AMENDMENT NO. 1
TO AGREEMENT FOR PROFESSIONAL SERVICES WITH CAROLLA ENGINEERS, INCORPORATED FOR THE DESIGN OF LAGUNA COUNTY SANITATION DISTRICT WASTEWATER RECLAMATION PLANT UPGRADES

THIS AMENDMENT, effective as of the date last written below, is entered into between the Laguna County Sanitation District, a dependent special district of the County of Santa Barbara, a political subdivision of the State of California (hereinafter DISTRICT) and Carollo Engineers, Incorporated, having its principal place of business at 3150 Bristol Street, Suite 500 Costa Mesa, CA 92626 (hereafter ENGINEER).

WHEREAS, the parties hereto, on September 22, 2015, entered into an agreement (BC16-110) for performance of professional services by ENGINEER in connection with the Laguna County Sanitation District Plant Upgrades Project; and

WHEREAS, the original agreement amount for said services was in the not to exceed amount of $2,980,949 and a contingency of $150,000 for a total contract amount of $3,130,949; and

WHEREAS, a proposal for this work has been negotiated with ENGINEER and found to be appropriate;

NOW THEREFORE, the parties hereto agree as follows:

A. The additional statement of services shown on Exhibit 1, attached hereto and incorporated herein by this reference, is hereby, added to the previously agreed upon Scope of Work:

   Contractor shall perform additional engineering work comprising an overall Electrical System Study including:

   1. Short circuit fault current study.

   2. Protective device coordination study.

   3. Updated arc flash study.

B. ENGINEER hereby agrees to accept the following as full and final compensation for the Scope of Work as amended herein:

   1. Compensation for additional services in the amount of $38,791 for the items above.

   2. CONTRACTOR shall be paid a total contract amount, not to exceed $3,019,740.

C. In all other respects the contract shall remain in full force and effect.

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Amendment No. 1 to Agreement for Services of Independent Contractor between the **Laguna County Sanitation District** and **Carollo Engineers, Incorporated**.

IN WITNESS WHEREOF, the parties have executed this Amendment to be effective on the date executed by DISTRICT.

ATTEST:
Mona Miyasato
County Executive Officer
Ex-Officio Clerk of the Board

By:_____
Deputy Clerk

DISTRICT:
LAGUNA COUNTY SANITATION DISTRICT

By:_____
Peter Adam, Chair, Board of Supervisors
Ex-Officio Chair, Board of Directors

Date:_____

RECOMMENDED FOR APPROVAL:
Public Works Department

By:_____
Scott McGolpin, Department Head

ENGINEER:
Carollo Engineers, Incorporated

By:_____
Authorized Representative
Name: Troy Hedlund, P.E.
Title: Vice President

By:_____
Authorized Representative
Name: Rick Wheadon, P.E.
Title: Senior Vice President

APPROVED AS FORM:
Michael C. Ghizzoni
County Counsel

By:_____
Deputy County Counsel

APPROVED AS FORM:
Ray Aromatorio, ARM, AIC
Risk Manager

By:_____
Risk Manager

APPROVED AS TO ACCOUNTING FORM:
Robert W. Geis, CPA
Auditor-Controller

By:_____
Deputy

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EXHIBIT 1
SCOPE OF WORK

BACKGROUND

In 2012, the District engaged a consultant to conduct an Arc-Flash Study for the Wastewater Reclamation Plant (WRP). As part of that effort, Arc-Flash labels were produced and installed on the pertinent pieces of electrical equipment. Since 2012, some significant modifications have been made to the WRP electrical power distribution system that necessitate an update to the 2012 Arc-Flash Study. Specifically, with the addition of the standby diesel engine generators, it is likely that the calculated arc-flash incident energy values at certain locations in the electrical power distribution system are higher than they were in 2012 when the initial Arc-Flash Study was completed, and thus some of the arc-flash hazard labels may indicate a lesser hazard than what is actually present.

In hopes of minimizing the amount of rework with respect to the initial Arc-Flash Study, we have reviewed the PTW model, which is the software model of the WRP electrical power distribution system that was used in the initial Arc-Flash Study to calculate the short-circuit fault current values, configure the protective device coordination, and calculate the arc-flash incident energy values. Although the PTW model appears to include the major pieces of electrical equipment comprising the WRP electrical power distribution system (with the exception of the standby engine generators which were not installed at the time the initial Arc-Flash Study was completed), it is our professional opinion that this model is inadequate for 2 reasons:

1. Conductor lengths for nearly all feeder and branch circuits have the same value, which implies that the actual cable lengths were not used. Using accurate conductor lengths in short-circuit fault current and arc-flash incident energy calculations is important because the impedance of a circuit is directly proportional to the conductor length, and the fault current magnitude is inversely proportional to the impedance; this is similar in principle to friction losses in a pipe. Our recommendation to address this issue is to estimate conductor lengths of feeder and branch circuits through review of as-built documents in conjunction with field investigation and refine the PTW model accordingly.

