

**Center for Irrigation Technology
Water, Energy and Technology Center**

California Agricultural Technology Institute

Jordan College of Agricultural Sciences and Technology

Annual Report 2019 - 2020

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by

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2019-2020 ANNUAL REPORT

Center for Irrigation Technology Water, Energy and Technology Center

EXECUTIVE SUMMARY

Fresno State's Center for Irrigation Technology (CIT) is built on a foundation of innovation and technology transfer focused on testing, applied research, and entrepreneurship. CIT's mission is to support the development and deployment of technologies that will bring the world the most innovative products and resource management tools.

In 2020, CIT celebrates its 40th anniversary, while tracing Fresno State's irrigation testing roots back over twice as long to the pioneering work of Dr. Winston Strong. CIT directors Edward Norum, Kenneth Solomon, David Zoldoske, Sargeant Green (acting), and current director Charles Hillyer continue to build on his work.

Today, CIT:

- is internationally recognized as the leading independent testing laboratory and applied research facility for the irrigation industry.
- works with the public and private sector to advance water, energy, and ag technologies and management practices
- reflects the need to integrate agricultural, environmental, and urban concerns in all its activities.
- is conducting educational events reaching thousands of people over the years including farmers, government and policy makers, innovators and entrepreneurs, academia, business leaders, end users, investors, private industry, regulatory agencies, and utilities.
- provides valuable hands-on experience to Fresno State undergraduate and graduate students.
- works with faculty and staff researchers who are instrumental in developing data and resource management tools that are easily accessible to anyone.
- collaborates with the University Agricultural Laboratory (UAL) to conduct research projects on farm that provides access to a wide variety of crops and a full complement of irrigation systems including flood, drip and overhead with water sources including groundwater from wells and district water from canals.

Challenges

Two years ago, the three Centers decided that the CATI budget should be divided equally between the centers. This decision resulted in a more equitable distribution of funding between the centers. The decision also resulted in a reduction of CIT's CATI budget. The reduction was phased in over two years and CIT is adjusting to the new funding level. Adjustments have been focused on moving some expenses to grant and contract funding. Further adjustments were made by shifting the administrative burden of ARI projects to the other two centers. The remaining

shortfall was compensated for by drawing on the CIT Trust fund. We continue to search for ways to compensate for the reduced funding.

On November 3, 2019, a vehicle crashed into the northeast corner of the WET Center building. The driver was taken to the hospital and recovered. However, the impact caused significant damage to the building and contaminated the water in the Hydraulics Lab's test pit. The contamination required a halt of all testing activity in the Hydraulics Lab for four months. This work stoppage had a significant impact on the Lab's budget since there was no income from testing during that period. The Hydraulics Lab manager was able to shift staff to other projects, which helped sustain salary support. We also used the down time as an opportunity to perform maintenance on the test pit. In approximately February of 2020, the Hydraulics Lab was operational again. Repairs to the building were completed in June of 2020.

The COVID-19 pandemic has had a profound impact on CIT. Some of these challenges are summarized in the bullet points below.

- Because of our association with the UAL, and our time-sensitive field research program, field experiments were able to continue; but not without some impacts. Particularly, off-campus research faced higher travel costs (1 person per vehicle). Several of the projects were able to shift funds to compensate and other projects were able to request increased funding from the sponsor. To date, all field research (both on and off campus) have been able to achieve project goals set prior to the pandemic. This achievement is due almost entirely to the flexibility and dedication of the staff, students, and faculty conducting the research.
- The Hydraulics Lab is not allowing clients into the laboratories during the pandemic. Instead, CIT staff set up impromptu zoom or video calls with the clients so that they can observe and participate when appropriate. This compromise allowed the Lab to continue operating and maintain safety.
- The WET Center staff are all working remotely and have remained engaged and productive throughout the shelter-in-place order.
- There have been no in-person events since mid March 2020. This limitation has forced reevaluation of the education and outreach activities across CIT and the WET.
- Several essential CIT staff were required to work from home (b/c of their status as a vulnerable group) and some staff continued to work on-site to support field research. This required some adjustment and additional effort to keep everyone engaged and productive.
- Closures, conference cancellations, and restrictions on size of gatherings have limited networking opportunities that are typically essential to find and maintain engagement with Lab clients.

