

STATE OF CALIFORNIA
STANDARD AGREEMENT
 STD 213 (Rev 08/17)

AGREEMENT NUMBER 17-C0100
REGISTRATION NUMBER

1. This Agreement is entered into between the State Agency and the Contractor named below:

STATE AGENCY'S NAME

California Department of Pesticide Regulation, hereinafter referred to as "State"

CONTRACTOR'S NAME

University of California, Davis, hereinafter referred to as "University"

2. The term of this Agreement is: **May 15, 2018** through **April 15, 2020**

3. The maximum amount of this Agreement is: **\$ 276,372.00**

4. The parties agree to comply with the terms and conditions of the following Exhibits, which by this reference are made a part of the Agreement.

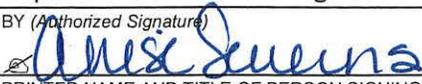
- Exhibit A – A7:** A–Scope of Work; A1–Deliverables; A2–Key Personnel; A3–Authorized Representatives; A4–Preexisting Intellectual Property; A5–CV/Resumes; A6–Current & Pending Support; A7–Third Party Confidential Information (if applicable) 14 page(s)
- Exhibit B – B–Budget; B1–Budget Justification; B2–Subrecipient Budgets (if applicable); B3– Invoice Elements** 4 page(s)
- Exhibit C* – University Terms and Conditions** UTC-817

Check mark additional Exhibits below, and attach applicable Exhibits or provide internet link:

- Exhibit D** – Additional Requirements Associated with Funding Sources page(s)
- Exhibit E** – Special Conditions for Security of Confidential Information page(s)
- Exhibit F** – Access to State Facilities or Computing Resources page(s)
- Exhibit G** – Negotiated Alternate UTC Terms 1 page(s)

Items shown with an Asterisk (*) are hereby incorporated by reference and made part of this agreement as if attached hereto.
 These documents can be viewed at <http://www.dgs.ca.gov/ols/Resources/StandardContractLanguage.aspx>.

IN WITNESS WHEREOF, this Agreement has been executed by the parties hereto.

CONTRACTOR	
CONTRACTOR'S NAME (if other than an individual, state whether a corporation, partnership, etc.)	
The Regents of the University of California	
BY (Authorized Signature)	DATE SIGNED (Do not type)
	4/23/2018
PRINTED NAME AND TITLE OF PERSON SIGNING	
Grace I. Lui, Associate Director, Sponsored Programs Ahmad Hakim-Elahi, Ph.D., J.D. Executive Director, Research Administration	
ADDRESS	
1850 Research Park Dr. Ste 300, Davis, CA. 95618	
STATE OF CALIFORNIA	
AGENCY NAME	
Department of Pesticide Regulation	
BY (Authorized Signature)	DATE SIGNED (Do not type)
	5/7/18
PRINTED NAME AND TITLE OF PERSON SIGNING	
Anise Severns, Assistant Director	
ADDRESS	
1001 I Street, 4 th Floor, Sacramento, CA. 95814	

California Department of General Services Use Only

APPROVED

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OFFICE OF LEGAL SERVICES
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Exempt per:

Exhibit A

Project Summary & Scope of Work

Contract Grant

Project Summary/Abstract

Briefly describe the long-term objectives for achieving the stated goals of the project.

1. The working hypothesis in this study is that field-scale bioreactors designed for nutrient removal from agricultural runoff can provide treatment benefit for pesticide removal and that understanding the primary removal mechanisms in the reactors can lead to enhanced system designs for increasing pesticide removal alongside nutrient capture. Results of this project will be used to develop design recommendations and best practices for pesticide removal from agricultural drainage via catchment bioreactors. The working hypothesis will be investigated by pursuing the following research objectives:
 - 1) Evaluate the pesticide removal potential of woodchip and aquatic macrophyte bioreactors designed for nutrient retention via field sampling.
 - 2) Determine primary pesticide removal mechanisms in bioreactor systems evaluated at a laboratory-scale and test design modifications to enhance pesticide removal alongside nutrients.
2. The data and objectives will be used to support research and regulatory requirements, including:
 - a. Evaluating a best management practice (BMP) for pesticide removal. This will aide in achieving Surface Water Protection Program goals, as it has the potential to remove pesticides from water and reduce toxicity.
 - b. This includes the potential to reduce levels of pesticides of concern, such as pyrethroids, organophosphates, and neonicotinoids, in agricultural waters.
 - c. This takes an existing BMP for nitrate removal and extends it to pesticide removal, which will make it an attractive BMP since it serves several purposes.
 - d. This will determine mechanisms and design modifications that will allow for optimization of the bioreactors and therefore pesticide removal.
 - e. Bioreactors have the potential to help growers comply with Agricultural Orders and Total Maximum Daily Load Reductions for pyrethroids in the Central Valley and Central Coast.

If Third-Party Confidential Information is to be provided by the State:

- Performance of the Scope of Work is anticipated to involve use of third-party Confidential Information and is subject to the terms of this Agreement; **OR**
- A separate CNDA between the University and third-party is required by the third-party and is incorporated in this Agreement as Exhibit A7.

Scope of Work

Describe the goals and specific objectives of the proposed project and summarize the expected outcomes. If applicable, describe the overall strategy, methodology, and analyses to be used. Include how the data will be collected, analyzed, and interpreted as well as any resource sharing plans as appropriate. Discuss potential problems, alternative strategies, and benchmarks for success anticipated to achieve the goals and objectives.

