STATE OF CALIFORNIA
GRANT REQUEST FORM (GRF)
CEC-270 (Revised 12/2019) CALIFORNIA ENERGY COMMISSION

A) New Agreement # EPC-20-001 (to be completed by CGL office)

B) Division	Agreement Manager:	MS-	Phone
ERDD	Christian Fredericks	51	916-327-1631

C) Recipient's Legal Name	Federal ID Number
Lawrence Berkeley National Laboratory	94-2951741

D) Title of Project
Energy-Water Desalination Hub

E) Term and Amount

Start Date	End Date	Amount
8/30/2020	3/31/2025	$ 3,000,000

F) Business Meeting Information

☐ ARFVTP agreements $75K and under delegated to Executive Director

Proposed Business Meeting Date 8/12/2020 ☐ Consent ☒ Discussion

Business Meeting Presenter Christian Fredericks Time Needed: 5 minutes

Please select one list serve. EPIC (Electric Program Investment Charge)

Agenda Item Subject and Description:

LAWRENCE BERKELEY NATIONAL LABORATORY. Proposed resolution approving agreement EPC-20-001 with Lawrence Berkeley National Laboratory for a $3,000,000 grant toward a $100,000,000 federal cost share from the Department of Energy to create a Hub to lead early-stage applied research to develop innovative new technologies that lower the cost of desalination and associated water treatment, focusing on enabling distributed desalination and localized water reuse, and adopting staff's determination that this action is exempt from CEQA. The research areas include materials and manufacturing, process innovation and intensification, modeling and simulation and integrated data and analysis. Contact: Christian Fredericks (Staff presentation: 5 minutes)

G) California Environmental Quality Act (CEQA) Compliance

1. Is Agreement considered a "Project" under CEQA?
   ☒ Yes (skip to question 2)
   ☐ No (complete the following (PRC 21065 and 14 CCR 15378)):

   Explain why Agreement is not considered a "Project":

2. If Agreement is considered a "Project" under CEQA:
   a) ☒ Agreement **IS** exempt.
      ☐ Statutory Exemption. List PRC and/or CCR section number:
      ☒ Categorical Exemption. List CCR section number: Cal. Code Regs., tit. 14, § 15301; Cal. Code Regs., tit. 14, § 15306
      ☐ Common Sense Exemption. 14 CCR 15061 (b) (3)

Explain reason why Agreement is exempt under the above section: Under the U.S. Department of Energy's (DOE) Energy-Water Desalination Program, government and university laboratories and some private research institutions would apply for research funding for development of energy-efficient and cost-competitive desalination technologies and for treating nontraditional water sources. A consortium of national laboratories, universities, and private institutions, called the National Alliance for Water Innovation (NAWI), led by the Lawrence Berkeley National Laboratory (LBNL), is to administer the program across the nation. LBNL would coordinate efforts, including NAWI's reviewing, awarding, and overseeing funded research. Federal funding would total approximately $100 million over five years. DOE prepared a Categorical Exclusion Determination, dated 1/7/2020, under the National Environmental Policy Act. DOE's analysis took into account restrictions on Program activities, including, but not limited to: (a) research by qualified scientific staff; (b) all legal and regulatory requirements regarding environmental, health, and safety to be met; (c) activities to be indoors and in existing laboratory and research facilities; (d) no funding of large-scale "demonstration" activities; and (e) no support for the construction of new facilities or the expansion of existing facilities.

LBNL prepared an internal evaluation under the California Environmental Quality Act, dated 12/23/2019, and concluded that the proposed project is exempt under Sections 15301 and 15306 of CEQA regulations. LBNL relied upon similar reasoning to DOE, including that LBNL would ensure that future funded activities meet the research conditions through "flow-through" requirements in the application process and in contracts with funding awardees.

The CEC's co-funding of the Program will be $3 million through the EPC-20-001 grant. The CEC has independently reviewed the project's environmental aspects. The project consists of the operation of existing public or private facilities, involving negligible or no expansion of existing or former use. Therefore, this project is exempt under California Code of Regulations, title 14, section 15301, Existing Facilities. In addition, the project involves data collection, research, and experiments, which would not result in a serious or major disturbance to an environmental resource. Therefore, this project is exempt under California Code of Regulations, title 14, section 15306, Information Collection.

b) Agreement **IS NOT** exempt. (consult with the legal office to determine next steps)

Check all that apply

- ☐ Initial Study
- ☐ Negative Declaration
- ☐ Mitigated Negative Declaration
- ☐ Environmental Impact Report
- ☐ Statement of Overriding Considerations

H) List all subcontractors (major and minor) and equipment vendors: (attach additional sheets as necessary)

Legal Company Name:	Budget
	$

I) List all key partners: (attach additional sheets as necessary)

Legal Company Name:
U.S. Department of Energy

J) Budget Information

Funding Source	Funding Year of Appropriation	Budget List Number	Amount
EPIC	19-20	301.001G	$3,000,000

R&D Program Area: EERO: Energy Efficiency TOTAL: $ 3,000,000

Explanation for "Other" selection

Reimbursement Contract #: Federal Agreement #:

K) Recipient's Contact Information

1. Recipient's Administrator/Officer

Name: Besty Quayle

Address: 1 Cyclotron Rd

City, State, Zip: Berkeley, CA 94720-8099

Phone: 510-486-7391

E-Mail: BEQuayle@lbl.gov

2. Recipient's Project Manager

Name: Peter Fiske

Address: 1 Cyclotron Rd

City, State, Zip: Berkeley, CA 94720-8099

Phone: 415)309-0336

E-Mail: PFiske@lbl.gov

L) Selection Process Used

☒ Competitive Solicitation Solicitation #: GFO-18-902

☐ First Come First Served Solicitation Solicitation #:

M) The following items should be attached to this GRF

1.	Exhibit A, Scope of Work		☒ Attached
2.	Exhibit B, Budget Detail		☒ Attached
3.	CEC 105, Questionnaire for Identifying Conflicts		☒ Attached
4.	Recipient Resolution	☒ N/A	☐ Attached
5.	CEQA Documentation	☐ N/A	☒ Attached

