

**AMENDMENT NUMBER 2 TO  
AGREEMENT FOR PROFESSIONAL SERVICES  
BETWEEN  
LG Design, Inc.  
AND  
THE CITY OF ANN ARBOR**

This Amendment Number 2 ("Amendment") is to the agreement between the City of Ann Arbor, ("City") and LG Design, Inc. (a wholly owned subsidiary of Jacobs Engineering Group), ("Contractor"), having its offices at 200 Verdae Blvd., Greenville, SC 29607 for the project WTP Interim UV Disinfection System, which is dated November 28, 2018 ("Agreement"). City and Contractor agree to amend the Agreement as follows:

- 1) Article III, SERVICES, is amended to read as follows:
  - A. The Contractor agrees to provide Professional Engineering Services ("Services") in connection with the Project as described in Exhibit A and Exhibit A-1, and as amended for additional tasks by Amendment Number 2 (Exhibit A-2). 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 contract sum shall be adjusted accordingly. All such changes shall be executed under the conditions of the original Agreement.
  - B. Quality of Services under this Agreement shall be of the level of quality performed by persons regularly rendering this type of service. Determination of acceptable quality shall be made solely by the Contract Administrator.
  - C. The Contractor shall perform its Services for the Project in compliance with all statutory, regulatory, and contractual requirements now or hereafter in effect as may be applicable to the rights and obligations set forth in the Agreement.
  - D. The Contractor may rely upon the accuracy of reports and surveys provided to it by the City (if any) except when defects should have been apparent to a reasonably competent professional or when it has actual notice of any defects in the reports and surveys.
- 2) Article V, COMPENSATION OF CONTRACTOR, is amended to read as follows:
  - A. The Contractor shall be paid in the manner set forth in Exhibit B and Exhibit B-1, and as amended for additional tasks by Amendment Number 2 (Exhibit B-2). The total fee to be paid to the Contractor for the Services shall not exceed \$428,235.00. The original contract amount was \$145,060.00. The Amendment No. 1 amount was \$229,255.00. The Amendment No. 2 amount is \$53,920.00. Payment shall be made monthly, unless another payment term is specified in Exhibit B-2, following receipt of invoices submitted by the Contractor, and approved by the Contract Administrator.

- B. The Contractor will be compensated for Services performed in addition to the Services described in Article III, only when the scope of and compensation for those additional Services have received prior written approval of the Contract Administrator.
- C. The Contractor shall keep complete records of work performed (e.g. tasks performed, hours allocated, etc.) so that the City may verify invoices submitted by the Contractor. Such records shall be made available to the City upon request and submitted in summary form with each invoice.

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.