3. Background

Bioreactors provide a relatively low-cost and small footprint means of reducing nitrates from water in tile drainage systems and may also provide treatment benefit for pesticides based on observed removal of various hydrophobic organic contaminants (HOCs) (Gottschall et al., 2016; Ilhan et al., 2012). A multi-channel experimental bioreactor with three side-by-side treatments established in triplicate was recently constructed in Castroville, CA to evaluate nitrate removal potential at varying influent concentrations and to develop best practices for such catchment systems. The 12-channel reactor consists of locally sourced woodchips, covered woodchips intended to increase the temperature of treatment, pennywort (*Hydrocotyle ranunculoidese*) floating plants and a water-only agricultural ditch control, each with typical hydraulic residence times of 20-24 hours. Summertime assessment of nitrate removal in the reactor demonstrated approximately 45% reduction of nitrate in the uncovered woodchip channels, with lower removal efficiencies in the covered woodchip and aquatic macrophyte channels. Preliminary results (Figure 1) also indicate the potential for pesticide removal in woodchip bioreactors, but analysis was limited to grab samples at one time point and a targeted list of pesticides. Little is known regarding the potential of such systems to remove a diverse suite of pesticides or the mechanisms governing removal processes. An evaluation of pesticide removal capacity and mechanisms as well as new design strategies to enhance pesticide removal alongside denitrification in agricultural drainage bioreactors will provide value in the design and implementation of bioreactor treatment systems.

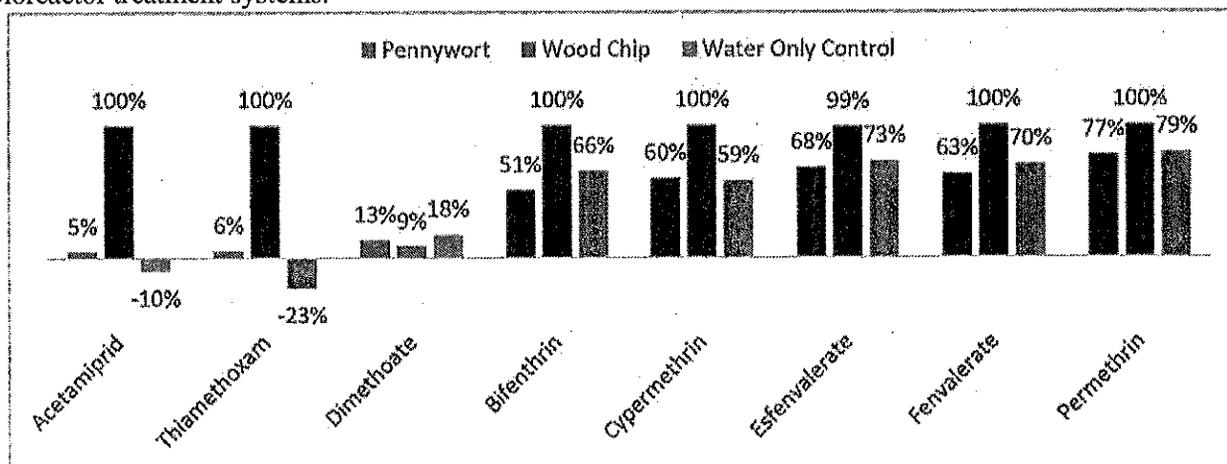


Figure 1. Summertime removal efficiency (%) of pesticides in multi-channel reactors (Bryn Phillips, unpublished data)

4. Work to be Performed by University

- 1) University, with the input of State, will select a representative, targeted list of pesticides, based on both results from the field study and additional pesticides of interest to State.
- 2) University has targeted and suspect screening analytical approaches to identify and measure pesticides in water. However, not all pesticides and degradates of interest to State are included in these approaches. Therefore, University will develop analytical methods for those pesticides of interest or incorporate those pesticides into their current analytical methods.

- 3) University will analyze the influent and effluent samples from the multichannel bioreactors and will determine the removal efficiency of pesticides in the influent.
- 4) University will construct a flow through reactor(s) in their laboratories to represent existing field conditions, and University will analyze removal of pesticides of interest in the flow through reactor(s).
- 5) University will construct batch reactors with appropriate controls to evaluate pesticide removal mechanisms in a woodchip bioreactor.
- 6) University will test design modification to promote enhanced pesticide removal. Based on results from baseline flow through experiments, modifications may include, but not limited to, temperature, flow path alterations, source and size of woodchips, and additional biological modifications. University will consult State staff scientists on additional modifications to the bioreactor of interest.
- 7) University shall have informal meetings with State concerning results from the field and laboratory studies. The informal meetings shall be held bi-annually, depending on the schedules of both University and State staff.
- 8) University will provide State with analytical results from field sampling from the bioreactors (i.e., results from Task 1 – 4).
- 9) University will provide a draft Final Study Report detailing the results from the field studies and laboratory studies for review by State.
- 10) University will provide a Final Study Report, detailing the results from the field studies and laboratory studies.
- 11) University will provide a seminar to State's Surface Water Protection Program's staff scientists on results to foster discussion.

5. Responsibilities of State

- 1) State will collect samples, with the aid of bioreactor manager Ross Clark from Moss Landing Marine Laboratory, from the inlet and at the outlet of each operation bioreactor channel (up to 12 channels) over a period of several seasons.
- 2) State will review the draft Final Report within 15 calendar days of submission by University.