Opportunities

As a result of the CIT retreat (see Goal 1 below), and ongoing conversations with stakeholders, we identified the following opportunities:

1. The production of irrigation management software from major equipment manufacturers indicates the potential of software testing as a service similar to the testing services currently offered by the Hydraulics Lab.

2. Recent publication of Groundwater Sustainability Plans (CSP) by Groundwater Sustainability Agencies (GSA) has highlighted the need and opportunities for increased education and outreach relating to the Sustainable Groundwater Management Act (SGMA).
3. The Technology Innovation Evaluation (TIE) committee from the WET center has highlighted some opportunities for enhancing the technology testing pipeline between CIT and WET.
4. The future of the Advanced Pumping Efficiency Program (APEP) was in question during most of FY19-20. However, in early July, we learned that with some restructuring of the program, funding would continue through 2021. This opportunity, combined with the virtualization efforts associated with COVID, will enable creation and delivery of more APEP educational programming.

2019-2020 GOALS AND OBJECTIVES

CIT Goal #1

Implement a new organizational structure to make the new Director's job more manageable.

CIT Goal #1 Progress

CIT held a retreat on January 23, 2020. This was the first retreat in many years. During the event, we discussed and reached general consensus on a new organizational structure for CIT. An org chart is included at the end of this report. The previous structure was "flat" where most staff reported to the Center Director. The actual operational behavior of the organization did not reflect the official organizational structure and this disparity led to significant communication problems within the organization. The new structure closely reflects the operational behavior of CIT. Some changes were made. Three staff members were designated as Assistant Directors; a title previously held only by Dr. Florence Cassel.

CIT Goal #2

Re-focus the organization on its core strengths.

CIT Goal #2 Progress

The reorganization described in Goal 1 also clarified the core strengths of the CIT organization, and helped identify areas where CIT should focus its efforts. Two important core strengths are the development of industry standards and the testing services provided by the Hydraulics Lab. The following progress was made towards this refocusing:

- Renewed outreach and engagement with industry and stakeholders, intended to improve utilization of the Hydraulics Lab's testing services, including:
 - Revision of pricing of testing services
 - Direct outreach at the 2019 Irrigation Association (IA) trade show by Drs Vang and Hillyer
 - Advertising and printed materials to publicize lab services
 - Expansion of certified testing services to include SWAT Soil Moisture Based Irrigation Controllers

- Renewed and increased participation with standards development bodies
 - CIT Director Charles Hillyer is taking over for Stephen Smith as the newly elected Chair of NRES-03/2 and US TAG TC 23/SC 18. ASABE provides the administrative support for the TAG international standards work with support from IA.
 - Drs Hillyer and Vang are now voting members of the ASABE committee that develop the SMART irrigation controllers for landscape and are actively participating in that committee.

To maintain this focus, and develop new strengths, CIT and the WET have jointly engaged in an ongoing strategic planning activity. This activity helps to maintain focus on strategic goals and promotes self-accountability for achieving those goals.

CIT Goal #3

Hire and train new staff to replenish areas that have ongoing high value returns for the organization.

CIT Goal #3 Progress

CIT had several significant changes to staffing during FY19-20. The **STAFFING** section details changes to CIT staff.

CIT Goal #4

Re-organize the training program and train all staff on the basic facts about water in California, and water and allied resources management for multiple uses, our core mission, career pathways and the value training has to advancement.

CIT Goal #4 Progress

- Prior to the COVID-19 pandemic, CIT staff attended several “Lunch & Learn” sessions, including one specifically on SGMA which was led by Sargent Green.
- We continue to look for opportunities to train staff on California water issues

CIT Goal #5

Re-invigorate our relationships with our industry and agency partners.

CIT Goal #5 Progress

- This activity has been severely hampered by the COVID-19 pandemic
- During the 2019 Irrigation Association trade show, Drs Vang and Hillyer actively sought out previous lab clients and distributed updated printed materials promoting the Hydraulics Lab’s testing services.
- CIT staff have written two articles detailing the 40-year history of CIT and used those to promote CIT’s testing, research, entrepreneurship, and education services.
- CIT is using the Irrigation Innovation Consortium (IIC) as a vehicle to engage with startup companies and existing industry partners

CIT Goal #6

Produce results in testing, research and business development that have superior value to agriculture and the water industry.

