

# 2017 Research at SERL

The Charles E. Via, Jr. Department of Civil and Environmental Engineering  
National Capital Region (NCR) Campus



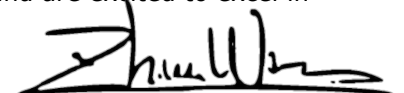
## Welcome!

This report is a review of our accomplishments at the Sustainable Environment Research Laboratory (SERL), a thriving component of the Occoquan Watershed Monitoring Laboratory (OWML) located in Manassas, Virginia. This past year, we gained new students and expanded the breadth of our research even more. Our research has delved into many topics within the environmental engineering realm, such as solid and liquid waste management modeling, biofiltration modeling, stormwater treatment, pathogenic control in drinking water, anaerobic digestion techniques, aerobic granulation, and absolute DNA quantification.

Due to the prime location of the laboratory, we are able to maintain ongoing contact with local utilities and consulting firms to advance research within the field. Our successful efforts thus far have strengthened these relationships and garnered more support for additional projects and funding.

In 2017, SERL was represented at several conferences and expos, including those hosted by the American Chemical Society (ACS), Association of Environmental Engineering and Science Professors (AEESP), American Society of Agricultural and Biological Engineers (ASABE), Virginia Water Environment Association (VWEA) Water-JAM, Chesapeake Water Environment Association (CWEA) Stormwater Committee, and International Ozone Association (IOA).

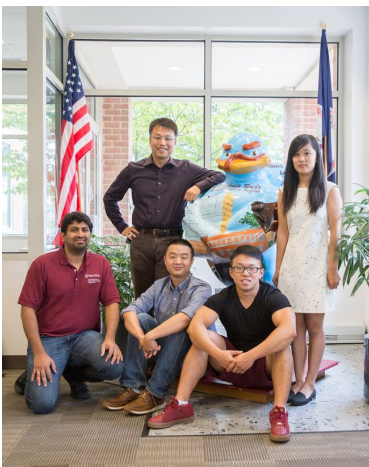
We are appreciative of all the support we've received and are excited to excel in 2018!