Exhibit A1

SCHEDULE OF DELIVERABLES

List all items that will be delivered to the State under the proposed Scope of Work. Include all reports, including draft reports for State review, and any other deliverables, if requested by the State and agreed to by the Parties.

If use of any Deliverable is restricted or is anticipated to contain preexisting Intellectual Property with any restricted use, it will be clearly identified in Exhibit A4, Use of Preexisting Intellectual Property.

Unless otherwise directed by the State, the University Principal Investigator shall submit all deliverables to the State Contract Project Manager, identified in Exhibit A3.

Deliverable	Description	Due Date
Field Sample Analysis Results	University shall provide analytical results from the field study upon completion of field sampling. Since State and University have no control over irrigation schedules of agricultural fields surrounding the multi-channel bioreactor, this will be submitted within three months following receipt of the last set of field samples.	Within three months of final field sample receipt
Draft Final Study Report	A draft Final Study Report documenting the description of newly developed analytical methods, the field study results, the laboratory study results, including mechanisms and removal efficiencies, and the test design modifications will be submitted to State.	By March 1, 2020
Final Study Report	A Final Study Report documenting the description of newly developed analytical methods, the field study results, the laboratory study results, including mechanisms and removal efficiencies, and the test design modifications will be submitted to State.	By April 15, 2020
Final Study Seminar	A seminar will be given to State Surface Water Protection Program on the analytical methods, the field study results, the laboratory study results, including mechanisms and removal efficiencies, and the test design modifications. This includes a question and answer session to foster discussion.	By April 15, 2020

Exhibit A2

KEY PERSONNEL

List Key Personnel as defined in the Agreement starting with the PI, by last name, first name followed by Co-PIs. Then list all other Key Personnel in alphabetical order by last name. For each individual listed include his/her name, institutional affiliation, and role on the proposed project. Use additional consecutively numbered pages as necessary.

Last Name, First Name	Institutional Affiliation	Role on Project
PI:		
<i>Bischel, Heather</i>	<i>UC Davis</i>	<i>PI</i>
Co-PI(s) – if applicable:		
<i>Young, Thomas</i>	<i>UC Davis</i>	<i>Co-PI</i>
<i>Last name, First name</i>	<i>Institutional affiliation</i>	<i>Role on the project</i>
Other Key Personnel (if applicable):		
<i>Last name, First name</i>	<i>Institutional affiliation</i>	<i>Role on the project</i>
<i>Last name, First name</i>	<i>Institutional affiliation</i>	<i>Role on the project</i>

Exhibit A3

AUTHORIZED REPRESENTATIVES AND NOTICES

The following individuals are the authorized representatives for the State and the University under this Agreement. Any official Notices issued under the terms of this Agreement shall be addressed to the Authorized Official identified below, unless otherwise identified in the Agreement.

State Agency Contacts	University Contacts
<p>Agency Name: Department of Pesticide Regulation</p> <p>Contract Project Manager (Technical)</p> <p>Name: Aniola Burant Environmental Scientist</p> <p>Address: Department of Pesticide Regulation 1001 I Street, PO Box 4015 Sacramento, CA 95812</p> <p>Telephone: 916-445-2799 Fax: 916-324-4088 Email: Aniola.burant@cdpr.ca.gov</p>	<p>University Name: University of California, Davis</p> <p>Principal Investigator</p> <p>Name: Bischel, Heather Assistant Professor</p> <p>Address: Civil and Environmental Engineering One Shields Avenue Davis, CA 95616</p> <p>Telephone: 530-752-6772 Fax: 530-752-7872 Email: hbischel@ucdavis.edu</p> <p>Designees to certify invoices under Section 14 of Exhibit C on behalf of PI:</p> <ol style="list-style-type: none"> 1. Tiffany Hsieh, Financial Analyst, tthsieh@ucdavis.edu
<p>Authorized Official (contract officer)</p> <p>Name: Anise Severns Assistant Director</p> <p>Address: Department of Pesticide Regulation 1001 I Street, 4th Floor Sacramento, CA. 95814</p> <p>Send notices to (if different):</p> <p>Name: Aniola Burant Environmental Scientist</p> <p>Address: Department of Pesticide Regulation</p>	<p>Authorized Official</p> <p>Name: Grace I. Liu Associate Director, Sponsored Programs</p> <p>Address: Sponsored Programs 1850 Research Park Drive, Suite 300 Davis, CA 95618</p> <p>Telephone: (530) 754-7687 Fax: (530) 752-0333 Email: giliu@ucdavis.edu</p> <p>Send notices to (if different):</p> <p>Name: Ahmad Hakim-Elahi, Ph.D., J.D. Executive Director, Research Administration</p> <p>Address: Sponsored Programs</p>