CIT Goal #6 Progress

- CIT continues to support a robust research program, as evidenced by the publications list and summary of grants and contracts.
- Despite the four-month shutdown (described in the Challenges section) and the COVID-19 restrictions, the Hydraulics Lab continues to offer testing services. The chart shown in Figure 1 shows the Completed, Pending, and In-queue activity in the Hydraulics Lab this fiscal year.

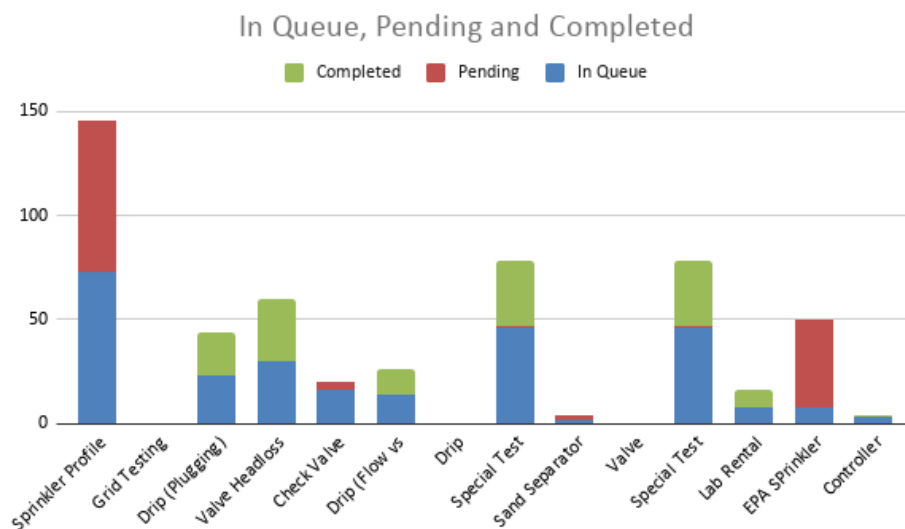


Figure 1: Summary of testing activity in the CIT laboratories

WET Goal #1

Conduct sustainability and strategic planning with the goal to develop a three-year strategic plan focusing on the sustainability of the WET Center going forward. The plan will identify which programs and services are valued and will draw support and resources from stakeholders and funders; the staffing and facilities needed to offer quality services and programs; the required funding; and the funding strategy to reach those goals. The plan will focus on developing sustainable programs for the future.

WET Goal #1 Progress

- In January 2020, the WET Center team participated in a facilitated strategic retreat with the goal of initiating the development of a strategic plan. The plan includes planning around programs, funding, sustainability, processes and team, as well as solidifying the WET's mission and vision.

- The WET team is utilizing an online platform to track progress on the strategic goals set forward in the plan. In addition, bi-monthly meetings with the facilitator are planned to keep the momentum and focus on the planning.

WET Goal #2

Work with the CIT Director and Advisory Committee with the goal of providing advice and guidance in regards to current and future programming, fundraising, connections to industry and other subjects relevant to the growth of the WET Center resources and services.

WET Goal #2 Progress

- The CIT Advisory Committee is under formation. When in place, the WET will work closely with the committee to meet deliverables under WET Goal #2.
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WET Goal #3

Positioning the BlueTechValley Innovation Cluster for potential refunding from the California Energy Commission in 2021. Encouraged by the funding agency, the WET Center will strategically disseminate success stories and promote results and impact to support refunding.

WET Goal #3 Progress

- The California Energy Commission is awaiting a decision from the California Public Utilities Commission that would allow for renewing the four Energy Clusters' contracts for another five years. WET staff stays in close contact with the California Energy Commission to ensure that the WET is meeting its current obligations and is well positioned to be refunded.
- The CEC developed a bi-annual cumulative reporting tool that went into use in June 2018. The WET staff conducts phone calls to gather data from ventures receiving services. The data includes funding amounts and sources, jobs created, and increases in sales revenue and is shared with funding agencies to show impact and results.
- The WET's communication team is continuously promoting success stories and results in the monthly newsletter, social media platforms and press releases.

WET Goal #4

Re-organize the training program and train all staff on the basic facts about water in California, and water and allied resources management for multiple uses, our core mission, career pathways and the value training has to advancement

WET Goal #4 Progress

With the focus on strategic planning on the organizational level, no significant progress has been made on WET Goal #4.