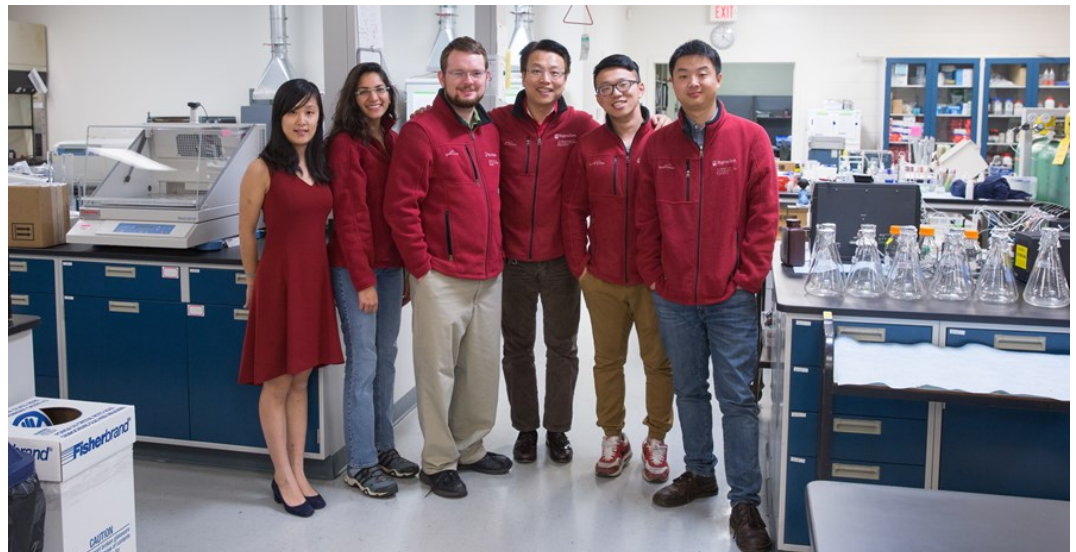
Dr. Zhiwu (Drew) Wang

### 2017 Highlights:

- New Students
- New Sponsors
- New Projects
- New Publications
- New Funding



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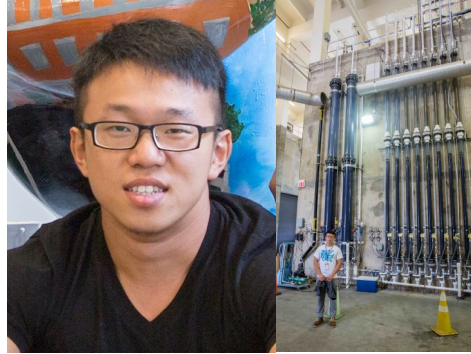


# Current Research Endeavors

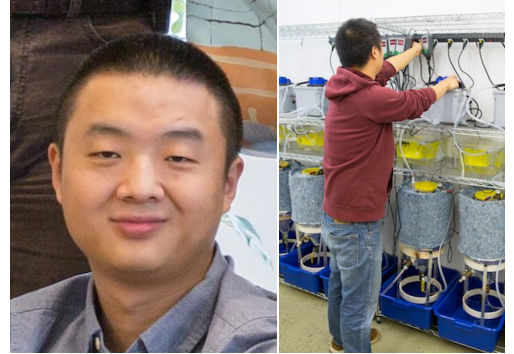
## Our PhD Students



Karthik is developing a novel mathematical modeling system of solid-state anaerobic digestion using BioWin. Karthik is using the model to determine the magnesium hydroxide dosage for alkalinity control at a WWTP.



Yewei analyzes daily samples from a pilot-scale Ozone-BAC reactor at the Upper Occoquan Service Authority (UOSA) located in Centreville, VA. In 2017, Yewei set up contact-stabilization sequencing batch reactors at UOSA to cultivate fast-growing bacterial aggregates for COD capture. Yewei is currently developing a biofiltration model for backwash predictions, in collaboration with Hazen & Sawyer and HRSD.



Dian investigates different dewatering methods and their impacts on odor control via lab-scale simulations at Arlington County Water Pollution Control Plant. In 2017, Dian focused on methanethiol generation and degradation kinetics. Dian is also assessing the cost-effectiveness of using cerium chloride for struvite control during sludge dewatering by centrifuge at UOSA. By modifying cerium chloride and phosphate profiles under different conditions, struvite may be efficiently precipitated out of sludge.

## Our Masters Students



Tim designed a benchtop reactor experiment for analyzing the role of free ammonia inhibition in controlling nitrite oxidizing bacteria. His airlift reactor is seeded with aerobic granules from a DEMON side-stream reactor and operated under main-stream conditions, e.g. 20°C and influent ammonium concentration of 50 mg N L<sup>-1</sup>.



Jie is evaluating the effect of point-of-use filtration in premise plumbing on water quality and biogrowth. Jie conducted sampling processes for this project at DC Water during the first half of the year, and is currently analyzing the data in efforts to develop best management practices (BMPs) in drinking water systems.



Parita is utilizing digital PCR for absolute quantification of soil nitrogen bacteria in wetland mesocosm soils. The results will aid in understanding if and how increased plant species richness within a mesocosm affects the bacterial community abundance and nitrogen cycling within the soils.