<p>1001 I Street, PO Box 4015 Sacramento, CA 95812 Telephone: 916-445-2799 Fax: 916-324-4088 Email: Aniela.burant@cdpr.ca.gov</p>	<p>1850 Research Park Drive, Suite 300 Davis, CA 95618 Telephone: (530) 754-8323 Fax: (530) 752-0333 Email: ahakimelahi@ucdavis.edu</p>
<p>Administrative Contact</p> <p>Name: Terry Harrison Contract Analyst Address: Department of Pesticide Regulation 1001 I Street, MS-4A Sacramento, CA. 95814 Telephone: 916-445-2511 Fax: 916-445-6845 Email: terry.harrison@cdpr.ca.gov</p>	<p>Administrative Contact</p> <p>Name: Cynthia Rosario Contracts & Grants Officer Address: 1850 Research Park Drive, Suite 300 One Shields Avenue Davis, CA 95618 Telephone: (530) 754-8266 Fax: (530) 754-8229 Email: crosario@ucdavis.edu</p>
<p>Financial Contact/Accounting</p> <p>Name: Department of Pesticide Regulation Address: Department of Pesticide Regulation Accounts Payable P.O. Box 4015, MS4A Sacramento, CA 95812-4015</p>	<p>Authorized Financial Contact/Invoicing</p> <p>Name: James Ringo Division Manager, Contracts & Grants Accounting Telephone: (530) 757-8523 Fax: (530) 757-8721 Email: jaringo@ucdavis.edu Address: Cashier's Office UC Davis P.O. Box 989062 West Sacramento, CA. 95798-9062 Designees for invoice certification in accordance with Section 14 of Exhibit C on behalf of the Financial Contact: 1.</p>

Exhibit A4

USE OF PREEXISTING INTELLECTUAL PROPERTY

If either Party will be using any third-party or pre-existing intellectual property (including, but not limited to data, copyrighted works, known patents, trademarks, service marks and trade secrets) "IP" with restrictions on use, then list all such IP and the nature of the restriction below. If no third-party or pre-existing IP will be used, check "none" in this section.

A. State: Preexisting IP to be provided to the University from the State or a third party for use in the performance in the Scope of Work.

None or List:

Owner (Name of State Agency or 3 rd Party)	Description	Nature of restriction:

B. University: Restrictions in Preexisting IP included in Deliverables identified in Exhibit A1.

None or List:

Owner (Name of University or 3 rd Party)	Description	Nature of restriction:

C. Anticipated restrictions on use of Project Data.

If the University PI anticipates that any of the Project Data generated during the performance of the Scope of Work will have a restriction on use (such as subject identifying information in a data set) then list all such anticipated restrictions below. If there are no restrictions anticipated in the Project Data, then check "None" in this section.

None or List:

Owner (University or 3 rd Party)	Description	Nature of Restriction:

Exhibit A5

RÉSUMÉ/BIOSKETCH

Attach 2-3 page Resume/Biosketch for the PI and other Key Personnel listed in Exhibit A2.

Heather N. Bischel

Department of Civil & Environmental Engineering
University of California
Davis, CA 95616

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fax: 530-752-7872
email: hbischel@ucdavis.edu

Education

Stanford University, Ph.D., Civil & Environmental Engineering, 2011
Stanford University, M.Sc., Civil & Environmental Engineering, 2007
University of California, Berkeley, B.S., Civil & Environmental Engineering, 2005

Professional Experience

University of California, Davis, Assistant Professor (6/16-present)
École Polytechnique Fédérale de Lausanne (EPFL), Postdoctoral Research Scientist (11/12-3/17)
Stanford University, Stanford, California, Postdoctoral Research Scientist (10/11-09/12)

Peer-Reviewed Journal Publications

- Pitol, A. K., Bischel, H. N., Kohn, T., & Julian, T. R. (2017). Virus Transfer at the Skin-Liquid Interface. *Environmental science & technology*, 51(24), 14417.
- Bischel, H.N., S. Schindelholz, M. Schoger, L. Decrey, C. Buckley, K. Udert, T. Kohn, *Bacteria inactivation during the drying of struvite fertilizers produced from stored urine*. *Environ. Sci. Technol.*, 2016, 50 (23), pp 13013–13023. <http://pubs.acs.org/doi/abs/10.1021/acs.est.6b03555>
- Bischel, H.N., B. D. Özel Duygan, L. Strande, C. McArdel, K. M. Udert, T. Kohn. *Pathogens and pharmaceuticals in source-separated urine in eThekweni, South Africa*. *Water Research*, 2015, 85, 57-65. <http://www.sciencedirect.com/science/article/pii/S0043135415301731>
- Bischel, H.N., A. Schertenleib, A. Fumasoli, K. Udert, T. Kohn, *Inactivation kinetics and mechanisms of bacterial and viral pathogen surrogates during urine nitrification*. *Environmental Science: Water Research & Technology*. 2015, 1, 65-76. <http://pubs.rsc.org/en/content/articlelanding/2015/ew/c4ew00065j/unauth>
- Lawrence, J.E., C.P.W. Pavia, S. Kaing, H.N. Bischel, R.G. Luthy, V.H. Resh, *Recycled water for augmenting urban streams in mediterranean-climate regions: a potential approach for riparian ecosystem enhancement*. *Hydrological Sciences Journal*. 2014, 59(3-4), 488-501. http://www.tandfonline.com/doi/full/10.1080/02626667.2013.818221#Um_YHxA8qIk
- Halaburka, B.J., J.E. Lawrence, H.N. Bischel, J. Hsiao, M.H. Plumlee, V.H. Resh, R.G. Luthy, *Economic and ecological costs and benefits of streamflow augmentation using recycled water in a coastal environment*. *Environmental Science & Technology*. 2013, 47(19), 10735-10743. <http://pubs.acs.org/doi/abs/10.1021/es305011z>
- Bischel, H.N., J.E. Lawrence, B.J. Halaburka, M.H. Plumlee, A.S. Bawazir, J.P. King, J.E. McCray, V.H. Resh, R.G. Luthy, *Renewing urban streams with recycled water for streamflow augmentation: hydrologic, water quality, and ecosystem services management*. *Environmental Engineering Science*. 2013, 30(8), 455-479. <http://online.liebertpub.com/doi/full/10.1089/ees.2012.0201>