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

**For Contractor**

By \_\_\_\_\_

Its:  
Date: \_\_\_\_\_

**Approved as to form and content**

\_\_\_\_\_  
Stephen K. Postema, City Attorney

**For City of Ann Arbor**

By \_\_\_\_\_  
Christopher Taylor, Mayor

By \_\_\_\_\_  
Jacqueline Beaudry, City Clerk

**Approved as to substance**

\_\_\_\_\_  
Tom Crawford, Interim City Administrator

\_\_\_\_\_  
Craig Hupy, Public Services Area Administrator

**EXHIBIT A-2  
SCOPE OF SERVICES**

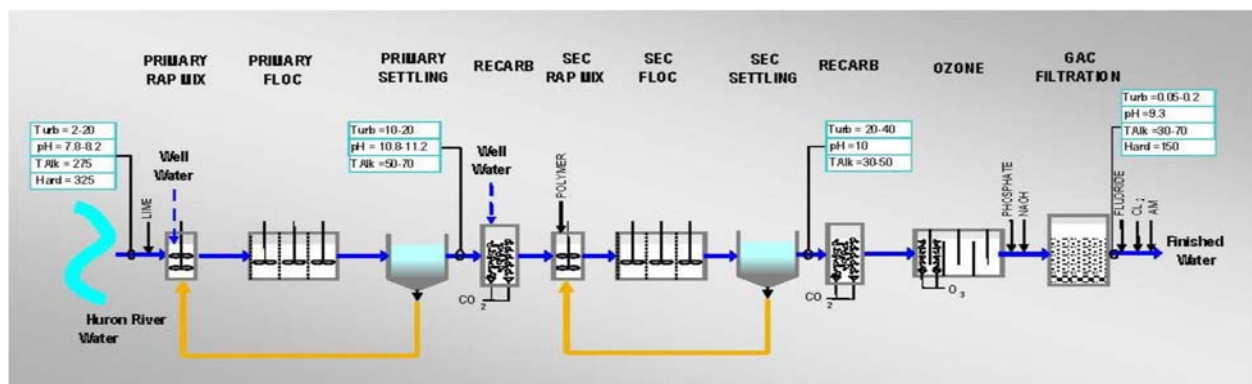
# City of Ann Arbor Disinfection Credit Calculation Support

## Scope of Work

### 1. Background

The source of Ann Arbor's water supply is an impoundment on Huron River and a well field located near the Ann Arbor airport. The City of Ann Arbor owns and operates a 50-million gallon per day (mgd) lime softening water treatment plant (WTP). The WTP consists of two softening plants: plant 1 has a capacity of 22 mgd and plant 2 has a capacity of 28 mgd. Treatment processes in plant 1 and 2 consist of two-stage rapid mixing, flocculation and lime softening. Water from plants 1 and 2 are combined and pass through recarbonation, ozonation, and biological granular activated carbon (GAC) filtration. After filtration, the water passes through two clearwells and then is pumped to an on-site storage reservoir. Water is distributed to customers by high-service pumps and can also flow by gravity to a portion of the service area. Exhibit 1 illustrates the basic process flow diagram for the Ann Arbor WTP.

Exhibit 1. Ann Arbor WTP Schematic.



Surface water utilities like Ann Arbor are required to demonstrate removal or inactivation of *Cryptosporidium*, *Giardia*, and viruses to comply with the USEPA Surface Water Treatment Rule (SWTR) and Long Term 2 Surface Water Treatment Rule (LT2SWTR) requirements. The Ann Arbor WTP has multiple barriers of protection against waterborne pathogens including two stage lime softening, filtration, ozonation, chlorination, and chloramination. The City has approved forms for tracking treatment system performance and summarizing in monthly reporting forms for Michigan Department of Environmental Quality (MDEQ).

Recently, elevated levels of *Cryptosporidium* were measured in the Huron River water source, requiring an additional 1-log *Cryptosporidium* inactivation through the treatment process at a minimum. A study was performed by CH2M (now Jacobs) in 2017 evaluating short-term and long-term alternatives for compliance. Based on the recommendations from the study, an interim UV disinfection system was selected by the City to provide compliance with the more stringent regulation by June 2020. Currently, UV disinfection is being installed at the WTP on the discharge from transfer pumps 4, 5, and 6.

As part of the UV commissioning, regulatory compliance forms will be developed specifically for the new UV disinfection system. This will allow the City to obtain additional log inactivation credits for *Cryptosporidium* and *Giardia* ranging from 1 to 3 log credit for any given day or month while the UV system is operating. The City will continue to obtain disinfection credits for their other treatment processes. Therefore, it will be imperative to align treatment operations, regulatory compliance and reporting across all available disinfection system processes. Required and eligible disinfection credits are summarized in Exhibit 2.