Agreement Manager **Date**

Office Manager	**Date**
Deputy Director	**Date**

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

I. TASK ACRONYM/TERM LISTS

A. Task List

Task #	CPR[1]	Task Name
1		General Project Tasks
2		Management & Operations (National Alliance for Water Innovation (NAWI) 2.1)
3		Development, Deployment, and Refinement of the Water Technology Data and Analysis Management System (Water-DAMS) (NAWI 3.2)
4	X	Roadmap to R&D Cycle: Technology Baselines, NAWI Performance Tracking, and Technology Roadmapping (NAWI 3.4)
5		PROTEUS: Integrated Computational Capability for Optimizing Advanced Water Treatment Systems (NAWI 4.2)
6		Computational Test Bed for Predictive Fouling Control (NAWI 5.4)
7		Machine Learning Platform for Catalyst Design (NAWI 6.2)
8		Evaluation Of Project Benefits
9		Technology/Knowledge Transfer Activities

B. Acronym/Term List

Acronym/Term	Meaning
CAM	Commission Agreement Manager
CAO	Commission Agreement Officer
CEC	California Energy Commission
CPR	Critical Project Review
DOE	U.S. Department of Energy
LBNL	Lawrence Berkeley National Laboratory
NAWI	National Alliance for Water Innovation
R&D	Research and Development
RO	Reverse Osmosis
TAC	Technical Advisory Committee
Water-DAMS	Development, Deployment, and Refinement of the Water Technology Data and Analysis Management System

II. PURPOSE OF AGREEMENT, PROBLEM/SOLUTION STATEMENT, AND GOALS AND OBJECTIVES

A. Purpose of Agreement

The purpose of this Agreement is to provide cost share funds to Lawrence Berkeley National Laboratory (LBNL), the technical and administrative lead of the Department of Energy's Energy-

[1] Please see subtask 1.3 in Part III of the Scope of Work (General Project Tasks) for a description of Critical Project Review (CPR) Meetings.

Water Desalination Hub. The National Alliance for Water Innovation (NAWI) brings together a world-class team of industry and academic partners to address the critical technical barriers and research needed to radically lower the energy consumption and cost of desalination.

B. Problem/ Solution Statement

Problem

Current desalination technologies cannot produce clean water from most inland brackish water aquifers, industrial and municipal wastewater, produced water from oil and gas extraction, or agricultural wastewaters at a cost and energy comparable to existing freshwater supplies.

Solution

The Recipient will lead an early-stage applied research program to develop innovative new technologies to lower the cost of desalination and associated water treatment, focusing on enabling distributed desalination and localized water reuse. The program will be organized into 4 Topic Areas: Materials and Manufacturing Research and Development (R&D), Process Innovation and Intensification R&D, Modeling and Simulation R&D, and Integrated Data and Analysis. Initial research projects include:

- Development of a novel Water Data Analysis and Management Systems (Water-DAMS) that will aggregate energy and cost data for desalination and other water treatment processes into a single, open-source, publicly-available database
- Conducting the first ever national Research Roadmap for Desalination of non-traditional water sources, utilizing surveys, interviews and extensive literature reviews
- Development of PROTEUS – an integrated simulation software package that will allow water treatment researchers, system designers, and policy makers to evaluate the cost and energy associated with a variety of hypothetical water treatment schemes
- Utilization of one of the most powerful computer modeling tools (TOUGH software suite developed by Lawrence Berkeley National Lab) to simulate the process of mineral scaling in reverse osmosis (RO) membrane desalination systems
- Examination of millions of possible combinations of electrocatalysis materials for desalination using advanced “genome-of-materials” methodologies.

C. Goals and Objectives of the Agreement

Agreement Goals

The goals of this Agreement are to:

- Conduct an integrated program of applied research that results in new technologies and methods to lower the cost and energy of desalination on “non-traditional” waters such as inland brackish groundwater, oil and gas produced water, and wastewater from power plants.
- Develop and release a new database (Water-DAMS) that enabled users to find current energy and cost data for water treatment in a wide variety of settings and industries
- Develop and release a computer modeling program (PROTEUS) that enables water treatment engineers and researchers to simulate treatment operations for the purpose of energy and cost optimization

- Conduct groundbreaking research into the causes of mineral scaling in RO systems – a leading cause of energy loss in desalination
- Develop novel electrocatalytic materials to treat key water contaminants that lead to high energy costs of water treatment and reuse

Ratepayer Benefits:[2] This Agreement is intended to result in the ratepayer benefit of lowering the energy demands of desalination in California, reducing the need for new generating capacity by developing new technologies and methods to lower the cost and energy associated with desalination and enabling an increase in water reuse.

Technological Advancement and Breakthroughs:[3] This Agreement is intended to lead to technological advancement and breakthroughs to overcome barriers to the achievement of the State of California's statutory energy goals by lowering the cost and energy required for desalination and reducing the State's dependence on freshwater sources which require large energy costs to transport long distances and enabling a greater amount of water reuse

The U.S. Department of Energy (DOE) Energy-Water Desalination Hub will invest in high-impact applied research and development in modular, autonomous water treatment technologies that could lower energy use and carbon emissions from California water agencies and industries. A key source of energy savings for California would come from local, distributed modular water treatment and reuse – reducing or eliminating the need to move water around the state: transport of water can represent upward of 20% of California's entire energy expenditures. The program will develop and test novel energy-efficient water treatment methods for conventional and non-conventional water sources including novel disinfection methods such as UV and ozone disinfection, biological wastewater treatment and system optimization of treatment plant and water distribution systems. The Hub is intended to produce a range of software and modeling products for use by California water and wastewater agencies to analyze and optimize the entire energy use of the water treatment and desalination process to identify key areas for energy reduction, carbon emission reduction, and efficiency improvement

Agreement Objectives
The objectives of this Agreement are to:

- Organize and manage an integrated national research program coordinating the R&D efforts of researchers from industry, academia and national labs, using a project management software platform to track all elements of the research program
- Develop and release version 1.0 of a new database (Water-DAMS) that enables users to find current energy and cost data for water treatment in a wide variety of settings and industries

[2] California Public Resources Code, Section 25711.5(a) requires projects funded by the Electric Program Investment Charge (EPIC) to result in ratepayer benefits. The California Public Utilities Commission, which established the EPIC in 2011, defines ratepayer benefits as greater reliability, lower costs, and increased safety (See CPUC "Phase 2" Decision 12-05-037 at page 19, May 24, 2012, http://docs.cpuc.ca.gov/PublishedDocs/WORD_PDF/FINAL_DECISION/167664.PDF).

