentlemen:

The undersigned Petition your Honorable Body to

Councillor Thibault-Munoz request the
addition to the existing City Code
Chapter 181 Zoning section 181.313
Table of Principal Use Regulations
subsection B. (Exempt and Institutional
uses) 7. (Use of land for the primary
purpose of agriculture, horticulture,
floriculture, or viticulture on a parcel of more
than five acres in area) to the following: The
raising or keeping of poultry of six (6) or less
for use by residents of the premises is
permitted by right in all districts with a
parcel of five acres or less.

2013 JAN 30 P 3:01
FITCHBURG CITY CLERK



CITY OF FITCHBURG
PLANNING BOARD
301 BROAD STREET
FITCHBURG, MASSACHUSETTS 01420

(978) 829-1891
PHONE

(978) 345-9687
FAX

MEMO

DATE: April 22, 2013
TO: City Council
City Clerk
FROM: Michael O'Hara, Principal Planner, DPW
SUBJECT: Petition # 029-2013
Raising Poultry as Accessory Use

FITCHBURG CITY CLERK
2013 APR 24 A 8:44

As noted previously, the Fitchburg Planning Board voted on March 27, 2013 voted unanimously to recommend against the above-noted petition, as originally submitted.

However, subsequent to the initial petition, the Councillor Munoz submitted additional information to the Board on proposed standards for raising chickens.

The Planning Board had numerous comments on these proposed standards. Their comments have been incorporated into the attached.

Accessory Keeping of Hens

- 1) Roosters are expressly Forbidden
- 2) The on-site slaughtering of Hens is prohibited
- 3) Adult egg-laying Hens shall be supervised and is Allowed exclusively in fenced areas
- 4) All storage containers for feed for Hens shall be rodent-proof
- 5) The owner of the Hens shall keep facilities clean, sanitary, free from decaying food, filth, feces, vermin infestation and stagnant water
- 6) Any noise of Hens must conform to the City's Noise Ordinance
- 7) Permit holders are responsible to ensure Hens are not able to wander off the property
- 8) Permits can only be granted to owner-occupied homes
- 9) Consent from abutters will be requested and abutters who object can be heard at a special permit hearing
- 10) Except for sick Hens being quarantined or requiring special care, all adult Hens must be kept outdoors and are expressly Forbidden from habitable structures and structures used for personal storage
- 11) Hens must have access to clean potable water at all times
- 12) No persons shall surrender Chicks or Hens to the City of Fitchburg.
- 13) In the event a Hen is known or suspected to be sick or injured, the Owner is responsible for providing adequate home care or veterinary care or for humanely

	culling and disposing of the Hen 14) All Hens must be sourced from a Salmonella Pullorum-free flock or a hatchery participating in NPIP (National Poultry Improvement Program). 15) All Hens over the age of 16 weeks should be tested for Salmonella Pullorum 16) Chicken Coops and Runs are allowed on a lot adjoining or immediately opposite and across a road from the lot on which the principal use it serves is located, provided that both lots are retained in identical ownership 17) Drainage or liquid effluent containing urine or fecal matter is not to be discharged in runoff, or to flow over the surface of the ground onto a neighboring property, public way or watercourse and shall not be susceptible to flooding 18) Water including drainage shall not become stagnant or collect or create a ponding affect upon said facility 19) Disposal of agricultural waste and dead animals shall be in accordance with local and state waste disposal regulations 20) The Board of Health may deny, suspend, revoke, or refuse to renew a permit for failure to comply with the provisions of the regulations. Any owner or person in charge of a covered facility who fails to comply with the regulations shall be subject to a fine of fifty (\$50) dollars for the first citation of a violation
Maximum Chickens	Propose amending current language to remove the language about 1-6 chickens. Up to 6 Hens may be kept on any residential

	property as long as all conditions of care are met. Additional hens can be requested depending on the lot size – councilors need to develop parameters.
Maintenance	1) Keeping of Hens at no time shall constitute a nuisance or a hazard to the surrounding neighborhood 2) Maintenance of the Coop and Run shall conform to all health and wetland regulations 3) Chicken waste must be composted with a material such as hay, bedding, or leaves in a rodent-proof composter or sealed container until it is fully composted or removed from the property 4) Coops and Runs need to be cleaned at least once a week
Coop & Run Design	1) Each Coop and Run must be kept clean, free of all odors and materials that can attract rodents 2) Coop structures should be constructed with a solid material on all sides and have a solid roof and doors that lock 3) Coops shall be constructed with adequate ventilation with vents covered in wire screening 4) A building permit, with the applicable fee, is required if any dimension of the coop meet the current standard for a building permit. If under the building permit requirements, the applicant can build w/o the permit request 5) Coop space must allow a minimum of two (2) square feet per Hen and one (1) nest box per three (3) Hens within

	6) Ventilation holes or gaps in the Coop should be covered with wire mesh. 7) The Coop floor should be securely built and predator-proof 8) Coop ceilings should be constructed with a roof or ceiling to help keep Hens dry 9) Coop floors shall be kept covered with an adequate dry supply of suitable bedding material to absorb moisture and subdue odor. Beddings such as pine shavings, straw, sawdust etc. are suitable. Regular raking to keep the litter in top condition is also recommended along with periodic removal of wet, caked litter 10) Runs must allow a minimum of four (4) square feet per Hen 11) All Runs shall be designed to be predator proof 12) The run fencing shall extend beneath the ground, to allow for settling 13) Most perimeter fencing or screening may be used to enclose the planned area for Hens (such as metal pickets, decorative metal, post and rail, vinyl coated chain link or board-type wood). The use of un-coated metal chain link fencing and plywood sheeting is not allowed. 14) Electrical fixtures shall be placed out of the reach of animals 15) Any associated plumbing or electrical work must be completed in accordance with current relevant local and state regulations
Coop Setbacks	1) All coop structures must be set back at least five (15') feet from all property lines. 2) Coops and Runs shall not be located in the

	front yard 3) Coops and Runs shall not be within a fifteen (25) foot buffer of habitable structures on adjacent properties unless prior permission is granted in writing by the neighboring property owner(s) 4) Coops and Runs must be a minimum of 20 feet from a public way and 50 feet from a well, stream or other water supply 5) Coops and Runs cannot interfere with any utilities or other property features that require access
Information Required to be provided during the Application for Keeping of Hens License	1) At minimum, an informal plot plan showing all current structures (including primary dwelling, garages, sheds etc.), the proposed site for coop(s) and run spaces, plans for confining fences and barrier, location of any septic system on the premises, location of any private wells within 100 feet of the perimeter of where the animals will be kept 2) At minimum, a sketch drawing for Coop and Run structure (with proposed dimensions for each) 3) Proposed number of Hens 4) Photographs of existing site and adjacent properties to provide site context 5) Proposed method for controls for storm water runoff and waste management 6) Written plan for management and disposal of animal waste, storage of feed, method used to control pests
Additional Information	1) License is proposed at \$25/yearly. 2) The person(s) who have had a permit

	denied or revoked shall be ordered to remove all unlicensed animals from the property within a time frame determined by the Board of Health 3) Permits are not transferable 4) Since permit holders are responsible for Hens, permit holders must live at the residence where Hens are kept
--	--

REPORT

The Committee on

Planning Board
Public Hearing July 16, 2013

to which was referred this petition would recommend that the petition be granted, be given leave to withdraw.

In City Council

Report Read and Accepted

Clerk

PETITION

of

Councillor Joel Kaddy

to

Rezoned Water St. on the West side from Wanoosnoc Rd. to the Leominster Line.

In City Council

May 21, 2013

Referred to Committee on

Planning Board
Public Hearing July 16, 2013

Anna M. Farrell

Clerk

No. _____ - 2013

REV 7/19/13
7/12 + 5/13/13
Nelle: 5-000163

PH
7/16/13

In City Council July 16, 2013 Hearing Held. Councillor Kaddy stated that the zoning should be changed so as to allow for an increase in the City's Commercial Base. Councillor DiNatale suggested that the Council wait until the report from the Planning Board has been received.

By unanimous vote, the petition was amended to read as follows: Councillor Joel Kaddy, to rezone Water Street on the West side from Wanoosnoc Road to the Leominster Line to Commercial Business District. Hearing on the amended petition was continued to September 3, 2013 by unanimous vote. 8 members present. Board consists of 11 members.
Anna M. Farrell, Clerk

ORDERS - FINANCE



CITY OF FITCHBURG
MASSACHUSETTS
OFFICE OF THE MAYOR

LISA A. WONG
MAYOR

NATHAN LaROSE
ASSISTANT TO THE MAYOR

IRENE HERNANDEZ
ADMINISTRATIVE ASSISTANT

July 9, 2013

Richard N. Sarasin
City Auditor/Finance Director
Fitchburg Municipal Offices
166 Boulder Drive
Fitchburg, MA 01420

Dear Mr. Sarasin:

Kindly draw a council loan-order appropriating \$1.1 million for the purchase of departmental equipment, summarized as follows:

<u>Description</u>	<u>Estimated Cost</u>
Fire Engine	\$ 424,000
Fire Chief Command Car	34,000
Fire Deputy Chief Command Car	42,000
Health - Pick-up Truck	23,000
Police - Pick-up Truck with plow	32,000
DPW - Two International Dump Trucks	440,000
DPW - One Backhoe	105,000
 Total	 \$1,100,000

Please see attached.

Thank you.