- Bischel, H.N., G. L. Simon, T. M. Frisby, R.G. Luthy, *Management experiences and trends for water reuse implementation in Northern California*. Environmental Science & Technology. 2012, 46(1), 180-188.
<http://pubs.acs.org/doi/abs/10.1021/es202725e>
- Bischel, H.N., L.A. MacManus-Spencer, C. Zhang, R.G. Luthy, *Strong associations of short-chain perfluoroalkyl acids with serum albumin and investigation of binding mechanisms*. Environmental Toxicology & Chemistry. 2011, 30(11), 2423-2430. <http://onlinelibrary.wiley.com/doi/10.1002/etc.647/full>
- Bischel, H.N. and E.R. Sundstrom, *5-Year evaluation of a course model for student-initiated engineering service learning*. International Journal of Service Learning in Engineering. 2011, 6(1), 1-13.
<http://library.queensu.ca/ojs/index.php/ijslc/article/view/3211>
- Frysinger, G. S., G.J. Hall, A.L. Pourmonir, H.N. Bischel, E.E. Peacock, R.N. Nelson, C.M. Reddy. *Tracking and Modeling the Degradation of a 30 Year Old Fuel Oil Spill with Comprehensive Two-Dimensional Gas Chromatography*. In: International Oil Spill Conference Proceedings (IOSC). American Petroleum Institute. 2011(1), 428. <http://www.ioscproceedings.org/doi/abs/10.7901/2169-3358-2011-1-428>
- Bischel, H.N., L.A. MacManus-Spencer, R.G. Luthy, *Noncovalent interactions of long-chain perfluoroalkyl acids with serum albumin*. Environmental Science & Technology. 2010, 44(13), 5263-5269.
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- MacManus-Spencer, L.A, M. Tse, P. C. Hebert, H.N. Bischel, R.G. Luthy. *Binding of perfluorocarboxylates to serum albumin: A comparison of analytical methods*. Analytical Chemistry. 2010, 82(3), 974-981.
<http://pubs.acs.org/doi/abs/10.1021/ac902238u>

RÉSUMÉ/BIOSKETCH

Attach 2-3 page Resume/Biosketch for the PI and other Key Personnel listed in Exhibit A2.

Thomas M. Young

Department of Civil & Environmental Engineering
University of California
Davis, CA 95616

ph: 530-754-9399
fax: 530-752-7872
email: tyoung@ucdavis.edu

Education

University of Michigan, Ph.D., Environmental Engineering, 1996
University of California, Berkeley, M.P.P., Graduate School of Public Policy, 1987
Michigan State University, B.S. with Honors, Chemical Engineering, 1985

Professional Experience

University of California, Davis, Professor (7/06-present)
University of California, Davis, Associate Professor (7/01-6/06)
University of California, Davis, Assistant Professor (11/95-6/01)
University of Michigan, Research and Teaching Assistant (9/91-9/95)
US Environmental Protection Agency, Environmental Protection Specialist (8/87-8/90)

Peer-Reviewed Journal Publications (Selected from 82 total)

- Moschet, C.; Anumol, T.; Lew, B.M.; Bennett, D.H.; Young, T.M. "Household dust as a repository of chemical accumulation: New insights from a comprehensive high-resolution mass spectrometry study," *Environmental Science and Technology*, in press.
- Rippner, D.A., Green, P.G., Young, T.M. Parikh, S.J. Dissolved organic matter reduces CuO nanoparticle toxicity to duckweed in simulated natural systems, *Environmental Pollution*, 2018, 234:692-698.
- Homan, N., Green, P.G., Young, T.M. "Evaluating Ferrous Chloride for Removal of Chromium from Ion-Exchange Waste Brines," *Journal AWWA*, in press.
- Rochman CM, Parnis JM, Browne MA, Serrato S, Reiner EJ, Robson M, Young, T.M., Diamond, M.L., Teh, S.J. "Direct and indirect effects of different types of microplastics on freshwater prey (*Corbicula fluminea*) and their predator (*Acipenser transmontanus*)," *PLoS ONE* 12(11): 2017, e0187664. <https://doi.org/10.1371/journal.pone.0187664>.
- Moschet, C.; Lew, B.M.; Hasenbein, S.; Anumol, T.; Young, T.M. "LC- and GC-QTOF-MS as Complementary Tools for a Comprehensive Micropollutant Analysis in Aquatic Systems," *Environmental Science and Technology*, 2017, 51: 1553-1561.
- Bair, D.A.; Mukome, F.N.D.; Popova, I.E.; Ogunyoku, T.A.; Jefferson, A.; Wang, D.; Hafner, S.C.; Young, T.M.; Parikh, S.J. "Sorption of Pharmaceuticals, Heavy Metals, and Herbicides to Biochar in the Presence of Biosolids," *Journal of Environmental Quality*, 2016, 45: 1998-2006.
- Parry, E.; Young, T.M. "Comparing targeted and non-targeted high-resolution mass spectrometric approaches for assessing advanced oxidation reactor performance," *Water Research*, 2016, 104, 72-81.
- Parry, E.; Lesmeister, S.; The, S.; Young, T.M. "Characteristics of suspended solids affect bifenthrin toxicity to the calanoid copepods, *Eurytemora affinis* and *Pseudodiaptomus forbesi*," *Environmental Toxicology and Chemistry*, 2015, 34(10): 2302-2309.