- Develop and release version 1.0 of a computer modeling program (PROTEUS) that enables water treatment engineers and researchers to simulate treatment operations for the purpose of energy and cost optimization
- Comprehensive research into the causes of mineral scaling in RO systems – a leading cause of energy loss in desalination
- Screen a large number of possible electrocatalytic materials and down-select to a small number to conduct effectiveness testing to treat key water contaminants that lead to high energy costs of water treatment and reuse

III. TASK 1 GENERAL PROJECT TASKS

PRODUCTS

Subtask 1.1 Products
The goal of this subtask is to establish the requirements for submitting project products (e.g., reports, summaries, plans, and presentation materials). Unless otherwise specified by the Commission Agreement Manager (CAM), the Recipient must deliver products as required below by the dates listed in the **Project Schedule (Part V).** All products submitted which will be viewed by the public, must comply with the accessibility requirements of Section 508 of the federal Rehabilitation Act of 1973, as amended (29 U.S.C. Sec. 794d), and regulations implementing that act as set forth in Part 1194 of Title 36 of the Federal Code of Regulations**.** All technical tasks should include product(s). Products that require a draft version are indicated by marking **"(draft and final)"** after the product name in the "Products" section of the task/subtask. If "(draft and final)" does not appear after the product name, only a final version of the product is required. With respect to due dates within this Scope of Work, **"days"** means working days.

The Recipient shall:

For products that require a draft version, including the Final Report Outline and Final Report

- Submit all draft products to the CAM for review and comment in accordance with the Project Schedule (Part V). The CAM will provide written comments to the Recipient on the draft product within 15 days of receipt, unless otherwise specified in the task/subtask for which the product is required.
- Consider incorporating all CAM comments into the final product. If the Recipient disagrees with any comment, provide a written response explaining why the comment was not incorporated into the final product.
- Submit the revised product and responses to comments within 10 days of notice by the CAM, unless the CAM specifies a longer time period, or approves a request for additional time.

For products that require a final version only

- Submit the product to the CAM for acceptance. The CAM may request minor revisions or explanations prior to acceptance.

For all products

- Submit all data and documents required as products in accordance with the following:

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

Instructions for Submitting Electronic Files and Developing Software:

- **Electronic File Format**
  - Submit all data and documents required as products under this Agreement in an electronic file format that is fully editable and compatible with the California Energy Commission's (CEC) software and Microsoft (MS)-operating computing platforms, or with any other format approved by the CAM. Deliver an electronic copy of the full text of any Agreement data and documents in a format specified by the CAM, such as memory stick.

  The following describes the accepted formats for electronic data and documents provided to the CEC as products under this Agreement, and establishes the software versions that will be required to review and approve all software products:
  - Data sets will be in MS Access or MS Excel file format (version 2007 or later), or any other format approved by the CAM.
  - Text documents will be in MS Word file format, version 2007 or later.
  - Project management documents will be in Microsoft Project file format, version 2007 or later.

- **Software Application Development**

  Use the following standard Application Architecture components in compatible versions for any software application development required by this Agreement (e.g., databases, models, modeling tools), unless the CAM approves other software applications such as open source programs:
  - Microsoft ASP.NET framework (version 3.5 and up). Recommend 4.0.
  - Microsoft Internet Information Services (IIS), (version 6 and up) Recommend 7.5.
  - Visual Studio.NET (version 2008 and up). Recommend 2010.
  - C# Programming Language with Presentation (UI), Business Object and Data Layers.
  - SQL (Structured Query Language).
  - Microsoft SQL Server 2008, Stored Procedures. Recommend 2008 R2.
  - Microsoft SQL Reporting Services. Recommend 2008 R2.
  - XML (external interfaces).

  Any exceptions to the Electronic File Format requirements above must be approved in writing by the CAM. The CAM will consult with the CEC's Information Technology Services Branch to determine whether the exceptions are allowable.

MEETINGS

Subtask 1.2 Kick-off Meeting

The goal of this subtask is to establish the lines of communication and procedures for implementing this Agreement.

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

The Recipient shall:

- Attend a "Kick-off" meeting with the CAM, the Commission Agreement Officer (CAO), and any other CEC staff relevant to the Agreement. The Recipient will bring its Project Manager and any other individuals designated by the CAM to this meeting. The administrative and technical aspects of the Agreement will be discussed at the meeting. Prior to the meeting, the CAM will provide an agenda to all potential meeting participants. The meeting may take place in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

  The administrative portion of the meeting will include discussion of the following:
  - Terms and conditions of the Agreement;
  - Invoicing and auditing procedures;
  - Administrative products (subtask 1.1);
  - CPR meetings (subtask 1.3);
  - Match fund documentation (subtask 1.7);
  - Permit documentation (subtask 1.8);
  - Subcontracts (subtask 1.9); and
  - Any other relevant topics.

  The technical portion of the meeting will include discussion of the following:
  - The CAM's expectations for accomplishing tasks described in the Scope of Work;
  - An updated Project Schedule;
  - Technical products (subtask 1.1);
  - Progress reports (subtask 1.5);
  - Final Report (subtask 1.6);
  - Technical Advisory Committee meetings (subtasks 1.10 and 1.11); and
  - Any other relevant topics.