Sincerely,

Lisa A. Wong, Mayor

2013 JUL - 9 A 11:38
FITCHBURG CITY CLERK



Kevin D. Roy
Chief of Fire Department

City of Fitchburg, Massachusetts
FIRE DEPARTMENT

33 North Street
Fitchburg, MA 01420

978-345-9666
FAX: 978-345-9589

August 21, 2013

To: Mayor Lisa A. Wong
From: Kevin D. Roy
Re: Donation of Rescue Equipment

Dear Mayor Wong and Councilors:

Please accept a gift of "Rescue Air Bags", for the Fitchburg Fire Department. These air bags are used for extraction during vehicle, heavy equipment, and building collapse emergencies.

The value of this donation is \$2,370.00, made by Rydemore Heavy Duty Truck Parts.

Rydemore Truck operates a business on Benson Street in Fitchburg and dismantles heavy duty trucks and other vehicles. The addition of these air bags would be a critical tool, should an accident occur at their facility as well as anywhere in our City.

If you have any questions regarding this donation, please contact me.

Sincerely,

A handwritten signature in black ink that reads "Kevin D. Roy". The signature is written in a cursive style with a large, stylized "K" and "R".

Kevin D. Roy
Chief of Department

cc: Richard Sarasin, City Auditor

KDR/rmk



Office of the

Board of Health

City Hall

Fitchburg, Massachusetts 01420

978-829-1870

MEMORANDUM

To: Mayor Lisa A. Wong

From: Stephen D. Curry,
Director of Public Health

Robert Lanciani,
Building Commissioner

cc: City Council,
Richard Sarasin, Auditor

Date: August 23, 2013

Re: Building Division-Vehicle Appropriation

Please be advised the Building Division is respectfully requesting an appropriation of \$128,000 for the purchase of city vehicles for the staff of the Building Division. The purpose of the appropriation is to purchase a total of five (5) vehicles; (one) 1 vehicle assigned to the Building Commissioner and (one) 1 vehicle assigned to each of the four (4) Inspectors. This appropriation is consistent with previous requests for city equipment as recommended by the Capital Improvement Commission meeting held June 25, 2013.

Please do not hesitate to contact this office if questions arise.



Kevin D. Roy
Chief of Fire Department

City of Fitchburg, Massachusetts
FIRE DEPARTMENT

33 North Street
Fitchburg, MA 01420

978-345-9666
FAX: 978-345-9589

August 8, 2013

To: Mayor Lisa A. Wong
From: Kevin D. Roy
Re: Emergency Management Performance Grant

Dear Mayor Wong:

I am requesting the City accept a grant from FEMA, which is administered through MEMA, (Massachusetts Emergency Management) in the amount of \$14,030.00. This federal grant will allow us to purchase items that will benefit our emergency management performance. We are looking to purchase the annual license/contract for the Code Red, "Reverse 911" System. We are also looking to purchase four (4) VHF Mobil radios to be used by the Emergency Management members.

If you have any questions regarding this grant, please contact me.

Respectfully,

Kevin D. Roy
Kevin D. Roy
Chief of Department

cc: Richard Sarasin, City Auditor

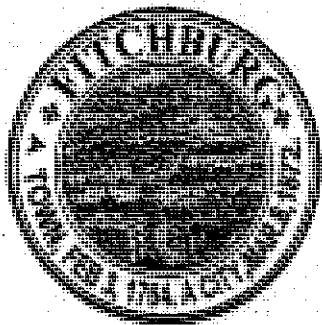
KDR/rmk

COMMONWEALTH OF MASSACHUSETTS ~ STANDARD CONTRACT FORM



This form is jointly issued and published by the Executive Office for Administration and Finance (EAF), the Office of the Comptroller (CTR) and the Operational Services Division (OSD) as the default contract for all Commonwealth Departments when another form is not prescribed by regulation or policy. Any changes to the official printed language of this form shall be void. Additional non-conflicting terms may be added by Attachment. Contractors may not require any additional agreements, engagement letters, contract forms or other additional terms as part of this Contract without prior Department approval. Click on hyperlinks for definitions, instructions and legal requirements that are incorporated by reference into this Contract. An electronic copy of this form is available at www.mass.gov/leg under Guidance For Vendor - Forms or www.mass.gov/leg under OSD Forms.

CONTRACTOR LEGAL NAME: CITY OF FITCHBURG (and d/b/a):		COMMONWEALTH DEPARTMENT NAME: MASS EMERGENCY MANAGEMENT AGENCY	
Legal Address: (W-9, W-4T&C): 718 MAIN ST, FITCHBURG, MA 01420-3155		MMARS Department Code: CDA, EMERGENCY MANAGEMENT AGENCY	
Contract Manager: Chief Kevin Roy		Business Mailing Address: 400 WORCESTER RD FRAMINGHAM MA 01702	
E-Mail: kroy@fitchburgma.gov		Billing Address (if different):	
Phone:		Contract Manager: KATHLEEN ESTRIDGE	
Fax:		E-Mail: KATHLEEN.ESTRIDGE@STATE.MA.US	
Contractor Vendor Code: VC6000192091		Phone: 508.820.1447 Fax: 508.820.2030	
Vendor Code Address ID (e.g. "AD001"): AD_001		MMARS Doc ID(s): FY14ENPG12000000FITCH	
(Note: The Address ID Must be set up for EFT payments.)		RFP/Procurement or Other ID Number: FFY2012 ENPG	
X NEW CONTRACT		CONTRACT AMENDMENT	
PROCUREMENT OR EXCEPTION TYPE: (Check one option only) ☐ Statewide Contract (OSD or an OSD-designated Department) ☐ Collective Purchase (Attach OSD approval, scope, budget) ☒ Department Procurement (Includes State or Federal grants 815 CMR 2.00) (Attach RFP and Response or other procurement supporting documentation) ☐ Emergency Contract (Attach justification for emergency, scope, budget) ☐ Contract Employee (Attach Employment Status Form, scope, budget) ☐ Legislative/Legal or Other (Attach authorizing language/justification, scope and budget)		Enter Current Contract End Date Prior to Amendment: ____, 20__ Enter Amendment Amount: \$ ____, (or "no change") AMENDMENT TYPE: (Check one option only. Attach details of Amendment changes.) ☐ Amendment to Scope or Budget (Attach updated scope and budget) ☐ Interim Contract (Attach justification for Interim Contract and updated scope/budget) ☐ Contract Employee (Attach any updates to scope or budget) ☐ Legislative/Legal or Other (Attach authorizing language/justification and updated scope and budget)	
The following COMMONWEALTH TERMS AND CONDITIONS (T&C) has been executed, filed with CTR and is incorporated by reference into this Contract.			
☒ Commonwealth Terms and Conditions ☐ Commonwealth Terms and Conditions For Human and Social Services			
COMPENSATION: (Check ONE option): The Department certifies that payments for authorized performance accepted in accordance with the terms of this Contract will be supported in the state accounting system by sufficient appropriations or other non-appropriated funds, subject to intercept for Commonwealth owed debts under 815 CMR 9.00. ☐ Rate Contract (No Maximum Obligation. Attach details of all rates, units, calculations, conditions or terms and any changes if rates or terms are being amended). ☒ Maximum Obligation Contract Enter Total Maximum Obligation for total duration of this Contract (or new Total if Contract is being amended): \$14,030.00			
PROMPT PAYMENT DISCOUNTS (PPD): Commonwealth payments are issued through EFT 45 days from Invoice receipt. Contractors requesting accelerated payments must identify a PPD as follows: Payment issued within 10 days __% PPD; Payment issued within 16 days __% PPD; Payment issued within 20 days __% PPD; Payment issued within 30 days __% PPD. If PPD percentages are left blank, identify reason: __agree to standard 45 day cycle __statutory/legal or Ready Payments (G.L. c. 29, § 23A); X __only initial payment (subsequent payments scheduled to support standard EFT 45 day payment cycle. See Prompt Pay Discounts Policy.)			
BRIEF DESCRIPTION OF CONTRACT PERFORMANCE or REASON FOR AMENDMENT: (Enter the Contract title, purpose, fiscal year(s) and a detailed description of the scope of performance or what is being amended for a Contract Amendment. Attach all supporting documentation and justifications.) Funding for this grant is provided through the FFY2012 Emergency Management Performance Grant, the Catalog of Federal Domestic Assistance (CFDA) number is 97.042. The community intends to purchase a Reverse 911 system, and VHF mobile radios.			
ANTICIPATED START DATE: (Complete ONE option only) The Department and Contractor certify for this Contract, or Contract Amendment, that Contract obligations: ☒ 1. may be incurred as of the Effective Date (latest signature date below) and no obligations have been incurred prior to the Effective Date. ☐ 2. may be incurred as of ____, 20__, a date LATER than the Effective Date below and no obligations have been incurred prior to the Effective Date. ☐ 3. were incurred as of a date PRIOR to the Effective Date below, and the parties agree that payments for any obligations incurred prior to the Effective Date are authorized to be made either as settlement payments or as authorized reimbursement payments, and that the details and circumstances of all obligations under this Contract are attached and incorporated into this Contract. Acceptance of payments forever releases the Commonwealth from further claims related to these obligations.			
CONTRACT END DATE: Contract performance shall terminate as of May 31, 2014 with no new obligations being incurred after this date unless the Contract is properly amended, provided that the terms of this Contract and performance expectations and obligations shall survive its termination for the purpose of resolving any claim or dispute, for completing any negotiated terms and warranties, to allow any close out or transition performance, reporting, invoicing or final payments, or during any lapse between amendments.			
CERTIFICATIONS: Notwithstanding verbal or other representations by the parties, the "Effective Date" of this Contract or Amendment shall be the latest date that this Contract or Amendment has been executed by an authorized signatory of the Contractor, the Department, or a later Contract or Amendment Start Date specified above, subject to any required approvals. The Contractor makes all certifications required under the attached Contractor Certifications (incorporated by reference if not attached hereto) under the pains and penalties of perjury, agrees to provide any required documentation upon request to support compliance, and agrees that all terms governing performance of this Contract and doing business in Massachusetts are attached or incorporated by reference herein according to the following hierarchy of document precedence, the applicable Commonwealth Terms and Conditions, this Standard Contract Form including the Instructions and Contractor Certifications, the Request for Response (RFR) or other solicitation, the Contractor's Response, and additional negotiated terms, provided that additional negotiated terms will take precedence over the relevant terms in the RFR and the Contractor's Response only if made using the process outlined in 801 CMR 21.07, incorporated herein, provided that any amended RFR or Response terms result in best value, lower costs, or a more cost effective Contract.			
AUTHORIZING SIGNATURE FOR THE CONTRACTOR:		AUTHORIZING SIGNATURE FOR THE COMMONWEALTH:	
X: <u>Kevin D. Roy</u> Date: <u>7/19/13</u> (Signature and Date Must Be Handwritten At Time of Signature)		X: <u>[Signature]</u> Date: <u>8-7-12</u> (Signature and Date Must Be Handwritten At Time of Signature)	
Print Name: <u>KEVIN D. ROY</u>		Print Name: <u>David Mahr</u>	
Print Title: <u>FIRE CHIEF</u>		Print Title: <u>Chief Financial Officer</u>	