WET Goal #5

Develop intern and educational opportunities for Fresno State students. The WET Center will continue to deploy interns to help with day-to-day tasks, programing, and special assignments. In

addition, the WET Center will facilitate connections between students and startup companies to expose students to relevant work experience and potential future employment.

WET Goal #5 Progress

- In FY19/20 the WET has employed 12 students to help with programmatic and day-to-day tasks. Most of the students have been employed for several semesters.
- The BTV Innovation Cluster also employs 46 students to facilitate the work at the Cluster Hubs.
- The WET facilitates connections between students and startups with the goal of future employment. Three students have received and accepted employment offers from startups upon their graduation. In addition, several alumni of Fresno State are employed by WET-affiliated ventures.

WET Goal #6

Launch Central Valley Regional Innovation Investment Fund (working title for Economic Development Agency funded Seed Fund). The WET Center team will cultivate, train and organize new and exciting investors to inject seed capital for emerging startups developing innovative new products and services at the nexus of the water–energy–food sector.

WET Goal #6 Progress

- The launch of the Central Valley Regional Innovation Investment Fund is a project funded by the Economic Development Agency. The WET team has conducted extensive research and analytic work to evaluate the efficacy and probability of success for the fund. One of the main issues remaining is the legal set-up of the fund as the WET is part of the Fresno State Foundation.
- In order to meet the deliverables of the grant, the WET has developed a program to work directly and targeted with a limited number of ventures with the goal of making them investment-ready and hereby increase their chances of receiving investments.

WET Goal #7

Continue to build awareness of the WET Center brand, including BlueTechValley and Valley Ventures. The brand awareness will allow the WET Center to increase industry connections, partnerships, and engagement, as well as increase the number of ventures and entrepreneurs entering into the programs via the Technology Innovation Evaluation (TIE).

WET Goal #7 Progress

Rebranding the WET Center is one of the strategic goals for 2019-2020. The communication team developed a re-branding proposal that was adopted and will change the WET's brand statement, image and differentiation. The re-branding includes changes to the website as well as setting up social media platforms and more. Prior to COVID 19, the WET has strategically been attending events and other in-person activities to engage with stakeholders such as industry, entrepreneurs and governmental agencies.

WET Goal #8

Collaborate more broadly with JCAST's institutes, faculty and students to promote Fresno State as a leader in AgTech development and application.

WET Goal #8 Progress

- The WET is committed to strengthen its relationship and collaboration with JCAST's institutes, faculty and students. In spring of 2020, WET was included in a proposal submitted by the Institute for Food and Agriculture (IFA).
- The WET hosts and facilitates tours for students and faculty and provides employment for JCAST students.
- WET staff was deeply involved in planning the tour of Fresno State's ag-related activities, which was a pre-event activity of the 2019 California Economic Summit program held in November. Guests visited the WET Center with the BlueTechValley programs featured.

PUBLICATIONS AND PRESENTATIONS

PUBLICATIONS

Student Accomplishments: On the below list of publications, Fresno State students are indicated with *Undergraduate Student ** Graduate student