- Provide *Kick-off Meeting Presentation* to include but not limited to:
  - Project overview (i.e. project description, goals and objectives, technical tasks, expected benefits, etc.)
  - Project schedule that identifies milestones
  - List of potential risk factors and hurdles, and mitigation strategy

- Provide an *Updated Project Schedule, Match Funds Status Letter,* and *Permit Status Letter*, as needed to reflect any changes in the documents.

The CAM shall:

- Designate the date and location of the meeting.
- Send the Recipient a *Kick-off Meeting Agenda*.

Recipient Products:

- Kick-off Meeting Presentation
- Updated Project Schedule *(if applicable)*
- Match Funds Status Letter (subtask 1.7) *(if applicable)*
- Permit Status Letter (subtask 1.8) *(if applicable)*

CAM Product:

- Kick-off Meeting Agenda

Subtask 1.3 Critical Project Review (CPR) Meetings

The goal of this subtask is to determine if the project should continue to receive CEC funding, and if so whether any modifications must be made to the tasks, products, schedule, or budget. CPR meetings provide the opportunity for frank discussions between the CEC and the Recipient. As determined by the CAM, discussions may include project status, challenges, successes, advisory group findings and recommendations, final report preparation, and progress on technical transfer and production readiness activities (if applicable). Participants will include the CAM and the Recipient and may include the CAO and any other individuals selected by the CAM to provide support to the CEC.

CPR meetings generally take place at key, predetermined points in the Agreement, as determined by the CAM and as shown in the Task List on page 1 of this Exhibit. However, the CAM may schedule additional CPR meetings as necessary. The budget will be reallocated to cover the additional costs borne by the Recipient, but the overall Agreement amount will not increase. CPR meetings generally take place at the CEC, but they may take place at another location, or may be conducted via electronic conferencing (e.g., WebEx) as determined by the CAM.

The Recipient shall:

- Prepare and submit a *CPR Report* for each CPR meeting that: (1) discusses the progress of the Agreement toward achieving its goals and objectives; and (2) includes recommendations and conclusions regarding continued work on the project.
- Attend the CPR meeting.
- Present the CPR Report and any other required information at each CPR meeting.

The CAM shall:

- Determine the location, date, and time of each CPR meeting with the Recipient's input.
- Send the Recipient a *CPR Agenda* with a list of expected CPR participants in advance of the CPR meeting. If applicable, the agenda will include a discussion of match funding and permits.
- Conduct and make a record of each CPR meeting. Provide the Recipient with a schedule for providing a Progress Determination on continuation of the project.
- Determine whether to continue the project, and if so whether modifications are needed to the tasks, schedule, products, or budget for the remainder of the Agreement. If the CAM concludes that satisfactory progress is not being made, this conclusion will be referred to the Deputy Director of the Energy Research and Development Division.
- Provide the Recipient with a *Progress Determination* on continuation of the project, in accordance with the schedule. The Progress Determination may include a requirement that the Recipient revise one or more products.

Recipient Products:

- CPR Report(s)

CAM Products:

- CPR Agenda
- Progress Determination

Subtask 1.4 Final Meeting
The goal of this subtask is to complete the closeout of this Agreement.

The Recipient shall:

- Meet with CEC staff to present project findings, conclusions, and recommendations. The final meeting must be completed during the closeout of this Agreement. This meeting will be attended by the Recipient and CAM, at a minimum. The meeting may occur in person or by electronic conferencing (e.g., WebEx), with approval of the CAM.

  The technical and administrative aspects of Agreement closeout will be discussed at the meeting, which may be divided into two separate meetings at the CAM's discretion.
  - The technical portion of the meeting will involve the presentation of findings, conclusions, and recommended next steps (if any) for the Agreement. The CAM will determine the appropriate meeting participants.
  - The administrative portion of the meeting will involve a discussion with the CAM and the CAO of the following Agreement closeout items:
    - Disposition of any procured equipment.
    - The CEC's request for specific "generated" data (not already provided in Agreement products).
    - Need to document the Recipient's disclosure of "subject inventions" developed under the Agreement.
    - "Surviving" Agreement provisions such as repayment provisions and confidential products.
    - Final invoicing and release of retention.
- Prepare a *Final Meeting Agreement Summary* that documents any agreement made between the Recipient and Commission staff during the meeting.
- Prepare a *Schedule for Completing Agreement Closeout Activities*.
- Provide copies of *All Final Products* on a USB memory stick, organized by the tasks in the Agreement.

Products:

- Final Meeting Agreement Summary *(if applicable)*
- Schedule for Completing Agreement Closeout Activities
- All Final Products

REPORTS AND INVOICES

Subtask 1.5 Progress Reports and Invoices
The goals of this subtask are to: (1) periodically verify that satisfactory and continued progress is made towards achieving the project objectives of this Agreement; and (2) ensure that invoices contain all required information and are submitted in the appropriate format.

The Recipient shall:

- Submit a monthly *Progress Report* to the CAM. Each progress report must:
  - Summarize progress made on all Agreement activities as specified in the scope of work for the preceding month, including accomplishments, problems, milestones, products, schedule, fiscal status, and an assessment of the ability to complete the

Agreement within the current budget and any anticipated cost overruns. See the Progress Report Format Attachment for the recommended specifications.

- Submit a monthly or quarterly *Invoice* that follows the instructions in the "Payment of Funds" section of the terms and conditions, including a financial report on Match Funds and in-state expenditures.

Products:

- Progress Reports
- Invoices

Subtask 1.6 Final Report

The goal of this subtask is to prepare a comprehensive Final Report that describes the original purpose, approach, results, and conclusions of the work performed under this Agreement. When creating the Final Report Outline and the Final Report, the Recipient must use the CEC Style Manual provided by the CAM.