**Exhibit 2. Summary of WTP disinfection compliance requirements and potential credits by process.**

Pathogen	Viruses	Giardia	Cryptosporidium	
Removal or inactivation requirement (log removal)	4.0	3.0	4.0 (LT2 Bin 2)	Additional 1-log Crypto required per LT2 Bin 2
<b>Eligible Disinfection Credits by Process (log removal)</b>				<b><u>Monitoring Requirements</u></b>
Lime Softening + Filtration	2.0	2.5	3.0	Combined filter turbidity < 0.3 ntu 95% of monthly samples
<i>Two-Stage Lime Softening</i>			0.5 additional	100% Flow, Chemical Treatment
<i>Combined Filter Effluent Turbidity</i>			0.5 additional	Combined filter turbidity < 0.15 ntu 95% of monthly samples
<i>Individual Filter Effluent Turbidity</i>			0.5 additional	Individual filter turbidity < 0.15 ntu 95% of monthly samples
Ozone Disinfection	>2.0, CT based	>0.5, CT based	Eligible, but not utilized	Average ozone residual, temperature, pH, detention time
Free Chlorine	Backup to ozone	Backup to ozone		Chlorine residual, pH, temperature, and detention time
Chloramines	Backup to ozone	Backup to ozone		Chloramine residual, temperature, pH, detention time
UV Disinfection	Eligible, but not utilized	1 to 3, based on UV dose	1 to 3, based on UV dose	Achieve required UV dose > 95% by volume per month

As shown in Exhibit 2, the City currently relies on lime softening, filtration, and ozone disinfection to achieve its disinfection requirements for viruses, *Giardia*, and *Cryptosporidium*. Free chlorine and chloramines are also eligible for disinfection credits if ozone is not in service or does not achieve the minimum contact time (CT). With the additional 1-log *Cryptosporidium* required to comply with LT2 Bin 2, the City can increase credits from its existing lime softening, filtration, and ozone disinfection processes if certain criteria are met. The 2017 LT2 Study (CH2M) identified multiple alternatives for increasing ozone disinfection credits, some of which would require operational or physical modifications to implement. The interim UV disinfection system can also be used for additional disinfection compliance once operational.

The purpose of this study is to assist the City with modifications to its disinfection strategy, disinfection credit calculations and compliance reporting approach with the addition of UV disinfection and increased *Cryptosporidium* inactivation requirements.

## 2. Task 1: Update Disinfection Credit Calculations

Task 1 will consist of reviewing the existing disinfection credit calculations for free chlorine, chloramine, ozone, lime softening, and filtration. A kickoff meeting will be held with City staff to review existing disinfection calculations and potential modifications required to accommodate UV disinfection. The attendees will review shortcomings of existing calcs and obtain user input for possible enhancements. Operational scenarios will be discussed to clarify how disinfection credits will be obtained. Jacobs will prepare a presentation summarizing background WTP information, disinfection regulations and CT calculations, and example CT sheets that could be adopted by the City.

Each of the disinfection treatment processes are discussed below in detail:

**Lime Softening** – Confirm calculations for single and two stage softening and incorporate *Cryptosporidium* and *Giardia* credits. Two stage lime softening is eligible for 0.5-log *Cryptosporidium* removal credit when in service.

**Filtration** – Confirm that calculations and turbidity sampling points account for both combined filter effluent and individual filter effluent turbidity for an additional 0.5 log or 1 log *Cryptosporidium* inactivation credit, respectively. Goal for City is 0.5-log credit for combined filter effluent turbidity.

**Ozone** – Discuss ozone feed points, detention time, baffle factor, ozone residual measurements, and ozone sample locations. Review potential enhancements to ozone disinfection credits as presented in the LT2 Study. Discuss using minimum residual in lieu of average ozone residual for calculating CT. Add *Cryptosporidium* inactivation credits based on EGLE approved methods. Focus will be towards using the USEPA recognized ozone CT method since it is simplest and recognized by EGLE. The USEPA approach uses a simple ozone residual x detention time approach similar to chlorine CT, but additional credits for viruses and *Giardia* can be obtained simply by meeting a minimum CT in the first cell. The ozone CT integration method will be reviewed but is not recommended as EGLE likely will not accept it. The differences between using the pressurized solution feed system versus bubble diffusion will be discussed. Ozone CT calcs will be revised and updated as necessary.

**Free Chlorine** – Confirm calculations for feed points, flow splits, detention time, baffle factors, pH, temperature and chlorine residual. Revise and update calculations as necessary based on possible operating scenarios with one clearwell or UV out of service. It is generally understood that the creation of disinfection by-products limits the use of free chlorine. New feed points for chlorine and ammonia will be discussed with respect to disinfection targets if ozone or UV is out of service.