Center for Irrigation Technology	<ul style="list-style-type: none"> • Hillyer, C., Norum, K. 2020. CIT celebrates 40 years. <i>Irrigation Today</i>, Summer 2020. • Hillyer, C., Zoldoske, D., 2020. CIT reflects on 40 years of transformation. <i>Irrigation Today</i>, Winter 2020. • Golubovic, N., C. Krintz, R. Wolski, B. Sethuramasamyraja and B. Liu. 2019. A scalable system for executing and scoring K-Means clustering techniques and its impact on applications in agriculture. <i>International Journal of Big Data Intelligence</i> Vol 6. Nos. 3 / 4, (2019) 163 – 175. • Yeasmin, D., J. T. Bushoven., A. Mucciardi., D. Chellemi. A. Vizcarra., and T. Xiong (2020). Ground Penetrating Radar (GPR) Application in Agriculture for Long-Term Non-Destructive Monitoring of Root Growth. Poster Presentation for American Society of Horticultural Science (ASHS) 2020 Conference, Orlando, Florida August 09, 2020 – August 13’ 2020. Abstract submitted. • Benes, S. and Putnam, D.H. (2019). Alfalfa may be more salt tolerant than we thought. <i>Hay and Forage Grower</i>. August/September 2019 issue. W.D. Hoard and Sons Company, Fort Atkinson, Wisconsin. • M. Khezri, Heerema R, Brar G and Feguson L. 2020. Alternate bearing in pistachio (<i>Pistacia vera</i>): a review. <i>Trees</i> 34, 855–868 (2020) Accepted • H. Singh, M. Khezri, S. Benes, J. Bushoven and G. Brar. (2020) Different photoperiod regimes with LED Lighting influence growth of container grown budded and non-budded citrus nursery trees. Accepted for publication in <i>Acta Horticulturae</i>. • Angeles, J., Hembree, K. J., Goorahoo, D., and Shrestha, A. 2020. Response of tomato transplants to varying soil residual levels of preplant herbicides. <i>Journal of Crop Improvement</i>, 1-18. • Goorahoo, D. 2020. How well do you know your soil? <i>Irrigation Today</i>, Winter 2020 Issue, pgs 26-27 • Goorahoo, D., and F Cassel S. 2019. Benefits of injecting air into the root zone. <i>Irrigazette</i>, #174- Sep.-Oct 2019, pgs 55-57. • Mahal, N., D. Goorahoo, B. Roberts, and F. Cassel S. 2020. Effect of Nutrisphere-N inhibitor on nitrous oxide emissions from cotton crop production in California. Submitted to <i>Agriculture</i>. • YellaReddy, S.K.R, D. Goorahoo, F. Cassel S., J. Bushoven and P. Yadav. 2020. Yield and nitrate leaching responses of vegetables to conventional and slow release nitrogen fertilizer applications. Submitted to <i>International Journal of Agricultural Systems (IJAS)</i>.
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- Zambrano, M. C., Yuan, L., Yin, X., and Bañuelos, G. (2020). *Agromining*. In Element case studies: Selenium. A. van der Ent (ed.), Updated: *Farming for Metals*. Springer International Publishing AG 2020. (in Print)
- Bañuelos, G.S., Lin, Z.Q., Liang, D. and X.B. Yin. (Eds). (2019). *Selenium Research for Environment and Human Health: Perspectives, Technologies and Advancements: Proceedings of the 6th International Conference on Selenium in the Environment and Human Health*. CRC Press. Boca Raton, FL. 227p
- Wang, X., Zhu, H., Yan, B., Shutes, B., Banuelos, G.S., Wen, H. (2020). Bioaugmented constructed wetlands for denitrification of saline wastewater: A boost for both microorganisms and plants. *Environmental International*: 138 :105628 DOI: [10.1016/j.envint.2020.105628](https://doi.org/10.1016/j.envint.2020.105628)
- Xu, Q., Song, Y., Lin, Z., Banuelos, G., Zhu, Y., Guo, Y. (2020). The small RNA chaperone Hfq is a critical regulator for bacterial biosynthesis nanoparticles and motility in *Rahnella aquatilis*. *Applied Genetics and Molecular Biotechnology* (pp. 1721-1735).
- Banuelos, G. S., Freeman, J., and Arroyo, I. (2020). Accumulation and speciation of selenium in biofortified vegetables grown under high boron and saline field conditions. *Food Chemistry*. <https://doi.org/10.1016/j.fochx.2019.100073>
- Chen, X., Zhu, H., Yan, B., Shutes, B., Xing, D., Bañuelos, G., Cheng, R. and Wang, X. (2020). Greenhouse gas emissions and wastewater treatment performance by three plant species in subsurface flow constructed wetland mesocosms. *Chemosphere* DOI:[10.1016/j.chemosphere.2019.124795](https://doi.org/10.1016/j.chemosphere.2019.124795)
- Cheng, R., Zhu, H., Bañuelos, G. S., & Centofanti, T. (2019). Feasibility of growing halophyte “agretti” (*Salsola soda*) as an alternative B-tolerant food crop in unproductive B-laden regions. *Plant and Soil*: 1-12.
- Dinh, Q. T., Wang, M., Tran, T. A. T., Zhou, F., Wang, D., Zhai, H., Peng, Q., Xue, M., Du, Z., Bañuelos, G. S., Lin, Z. Q., and Liang, D. (2019). Bioavailability of selenium in soil-plant system and a regulatory approach. *Critical Reviews in Environmental Science and Technology*: 1-75.
- Yu, X., Zhu, H., Yan, B., Xu, Y., Bañuelos, G., Shutes, B., Wen, H., and Cheng, R. (2019). Removal of chlorpyrifos and its hydrolytic metabolite 3, 5, 6-trichloro-2-pyridinol in constructed wetland mesocosms under soda saline-alkaline conditions: Effectiveness and influencing factors. *Journal of Hazardous Materials* 373:67-74.
- Chen, X., Zhu, H., Shutes, B., Cheng, X., Wu, H., and Bañuelos, G.S. (2019). Influence of salt stress on propagation, growth, and nutrient uptake of typical aquatic plant species. *Aquatic Botany* doi.org/10.1111/njb.02411