Subtask 1.6.1 Final Report Outline

The Recipient shall:

- Prepare a *Final Report Outline* in accordance with the *Energy Commission Style Manual* provided by the CAM.

Recipient Products:

- Final Report Outline (draft and final)

CAM Product:

- Energy Commission Style Manual
- Comments on Draft Final Report Outline
- Acceptance of Final Report Outline

Subtask 1.6.2 Final Report

The goal of this subtask is to prepare a Final Report that discusses the results of the project, including energy benefits to California ratepayers. The CAM will review and approve the Final Report, which will be due at least **two months** before the Agreement end date.

The Recipient shall:

- Prepare a
- *Final Report* that follows the Style Manual provided by the CAM and includes the following items, at a minimum:
- **Cover Page**
- **Summary of Project Purpose and Results**
- **Discussion** that includes the following, at a minimum:
    1. Project goals and the approach to meeting the goals
    2. Activities performed
    3. Project results, including:

- Success of the project as measured by the degree to which goals and objectives were achieved;
- How the project has resulted in the ratepayer benefits and technological advancements and breakthroughs identified in the solicitation proposal and Part II of the Scope of Work;
- Projected cost reduction impact and other benefits resulting from the project, including how the project has supported California's economic development in the near term and the number of jobs created or sustained;
- How the project results will be used by California industry, markets and others

4. The project budget, including:
   - The total project cost and the cost share of all funding partners;
   - How the Energy Commission funding was spent on the project, including any unique products and benefits
5. Observations, conclusions, and recommendations for further RD&D projects and improvements.

- If a ***Final Federal Report*** is required by the federal agency:
  - Submit a draft of the report to the CAM on the date the draft is due to the federal agency (subject to the federal agency's approval).
  - Submit the approved final version of the report and *Written Confirmation of the Federal Agency's Approval of the Final Federal Report* (e.g., email or letter), upon receipt of the written confirmation.

CAM Product:

- Style Manual

Recipient Products:

- Final Federal Report
- Final Report (draft and final)
- Federal Agency Report (draft and final)
- Written Confirmation of the Federal Agency's Approval of the Final Federal Report

Subtask 1.8 Permits

The goal of this subtask is to obtain all permits required for work completed under this Agreement in advance of the date they are needed to keep the Agreement schedule on track. Permit costs and the expenses associated with obtaining permits are not reimbursable under this Agreement, with the exception of costs incurred by University of California recipients. Permits must be identified and obtained before the Recipient may incur any costs related to the use of the permit(s) for which the Recipient will request reimbursement.

The Recipient shall:

- Prepare a *Permit Status Letter* that documents the permits required to conduct this Agreement. If no permits are required at the start of this Agreement, then state this in the letter. If permits will be required during the course of the Agreement, provide in the letter:
    - A list of the permits that identifies: (1) the type of permit; and (2) the name, address, and telephone number of the permitting jurisdictions or lead agencies.
    - The schedule the Recipient will follow in applying for and obtaining the permits.

  The list of permits and the schedule for obtaining them will be discussed at the Kick-off meeting (subtask 1.2), and a timetable for submitting the updated list, schedule, and copies of the permits will be developed. The impact on the project if the permits are not obtained in a timely fashion or are denied will also be discussed. If applicable, permits will be included as a line item in progress reports and will be a topic at CPR meetings.
- If during the course of the Agreement additional permits become necessary, then provide the CAM with an *Updated List of Permits* (including the appropriate information on each permit) and an *Updated Schedule for Acquiring Permits*.
- Send the CAM a *Copy of Each Approved Permit*.
- If during the course of the Agreement permits are not obtained on time or are denied, notify the CAM within 5 days. Either of these events may trigger a CPR meeting.

Products:

- Permit Status Letter
- Updated List of Permits *(if applicable)*
- Updated Schedule for Acquiring Permits *(if applicable)*
- Copy of Each Approved Permit *(if applicable)*

Subtask 1.9 Subcontracts

The goals of this subtask are to: (1) procure subcontracts required to carry out the tasks under this Agreement; and (2) ensure that the subcontracts are consistent with the terms and conditions of this Agreement.

The Recipient shall:

- Manage and coordinate subcontractor activities in accordance with the requirements of this Agreement.
- Incorporate this Agreement by reference into each subcontract.
- Include any required Energy Commission flow-down provisions in each subcontract, in addition to a statement that the terms of this Agreement will prevail if they conflict with the subcontract terms.
- If required by the CAM, submit a draft of each *Subcontract* required to conduct the work under this Agreement.
- Submit a final copy of each executed subcontract.
- Notify and receive written approval from the CAM prior to adding any new subcontractors (see the discussion of subcontractor additions in the terms and conditions).

Products:

- Subcontracts *(draft if required by the CAM)*

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

TECHNICAL ADVISORY COMMITTEE

Subtask 1.10 Technical Advisory Committee (TAC)
The goal of this subtask is to create an advisory committee for this Agreement. The TAC should be composed of diverse professionals. The composition will vary depending on interest, availability, and need. TAC members will serve at the CAM's discretion. The purpose of the TAC is to:

- Provide guidance in project direction. The guidance may include scope and methodologies, timing, and coordination with other projects. The guidance may be based on:
  - Technical area expertise;
  - Knowledge of market applications; or
  - Linkages between the agreement work and other past, present, or future projects (both public and private sectors) that TAC members are aware of in a particular area.
- Review products and provide recommendations for needed product adjustments, refinements, or enhancements.
- Evaluate the tangible benefits of the project to the state of California, and provide recommendations as needed to enhance the benefits.
- Provide recommendations regarding information dissemination, market pathways, or commercialization strategies relevant to the project products.
- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate, to the extent the TAC members feel is appropriate, on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project's strategic goals.

The TAC may be composed of qualified professionals spanning the following types of disciplines:

- Researchers knowledgeable about the project subject matter;
- Members of trades that will apply the results of the project (e.g., designers, engineers, architects, contractors, and trade representatives);
- Public interest market transformation implementers;
- Product developers relevant to the project;
- U.S. Department of Energy research managers, or experts from other federal or state agencies relevant to the project;
- Public interest environmental groups;
- Utility representatives;
- Air district staff; and
- Members of relevant technical society committees.