**Chloramine** – Confirm calculations for feed points, flow splits, detention time, baffle factors, pH, temperature and chloramine residual. Revise and update calculations as necessary based on possible operating scenarios. Simplification of calculations will be discussed. Per previous MDEQ correspondence, the finished water reservoir was granted a baffle factor of 0.23 based on tracer testing. Chloramine CT requirements are very high for cold water, therefore combination of free chlorine plus chloramines may be required. Also free chlorine and chloramines should only be used for backup disinfection. Review use of new chloramine analyzers for monitoring residual.

**UV Disinfection** – Review the range of log inactivation credits available under various operation scenarios for additional *Cryptosporidium* and *Giardia* inactivation credit. Review both intermittent and year-round use of UV disinfection.

After the kickoff meeting with the City, Jacobs will summarize the recommended disinfection strategy in a draft technical memorandum (TM) and draft monthly reporting forms. The draft TM and reporting forms will provide a disinfection strategy and outline for EGLE reporting for the following disinfection credit scenarios for Bin 2 compliance:

Current Operations Plus 1-log Crypto: Lime Softening (C) + Ozone (V/G) + Filtration (V/G/C)

UV Disinfection Operation: Ozone (V) + Filtration (V/G/C) + UV (G/C)

Emergency Operations: Lime Softening (C) + Free Chlorine (V/G) + Filtration (V/G/C) + Chloramines (V/G)

where V=virus, G=Giardia, C=Crypto

Monthly reporting forms will be excel based and include a brief regulatory requirements summary to explain basis for compliance strategy. Data collected in the forms will be set up in a manner to be conducive for automated data collection in SCADA into MORs/CT sheets.

#### **Task 1 Deliverables:**

- Project kickoff conference call with City and Jacobs
- Jacobs/City meeting Powerpoint presentation and summary notes.
- Draft TM and monthly reporting forms summarizing revised disinfection compliance strategy.

### **3. Task 2: Update Regulatory Compliance Reporting Forms**

Based on the updated disinfection credit calculations developed under Task 1, Jacobs will facilitate a meeting at the Ann Arbor WTP between EGLE and the City to review the proposed LT2 disinfection compliance approach. If acceptable to the City, the TM developed under Task 1 will be shared with EGLE in advance of the meeting. Required data collection will be confirmed in the meeting and draft monthly reporting forms will be reviewed. A power point will be developed to facilitate the meeting and summary notes will be developed.

Based on the meeting, the monthly disinfection compliance reporting forms for Michigan Department of Environment, Great Lakes and Energy (EGLE) will be revised accordingly. Forms will be developed in Word and Excel for the City. New monthly reporting forms with data collection tables will be developed for the following processes:

- Lime Softening

- Filtration
- Ozone Disinfection
- Free Chlorine or Chloramines
- UV Disinfection

The draft TM will be finalized based on EGLE input to document the disinfection credit calculations and reporting forms. Revisions to SCADA screens or PLC programming will not be conducted, but can be completed under a separate task if requested by the City (see Optional Task 3).

**Task 2 Deliverables:**

- Conference call with EGLE to discuss feasibility of using ozone integration method
- Jacobs/City/EGLE meeting powerpoint presentation and summary notes
- Final Technical Memorandum summarizing revised disinfection strategy, including monthly reporting forms for lime softening, filtration, ozonation, free chlorine (if applicable), chloramines, and UV disinfection.

**4. Task 3: Modify SCADA Screens and Data Acquisition**

To facilitate recording of relevant data for the monthly reporting forms, modifications to automatic recording of data in SCADA or data displayed on SCADA screens may be necessary. This task will involve a review of existing data sets and SCADA screens and an assessment of gaps or modifications required to facilitate completion of the new monthly reporting forms developed under Task 2.

Once data sources and SCADA modifications have been identified, opportunities for automatic data entry from field devices into SCADA and for prepopulating into the monthly report forms will be identified. Data entry will follow the monthly reporting form formats.