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## Publications

1. Cui Y.W., Gong X.Y., Shi Y.P. and Wang Z.W. (2017) Salinity effect on production of PHA and EPS by *Haloferax mediterranei*, RSC Advances, 7(84): 53587-53595
  2. Sun Y.W., Zhang D., and Wang Z.W. (2017) The potential of using biological nitrogen removal technique for stormwater treatment, Ecological Engineering, 106: 482-495
  3. Luo S., Wang Z.W., and He Z. (2017) Mathematical modeling of the dynamic behavior of an integrated photo- bioelectro-chemical system for simultaneous wastewater treatment and bioenergy recovery, Energy, 124: 227-237
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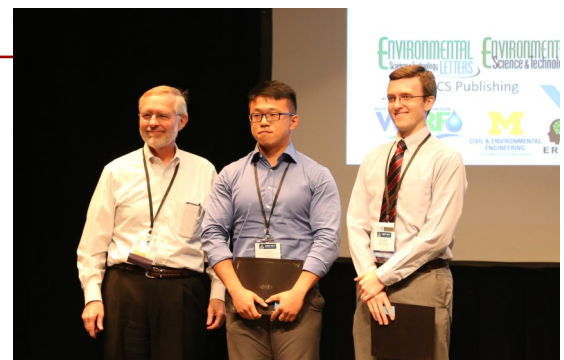
## Presentations

1. Manchala, K. (2017) Guest Lecturer Aeration Systems. In: CEE 5125 Wastewater Design.
2. Lin, J. (2017) Statistical exploration of the cause of bacterial regrowth in filtered drinking water. In: ACS 254th National Meeting, Washington, DC.
3. Zhang, D. and Wang, Z. W. (2017) Mathematical model of methanethiol generation and degradation in anaerobic chemostats. In: ACS 254th National Meeting, Washington, DC.
4. Sun, Y.W., Wang, Z.W. (2017) Biological nitrogen removal potential of stormwater. In: 254th ACS National Meeting, Washington, DC.
5. Sun, Y.W., Angelotti, B., Brooks, M., Dowbiggin, B., Evans, P., Devins, B., Wang, Z.W. (2017) Roles of Ozone Oxidation, Adsorption and Biodegradation in the Removal of Disinfection By-Products and Emerging Contaminants in Pilot-Scale Ozone BAC Contactors Applied for Potable Reuse. In: 254th ACS National Meeting, Washington, DC.
6. Sun, Y.W., Angelotti, B., Brooks, B., Evans, P., Wang, Z.W. (2017) Pilot-Scale Investigation of Ozone-Enhanced Biofiltration Using Spent and Regenerated Granular Activated Carbon Media for Potable Reuse. In: 254th ACS National Meeting, Washington, DC, USA
7. Zhang, D. and Wang, Z. W. (2017) Manipulating methanethiol generation and degradation for odor mitigation. In: AEESP 2017, Ann Arbor, Michigan.
8. Sun, Y.W., Angelotti, B., Evans, P., Wang, Z.W. (2017) Pilot-scale investigation of ozone-enhanced biofiltration using spent and regenerated granular activated carbon media for potable reuse. In: AEESP 2017, Ann Arbor, Michigan
9. Zhang, D. and Wang, Z. W. (2017) Manipulating methanethiol generation and degradation for odor control. In: 2017 ASABE Annual International Meeting, Spokane, Washington.
10. Sun, Y.W., Wang, Z.W. (2017) Biological nitrogen removal of stormwater runoff. In: ASABE 2017 Annual International Meeting, Spokane, Washington.
11. Zhang, D., Strawn M. and Wang, Z.W. (2017) Manipulating methanethiol generation and degradation for odor mitigation. In: 2017 Water JAM, Hampton, Virginia.
12. Sun, Y.W., Wang, Z.W. (2017) Biological nitrogen removal potential of stormwater. In: WaterJAM 2017, Hampton, Virginia.
13. Sun, Y.W., Wang, Z.W. (2017) The potential of using biological nitrogen removal technique for stormwater treatment. In: CWEA Stormwater Committee Spring Seminar, Linthicum Heights, Maryland.
14. Sun, Y.W., Angelotti, B., Brooks, M., Dowbiggin, B., Evans, P., Devins, B., Wang, Z.W. (2017) The role of ozone oxidation, adsorption and biodegradation in the removal of disinfection by-product precursors and emerging contaminants in pilot-scale ozone BAC contactors applied for potable reuse, The 23rd International Ozone Association World Congress, National Harbor, Maryland, USA

