

**AMENDMENT NUMBER 1 TO THE
PROFESSIONAL SERVICES
AGREEMENT BETWEEN
MOORE & BRUGGINK, INC., AND THE CITY OF ANN ARBOR FOR
BIODIGESTER FEASIBILITY STUDY**

This Amendment Number 1 ("Amendment") is to the agreement between the City of Ann Arbor, ("City") and Moore & Bruggink, INC. ("Contractor") for Professional Services Agreement (PSA) which is dated 05-31-2022 ("Agreement"). City and Contractor agree to amend the Agreement as follows:

1. III. Services, Paragraph A is amended to read as follows:

The Contractor agrees to provide professional engineering services ("Services") in connection with the Project as described in Exhibits A and A1. The City retains the right to make changes to the quantities of service within the general scope of the Agreement at any time by a written order. If the changes add to or deduct from the extent of the services, the compensation shall be adjusted accordingly. All such changes shall be executed under the conditions of the original Agreement.

2. V. Compensation of the Contractor, Paragraph A is amended to read as follows:

The Contractor shall be paid in the manner set forth in Exhibits B and B1. Payment shall be made monthly, unless another payment term is specified in Exhibits B or B1, following receipt of invoices submitted by the Contractor, and approved by the Contract Administrator.

3. The attached Exhibit A1 is included in this Agreement.
4. The attached Exhibit B1 is included in this Agreement.

All terms, conditions, and provisions of the Agreement, unless specifically amended above, shall apply to this Amendment and are made a part of this Amendment as though expressly rewritten, incorporated, and included herein.

City and Contractor agree that for this Amendment and any documents related to the Agreement: 1) signatures may be delivered electronically in lieu of an original signature; 2) to treat electronic signatures as original signatures that bind them; and 3) signatures may be executed and delivered by facsimile and upon such delivery, the facsimile signature will be deemed to have the same effect as if the original signature had been delivered to the other party.

This Amendment to the Agreement shall be binding on the Parties' heirs, successors, and assigns.

[SIGNATURE PAGE FOLLOWS]

MOORE & BRUGGINK, INC.

By: _____

Name: Brian J. Hannon, P.E.

Title: Vice President

Date: _____

CITY OF ANN ARBOR

By: _____

Name: Milton Dohoney Jr.

Title: City Administrator

Date: _____

Approved as to substance:

By: _____

Name: Brian Steglitz

Title: Public Services Area Administrator

Date: _____

Approved as to form:

By: _____

Name: Atleen Kaur

Title: City Attorney

Date: _____

(Signatures continue on the following page.)

CITY OF ANN ARBOR

By: _____

Name: Christopher Taylor

Title: Mayor

Date: _____

By: _____

Name: Jacqueline Beaudry

Title: Clerk

Date: _____

EXHIBIT A1
SCOPE OF SERVICES



Moore+Bruggink
Consulting Engineers

PHASE 2

REMAINING TASK 4 – SYSTEM RECOMMENDATION AND DESIGN CONSIDERATIONS

Elements of Task 4 were necessary to be completed in Phase 1 to evaluate the general type, sizing, and solids inputs and outputs of the digestion system in order to determine site layouts, ancillary solids processing equipment, and estimated capital costs. This determined that it is feasible to move into Phase 2, and review additional information that is pertinent to the Phase 2 evaluation.

Inputs Receiving

Completed in Phase 1.

Digester Size and Type

Completed in Phase 1.

Biogas Utilization

Biogas has several potential beneficial uses, including electrical energy production, heat for process or other uses, and upgrading to pipeline quality natural gas, specifically for use as transportation fuel. These potential uses will be explored and detailed, with capital cost, operational cost, and potential revenues (with sensitivity) all outlined. Our Team has experience with the design and operation of each of these alternatives and can help detail the most effective utilization of the biogas. A recommended solution will be proposed to the City.

Digested Solids Handling System Design

There are a range of options for handling the post digestion solids. Our Team's extensive experience with by-products allows for the exploration of several options, including use of the existing WWTP storage tanks, thickening/dewatering/composting or direct end-use such as land application, composting, or other beneficial reuses.

This will be an iterative step with Task 6 (Finances), as different handling options may have economic impacts to the project. This type of subtask has been completed many times by our team on municipal treatment plant designs.

Nutrient Recovery System Design

Our team suggests removing this item from the scope, as it does not affect the feasibility of the biodigester, and should be evaluated as a standalone project, due to the depth of options and second order process effects.

Construction and Operational Cost Opinion *(partially completed in Phase 1)*

The current construction environment is very volatile due to COVID, supply chain issues, workforce issues, inflation, and other factors. Our team will work together with BV's professional estimators to review and validate the cost opinions for the construction of the biodigester. Sensitivity factors can be placed on these estimates to help the City plan for a future project. The Team will leverage our real-world experience operating biodigester systems to estimate the operational expenses of running and maintaining the systems. In addition, cost/benefit of Class A versus Class B material and recommendations on potential markets for any remaining solid material will be reviewed and outlined as part of Task 5.