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

The Recipient shall:

- Prepare a *List of Potential TAC Members* that includes the names, companies, physical and electronic addresses, and phone numbers of potential members. The list will be discussed at the Kick-off meeting, and a schedule for recruiting members and holding the first TAC meeting will be developed.
- Recruit TAC members. Ensure that each individual understands member obligations and the TAC meeting schedule developed in subtask 1.11.
- Prepare a *List of TAC Members* once all TAC members have committed to serving on the TAC.
- Submit *Documentation of TAC Member Commitment* (such as Letters of Acceptance) from each TAC member.

Products:

- List of Potential TAC Members
- List of TAC Members
- Documentation of TAC Member Commitment

Subtask 1.11 TAC Meetings

The goal of this subtask is for the TAC to provide strategic guidance for the project by participating in regular meetings, which may be held via teleconference.

The Recipient shall:

- Discuss the TAC meeting schedule with the CAM at the Kick-off meeting. Determine the number and location of meetings (in-person and via teleconference) in consultation with the CAM.
- Prepare a *TAC Meeting Schedule* that will be presented to the TAC members during recruiting. Revise the schedule after the first TAC meeting to incorporate meeting comments.
- Prepare a *TAC Meeting Agenda* and *TAC Meeting Back-up Materials* for each TAC meeting.
- Organize and lead TAC meetings in accordance with the TAC Meeting Schedule. Changes to the schedule must be pre-approved in writing by the CAM.
- Prepare *TAC Meeting Summaries* that include any recommended resolutions of major TAC issues.

The TAC shall:

- Help set the project team's goals and contribute to the development and evaluation of its statement of proposed objectives as the project evolves.
- Provide a credible and objective sounding board on the wide range of technical and financial barriers and opportunities.
- Help identify key areas where the project has a competitive advantage, value proposition, or strength upon which to build.
- Advocate on behalf of the project in its effort to build partnerships, governmental support and relationships with a national spectrum of influential leaders.
- Ask probing questions that insure a long-term perspective on decision-making and progress toward the project’s strategic goals.

- Review and provide comments to proposed project performance metrics.
- Review and provide comments to proposed project Draft Technology Transfer Plan.

Products:
- TAC Meeting Schedule (draft and final)
- TAC Meeting Agendas (draft and final)
- TAC Meeting Back-up Materials
- TAC Meeting Summaries

IV. TECHNICAL TASKS

TASK 2 MANAGEMENT & OPERATIONS (NAWI 2.1)

The goal of this task is to effectively communicate with and engage stakeholders in the water ecosystem in the Hub research program. The Hub management team will accomplish this by establishing a range of communications and outreach modalities and products including an actively-managed website, a technical webinar series, and annual meetings in which research partners in academia, industry and the national labs can connect to formulate innovative research projects and to report on project progress.

The Recipient shall:
- Stand up a *Website* that permits Hub participants and the general public to obtain updates on the progress of the research program and access to data sets and software products.
    - Key features:
        - A publicly-accessible section providing details of Hub research activities, calendars, and resources for prospective Alliance members
        - A password-protected section providing access to data sets, software and research products for Alliance members
- Conduct *Monthly Technical Webinars,* which present updates on research progress and communicate research priorities to the Hub community.
    - Including:
        - Copies of slides from each webinar
        - Attendee list from each webinar
- Convene *Annual Meetings* in which researchers and stakeholders can interact, share results, and develop new research partnerships
    - Including:
        - Final agenda and program for each meeting
        - List of attendees for each meeting

Products:
- Website
- 12 Monthly Technical Webinars
- Annual Meeting in 2020, 2021, 2022, 2023, and 2024

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

TASK 3 DEVELOPMENT, DEPLOYMENT, AND REFINEMENT OF THE WATER TECHNOLOGY DATA AND ANALYSIS MANAGEMENT SYSTEM (WATER-DAMS) (NAWI 3.2)
The goal of this task is to develop and release a flexible, secure, and adaptable data management system to facilitate automated data collection, standardization, secure internal data sharing, and public information dissemination. The NAWI Water Data and Analysis Management System (Water-DAMS) will provide DOE, CEC, and the public access to foundational data that will enable researchers and decision-makers to identify and quantify opportunities for technology innovation to reduce the cost and energy intensity of non-traditional source water desalination and quantify the security, resiliency, and circular economy benefits of tapping non-traditional water sources.

The Recipient shall:

- Develop *Version 1.0 of the Water-DAMS Collaboration Space* that will house internal NAWI data (e.g., experimental performance data, proprietary information, interim modeling results) and all other data (e.g., baseline and road mapping data, final experimental and modeling results).
    - Built within the Data Foundry on the secure OpenEI platform
    - Modeled after other successful DOE collaboration spaces
- Develop *Version 1.0 of the Water-DAMS Data Repository,* which will serve as the primary external data sharing platform for publicly available water technology data. The Water-DAMS data repository will have data related to the pipe parity metrics outlined in the FOA (cost, process inputs thermal energy, steam temperature, electricity, chemicals], system reliability, water recovery (i.e. water use intensity), and the potential for use of alternative thermal or energy inputs) as well as potentially other metrics identified during the road mapping process and will consist of the following:
    - A functioning data repository with standardized data input and metadata submission requirements
    - A secure user authentication process
    - A feature to automatically disseminate public information to a network of data sharing partners, including Data.gov and DOE's Office of Science and Technical Information (OSTI).
- A data repository fully integrated with the collaboration space Train NAWI teams on standard data input protocol and produce the *Water-DAMS Documentation, Maintenance, and Support Manual.* The Water-DAMS Documentation, Maintenance, and Support Manual will be provided in Microsoft Word or PDF format.