- Ogunyoku, T.A. and Young, T.M. "Removal of triclocarban and triclosan during municipal biosolid production," *Water Environment Research*, **2014**, 86(3): 197-203.
- Luo, Y., Jorgenson, B.; Thuyet, D.; Young, T.M., Spurlock, F., Goh, K. "Insecticide washoff from concrete surfaces: characterization and prediction," *Environmental Science and Technology*, **2014**, 48(1): 234-243.
- Parry, E. and Young, T.M. "Distribution of pyrethroid insecticides in secondary wastewater effluent," *Environmental Toxicology and Chemistry*, **2013**, 32(12), 2686-2694.
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- Luo, Y., Spurlock, F., Jiang, W., Jorgenson, B.C., Young, T.M., Gan, J., Gill, S., Goh, K.S. "Pesticide washoff from concrete surfaces: literature review and a new modeling approach," *Water Research*, **2013**, 47: 3163-3172.
- Jorgenson, B.C., Wissel-Tyson, C., Young, T.M. "Factors Contributing to the Off-Target Transport of Pyrethroid Insecticides from Urban Surfaces," *Journal of Agricultural and Food Chemistry*, **2012**, 60(30): 7333-7340.
- Thuyet, D.Q., Jorgenson, B.C., Wissel-Tyson, C., Watanabe, H., Young, T.M. "Wash off of imidacloprid and fipronil from turf and concrete surfaces using simulated rainfall" *Science of the Total Environment*, **2012**, 414: 515-524.
- Giudice, B.D., Young, T.M. "Mobilization of endocrine disrupting chemicals, heavy metals, and estrogenic activity in simulated rainfall runoff from land-applied biosolids" *Environmental Toxicology and Chemistry*, **2011**, 30(10): 2220-2228.
- Fojut, T.L., Young, T.M. "Desorption of pyrethroids from suspended solids" *Environmental Toxicology and Chemistry*, **2011**, 30(8): 1760-1766.
- Fojut, T.L., Young, T.M. "Pyrethroid sorption to Sacramento River suspended solids and bed sediments" *Environmental Toxicology and Chemistry*, **2011**, 30(4): 787-792.
- Jorgenson, B.C., Young, T.M. "Formulation effects and the off-target transport of pyrethroid insecticides from urban hard surfaces" *Environmental Science & Technology*, **2010**, 44(13), 4951-7.
- Giudice, B., Young, T.M. "The Antimicrobial triclocarban stimulates embryo production in the freshwater mudsnail *Potamopyrgus Antipodarum*" *Environmental Toxicology and Chemistry*, **2010**, 29(4): 966-970.
- Hwang, H-M., Green, P.G., Young, T.M. "Historical trends of trace metals in a sediment core from a contaminated tidal salt marsh in San Francisco Bay" *Environmental Geochemistry and Health*, **2009**, 31:421-430.
- Hwang, H.M., Park, E.K., Young, T.M., Hammock, B.D. "Response to Occurrence of five classes of chemicals in indoor dust: An evaluation of the human health risk" *Science of the Total Environment*, **2009**, 407: 5197-5198.
- Hwang, H.M., Green, P.G., Young, T.M. "Tidal salt marsh sediment in California, USA: Part 3. Current and historic toxicity potential of contaminants and their bioaccumulation" *Chemosphere*, **2008**, 71: 2139-2149.
- Giudice, B.D., Massoudieh, A., Huang, X., Young, T.M. "A Stochastic Simulation Procedure for Selecting Herbicides with Minimum Environmental Impact" *Environmental Science and Technology*, **2008**, 42: 354-360.
- Hwang, H.-M., Green, P.G., Young, T.M. "Tidal salt marsh sediment in California, USA: 1. Occurrence and sources of organic contaminants," *Chemosphere*, **2006**, 64: 1383-1392.
- Huang, X., Massoudieh, A., Young, T.M. "Measured and Predicted Herbicide Removal by Mulch" *Journal of Environmental Engineering*, **2006**, 132(8): 918-925.
- Huang, X., Fong, S., Deanovic, L., Young, T.M. "Toxicity of Herbicides in Highway Runoff" *Environmental Toxicology and Chemistry*, **2005**, 24, 214-218.

Huang, X., Pedersen, T., Fischer, M., White, R., Young, T. M. "Herbicide Runoff Along Highways: II. Sorption Control" *Environmental Science & Technology*, 2004, 38, 3272-3278.

Huang, X., Pedersen, T., Fischer, M., White, R., Young, T. M. "Herbicide Runoff Along Highways: I. Field Observations" *Environmental Science & Technology*, 2004, 38, 3263-3271.

Exhibit A6

CURRENT & PENDING SUPPORT

University will provide current & pending support information for Key Personnel identified in Exhibit A2 at time of proposal and upon request from State agency. The "Proposed Project" is this application that is submitted to the State. Add pages as needed.