2. In many cases where load centers (e.g. motor control centers, switchboards, distribution panelboards) distribute power to multiple branch loads, instead of modeling the individual branch loads and associated conductors, the model aggregates all loads into a single "lump" load for that particular load center. Although this "lump" load approach is not uncommon in the industry, it is a "short cut" that may result in inaccurate short-circuit fault current and arc-flash incident energy calculations. Our recommendation to address this issue is to replace these "lump" loads with the actual individual branch circuit loads in the PTW model and recalculate that short-circuit fault current and arc-flash incident energy values.

The following scope of work was developed with the overall objective of providing a comprehensive Electrical System Study Report, comprised of a Short-Circuit Fault Current Study, Protective Device Coordination Study, and Arc-Flash Study, that addresses the

deficiencies of the initial 2012 Arc-Flash Study and accounts for the addition of the standby diesel engine generators.

SCOPE OF WORK

The scope of work is comprised of 9 tasks.

Task 1 - Field Investigation Sequencing Plan

Prior to conducting field investigation, Carollo will develop a field investigation sequencing plan that identifies the timing of various field investigation activities, including required equipment shut downs and shut down durations. Carollo will coordinate with the District in development of the sequencing plan to minimize the impacts of the field investigation and associated shut downs on WRP operation.

Task 2 - Field Investigation and PG&E Coordination

Carollo will provide site visits and field investigation to obtain the information about the existing WRP electrical power distribution system needed to develop the power system software model. As part of the field investigation effort, Carollo will engage Taft Electric to provide the services of field electricians to assist in lockout/tag out procedures and opening/closing of electrical panels.

In addition to field investigation, Carollo will coordinate with PG&E to obtain the PG&E system information needed for the short-circuit fault current calculations and protective device coordination study.

Task 3 - ETAP Model Development

Based on the information obtained in Task 2, Carollo will develop a software model of the WRP electrical power distribution system. The software model will be developed in ETAP electrical engineering software and will be sufficiently detailed to include:

- PG&E electric service equipment including primary fuses and padmount transformers;
- Switchgear and switchboards;
- Onsite power generation equipment including Standby Diesel Engine Generators and Solar Photovoltaic Inverters;
- Padmount and Dry-Type Transformers;
- Motor control centers;
- Individually enclosed variable frequency drives and motors starters;
- Disconnect switches;
- 3-Phase Motors (each motor will be individually modeled);
- 480-volt, 240-volt, and 208-volt panelboards;
- Vendor control panels;
- HVAC equipment.

Task 4 - Short-Circuit Fault Current Study

Using the ETAP software, Carollo will conduct a Short-Circuit Fault Current Study to calculate the 3-phase bolted fault, line-to-line fault, line-to-ground fault, double line-to-ground fault, short-circuit 1/2 cycle momentary symmetrical and asymmetrical RMS, 1-1/2 and 4 cycle, interrupting symmetrical RMS, and 30 cycle steady state short-circuit current values at each piece of

equipment in the electrical power distribution system. These values will be calculated for the following electrical power distribution system operating scenarios:

- Operation on normal (PG&E) source;
- Operation on normal (PG&E) source in parallel with solar photovoltaic systems;
- Operation on standby engine generator source;
- Main-breakers closed, tie-breaker open for equipment with main-tie-main configuration.
- Either main-breaker open, tie-breaker closed for equipment with main-tie-main configuration.

For equipment having grounding fault devices, the fault current calculations will also include line-to-ground and double line-to-ground momentary calculations.

Note that it is assumed that the existing cogeneration equipment will soon be decommissioned, and thus we have omitted it from this scope of work.

After calculating the various short-circuit fault current values, we will evaluate bus bracing, short circuit ratings, fuse interrupting capacity, and circuit breaker adjusted interrupting capacities against the calculated values and identify all devices and equipment as either inadequate or acceptable. In the case where inadequately rated equipment or devices are identified, Carollo will provide recommendations to resolve the identified issue(s).

Task 5 - Protective Device Coordination Study

Using the ETAP software and the "as-found" protection settings obtained in the field investigation for the existing protection devices (e.g. circuit breakers), Carollo will perform a Protective Device Coordination Study. Time Current Curves (TCC's) will be developed for the equipment/circuits comprising the electrical power distribution system to graphically depict the coordination between various protection devices. The "as-found" protection device settings and the adjustments to protection device settings recommended to achieve better coordination or lower arc-flash incident energy levels will be presented in tabular format.