	<ul style="list-style-type: none"> • Zhou, F., Dinh, Q. T., Yang, W., Wang, M., Xue, M., Bañuelos, G. S., & Liang, D. (2019). Assessment of speciation and in vitro bioaccessibility of selenium in Se-enriched <i>Pleurotus ostreatus</i> and potential health risks. <i>Ecotoxicology and Environmental Safety</i> 185:109675. • Zhang, L., Bañuelos, G.S., Wallis, C., Beede, R.H. & Ferguson, L. (2019). Dust interferes with pollen-stigma interaction and fruit set in Pistachio. <i>HortScience</i>. 14 doi.org/10.21273/HORTSCI14330-19. • Wang, M., Ali, F., Wang, M., Toan D.Q., Zhou, F. Bañuelos, G.S. & Liang D. (2019). Understanding boosting Se accumulation in wheat following foliar Se application at different stages, forms, and doses. <i>Environmental Pollution Research International</i> doi:10.1007/s11356-019-06914-0. 27:717-728 • Ellis, M.L., Diaz, J.*, Hutmacher, R.B., and Ulloa, M. 2019. Evaluation of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> race 4 as a seedling pathogen and in co-inoculation assays with <i>Rhizoctonia solani</i>. Pages 349-353 in: <i>Proceedings of the Beltwide Cotton Conference</i>. National Cotton Council of America, New Orleans, LA. • Ellis, M.L., Diaz, J.*, Hutmacher, R.B., and Ulloa, M. 2019. The past and current impact of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> race 4 on cotton production in California. Pages 717-717 in: <i>Proceedings of the Beltwide Cotton Conference</i>. National Cotton Council of America, New Orleans, LA. • Ellis, M.L., Diaz, J.*, Garcia, J.*, Lara, C.*, Hutmacher, R.B., Ulloa, M., and Nichols, R.L. 2020. Genotypic evaluation of current field populations of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> isolates from California. <i>Proceedings of the Beltwide Cotton Conference</i>. National Cotton Council of America, Austin, LTX. • Ulloa, M., Hutmacher, R.B., Ellis, M.L., and Nichols, R.L. 2019. Diagnosis of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> race 4 symptoms in Pima and Upland cotton cultivars. Page 714 in: <i>Proceedings of the Beltwide Cotton Conference</i>. National Cotton Council of America, New Orleans, LA. • Ulloa, M., Hutmacher, R.B., Frigulti, T.L.*, Ellis, M.L., Nichols, R.L., Saha, S., Stelly, D.M., Roberts, P.A. 2019. Experiences in breeding for FOV4 resistance/tolerance in Upland and molecular breeding opportunities. Page 215 in: <i>Proceedings of the Beltwide Cotton Conference</i>. National Cotton Council of America, New Orleans, LA. • Reddy, N., and D. Goorahoo. 20xx. Assessing Nitrogen Rates for Organic Vegetables Subjected to AirJection® Irrigation. To be re-submitted to <i>Organic Agriculture</i>. • Cassel S., F., T. Thao, D. Goorahoo, and J. Ayars. 20xx. Crop water requirements and crop coefficients for processing tomatoes grown under subsurface drip irrigation in the Central Valley of California. In
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	<p>preparation for submission to <i>Irrigation Science</i>.</p> <ul style="list-style-type: none"> • Goorahoo D., F. Cassel S., T. Thao, and A. Garcia. 20xx. Spatial and temporal variability in salinity levels for a tomato field subjected to Airjection® Irrigation. In preparation for submission to <i>Journal of Advanced Research</i>. • Thao T., L. Reyes Solorio, T. Frnzyan, D. Goorahoo, F. Cassel S., and J. Robles. 20xx. Nitrogen uptake and yield response of lettuce subjected to two irrigation regimes and four organic fertilizers. In preparation for submission to <i>Organic Agriculture</i>.
<p>Water, Energy and Technology Center</p>	<ul style="list-style-type: none"> • Norum, K.N., H. Petersen. 2020. Central Valley Energy Innovation Cluster-BlueTechValley: Year Four Annual Report. Consultant Report submitted to the California Energy Commission CEC). May 31, 2020. • BlueTechValley Innovation Cluster Monthly Newsletter. 2019. Water, Energy and Technology Center. July 2019. • BlueTechValley Innovation Cluster Monthly Newsletter. 2019. Water, Energy and Technology Center. August 2019. • BlueTechValley Innovation Cluster Monthly Newsletter. 2019. Water, Energy and Technology Center. September 2019. • BlueTechValley Innovation Cluster Monthly Newsletter. 2019. Water, Energy and Technology Center. October 2019. • BlueTechValley Innovation Cluster Monthly Newsletter. 2019. Water, Energy and Technology Center. November-December 2019. • BlueTechValley Innovation Cluster Monthly Newsletter. 2020. Water, Energy and Technology Center. January 2020. • BlueTechValley Innovation Cluster Monthly Newsletter. 2020. Water, Energy and Technology Center. February 2020. • BlueTechValley Innovation Cluster Monthly Newsletter. 2020. Water, Energy and Technology Center. March 2020. • BlueTechValley Innovation Cluster Monthly Newsletter. 2020. Water, Energy and Technology Center. April 2020. • Water, Energy and Technology Center Monthly Newsletter (BlueTechValley Innovation Cluster). 2020. Water, Energy and Technology Center. May 2020. • Water, Energy and Technology Center Monthly Newsletter (BlueTechValley Innovation Cluster). 2020. Water, Energy and Technology Center. June 2020.