Jacobs will provide guidance for City staff to implement the changes in SCADA and coordinated with the SCADA upgrades project. Recommended SCADA screen modifications, I/O lists, and data automation for monthly reporting will be included in a summary TM.

**Task 3 Deliverables:**

No formal deliverables, but outcome will be updated SCADA screens and integration with MORs



## **5. Task 4: Ozone Integration Method Adoption (OPTIONAL)**

Task 4 is an optional task to be executed by the City if EGLE endorses pursuit of the ozone CT integration method. Using the ozone Integration method may be beneficial for the City by increasing the ozone CT utilizing existing system assets and ozone dose. It is a method approved by USEPA and utilized by other water systems for ozone disinfection credits. Anticipated activities in Task 4 include:

- Summary of other water systems using ozone CT integration method and example calculation sheets
- Conference call with EGLE to discuss feasibility and information needs
- Workshop with City and EGLE to develop regulatory approval approach
- Development of test plan if required by EGLE
- Update of disinfection approach TM and reporting forms to include ozone integration method
- Assistance with SCADA screens and data automation for MORs

## **6. Schedule**

The following proposed schedule has the goal of providing updated disinfection calculations and compliance forms prior to commissioning the UV disinfection system in May 2020:

**February 18, 2020** – Receive notice to proceed.

**March 2, 2020** – Initial kickoff phone call with City to discuss goals and available information.

**March 18, 2020** – Meeting with City to discuss regulatory reporting formats and final disinfection credit calculations.

**March 25, 2020** - Draft Technical memorandum and reporting forms for City review.

**April 8, 2020** – Draft Technical memorandum and reporting forms for EGLE.

**April 15, 2020** - Meeting with City and EGLE to review proposed modifications to disinfection credit calculations and regulatory reporting forms.

**May 15, 2020** - Final Technical memorandum and reporting forms.

**May-June 2020** – Complete Task 3 activities.

**TBD** - Complete Task 4 activities.

**EXHIBIT B-2  
COMPENSATION**

General

Contractor shall be paid for those Services performed pursuant to this Agreement in accordance with the terms and conditions herein. The Compensation Table below states nature and amount of compensation the Contractor may charge the City:

A summary of the fee associated with this work is provided below. This scope of work will be included as additional services to the existing Ann Arbor WTP UV Disinfection Project as Amendment No. 2. Total fees for the contract will total \$428,235, including Task 4 optional services.

City of Ann Arbor Michigan													
WTP Disinfection Compliance Study													
Mar-20													
Jacobs Engineering													
		Senior Project Manager		Senior Engineer		Project Engineers		Administrative, CAD					
Task Description										Total Labor By Task	Total Hours by Task	Total Expense	Total by Task
Billing Rate		\$ 250.00		\$ 190.00		\$ 175.00		\$ 100.00					
		Hours	Fees	Hours	Fees	Hours	Fees	Hours	Fees				
Subtask 1	Update Disinfection Credit Calculations (1 onsite meeting; review and update of calculations)	12	\$3,000	40	\$7,600		\$0	4	\$400	\$11,000	56	\$1,500	\$12,500
Subtask 2	Reporting Forms (1 onsite meeting; review and revise forms)	12	\$3,000	40	\$7,600		\$0	4	\$400	\$11,000	56	\$1,500	\$12,500
Subtask 3	SCADA Support Services to City	4	\$1,000	8	\$1,520	32	\$5,600	4	\$400	\$8,520	48	\$1,500	\$10,020
Subtask 4	Ozone Integration Method Adoption	32	\$8,000	40	\$7,600	8	\$1,400	4	\$400	\$17,400	84	\$1,500	\$18,900
<b>Original Scope of Work Total</b>		<b>60</b>	<b>\$ 15,000</b>	<b>128</b>	<b>\$ 24,320</b>	<b>40</b>	<b>\$ 7,000</b>	<b>16</b>	<b>\$ 1,600</b>	<b>\$ 47,920</b>	<b>244</b>	<b>\$ 6,000</b>	<b>\$ 53,920</b>