Products:

- Version 1.0 of the Water-DAMS Collaboration Space
- Version 1.0 of the Water-DAMS Data Repository
- Water-DAMS Documentation, Maintenance, and Support Manual

TASK 4 ROADMAP TO R&D CYCLE: TECHNOLOGY BASELINES, NAWI PERFORMANCE TRACKING, AND TECHNOLOGY ROADMAPPING (NAWI 3.4)
The goal of this task is to develop and release a national Desalination Roadmap that tabulates current energy and cost baselines for the treatment of different non-traditional water sources and identifies the key technical barriers to lowering the cost and energy of desalination and water reuse. The Roadmap process will also track the technical progress the NAWI research program makes toward achieving its technical goals.

Exhibit A
Scope of Work
Lawrence Berkeley National Laboratory

The Recipient shall:

- Launch 5 End-use Roadmapping teams to gather baseline information on treatment methods and cost and energy for specific treatment processes
    - Teams will meet regularly to coordinate data collection and analysis
- Conduct a national written survey of water users to obtain baseline information
    - Survey will be administered by the Nexight Group
- Conduct expert interviews to identify key barriers to lowering the cost and energy of desalination for specific end uses.
    - Notes from interviews will be posted on Water-DAMS
- Publish a *Desalination Roadmap* at the end of Year 1 to identify specific research Areas of Interest for subsequent RFPs. The Desalination Roadmap includes the following information.
    - Consistent baseline and technology assessments for nine source water types
    - A coordinated roadmap report for each of five water use types
    - Procedures for tracking NAWI research projects and roadmapping updates
- Prepare *CPR Report* in accordance with subtask 1.3.

Products:

- Desalination Roadmap (draft and final)
- CPR Report

TASK 5 PROTEUS: INTEGRATED COMPUTATIONAL CAPABILITY FOR OPTIMIZING ADVANCED WATER TREATMENT SYSTEMS (NAWI 4.2)

The goal of this task is to develop ProteusLib, a new library of water-specific property, process unit, and network models built on the IDAES framework. IDAES consists of computational tools that enable the use of advanced solvers and computer architectures for (1) process simulation and optimization, (2) process synthesis and conceptual design, (3) integration of multi-scale models, and (4) dynamic modeling and control. It includes an extensible, hierarchical model library that covers physicochemical properties and process units typically associated with chemical and energy production. In this task, we will leverage the capabilities of IDAES and apply them to water treatment by developing property packages that represent the physical and thermodynamic properties for bulk and trace brine components in water sources of interest, process unit models of existing and novel water treatment technologies, and network models of water management systems.

The Recipient shall:

- Develop 1.0 versions of the *Property and Unit Models* that compose ProteusLib
- Integrate ProteusLib with the IDAES platform to simulate, design, and optimize water treatment trains and water management networks
- Expand the capabilities of ProteusLib to include conceptual design and network-level optimization.
- Identify the data required for model validation at both the unit and system level, process the data to ensure consistency, and develop models of the specific facilities, pilot plants, and units based on design drawings, P&IDs, plant visits and discussions with the operators of each source of validation data

- Facilitate user adoption of ProteusLib through the development of Training Documentation, Tutorials, and Workshops and the open-source release of the software package. *Training Documentation* and *Tutorials* will be provided via Microsoft Word, online, or pdf document.

Products:
- Property and Unit Models
- Training Documentation
- Tutorials

TASK 6 COMPUTATIONAL TEST BED FOR PREDICTIVE FOULING CONTROL (NAWI 5.4)
The goal of this task is to develop and apply predictive models linking meso-scale reactive transport phenomena that occur on and within RO membranes to system-level desalination performance, and to validate those models against experimental membrane crossflow experiments.

The Recipient shall:
- Produce a *Draft Manuscript* that describes the results of the following research
    - Test and upgrade the geosystems model TOUGHREACT, previously re-tooled to describe coupled reaction-transport phenomena occurring near, on, and through a realistic RO membrane.
    - Incorporate the effects of feed spacers on 3D mixing, concentration polarization, and onset of mineral scaling on the membrane surface.
    - Establish standard experimental crossflow testing procedures for measurement of foulant accumulation
    - Characterize the accumulation of foulants on membranes and in membrane feed spacers from feed waters containing mineral foulants.

Products:
- Draft Manuscript Tentatively Titled ‘Predictive Modeling of RO Fouling’

TASK 7 MACHINE LEARNING PLATFORM FOR CATALYST DESIGN (NAWI 6.2)
The goal of this task is to build new research capabilities in the water treatment area, using state-of-the-art DOE user facilities at LBNL (NERSC, Molecular Foundry) for materials discovery. We will develop a high-throughput platform for identifying new water desalination materials that integrates machine learning, high fidelity simulation, and combinatorial experimental screening. While previously applied to materials discovery in other fields (e.g., batteries, sorbents, etc.), this approach has not been systematically developed for the diverse feed stream compositions expected in water and wastewater treatment.

The Recipient shall:
- Produce a *Draft Manuscript* suitable for publication that describes the results of the following research:
    - Identify relevant computational descriptors for predicting nitrate removal capability for arbitrary metals and alloys

- Perform a large-scale computational search for optimal zero-valent metals and alloys for oxyanion removal.
- **I**nvestigate two synthesis approaches to study the effects of these material properties using zero-valent iron as a testing material to identify the precursor synthesis approach.
- Evaluate the techno-economic prospects for materials in the pipeline based on performance characteristics as well as cost considerations.

Products:

- Draft Manuscript Tentatively Titled 'Machine Learning Methods for Catalyst Design in Water Treatment'

TASK 8 EVALUATION OF PROJECT BENEFITS

The goal of this task is to report the benefits resulting from this project.