CITY OF FITCHBURG POLICE DEPARTMENT

20 Elm Street
Fitchburg, Massachusetts 01420-3204
www.fitchburgpolice.com

DEPARTMENT/OPERATIONS
978-345-9648
FAX: 978-345-4088

CRIMINAL INVESTIGATIONS
978-345-9650

RECORDS BUREAU
978-345-9643
FAX: 978-342-7608

CHIEF OF POLICE
978-345-9656
FAX: 978-343-6007

ROBERT A. DEMOURA
CHIEF OF POLICE

August 27, 2013

Honorable Mayor Lisa A. Wong
City Hall
718 Main Street
Fitchburg, MA 01420

Re: FY14 Local JAG Award – LLEBG 17

Dear Honorable Mayor:

The Fitchburg Police Department has received an allocation of funds totaling \$25,413.00 from the Department of Justice, Office of Justice Programs.

These awarded monies are intended to purchase equipment that supports the tactical, investigative and administrative needs of law enforcement, such as a remote camera system with software, computer tablets for our Detective Bureau, vest carriers and shirts for our patrol officers, and supplies to be utilized by our interns and Citizens on Patrol program. We have also set aside a portion of funds to support our community policing efforts.

I request your approval to start spending funds from this award to benefit both our department and the City of Fitchburg. Thank you for your attention to this matter.

Sincerely,

Robert A. DeMoura
Chief of Police

RAD/rfs



Office of the

Board of Health

City Hall

Fitchburg, Massachusetts 01420

978-829-1870

MEMORANDUM

To: Mayor Lisa A. Wong

From: Stephen D. Curry,
Director of Public Health

cc: City Council,
Richard N. Sarasin

Date: August 26, 2013

Re: CHNA-9 Mini-grant

Please be advised I respectfully request an order be directed to the City Council to approve the expenditures of the CHNA-9 Mini-grant in the amount of \$1,670.00 for the purposes of the grant. This grant will provide Stroke Education Seminars to the public to be held at Senior Centers in towns whom are members of the Montachusett Public Health Network (MPHN).

Please do not hesitate if questions arise.

**PETITION
BACK UP
DOCUMENTATION**

TO THE HONORABLE CITY COUNCIL OF THE CITY OF FITCHBURG

Ladies and gentlemen:

The undersigned PETITION your Honorable Body to RELEASE, REMOVE and/or ABANDON the RIGHT OF WAY easement held by the City of Fitchburg at Lot 7 Davis Road, Westminster, MA and the contiguous land to the West that leads to Mare Meadow Reservoir. This Right of Way is an "old cart path" that starts to the East at Davis Road and meanders through to the rear or NW boundary line of my property. (See Exhibit A – Land Survey – 6/19/2013) Said Right of Way is referenced in Book 694 Page 274 recorded 12/18/1951 and Book 746 Page 417 recorded 9/10/1954, Worcester Northern District Registry of Deeds. (Both Deeds can be accessed via www.fitchburgdeeds.com.) Born in Fitchburg, MA and raised on Davis Road, Westminster, I recall the above dates coinciding with when the City of Fitchburg undertook the construction of Mare Meadow Reservoir. In retrospect, I trust they could have used this Right of Way for construction purposes. Construction has long been over and it is my understanding that there is no planned future use of this Right of Way. In light of this history, I return to my roots and I am respectfully requesting that this Honorable Body give due consideration of my request and grant the RELEASE of the Right of Way that moves from beneath the surface of Mare Meadow to its shores and eventually works its way East to Davis Road.

(RE: Lot 7 Davis Road – Westminster, MA – Book 6935, Page 291 and Book 7087, Pages 291-302
- City of Fitchburg, MA Right of Way)

Respectfully Submitted:



Duane W. Winter

2735 Amsler Drive, Adrian, MI 49221-9238

dvwinter@tc3net.com

(H) 517.265.5512 (C) 517.215.9395

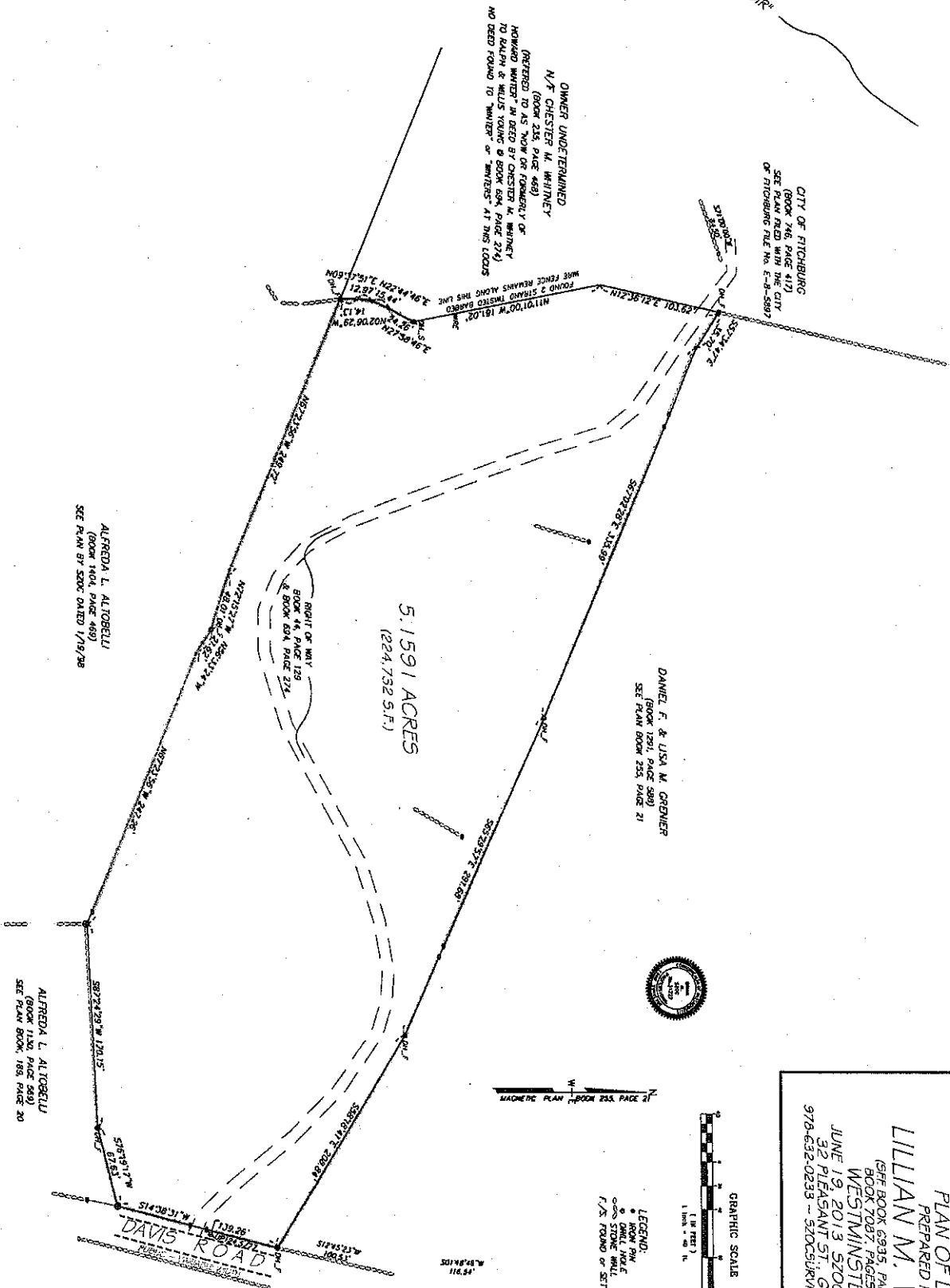
DATE: 8-27-13

For City Council Consideration on 9-03-13

FITCHBURG CITY CLERK
2013 AUG 28 P 2:36

Exhibit A

PLAN OF LAND
PREPARED FOR
LILLIAN M. WINTER
(SEE BOOK 6935, PAGE 291, AND
BOOK 7087, PAGES 291-302)
WESTMINSTER, MA
JUNE 19, 2013 SIOC SURVEYORS
32 PLEASANT ST. GARDNER, MA
978-632-0235 - SIOCSURV@GARDNER.NET