PI: Heather N. Bichsel					
Status (currently active or pending approval)	Award # (if available)	Source (name of the sponsor)	Project Title	Start Date	End Date
Proposed Project	17-C0100	CA Department of Pesticide Regulation	Removal of Pesticides from Agricultural Runoff in Bioreactors: A field and laboratory assessment of removal rates, mechanisms and enhanced design strategies	05/15/2018	04/15/2020
PENDING	--	National Science Foundation	GOALI: WERF: Facilitating onsite resource recovery through implementation and evaluation of novel urine source separation systems for nutrient recovery and micropollutant removal	07/01/2018	06/30/2021
Young, Thomas (CO-PI)					
Status	Award #	Source	Project Title	Start Date	End Date
Proposed Project	17-C0100	CA Department of Pesticide Regulation	Removal of Pesticides from Agricultural Runoff in Bioreactors: A field and laboratory assessment of removal rates, mechanisms and enhanced design strategies	05/15/2018	04/15/2020
CURRENT	P42ES004699 (Hammock)	NIH, NIEHS	Optimizing Bioremediation for Risk Reduction Using Integrated Bioassay, Non-Target Analysis and Genomic Mining Techniques	07/2017	06/2022
CURRENT	--	California Air Resources Board	Evaluation and Identification of Constituents Found in Common Carrier Pipeline Natural Gas, Biogas and Upgraded Biomethane in California	11/2017	10/2018
CURRENT	--	Office of Environmental Health Hazard Assessment	Constituents of Concern from Biogas and its Stove Combustion	07/2017	03/2018
CURRENT	--	US Environmental Protection Agency	Identification of Unique Candidate Compound(s) in Dust to Estimate Children's Dust Ingestion	10/2016	03/2018

Exhibit B
Budget for Project Period

Principal Investigator (Last, First):

Bischel, Heather

Exhibit B

COMPOSITE BUDGET FOR ENTIRE PROPOSED PROJECT PERIOD					
5/15/2018 to 4/15/2020					
BUDGET CATEGORY	From: To:	5/15/2018 6/30/2018 Year 1	7/1/2018 6/30/2019 Year 2	7/1/2019 4/15/2020 Year 3	TOTAL
PERSONNEL: <i>Salary and fringe benefits.</i>		\$0	\$99,854	\$92,078	\$191,932
TRAVEL		\$0	\$3,000	\$3,000	\$6,000
MATERIALS & SUPPLIES		\$4,000	\$12,000	\$8,000	\$24,000
EQUIPMENT		\$0	\$0	\$0	\$0
CONSULTANT		\$0	\$0	\$0	\$0
SUBRECIPIENT		\$0	\$0	\$0	\$0
OTHER DIRECT COSTS (ODC)	<i>Subject to IDC Calc</i>				
ODC #1: GAEL	Y	\$0	\$381	\$349	\$730
ODC #2	Y	\$0	\$0	\$0	\$0
ODC #3	Y	\$0	\$0	\$0	\$0
ODC #4	Y	\$0	\$0	\$0	\$0
ODC #5	Y	\$0	\$0	\$0	\$0
ODC #6	Y	\$0	\$0	\$0	\$0
TOTAL DIRECT COSTS		\$0	\$0	\$0	\$0
Indirect (F&A) Costs	F&A Base Rate25% MTDC *	\$4,000	\$93,356	\$82,396	\$179,751
		\$1,000	\$23,329	\$20,599	\$44,938
TOTAL COSTS PER YEAR		\$5,000	\$143,329	\$128,043	
TOTAL COSTS FOR PROPOSED PROJECT PERIOD					\$276,372

* MTDC = Modified Total Direct Cost

JUSTIFICATION. See Exhibit B1 - Follow the budget justification instructions.

Funds Reversion Dates

06/30/2020

06/30/2021

06/30/2022

Project Period Budget Flexibility (lesser of % or Amount)

Prior approval required for budget changes between approved budget categories above the thresholds identified.

% 10.00%
 or
 Amount \$10,000

Exhibit B1

Budget Justification

The Budget Justification will include the following items in this format.

Personnel

Name. Starting with the Principal Investigator list the names of all known personnel who will be involved on the project for each year of the proposed project period. Include all collaborating investigators, individuals in training, technical and support staff or include as "to be determined" (TBD).

Role on Project. For all personnel by name, position, function, and a percentage level of effort (as appropriate), including "to-be-determined" positions.

Heather Bischel (Prof & PI): Oversees overall project; manages project personnel and coordination with STATE; ensures completion project of deliverables. Year 1: 0% effort; Year 2: 8% effort; Year 3: 11% effort

Thomas Young (Prof & Co-PI): Manages project personnel and instrumentation for analytical method development and sample analysis. Year 1: 0% effort; Year 2: 4% effort; Year 3: 3% effort

TBD (GSR III): Analytical method development; analysis and interpretation of field samples; analysis of flow-through and batch-reactor samples. Year 1: 0% effort; Year 2: 28% effort; Year 3: 31.5% effort

TBD (GSR III): Construction, operation and sampling of baseline flow-through reactors; construction, operation and sampling of modified flow-through reactors and batch reactors for mechanistic evaluation.
Year 1: 0% effort; Year 2: 25% effort; Year 3: 31.5% effort

Fringe Benefits.

In accordance with University policy, explain the costs included in the budgeted fringe benefit percentages used, which could include tuition/fee remission for qualifying personnel to the extent that such costs are provided for by University policy, to estimate the fringe benefit expenses on Exhibit B.

Fringe benefits are calculated using the University composite rates developed by the University Costing and Policy office as required per institutional policy. Rates are applied by title code and fiscal year (University' fiscal year is from July 1 to June 30). The fringe benefit rates are projected starting 2018-19, and include a 3% annual increase from current (2017-18) rates. Tuition & fees for the GSRs for Years 2 & 3 are included as required by University policy, and include a 5% annual increase.