The Recipient shall:

- Complete three Project Benefits Questionnaires that correspond to three main intervals in the Agreement: (1) *Kick-off Meeting Benefits Questionnaire*; (2) *Mid-term Benefits Questionnaire*; and (3) *Final Meeting Benefits Questionnaire*.
- Provide all key assumptions used to estimate projected benefits, including targeted market sector (e.g., population and geographic location), projected market penetration, baseline and projected energy use and cost, operating conditions, and emission reduction calculations. Examples of information that may be requested in the questionnaires include:

    - <u>For Product Development Projects and Project Demonstrations:</u>
        - Published documents, including date, title, and periodical name.
        - Estimated or actual energy and cost savings, and estimated statewide energy savings once market potential has been realized. Identify all assumptions used in the estimates.
        - Greenhouse gas and criteria emissions reductions.
        - Other non-energy benefits such as reliability, public safety, lower operational cost, environmental improvement, indoor environmental quality, and societal benefits.
        - Data on potential job creation, market potential, economic development, and increased state revenue as a result of the project.
        - A discussion of project product downloads from websites, and publications in technical journals.
        - A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.
        - <u>Additional Information for Product Development Projects</u>:
            - Outcome of product development efforts, such copyrights and license agreements.
            - Units sold or projected to be sold in California and outside of California.
            - Total annual sales or projected annual sales (in dollars) of products developed under the Agreement.
            - Investment dollars/follow-on private funding as a result of Energy Commission funding.

- Patent numbers and applications, along with dates and brief descriptions.

▪ Additional Information for Product Demonstrations:
- Outcome of demonstrations and status of technology.
- Number of similar installations.
- Jobs created/retained as a result of the Agreement.

o For Information/Tools and Other Research Studies:
- Outcome of project.
- Published documents, including date, title, and periodical name.
- A discussion of policy development. State if the project has been cited in government policy publications or technical journals, or has been used to inform regulatory bodies.
- The number of website downloads.
- An estimate of how the project information has affected energy use and cost, or have resulted in other non-energy benefits.
- An estimate of energy and non-energy benefits.
- Data on potential job creation, market potential, economic development, and increased state revenue as a result of project.
- A discussion of project product downloads from websites, and publications in technical journals.
- A comparison of project expectations and performance. Discuss whether the goals and objectives of the Agreement have been met and what improvements are needed, if any.

- Respond to CAM questions regarding responses to the questionnaires.

The CEC may send the Recipient similar questionnaires after the Agreement term ends. Responses to these questionnaires will be voluntary.

Products:
- Kick-off Meeting Benefits Questionnaire
- Mid-term Benefits Questionnaire
- Final Meeting Benefits Questionnaire

TASK 9 TECHNOLOGY/KNOWLEDGE TRANSFER ACTIVITIES
The goal of this task is to ensure the scientific and techno-economic analysis and tools developed under this agreement are utilized in the energy policy, and/or planning decisions at the state and/or local levels, academic community and/or commercial sector.

The Recipient Shall:

- Develop and submit a *Knowledge Transfer Plan (Draft/Final)* that identifies the proposed activities the recipient will conduct to meet the goal of the task. The *Knowledge Transfer Plan* should include at a minimum:

  o Specific policy and planning efforts this project is expected to inform.
  o Specific stakeholder groups and energy policy and planning practitioners who will utilize the results of this project.

  - Proposed activities the recipient will conduct to ensure the tools and results from this project be utilized and adopted by the groups identified above.

- Present the *Draft Knowledge Transfer Plan* to the TAC for feedback and comments.
- Develop and submit a *Summary of TAC Comments* that summarizes comments received from the TAC members on the *Draft Knowledge Transfer Plan*. This document will identify:
  - TAC comments the recipient proposes to incorporate into the *Final Knowledge Transfer Plan*.
  - TAC comments the recipient does not propose to incorporate with and explanation why.
- Submit the *Final Knowledge Transfer Plan* to the CAM for approval.
- Implement the activities as described in the *Final Knowledge Transfer Plan.*
- Develop a *Knowledge Transfer Summary Report (Draft/Final)* that includes high level summaries of the activities, results, and lessons learned of tasks performed relating to implementing the *Final Technology Transfer Plan*. This report should not include any proprietary information.
- When directed by the CAM, develop presentation materials for an CEC- sponsored conference/workshop(s) on the project.
- When directed by the CAM, participate in annual EPIC symposium(s) sponsored by the California CEC.
- Provide at least (6) six *High Quality Digital Photographs* (minimum resolution of 1300x500 pixels in landscape ratio) of pre and post technology installation at the project sites or related project photographs.

Products:

- Knowledge Transfer Plan (Draft/Final)
- Summary of TAC Comments
- Technology Transfer Summary Report (Draft/Final)
- High Quality Digital Photographs

V. PROJECT SCHEDULE

Please see the attached Excel spreadsheet.

RESOLUTION NO: 20-0812-08

STATE OF CALIFORNIA

STATE ENERGY RESOURCES
CONSERVATION AND DEVELOPMENT COMMISSION

RESOLUTION - RE: LAWRENCE BERKELEY NATIONAL LABORATORY

RESOLVED, that the State Energy Resources Conservation and Development Commission (CEC) adopts the staff CEQA findings contained in the Agreement or Amendment Request Form (as applicable); and

RESOLVED, that the CEC approves Agreement EPC-20-001 with Lawrence Berkeley National Laboratory for a $3,000,000 grant toward a $100,000,000 federal cost share from the Department of Energy to create a Hub to lead early-stage applied research to develop innovative new technologies that lower the cost of desalination and associated water treatment, focusing on enabling distributed desalination and localized water reuse. The research areas include materials and manufacturing, process innovation and intensification, modeling and simulation and integrated data and analysis; and

FURTHER BE IT RESOLVED, that the Executive Director or his/her designee shall execute the same on behalf of the CEC.

CERTIFICATION

The undersigned Secretariat to the CEC does hereby certify that the foregoing is a full, true, and correct copy of a Resolution duly and regularly adopted at a meeting of the CEC held on August 12, 2020.

AYE:
NAY:
ABSENT:
ABSTAIN:

_____
Cody Goldthrite
Secretariat