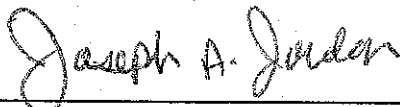
TO THE HONORABLE CITY COUNCIL OF THE CITY OF FITCHBURG

Ladies and Gentlemen:

The undersigned Petition your Honorable Body to

Declare the following vehicles as scrape property:

- | | |
|--------------------------|-------------------------|
| 1. 1992 Buick Century | Vin # 1G4AG54N7N6471288 |
| 2. 1993 Ford F150 Pickup | Vin # 1FTEF14N8PNA38976 |
| 3. 1995 Ford F250 Pickup | Vin # 2FTHF26H6SCA23983 |
| 4. 1999 Ford Ranger | Vin # 1FTYR11V3XTA27422 |



Joseph A. Jordan
DPW Deputy Commissioner Wastewater

FITCHBURG CITY CLERK
2013 AUG 27 P 3:14

City of Fitchburg

Organics to Energy Feasibility Study

Project Update Meeting
March 5, 2014



Solid Waste Master Plan Goals

- Reduce total disposal by 2 million tons/year by 2020 (30 percent reduction in disposal tonnage)
- Capture additional 350,000 tons per year of food waste (about 35% of generation)
- Develop at least 250,000 – 300,000 tons per year of processing capacity and supporting collection infrastructure for food waste



Food Waste: Need/Opportunity

- Why focus on food waste?
 - Food waste about 15-20% of disposal – just over 1 million tons/year from Massachusetts
 - Has value first as food
 - Can be used to create compost, soil amendment, fertilizer, and clean, renewable energy
- Manage other organics with food waste:
 - Leaf and yard waste
 - Agricultural wastes



Why Anaerobic Digesters?

- AD is a “win-win”:
 - Provides renewable energy
 - Organics waste management
 - Reduce emissions of greenhouse gases
 - Cuts energy use and generates revenue for municipalities



Waste Bans

- Organics waste ban regulation issued 1/31/14
- Effective date of organics waste ban – 10/1/14
- Applies only to large producers of food waste (>1 ton per week) not currently diverting food waste from disposal

Organics Management in Massachusetts

- Existing Capacity for Organics
 - Farm-based and commercial food waste composting capacity (100,000 tons per year)
 - 2010 – 70 farm composting operations registered with Dept. of Agricultural Resources
 - 200 additional leaf and yard waste compost sites – municipal and private
 - Six active POTW digesters
 - Two operating farm-based digesters
 - Three industrial AD's in operation



Experience Elsewhere

- Most experience with farm-based digesters
- Europe has thousands of farm-based units led by Germany with 6,800
- Recently constructed N. American facilities:
 - Osh-Kosh, WI
 - Toronto, ON
 - Richmond, BC
- Pilot facility now under construction in Dartmouth, MA at the Crapo Hill LF



Permitting

- 3 Permitting Scenarios for Anaerobic Digesters:
 - Solid Waste
 - General Permit
 - Small (<100 tpd) AD, generally farm sized units
 - Recycling, Composting or Conversion (RCC) Permit
 - Exempts larger AD facilities >100 tpd from site assignment
 - Limited to source-separated organics (food manufacturing organics, food waste, FOG)
 - Wastewater Treatment Facility
 - Amend WWTP permit



Air Permitting

- Comprehensive Plan Approval
 - Air emissions from generator unit
 - BACT (Best Available Control Technology) – Add on controls to reduce air emissions
 - NO_x
 - PM_{2.5}
 - H₂S
 - Noise
 - Odors
 - Modeling ambient air quality impacts



Other Permits

- Department of Agricultural Resources (DAR)
 - Fertilizer license if digestate is to be sold as fertilizer

MassCEC Grant

- OTE FS Technical Assistance Grant
- Preliminary Study Fall 2012
- Application Filed in Winter 2012
- Selected Spring 2013
- Grant Awarded Summer 2013

MassCEC Grant

- Grant Amount \$63,150
- 5% (\$3,150) City Cost Share
- Phase I – Feasibility Study, Outreach
- Phase II – Procurement Support, Outreach
- Study Completion ~ April 2014

OTE Feasibility Study Phase 1

- Evaluation of Project Site and Vicinity
- Environmental and Permitting Review
- Community Engagement/Outreach
- Identification of Offsite Substrates
- Bio-Process Modeling
- Anaerobic Digester Conceptual Design
- Energy Production and Financial Analysis
- Evaluation of Project Risk Factors
- Evaluation of Business Model Options
- Draft Feasibility Study Report

OTE Feasibility Study Phase 2

- Community Outreach
- Sound and Odor Study
- Solicit Interest for Chosen Business Model
- Permit Review and Applications
- Procurement Support

Project Site

- Cities West WWTF at 230 Princeton Road
- Built in 1970's at cost of \$13 Million
- Plant Designed to Treat 15.3 MGD
- Backwash Lagoon, Flocculation Tanks, Clarifiers, Roadways, Buildings, etc...
- Currently Underutilized Assets

Site Location

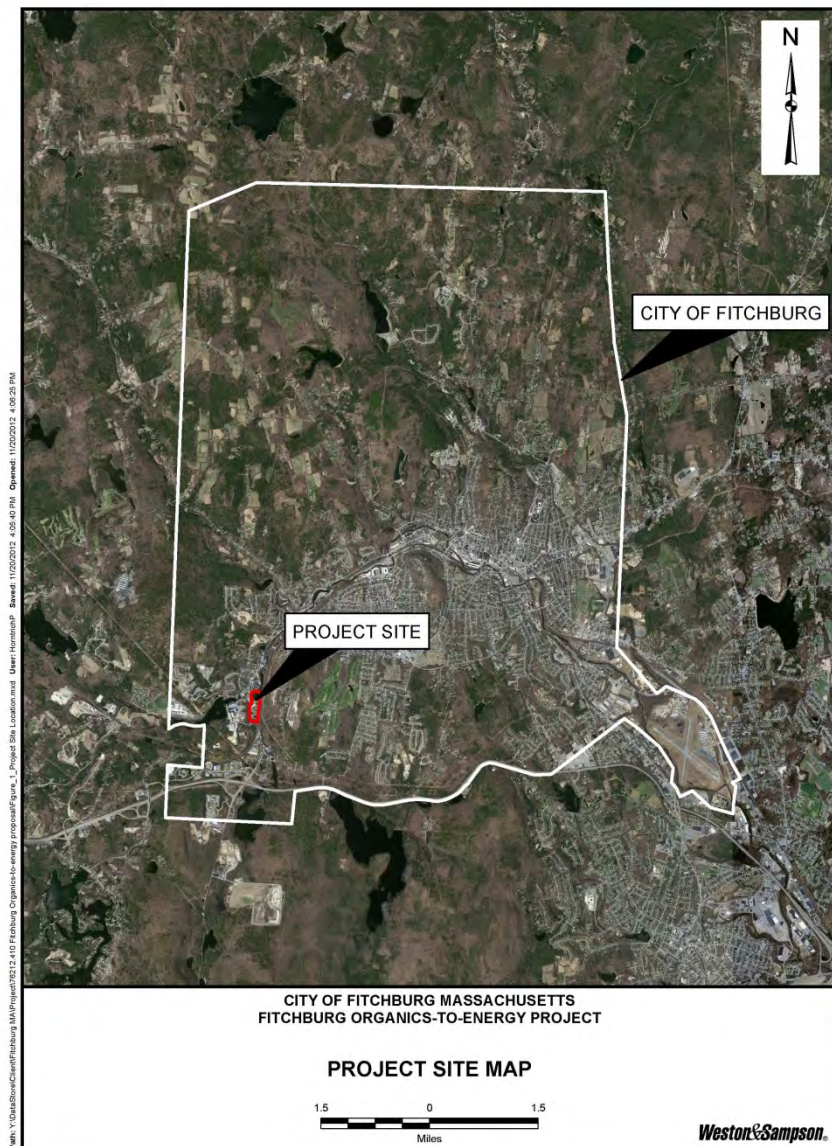
230 Princeton Rd
Fitchburg, MA

City Owned

16.5 Acres

Industrial Area

Permitted WWTF



Site Use

- Site Access
- Zoning
- Market
- Electricity Use
- Expansion
- Risk Factors



Source Separated Organics



Source Separated Organics

Massachusetts plans to ban commercial food waste in 2014



July 11, 2013
By Catherine Kavanaugh

Tweet 65

ShareThis 613

Share 83

Advertisement



The plan calls for food waste to be shipped to a facility that will turn the waste into a biogas that produces electricity and heat for industrial operations. However, state officials are sweetening the deal with \$3 million in low-interest loans to private companies to help offset the cost of organic waste.