Task 6 - Arc-Flash Study

Based on the Short-Circuit Fault Current and Protective Device Coordination studies, Carollo will perform an Arc-Flash Study to calculate the arc-flash boundary and incident energy (in calories per square centimeter) at each piece of equipment comprising the WRP electrical power distribution system. Specific criteria that will govern the arc-flash boundary and incident energy calculations is as follows:

- Calculations will be performed with 15 percent arcing fault variation as defined by IEEE 1584.
- Calculations will be performed to reflect minimum and maximum PG&E fault contributions and fault contributions from onsite power sources (e.g. solar photovoltaic, standby diesel engine generators).
- Calculations will be performed for both the line side and load side of switchgear, switchboard, motor control center and panelboard main breakers.
- Calculations will be performed for all short-circuit scenarios with all motors on for 3 to 5 cycles and with all motors off.
- For calculations, protective device clearing time will be limited to a maximum of 2 seconds.

Task 7 - Draft Electrical System Study

The results of the Short-Circuit Fault Current, Protective Device Coordination, and Arc-Flash studies will be summarized in a comprehensive Draft Electrical System Study, which will be submitted to the District for review. Four (4) hard-copies, bound in 3-ring binders, of the draft study will be provided.

After the District has had sufficient time to review the Draft Electrical System Study, Carollo will schedule and conduct a meeting with District Staff to discuss the contents of the draft study and the District's review comments. Additionally, Carollo will present modifications to existing protection device settings recommended to achieve better protective device coordination or lower arc-flash incident energy values.

Task 8 - Final Electrical System Study

Carollo will incorporate the District's review comments on the draft study and update calculations as necessary to compile the Final Electrical System Study. Five (5) hard-copies, bound in 3-ring binders, of the draft study will be provided. In addition to the hard-copies, Carollo will provide the software files used in the development of the ETAP power system model, such that the files will be available in the future should subsequent updates or modifications be necessary.

Task 9 - Arc-Flash Hazard Labels

Based on the arc-flash calculations presented in the Final Electrical System Study, Carollo will provide arc-flash hazard labels for the various pieces of equipment comprising the WRP electrical power distribution system. Specifically, arc-flash hazard labels will be provided for:

- The front of each main or incoming PG&E service compartment included in the scope of the study.
- The front of each low voltage switchgear section included in the scope of the study.
- The front of each accessible auxiliary or conductor compartment included in the scope of the study.
- Each accessible rear or side vertical section included in the scope of the study.
- Each motor control center compartment included in the scope of the study.
- Each panelboard included in the study included in the scope of the study.
- Each control panel, individual starter or VFD or other equipment included in the study included in the scope of the study.

The size, format, and content of the arc-flash hazard labels will conform to the most current version of NFPA 70E - Standard for Electrical Safety in the Workplace.

Carollo will engage Taft Electric to provide the services of field electricians to remove the existing arc-flash hazard labels and install the new arc-flash hazard labels.

FEE

The fee to provide the engineering services comprising the scope of work is $38,791; refer to Attachment A for a breakdown of hours and costs.

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EXHIBIT 1
ATTACHMENT A
BREAKDOWN OF HOURS AND COSTS

	CAROLLO LABOR					PROJECT COSTS				
Task	Project Professional	Professional	Assistant Professional	Document Processing and Clerical	TOTAL LABOR HOURS	Total Labor Cost	Project Equipment and Communications Expense	Subcontractor: Taft Electric	Other Direct Costs	TOTAL COST
Prepare Field Investigation Sequencing Plan	2	8	0	0	10	$ 2,012	$ 117	$ -	$ -	$ 2,129
Field Investigation	0	16	16	0	32	$ 5,648	$ 374	$ 2,000	$ 1,100	$ 9,122
ETAP Model Development	0	8	16	0	24	$ 4,096	$ 281	$ -	$ -	$ 4,377
Fault Current Study	0	0	4	0	4	$ 636	$ 47	$ -	$ -	$ 683
Protective Device Coordination Study	0	0	8	0	8	$ 1,272	$ 94	$ -	$ -	$ 1,366
Arc-Flash Study	2	8	8	0	18	$ 3,284	$ 211	$ -	$ -	$ 3,495
Compile Draft Electrical System Study	2	8	8	16	34	$ 4,980	$ 398	$ -	$ -	$ 5,378
Draft Electrical System Study Review Meeting	8	8	0	0	16	$ 3,392	$ 187	$ -	$ 250	$ 3,829
Final Electrical System Study QA/QC	8	0	0	0	8	$ 1,840	$ 94	$ -	$ -	$ 1,934
Compile Final Electrical System Study	2	4	8	8	22	$ 3,356	$ 257	$ -	$ 250	$ 3,863
Develop & Print Arc-Flash Labels	0	0	8	0	8	$ 1,272	$ 94	$ -	$ 250	$ 1,616
Install Arc-Flash Labels	0	0	0	0	0	$ -	$ -	$ 1,000	$ -	$ 1,000
Total	**24**	**60**	**76**	**24**	**184**	**$ 31,788**	**$ 2,153**	**$ 3,000**	**$ 1,850**	**$ 38,791**