Travel

Itemize all travel requests separately by trip and justify in Exhibit B1, in accordance with University travel guidelines. Provide the purpose, destination, travelers (name or position/role), and duration of each trip. Include detail on airfare, lodging and mileage expenses, if applicable. Should the application include a request for travel outside of the state of California, justify the need for those out-of-state trips separately and completely.

\$6000 total, including: Travel to field site for evaluation of site conditions in reactor construction. Conference presentation by project personnel in Year 2 and 3.

Materials and Supplies

Itemize materials supplies in separate categories. Include a complete justification of the project's need for these items. Theft sensitive equipment (under \$5,000) must be justified and tracked separately in accordance with State Contracting Manual Section 7.29.

\$24000 total, including: Analytical grade solvents, analytical standards, solid phase extraction columns, general consumable laboratory supplies, chromatography columns, flow-through reactor construction materials, batch reactor construction materials.

Equipment

List each item of equipment (greater than or equal to \$5,000 with a useful life of more than one year) with amount requested separately and justify each.

None

Consultant Costs

Consultants are individuals/organizations who provide expert advisory or other services for brief or limited periods and do not provide a percentage of effort to the project or program. Consultants are not involved in the scientific or technical direction of the project as a whole. Provide the names and organizational affiliations of all consultants. Describe the services to be performed, and include the number of days of anticipated consultation, the expected rate of compensation, travel, per diem, and other related costs.

None

Subawardee (Consortium/Subrecipient) Costs

Each participating consortium organization must submit a separate detailed budget for every year in the project period in Exhibit B2 Subcontracts. Include a complete justification for the need for any subawardee listed in the application.

None

Other Direct Costs

Itemize any other expenses by category and cost. Specifically justify costs that may typically be treated as indirect costs. For example, if insurance, telecommunication, or IT costs are charged as a direct expense, explain reason and methodology.

GAEL for project personnel as required by University policy. GAEL is the University's assessment of the costs of the liability insurance policies which cover all employees. Rates are assessed based on each employee's salary.

Rent

If the scope of work will be performed in an off-campus facility rented from a third party for a specific project or projects, then rent may be charged as a direct expense to the award.

None

Indirect (F&A) Costs

Indirect costs are calculated in accordance with the University budgeted indirect cost rate in Exhibit B.

Indirect Costs are calculated at a rate of 25% of Modified Total Direct Costs (MTDC).

Exhibit B3

Invoice and Detailed Transaction Ledger Elements

In accordance with Section 14 of Exhibit C – Payment and Invoicing, the invoice, summary report and/or transaction/payroll ledger shall be certified by the University's Financial Contact and the PI.

Summary Invoice – includes either on the invoice or in a separate summary document – by approved budget category (Exhibit B) – expenditures for the invoice period, approved budget, cumulative expenditures and budget balance available¹

- Personnel
- Equipment
- Travel
- Subawardee – Consultants
- Subawardee – Subcontract/Subrecipients
- Materials & Supplies
- Other Direct Costs
 - TOTAL DIRECT COSTS (if available from system)
- Indirect Costs
 - TOTAL

Detailed transaction ledger and/or payroll ledger for the invoice period²

- Univ Fund OR Agency Award # (to connect to invoice summary)
- Invoice/Report Period (matching invoice summary)
- GL Account/Object Code
- Doc Type (or subledger reference)
- Transaction Reference#
- Transaction Description, Vendor and/or Employee Name
- Transaction Posting Date
- Time Worked
- Transaction Amount

¹ If this information is not on the invoice or summary attachment, it may be included in a detailed transaction ledger.

² For salaries and wages, these elements are anticipated to be included in the detailed transaction ledger. If all elements are not contained in the transaction ledger, then a separate payroll ledger may be provided with the required elements.

Exhibit G – Negotiated Alternate UTC Terms (if applicable)

An alternate provision in Exhibit G must clearly identify whether it is replacing, deleting or modifying a provision of Exhibit C. The Order of Precedence incorporated in Exhibit C clearly identifies that the provisions on Exhibit G take precedence over those in Exhibit C.

While every effort has been made to keep the UTC as universal in its application as possible, there may be unique projects where a given term in the UTC may be inappropriate or inadequate. AB20 allows for those terms to be changed, but only through the mutual agreement and negotiation of the State agency and the University campus. If a given term in the UTC is to be changed, the change should not be noted in Exhibit C, but rather noted separately in Exhibit G.

1. Harassment Free Workplace

DPR is committed to providing a safe, secure environment, free from sexual misconduct. It is policy of the Department that employees have the right to work in an environment that is free from all forms of discrimination, including sexual harassment. This policy specifically speaks to freedom from a sexually harassing act that results in the creation of an intimidating, hostile or offensive work environment or that otherwise interferes with an individual's employment or work performance. As a Contractor with DPR, you and your staff are expected to comply with a standard of conduct that is respectful and courteous to DPR employees and all other persons contacted during the performance of this Agreement. Sexual harassment is unacceptable, will not be tolerated; and may be cause for prohibiting some or all of the Contractor's staff from performing work under this Agreement.

2. Rights in Data

The Parties agree that all data, plans, drawings, specifications, reports, computer programs, operating manuals, notes, and other written or graphic work submitted under Exhibit A in the performance of this Contract shall be in the public domain.

3. Indirect Costs

Overhead/Indirect Costs for University may not exceed 25% of the Modified Total Direct Cost.