The low-interest loans will be administered by BCD Capital through a Massachusetts Department of

Mass.Gov State Offices & Courts | State A-Z Topics | State Forms

The Official Website of the Executive Office of Energy and Environmental Affairs

Energy and Environmental Affairs

Search in Energy & Environment

Home > Plan to Ban Disposal of Commercial Food Waste

DEVAL PATRICK
GOVERNOR

RICHARD K. SULLIVAN JR.
SECRETARY

Media Contact

Mary-Leah Assad (EEA/DOER)
617-626-1809 or
mary-leah.assad@state.ma.us

Joe Ferson (MassDEP)
617-654-6523 or
joseph.ferson@state.ma.us

For Immediate Release - July 10, 2013

Patrick Administration Announces Plan to Ban Disposal of Commercial Food Waste

\$4M in grants, low-interest loans available for converting organics to renewable energy

BOSTON - July 10, 2013 - Energy and Environmental Affairs (EEA) officials today announced a proposed commercial food waste ban and funding to support anaerobic digestion (AD), a process that converts food waste into renewable energy.

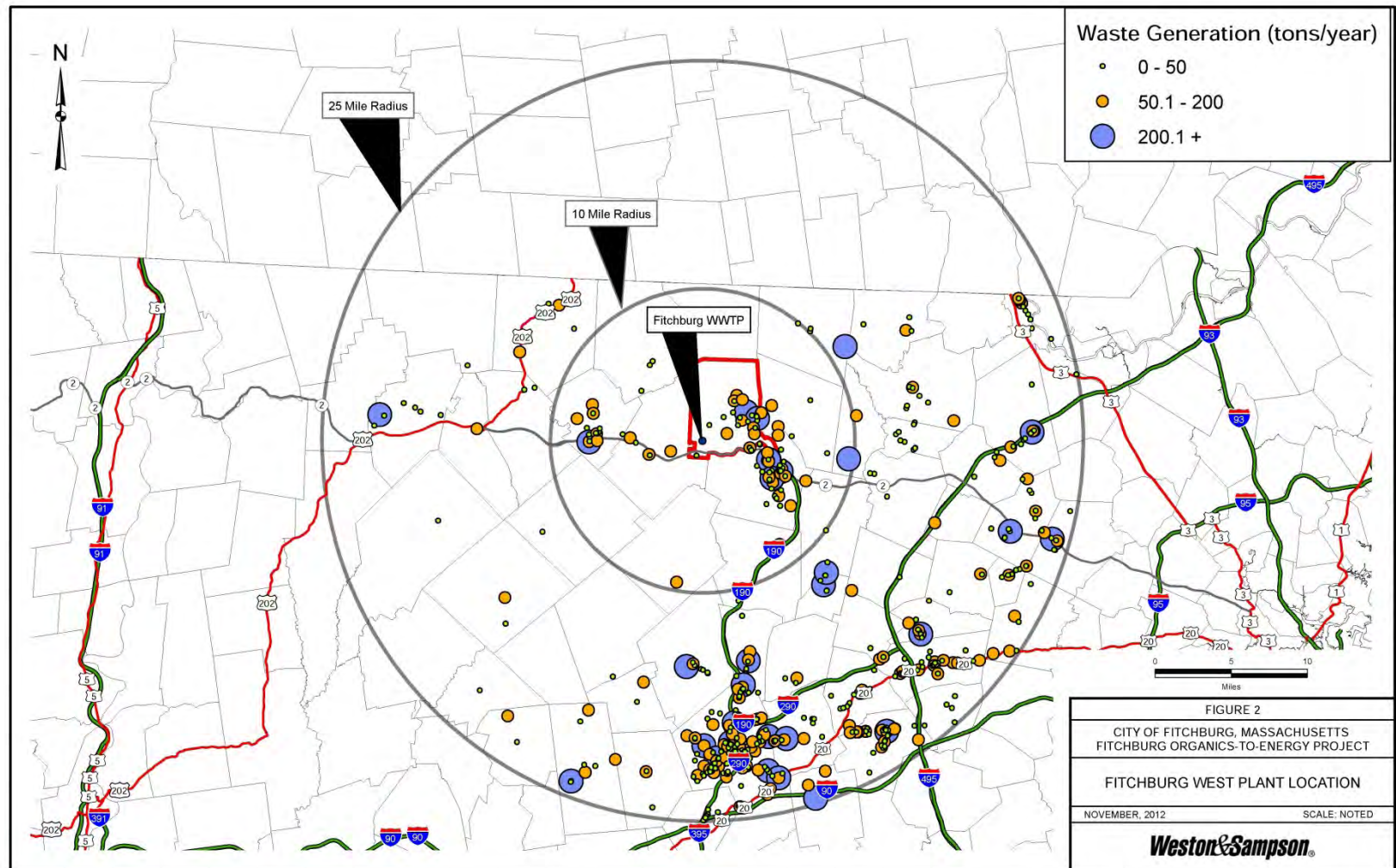
"Banning commercial food waste and supporting the development of AD facilities across the Commonwealth is critical to achieving our aggressive waste disposal reduction goals," said Energy and Environmental Affairs Secretary Rick Sullivan. "These policies and programs will continue the Patrick Administration's commitment to growing the clean energy sector in Massachusetts, creating jobs and reducing emissions."

The Massachusetts Department of Environmental Protection (MassDEP) has proposed a commercial food waste ban, to take effect by July 1, 2014, that would require any entity that disposes of at least one ton of organic waste per week to donate or re-purpose the useable food. Any remaining food waste would be required to be shipped to an AD facility, a composting operation or an animal-feed operation. Residential food waste is not included in the ban.

To harness the energy in organic waste, the Patrick Administration has made \$3 million in low-interest loans available to private companies building AD facilities. The low interest loans will be administered by BCD Capital through MassDEP's

Weston & Sampson

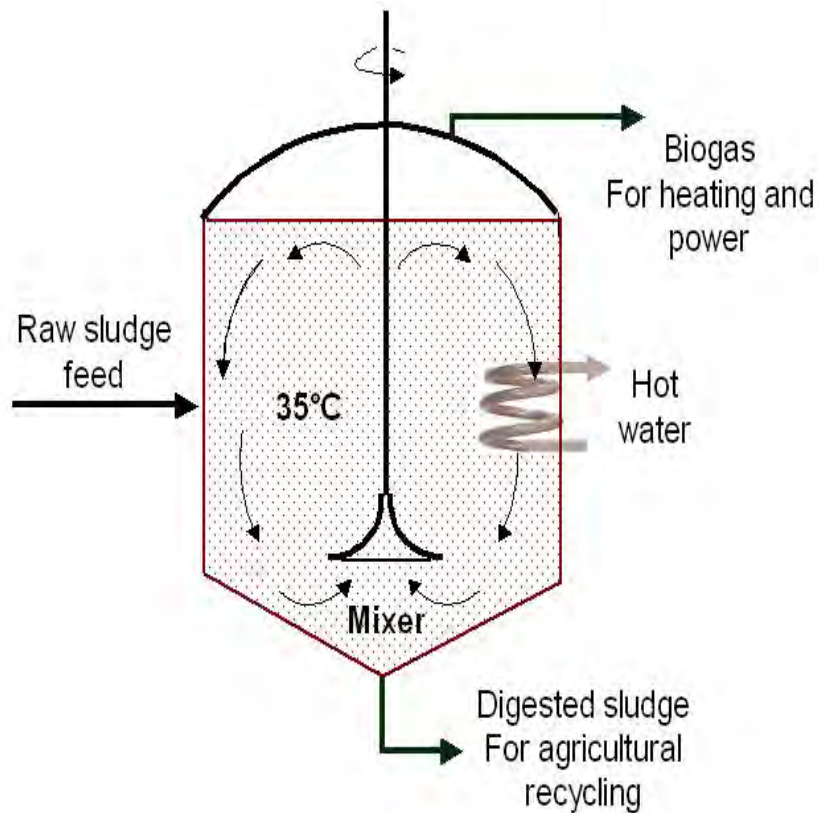
Source Separated Organics



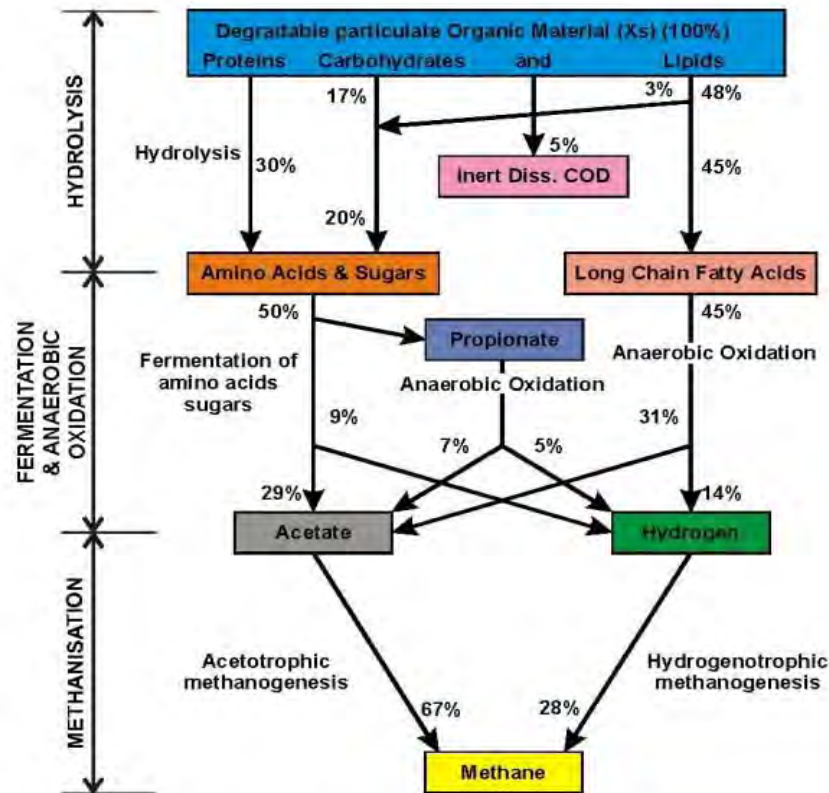
Anaerobic Digestion

- A collection of natural biologic processes
- Microorganisms break down biodegradable material in the absence of oxygen.
- Process used in many industrial and domestic purposes to manage waste and/or to produce fuels.
- Digestate is produced by anaerobic digestion.