TASK 5 – EXPANDED ANALYSIS OF OUTPUTS

The digestion system will have multiple outputs, including biogas that can be utilized for multiple purposes, including electrical energy generation, heat for systems or buildings or other purposes, and upgrading to renewable natural gas that can be utilized in vehicle fuel. In addition, there are solid waste outputs that have value as compost material or saleable soil amendment, and liquid wastes that have the potential for nutrient recovery to be sold as fertilizer product.

Our Team will develop a model that can review the inputs from Task 3 and determine the output volumes and characteristics of the various outputs described above. From there, we will expand upon and determine costs and benefits, and economics related to the following:

1. **Electricity Generation.** The biogas generated by the digestion system can be utilized to produce electricity in cogeneration engines. Gas quality will be predicted based on our knowledge of similar systems, and economics will be put to the costs and benefits of electricity offset at nearby City facilities or production and distribution into the grid. Generally, with cogeneration engines, there is also a component of heat recovery, which will also be evaluated.
2. **Renewable Natural Gas (RNG).** As identified in the 2017 report, this is most likely the avenue of biogas usage that would have the largest payback. If the biogas was upgraded to natural gas quality, and utilized for transportation fuel, the City can capture RINS (renewable identification numbering system) and get paid for those that qualify. This can be a substantial revenue stream; however, it is subject to market forces (e.g., increased risk). If the vehicles that are driven by this fuel are City fleet vehicles, then it provides another benefit to the City in reduction of fuel costs, and resiliency against market forces on gasoline or diesel fuels.
3. **Heat Recovery and Use.** This will most likely be heat generated by the boiler, cogeneration unit, or other process equipment. We will review the quantity available for recovery and determine if there are any economical uses in proximity to the facility that would help obtain a payback of additional heat distribution equipment.
4. **Biosolids Beneficial Use.** There are many opportunities for the beneficial use of biosolids. This task will include a review of the federal and state regulatory conditions related to the various classifications of biosolids. The City of Ann Arbor currently contracts with WeCare Organics (Denali) to manage composting facilities for the City. The contractor is paid a tipping fee for compost processing and sales, and a per-ton fee for incoming merchant organics and another fee for outgoing finished products. Our team will meet with the Contractor to determine:
 - Delivery of digested solids to compost facility, including required moisture levels and tonnage;
 - Pricing structure for materials, transportation, and labor;
 - Market value for nutrients, and available technology for nutrient extraction; and
 - Potential concerns about the inclusion of biosolids into the compost supply (regulatory issues).

In addition to composting, opportunities exist for land application of Class B biosolids, although there is some risk associated with public perception, emerging contaminants, and changing regulations. The costs of use alternatives and potential risk factors will be evaluated. Class B biosolids can also be dewatered and sent to a landfill, although these costs are rising, and there is less appetite from landfills to accept this “wet” waste. It would also have to be evaluated against the desire to divert waste from the landfills.



If the biosolids are further managed to meet Class A pathogen reduction requirements and have high quality characteristic, they can be marketed and distributed to the public if they meet regulatory requirements. As part of the alternatives evaluation, we will review the cost and benefits of these processes.

Recommendations for more in-depth marketing studies will be included with this section.

- Nutrient recovery.** As discussed above, there is the potential to take filtrate from thickened or dewatered biosolids and recover nutrients such as phosphorus or nitrogen. Given sufficient quality and quantity, these can be saleable products. We will model the potential and weigh the cost/benefit of the additional equipment and detail the market availability for these byproducts.

This will be an iterative conceptual design step in conjunction with Task 6, as each consideration will have economic impacts to the project cost and return on investment. Resiliency considerations will need to be accounted for to manage things such as wet weather events, and so on.

Summary: Each beneficial use will be modeled in the Excel model, and a comparison sheet will be developed to allow the user to compare options in terms of:

- Financial cost or savings as compared to different fossil fuels; and
- Environmental benefits (carbon reduction, landfill reduction, nutrient management).

TASK 6 – FINANCES

A key to this project is the ability to finance it. Our team is well versed in various funding sources through both Michigan and national programs such as SRF and WIFIA, and have helped many clients procure grants as well as low interest funding for projects. We will review these programs to identify potential grants and low interest loans, and work with the City’s finance group to compare these programs versus traditional financing sources such as municipal debt to ensure the City is making informed decisions about how to pursue this project, and detail recommendations in our final report.