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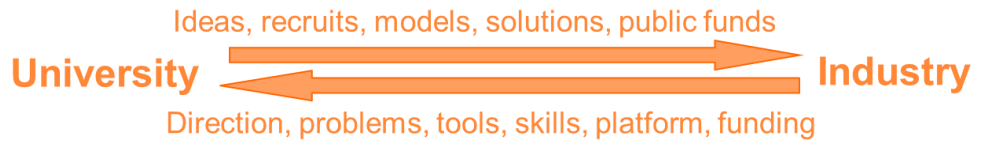
## Awards

- Ms. Jie Lin received a National Association of Sewer Service Companies (NASSCO) scholarship in Spring 2017.
- Mr. Dian Zhang received an Edna Bailey Sussman Internship Award in Summer 2017.
- Mr. Yewei Sun received an AEESP 2017 Conference Student Travel Award, sponsored by Hydromantis, in Summer 2017.



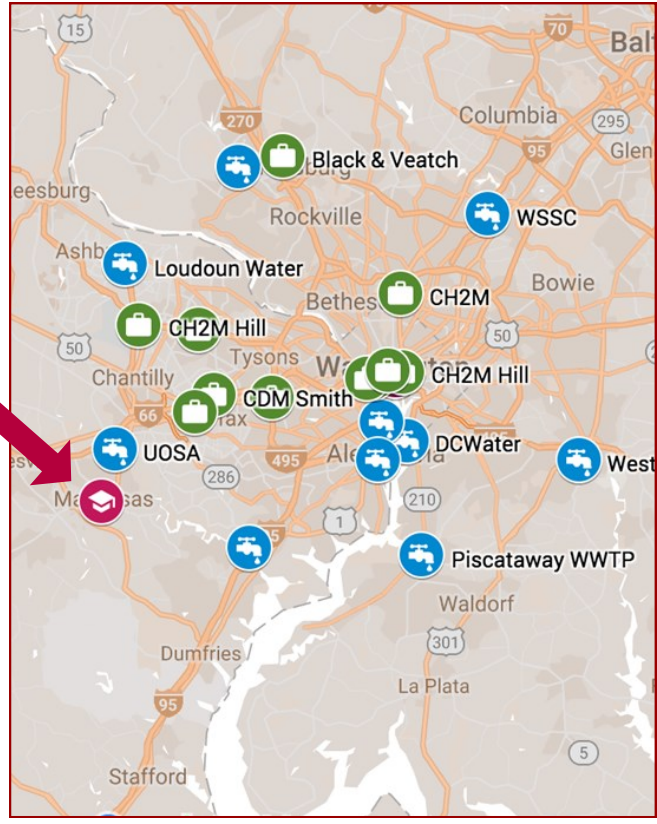


# Our Sponsors



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Uniquely located, the Occoquan Laboratory monitors the Washington, D.C. metropolitan area. We work closely with utilities and consulting firms to research water treatment and better serve the growing urban population.

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## New Projects (\$165,828)

1. Development of a mechanistic biofiltration model for describing biological and hydraulic phenomena (funded by Hazen & Sawyer)
2. DC Water Biostability Operations Study (funded by DCWater)
3. Verification of the long-term stability of partial nitrification in stratified aerobic granules under high residual ammonium concentration (funded by HRSD)
4. Effect of cerium addition on sludge dewatering using centrifuge (funded by UOSA)
5. DC Water study of microbial effects from point of use filters (funded by DCWater)
6. Develop an asynchronous, online version of CEE 3104 - Introduction to Environmental Engineering (funded by TLOS)
7. A 4-VA collaborative study of wetland resilience to nitrogen pollutant loading (funded by 4VA)