Anaerobic Digestion



Anaerobic Digestion



Graphic 1 : Anaerobic Digestion Processes

Anaerobic Digestion



Digestion Products



Digestion Products



Digestion Products



Digestion Products



Digestion Products



Digestion Modeling

- Gas yields
- Chemical oxygen demand in effluent
- System pH
- Process Inhibitors
- Acetic acid content in digester effluent
- Evaluations of optimal digester sizing
- Recommendations

Potential Benefits

- Re-use of an underused asset (West plant)
- Potential to create jobs for the area
- Diverting FOG from wastewater, combined sewer overflows, which protects water quality
- Creates renewable energy
- Extending life of the landfill (City's landfill near capacity)
- Creates product for beneficial use from waste
- Process wastewater treatment sludge generated at the City's East plant (save \$)
- The City may also be able to accept surrounding communities' wastewater sludge, thereby obtaining additional tipping fee
- Potential income from the waste tipping fees, sale of organic fertilizer and other by-products, Class I Renewable Energy Certificates (RECs), Alternative Energy Credits (AECs) and net metering credits for excess power
- Eligible for tax credits under certain ownership models

Potential Benefits

- Value of Net Metering Credits depends upon size and ownership of facility, but would likely be on the order of \$0.09 to \$0.12 per kWh. The electricity could be used to save money on electricity use at the West Plant, which is on the order of \$100,000 per year.
- The market value of Class I RECs have recently been in the \$0.05 to \$0.06 kWh (\$50-\$60 MWh)
- The market value of AECs start at \$0.021 kWh (\$21 MWh) and increase at rate of inflation over life of project.
- Value of heat energy will depend on finding suitable users, but values could be in the range of \$0.60 to \$0.80 per Therm. Heat could be used to offset gas use at the West plant, which is on the order of \$50,000 per year.
- Potential to save WWTF sludge disposal costs
- AD project capital costs are typically on the order of \$4,000 to \$6,000 per kW
- 1.0 MW AD could produce on the order of 7,500,000 kWh (7,500 MWh) of electricity and 2 MW of equivalent heat energy per year, depending on the substrates available and system optimization.

West Fitchburg WWTF

Municipal Influent Structure

Yard Piping

Municipal Clarifiers

Wastewater Clarifiers

Flocculation Basin and Rapid Mix Tanks

Post Aeration Basin

Backwash Lagoons

Sludge Lagoons

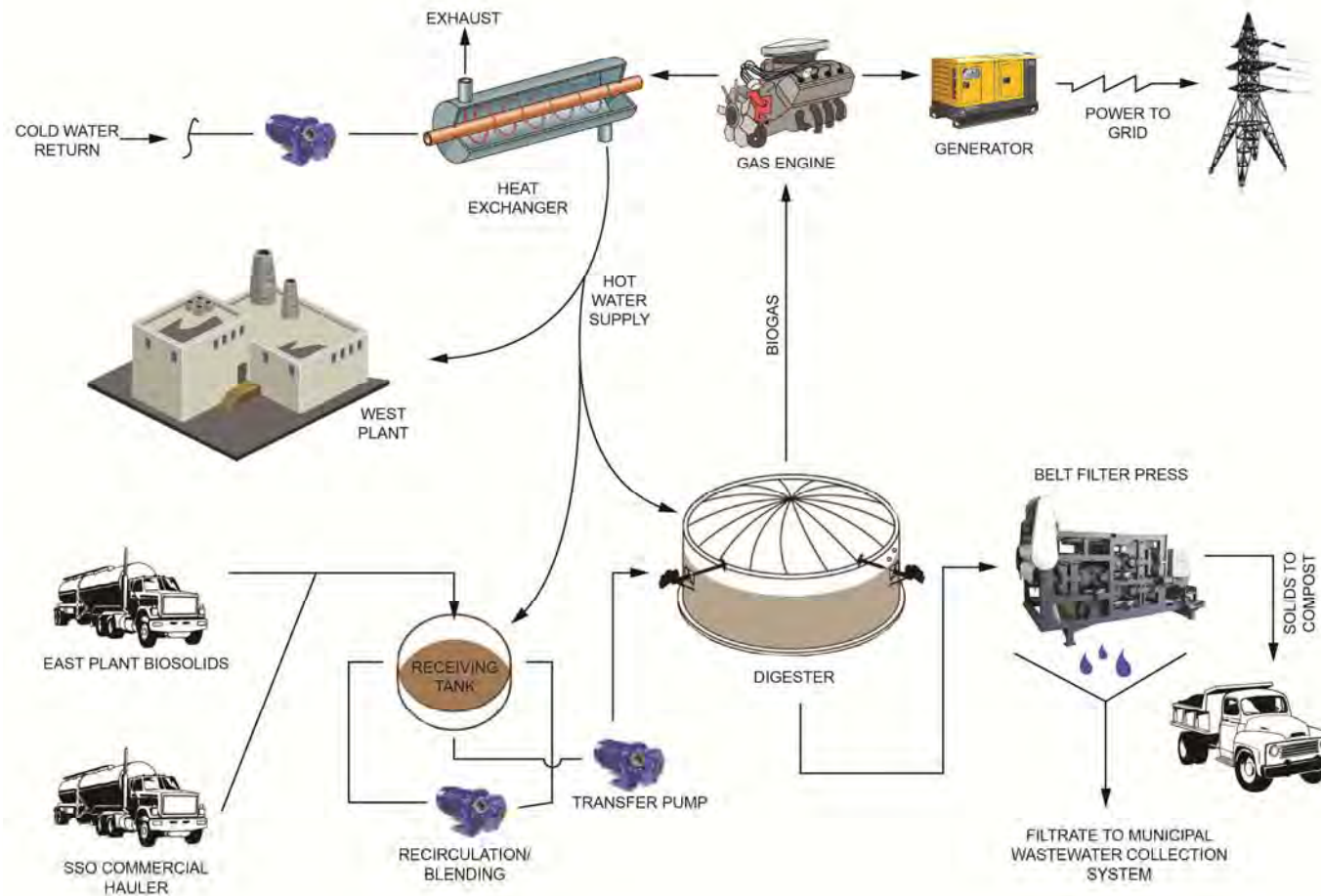
Ejector Vault

Filter Building

Wet Wells



Conceptual Model



Plot Plan



West Fitchburg WWTF



Rear of Filtration Building



Rear of Filtration Building



Community Compatibility

- Design Considerations
 - Traffic Study
 - Odor Control
 - Noise Minimization
 - Gas Handling Safety
 - Operational Issues
- Financial Risk
 - Public Project vs. Private Enterprise

Questions?

City of Fitchburg
Organics to Energy Feasibility Study

Project Description

A feasibility study will be conducted to evaluate the potential for developing an organics to energy project at the City-owned West Wastewater Treatment Facility (West Plant). A phased approach to the study is intended to focus on the technical feasibility and economic viability for the development of an anaerobic digester at the West Plant, which will seek to convert sewage sludge, source separated organics (SSO) or other feed stocks, into to heat, electricity, and compost, fertilizers, soil amendments or other marketable byproducts.

What is Anaerobic Digestion?

Anaerobic digestion is a series of biological processes in which microorganisms break down biodegradable material in the absence of oxygen. One of the end products is biogas, which is combusted to generate electricity and heat. A range of anaerobic digestion technologies are converting livestock manure, municipal wastewater solids, food waste, high strength industrial wastewater and residuals, fats, oils and grease (FOG), and various other organic waste streams into biogas, 24 hours a day, 7 days a week. Separated digested solids can be composted, utilized for dairy bedding, directly applied to cropland or converted into other products. Nutrients in the liquid stream are used in agriculture as fertilizer.

Background Information

- The City's West Plant is located at 230 Princeton Road. It is situated on approximately 16.5 acres of City-Owned land.
- The facility is currently serving as a pump station to convey wastewater generated at two paper mills to the East WWTF, located approximately 7 miles east of the West plant.
- Because the West Plant is a WWTF, a large portion of the supporting infrastructure is already in place including access roads, utilities, and administrative offices; thus making the site a desirable location.
- It is anticipated that the digester equipment will be retrofitted into the existing property.

Project Benefits

- The project will include the re-use of an underused developed property (West plant).
- The project would create additional jobs for the area
- Diverting FOG from wastewater to anaerobic digesters prevents combined sewer overflows, which protects water quality and saves money.
- This project will not only serve to produce a form of renewable energy, but will help this region to meet the State's new organics diversion goals, while extending the life of the landfill.
- Anaerobic digestion destroys a wide range of pathogenic and fecal micro-organisms, thereby minimizing cross contamination of pathogens or weeds.
- The City's municipal solid waste landfill, is nearing the end of its design life in terms of capacity. Wastewater treatment plant sludge generated at the City's East plant can be treated through the digesters, rather than disposed of at the landfill.
- The City may also be able to accept surrounding communities' wastewater sludge, thereby obtaining additional tipping fee.
- Income for the City of Fitchburg could be gained from the processing of waste (tipping fees), sale of organic fertilizer and other by-products, Class I Renewable Energy Certificates (RECs) and net metering credits for excess power.
- This project may also be eligible for tax credits under certain ownership models being considered.