Our financial model will review various scenarios based on the inputs, outputs, capital, and life cycle costs, and determine the most cost-effective way to proceed. This model will be Excel based (which can be utilized by the City in the future), and will support the following scenarios:

Parameters to Include in the Biodigester Financial Model

Item	Scenario 1	Scenario 2	Scenario 3
Financing Structure	Municipal Debt	Municipal Debt	Private Capital
Ownership of Capital	City	City	Private
Ops & Maintenance	City Staff	Contracted Operation	Contracted Operation
Responsibility for Outside Feedstocks	City Staff	Contractor	Contractor
Incentive for Outside Feedstocks	n/a	Adjustable parameters in the Model	Adjustable parameters in the Model
Profit Sharing	n/a	Negotiated with City	Negotiated with City
Compensation for Debt	n/a	Debt sharing potential	Roll into monthly payments
Unit Processing Payments	Coordinate between AA business units	Per dry ton charges + additional contractor expense	Per dry ton charges + additional contractor expense
Electrical Generation Payments	On-site use value compared to grid sales	Per kWh charges to City, or sold to Grid, or combination thereof.	Per kWh charges to City, or sold to Grid, or combination thereof



A detailed model of financial performance will be a useful tool to project financial performance over the lifetime of the project. As a city with a strong financial status (AA+ rating), Ann Arbor has the ability to obtain grants and low interest financing from multiple sources such as SRF and WIFIA programs in addition to or in lieu of the municipal bond market (either general obligation or enterprise revenue bonds).

Outputs from the model will be in a Pro Forma format to allow various financing and operational scenarios to be explored. The model will deliver financial forecasts for the Biodigester over a 20- to 30-year lifespan based on the assumptions agreed to by the City. (Lifespan and a host of other variables will be user-selectable.)

Several key tradeoffs can be explored, including (but not limited to):

- **Incentive for Outside Feedstocks:** For Scenarios 2 and 3, an incentive structure can be included in the operation contract. BioWorks Energy has direct experience with incentives due to its long-term contract with the City of Flint to bring in additional feedstocks to the Flint Biogas Plant. The incentive structure offered by Flint will provide one of many possible incentive structures.
- **Unit Processing:** Depending on the financing structure, the unit processing fee (per dry ton) can include operational expenses, debt service, and other contractor expenses. Once debt is retired, the unit processing fee will decrease.
- **Electrical Generation/Renewable Natural Gas (RNG) Production:** The production of power in either the form of electricity or RNG represents both revenue and expense and is complex to model. For contractor-operation scenarios, electricity is often sold back to the City at the current electrical rate charged by the electric utility provider, whereas RNG, along with its environmental attributes, would be sold to the open market.

A summary of revenues and cost savings parameters include (but are not limited to):

Revenues and Expenses Summary for Financial Model

Revenues and Expenses	
Revenues (incl. cost savings)	Expenses
Electrical Power and/or RNG generation revenue	Labor for operations, maintenance, and management
Reduced biosolids disposal costs	Electrical power generation and/or RNG production (pass-through at utility rates)
Reduced chemical costs (polymer & lime)	Biogas conditioning
Reduced odor control costs	Thickening polymer (as needed)
Reduced labor costs	Utility charges and marketing fees
Revenue from tipping fees	Equipment maintenance
Revenue from digestate sales	Laboratory analysis

TASK 7 – OTHER ENVIRONMENTAL BENEFITS

Ann Arbor recently adopted the A²Zero Carbon Neutral Initiative in June 2020. This initiative creates a plan that aims to move the City toward carbon neutrality by 2030 from a 2018 emissions benchmark. The four sectors of the City that are defined in this plan include Energy, Mobility, Adaptation and Resilience, and Resource Reduction. There are multiple strategies and specific actions that are outlined. The potential to utilize a biodigester for wastewater solids and community waste fits very well within the framework of the plan. Detailed in the table below, we demonstrate how we will review and quantify areas of the plan that are impacted by the biodigester.



Four Sectors of Carbon Neutral Strategies Per A2Zero Plan	
ENERGY	MOBILITY
Examine production of renewable sourced energy from digester biogas	Examine production of renewable fuel from digester biogas that can be utilized in vehicles or to produce electricity for electric vehicles
Examine production of renewable biogas in place of fossil fuels	
ADAPTATION & RESILIENCE	RESOURCE REDUCTION
Examine how biodigestion fits into the enhanced use of green infrastructure	Examine how food waste can be diverted from landfill to biodigester
Demonstrate how biodigestion makes the wastewater treatment system and local economy more resilient	Examine how composting can support beneficial reuse of stabilized biosolids

As part of this study, our team will use the models developed during the tasks above to identify the actual impact of a biodigester. Specific values can be supplied for parameters such as: reduced CO₂ emissions, tons of landfill material diverted, electricity or renewable natural gas generated, tons of lime saved, gallons of diesels saved, and BTUs of heat recovered. This data will **quantify** the environmental benefits of an investment in an Ann Arbor Biodigester by City planners.