Project Risk Factors

- Public Perception - Nuisance conditions, such as odor and noise
- Financial Risk

Preliminary Project Economics

- Value of Net Metering Credits depends upon size and ownership of facility, but would likely be on the order of \$0.09 to \$0.12 per kWh. The electricity could be used to save money on electricity use at the West Plant, which is on the order of \$100,000 per year.
- The market value of Class I RECs have recently been in the \$0.05 to \$0.06 kWh (\$50-\$60 MWh)
- Value of heat energy will depend on finding suitable users, but values could be in the range of \$0.60 to \$0.80 per Therm. Heat could be used to offset gas use at the West plant, which is on the order of \$50,000 per year.
- Potential to eliminate WWTF sludge disposal costs, which currently costs City \$40 per ton for, or \$100,000 year in tipping fees.
- AD project capital costs are typically on the order of \$4,000 to \$6,000 per kW of installed capacity.
- A 1.0 MW AD could produce on the order of 7,500,000 kWh (7,500 MWh) of electricity and 2 MW of equivalent heat energy per year, depending on the substrates available and system optimization.
- MassCEC Feasibility Study Grant award is \$63,150 with a 5% (\$3,150) cost share by City.

To print this article open the file menu and choose Print.
Click here to return to previous page
Article published Mar 22, 2015

Fitchburg wants to turn sludge into electricity

By Paula J. Owen TELEGRAM & GAZETTE STAFF

FITCHBURG — The city is seeking public input on the repurposing of the west side wastewater treatment plant — which no longer treats wastewater or discharges treated effluent — to an anaerobic digestion facility that would produce power and possibly generate additional revenue for the city.

The public meeting is scheduled for 6 p.m. March 31 in Kent Recital Hall, in the Conlon Fine Arts Building at Fitchburg State University.

The city received a grant from the Massachusetts Clean Energy Center to partially fund a feasibility study for the project in 2013.

The original scope of the study included development of an anaerobic digestion project that would generate biogas that could be converted into power, from easterly wastewater treatment plant residuals and source separated organics from a service area, centered on Fitchburg, said Jeffrey A. Murawski, deputy commissioner of wastewater.

Mr. Murawski said that as the feasibility study on the project moved forward, it became evident that original "feed stock materials" — treatment sludge residuals from the easterly plant and source-separated organics materials — would not be enough to generate sufficient biogas in the anaerobic digestion process. As a result, the scope of the study changed to accommodate regional municipal wastewater sludge residuals and paper mill sludge residuals in order for the facility to generate 1.5 megawatts of power, he said.

The firm conducting the feasibility study, Weston & Sampson Engineers, sent city officials a memorandum last week regarding the change to the scope of the project.

"It became evident, that these two organic substrates alone would not be enough to create a viable energy project," the memo said. "Weston & Sampson found, through their discussions with several solid waste contractors, that there is a strong need for a regional facility in Central Massachusetts which can process wastewater treatment residuals, as well as SSO substrates. They also found that there is a large source of organic solids at Newark Paper, within a half mile of the West Wastewater Treatment Facility site. With these added organic substrates, a project could be developed at the site which could support a 1.5 MWh-rated power generation facility. Additional grant funding was secured to allow for the study to be revised to include regional wastewater treatment residuals and paper mill residuals."

According to Mr. Murawski, Fitchburg is like many other state cities and towns, that face long-term management issues for wastewater treatment sludge residuals.

The city's sludge residuals are currently deposited in a landfill in Fitchburg, but the estimated capacity of the landfill will be consumed by 2025, he said. The goals of the proposed project include developing zero-cost disposal of the city's sludge residuals, providing reuse of the city's westerly wastewater treatment plant, and potentially providing a source of revenue for Fitchburg, he said.

In fiscal 2014 (the first full fiscal year following the shutdown of the incinerator at the easterly plant in October 2012), the city spent approximately \$490,000 in sludge hauling and disposal costs, he said.

"Trucking costs will increase, and if the city is forced to haul the city's sludge for landfill disposal after the Fitchburg landfill closes, we anticipate a significant cost increase for trucking sludge to a more remote landfill disposal site," Mr. Murawski said.

Contact Paula Owen at powen@telegram.com. Follow her on Twitter @PaulaOwenTG

Fitchburg DPW eyes ex-facility for wastewater

By Michael Hartwell

mhartwell@sentinelandenterprise.com

FITCHBURG — The city is looking to bring its Westerly Wastewater Treatment Facility back online as a place where microorganisms will break down human waste and other materials, in place of the city's current strategy of dumping the waste in the city landfill.

"It's an underutilized city asset," said Jeff Murawski, an engineer and deputy commissioner of wastewater for the Department of Public Works.

Next week, the city will host a public forum to inform residents of the project and give them a chance to voice any concerns.

The Westerly Wastewater Treatment Facility was built in the 1970s off Princeton Road and started operations in 1975, according to Murawski. The facility was built to

Please see **DPW/6**



Jeff Murawski, Fitchburg DPW's deputy commissioner of wastewater, talks about the DPW's plans for the former Westerly Wastewater Treatment Facility on Monday morning.

SENTINEL & ENTERPRISE / JOHN LOVE

Fitchburg DPW eyes offline facility for wastewater

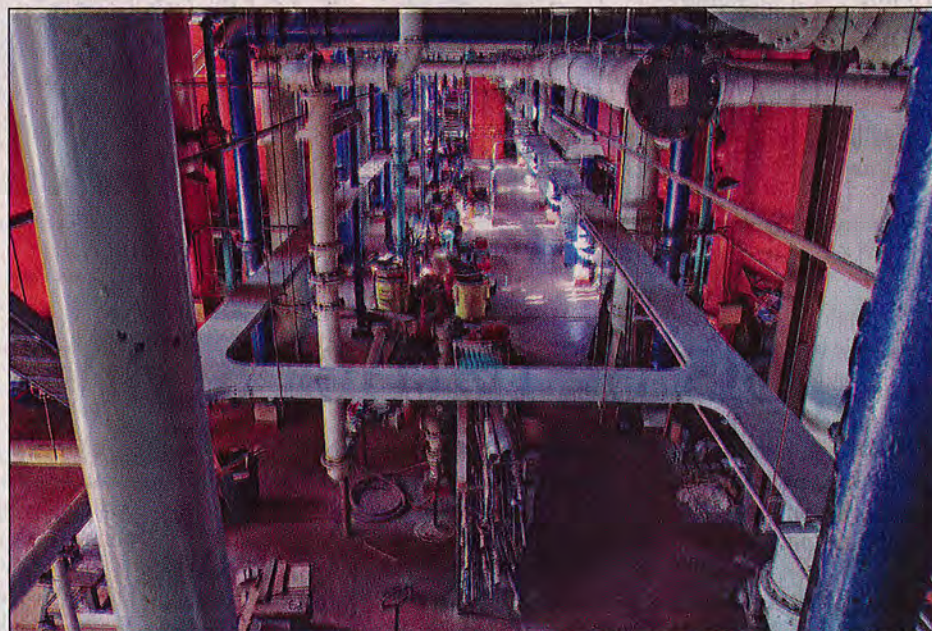
DPW/From Page 1

treat industrial waste from the paper mills in the area, and the waste was fed directly to the plant using underground tubes like a sewer system. It never treated human waste, only paper-mill waste.

Since then, a shrinking demand for paper has caused the paper industry to decline. The Westerly Wastewater Treatment Facility went offline in 2010, but it is still used as a pump station for the gravity-fed wastewater system. Two people work there today — Murawski and an office manager.

Human waste is treated at the city's Easterly Wastewater Treatment Facility. That leaves behind a dry waste substance called dewatered sludge.

Murawski said the city had been burning the



Fitchburg's Westerly Wastewater Treatment Facility, which closed in 2010, is being eyed by the DPW for a new facility.

SENTINEL & ENTERPRISE / JOHN LOVE

sludge in an incinerator at the Easterly Wastewater Treatment Facility and burying the ashes in the Fitchburg Municipal Landfill, but that incinerator

was taken offline in 2012, and the city trucks several loads of dewatered sludge to the landfill each day.

However, the landfill is expected to be filled and capped by 2025, and the city needs a long-term solution for what to do with its waste.

In July 2013, the Massachusetts Clean Energy Center gave Fitchburg a grant to fund a study for the implementation of a new system.

Murawski said the state is discouraging the use of incinerators for solid waste, and encouraging a process called anaerobic digestion, in which microorganisms feed on organic waste in a temperature-controlled environment that is free of oxygen.

Joseph Ferson,

spokesman for the state Executive Office of Energy and Environmental Affairs, said disposal costs for landfill space are rising and the space is limited, while anaerobic digestion converts organic materials into useful materials like methane, which he referred to as a "biogas."

Methane is also the primary component of natural gas and can be burned to generate electricity.

The process also breaks down the material into water, carbon dioxide and, in some versions of the processes, solid pellets. Ferson said those pellets can be used as a fertilizer.