TASK 8 – STAKEHOLDER ENGAGEMENT

The City has also requested our consultant group work to engage several stakeholder groups with information regarding the project, the benefits to the community, etc. We have discussed this task with the City to understand the intent of this task. Based on our understanding of this task, we would complete the following scope:

1. Prepare verbiage and information to evaluate how the biodigester investment relates to and helps achieve the “Criteria and Principals for Achieving Renewable Energy Goals.” (This information would be included in the meetings below, and in the final feasibility report.)
2. Prepare for and attend meetings to include the following (meetings will include agenda and PowerPoints that can ultimately be used for future public engagement):
 - a. One in person and two virtual with City Staff to introduce project elements specifically around sustainability and A²Zero, refine information and present, and further refine and present again based on feedback. Focus on collective goals and alignment on how this benefits the City related to these initiatives.
 - b. Two virtual meetings with environmental committee to present and engage with their comments based on information prepared in the staff meetings.
 - c. Two virtual meetings with the Office of Sustainability Initiatives, tied in with their existing stakeholder meetings, focused on how this project relates and ties in to their initiatives.
3. Prepare a scope for “next steps” of public engagement with stakeholders such as townships and other ratepayers. We would not be assuming any public meetings at this time; that would be for the future scope or “phase 3” if the City wishes to move forward with additional public engagement campaign activities, which could be several years out.
4. Summarize meetings and public engagement scope into the final feasibility report.

EXHIBIT B1
COMPENSATION



HOURS							
PHASE 2							
Firm/Staff/Position	Task 4	Task 5	Task 6	Task 7	Task 8	Final Report	Total
M+B/B. Hannon - VP/Proj Mgr	8	6	8	4	22	8	56
M+B/A. DeYoung, Proj Mgr	8	12	8	2		12	42
M+B/K. Place, Proj Eng	24	28	12	16	32	24	136
M+B/J. Markosky, Proj Eng	8	12	4	8	12	8	52
BWE/C. Antle, Owner	4	32	32	8		16	92
BV/H. Cheslek, Sr. Proj Mgr	2	6	4	1	8	4	25
BV/E. Schlanderer, Proj Mgr		4		4	20	4	32
BV/J. Blischke, Sr. Process/Organics		11		10	14		35
BV/S. Carr, Biosolids Specialist				2			2
BV/F. McCann, Financial Specialist		2	8	4	2	2	18
HRG/ Karen Sikkenga					20		20
TOTAL:	54	113	76	59	130	78	510

FEE								
PHASE 2								
Firm/Staff	Rate	Task 4	Task 5	Task 6	Task 7	Task 8	Final Report	Total
M+B/Hannon	\$202.00	\$1,616.00	\$1,212.00	\$1,616.00	\$808.00	\$4,444.00	\$1,616.00	\$11,312.00
M+B/DeYoung	\$128.00	\$1,024.00	\$1,536.00	\$1,024.00	\$256.00	\$0.00	\$1,536.00	\$5,376.00
M+B/Place	\$117.00	\$2,808.00	\$3,276.00	\$1,404.00	\$1,872.00	\$3,744.00	\$2,808.00	\$15,912.00
M+B/Markosky	\$105.00	\$840.00	\$1,260.00	\$420.00	\$840.00	\$1,260.00	\$840.00	\$5,460.00
BWE/Antle	\$145.00	\$580.00	\$4,640.00	\$4,640.00	\$1,160.00	\$0.00	\$2,320.00	\$13,340.00
BV/Cheslek	\$280.00	\$560.00	\$1,680.00	\$1,120.00	\$280.00	\$2,240.00	\$1,120.00	\$7,000.00
BV/Schlanderer	\$220.00	\$0.00	\$880.00	\$0.00	\$880.00	\$4,400.00	\$880.00	\$7,040.00
BV/Blischke	\$310.00	\$0.00	\$3,410.00	\$0.00	\$3,100.00	\$4,340.00	\$0.00	\$10,850.00
BV/Carr	\$320.00	\$0.00	\$0.00	\$0.00	\$640.00	\$0.00	\$0.00	\$640.00
BV/McCann	\$400.00	\$0.00	\$800.00	\$3,200.00	\$1,600.00	\$800.00	\$800.00	\$7,200.00
HRG/ Karen Sikkenga	\$200.00	\$0.00	\$0.00	\$0.00	\$0.00	\$4,000.00	\$0.00	\$4,000.00
TOTAL:		\$7,428.00	\$18,694.00	\$13,424.00	\$11,436.00	\$25,228.00	\$11,920.00	\$88,130.00

Firm Multipliers: Moore+Bruggink = 3.05 Black&Veatch = 3.13 BioWorks Energy = 2.50