Murawski said it is possible, but not yet known, that a Fitchburg anaerobic digestion system would produce a profitable

amount of methane that could be sold as a fuel source.

If there is a profit, the city would split it with whatever entity manages the anaerobic digestion system.

Murawski said the city may end up having a private company manage the anaerobic digestion system, but that has not yet been determined.

The public forum for the project is set for Tuesday, March 31, at 6 p.m., in the Kent Recital Hall in Fitchburg State University's Conlon Fine Arts building.

The project will need approval of the City Council, Planning Board, the Commission on Energy and the Environment, and the Water and Wastewater Commission.

Murawski said there will be future presentations and public hearings before those four boards and committees, but no dates have been set.

In fiscal 2014, the city spent \$494,000 hauling and disposing of sludge, and Murawski said one goal for the anaerobic digestion system is to stay at that cost or save money on net.

Originally, the plan was for the anaerobic digestion facility to handle Fitchburg waste, but Murawski said that as the study went on, it became apparent that it wouldn't produce enough biogas. The scope of the study was changed to incorporate regional treatment of organic

wastewater, including biological waste, paper-mill waste and waste produced by food companies.

Ferson provided a list of existing anaerobic digestion plants in the state. There are publicly owned plants in Pittsfield, Clinton, Lawrence, Fairhaven, Rockland and Deer Island, as well as three farm digesters — Jordan Dairy in Rutland, Pine Island Farm in Sheffield and Bartow's Longview Farm in Hadley. Garelick Farms has plants in Lynn and Franklin, Ken's Salad Dressing in MetroWest, and the Commonwealth Resource Management Corporation operates a plant at the Crapo Hill Landfill in Dartmouth.

UMass Amherst, Easthampton, Ayer, Barnstable, Brockton and Plymouth are all studying the possibility of building publicly owned anaerobic digestion plants.

Barway Farm in South Deerfield is in the process for getting a permit, and the Stop & Shop product-recovery site in Freetown has a permit for a plant but has not built it yet.

Future projects are being explored for the Bourne Landfill, and at state correctional institutions in Shirley and Norfolk. Neo Energy is developing plans for Fall River and Millbury.

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Memorandum

To: Michael A. Smith, P.E., Weston
& Sampson
Stephen P. Wiehe, P.G., Weston
& Sampson
Amy Barad, Massachusetts
Clean Energy Center
Stacie N. Smith, Consensus
Building Institute

From: Jeffrey A. Murawski, P.E.
Fitchburg DPW Wastewater
Deputy Commissioner

Cc: File

Date: April 2, 2015

Re.: Public Forum Meeting Presentation, Comments & Questions
Proposed Anaerobic Digestion Facility – Fitchburg, Massachusetts

- On Tuesday – March 31, 2015, a “Public Forum Meeting” presentation was made to update the public on the project and on the project’s change of scope. The presentation meeting was held on the campus of Fitchburg State University, beginning at approximately 6:00 PM, and was held in Kent Recital Hall in the Conlon Fine Arts Building.
 - Steve Wiehe and Mike Smith alternated, taking turns through the course of the presentation, based on the subject matter.
 - Scanning the room, the audience attendance appeared to be between 30 & 40 attendees.
 - Stacie Smith circulated a sign in sheet for audience attendees.
 - Presentation Concluded at Approximately 7:05 PM
 - Following the conclusion of the presentation, Stacie Smith facilitated a question & answer, and concerns & comments period. The summary presented below includes those questions and comments received.
-
1. Question/comment raised regarding “paper fiber” and “clay content” of the discussed paper mill residuals feedstock to the AD process. Commenter suggested that the possible high clay content of the paper mill residuals feedstock would likely be problematic to the AD process.

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2. Question/comment concerned water content of biosolids end product leaving the digester, whether polymers would be required in belt press dewatering of biosolids end product leaving the digester, how are the solids handled.
3. Question/comment concerned whether or not marketing/modeling of the end product disposition had been performed.
4. Question/comment concerned if finished, dewatered biosolids end product would be stored onsite, and if yes....what provisions would there be for onsite storage of biosolids end product.
5. Question/comment asked about how net metering works.
6. Question/comment asked about what the estimate for how many employees would be required to run the proposed AD facility.
7. Question/comment asked about the "Return on Investment" (presented in the 31st slide, titled "Financial Feasibility"), and how ROI was calculated/determined (factors/assumptions used in ROI determination). In addition, the question was also asked whether or not pension costs of municipal employees associated with the proposed facility were factored into the ROI analysis.
8. Question/comment asked about the presented preliminary project cost (presented in the 31st slide, titled "Financial Feasibility"), the procurement/ownership model of the presented preliminary project cost, alternate procurement/ownership models, and factors that can affect project cost/lifecycle cost.
9. Question/comment asked about the risk/liability exposure (future) for the proposed facility, possible future "unfunded mandates" that could affect the operation (& cost of operation) of the proposed AD facility.
10. Question/comment asked about the expected life (design life) of the proposed AD facility.
11. Question/comment asked about relative makeup (%) of anticipated feedstocks to the proposed AD facility. Follow-up Question/comment asked if project team considered impacts to proposed AD facility if the paper mill residuals feedstock were to reduce, or cease/terminate (business impact of closing of paper mills).
12. Question/comment expressed concerns regarding traffic (and traffic safety) and odor concerns. In particular the railroad bridge over Princeton Road as a safety hazard to the public. Could operational truck traffic associated with the proposed AD facility be controlled to avoid high traffic periods for improved safety?

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13. Question/comment asked for additional clarification on "what is in it for the tax payer" (with respect to the proposed AD facility). Follow-up question asked if a grid upgrade would be necessary, and if this had been looked into.
14. Question/comment asked about the "viability of getting solids" (understood to refer to those feedstocks to the proposed AD facility).
15. Question/comment asked clarifying question regarding process of the generated biogas and storage of the generated biogas onsite. Follow-up questions (and discussion) regarding gas safety issues, gas flaring of surplus gas or gas not utilized for electricity and heat generation, siting considerations for gas flares, safety standards regarding the proposed AD facility and biogas (from both electric safety and fire safety perspectives). Follow-up clarifying question asked for distinguishing between "biogas" and methane gas (CH₄).
16. Question/comment asked about air emissions permitting, and if makeup of feedstocks materials presents air emission of H₂S, SO_x, NO_x, etc. issues, and what considerations there would be for managing air emissions from the either the flaring of "biogas" or the emissions from the co-generation units. Follow-up question was also asked concerning the potential impact of significant siloxane content from the paper mill residuals on the AD process, and struvite formation in the process piping.
17. Question/comment asked, relative to the presented preliminary project cost (presented in the 31st slide, titled "Financial Feasibility"), could the proposed AD facility be scaled down to a smaller size....then expanded later as supply/demand warranted. Follow-up question concerned the presented capacity of the proposed AD facility, and the likelihood of having full/adequate supply of feedstock materials to the process at the startup of the facility.
18. Question/comment reiterated both traffic (safety) concerns and odor concerns. Follow-up question asked if in the traffic considerations/evaluations took into account both delivery traffic (of feedstock materials) and outgoing traffic for removal of AD facility, final end product biosolids.
19. Question/comment asked if "baseline" air quality study could be conducted, to in part address odor concerns, and potential odor impacts of the proposed AD facility.
20. Question/comment again addressed concerns relative to traffic safety and the railroad bridge over Princeton Road. Follow-up discussion on mitigating/alleviating alternatives to traffic safety and the railroad bridge. Follow-up question/request for City/project team to seek definitive statement from railroad (entity with authority/jurisdiction over the railroad bridge) concerning if and when the bridge can be modified, what estimated costs would be for modification of bridge and bridge abutments to public safety on Princeton Road.



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21. Question/comment asked about tipping fees for receiving of feedstock materials to the proposed AD facility.
22. Question/comment asked about likely time frame for the proposed AD facility ("best case" scenario / "worst case" scenario) for the proposed project advancing to a built facility. Discussion addressed the feasibility study process that is currently in-progress, the necessary additional engineering work that would follow the feasibility study (including "basis of design" study, and any other specific studies or investigations that address concerns raised through the feasibility study process, project procurement options, the likely period design and associated permitting, the likely period of construction and startup for the facility.
23. Question/comment asked has fats, oils and grease ("FOG") been considered as a feedstock to the AD facility, or is it accounted as a fraction (as a %) within the Separated Source Organics ("SSO") feedstock materials.
24. Question/comment asked that when subsequent presentations on the proposed AD facility are made, that additional detail be provided for the analysis that went into the "Return On Investment", and the "true costs" of the facility life cycle are addressed, in particular the "true labor costs" of the labor burden for personnel associated with the facility operation period.
25. Synopsis of process/timeline of the feasibility study: "Public Forum Meeting" comments & concerns would be addressed and incorporated into the "Draft Feasibility Report"; Draft Feasibility Report will be made publicly available, and DFR will be presented to City Council, Planning, Energy & Environment, and Water/Wastewater in meetings that are open to the public; feedback received on the DFR will be addressed and incorporated into the "Final Feasibility Report".
26. Project team states that this presentation will be made publicly available, and will (on request) be provided to those requesting copy of the presentation.

Subsequent to the March 31, 2015 Public Meeting, at Fitchburg State University, one additional comment was submitted to the Massachusetts Clean Energy Center:

27. How will the ammonia load from the proposed digestion facility impact the Fitchburg East Plant, which is undergoing a permit review which will most likely further restrict effluent nitrogen limitations?