PRESENTATIONS

Student Accomplishments: On the below list of presentations, Fresno State students are indicated with *Undergraduate Student ** Graduate student § Medal/award winner

Center for Irrigation Technology	<ul style="list-style-type: none"> • Adhikari, D., Berger, A. Berne, D. Ferreyra, R. A. Hillyer, C. Mecham, B., and Smith, S. 2020. Recipes for Reality in Irrigation Data Exchange: Enabling Implementation of the S-632 (PAIL) Standard. ASABE 2020 Annual International Conference (virtual). • Hillyer, C. 2020. The Irrigation Innovation Consortium Overview. ASABE 2020 Annual International Conference (virtual). • Hillyer, C. 2019. Irrigation: Where Production Meets Conservation: How the irrigation industry is driving the future through efficient technologies. Invited lecture at Jiangsu University, Zhenjiang, China. • Hillyer, C. 2019. What is NGO's Role in Irrigation Industry Governance and Administration? 2019 China International Irrigation Summit. Qingdao, China. • Hillyer, C. 2019. Precision Ag Irrigation Language, ASABE S632, and US objections to ISO 21622. ISO TC23/SC18 2019 Plenary, Hangzhou, China. • Black A*§, A. Garcia*, J. Robles, F. Cassel S. and D. Goorahoo. 2020. Evaluating Nitrate Leaching Potential for Broccoli Grown in a Sandy Loam Soil. JCAST Honors Program 5th Cohort Presentations. California State University, Fresno. May 4th 2020. (§Medal Recipient). • Brar R K.* §, T. Frnzyan*, L. Reyes-Solorio*, F. Cassel S., T. Jacobson, C. Muraka*, K. Steinhauer, J. Robles, A. Venegas*, D. Goorahoo, A. Mele*, and A. Garcia*. 2019. Comparing yield and water use efficiency of drip and deficit drip irrigated sorghum (Sorghum bicolor) and corn (Zea mays) subjected to varying nitrogen fertilizer rates. FREP conference, Fresno, CA. Oct 2019. (§Received 2nd place award for graduate student poster presentation) • Brar R K.* §, T. Frnzyan*, L. Reyes-Solorio*, F. Cassel S., T. Jacobson, C. L. Muraka*, K. Steinhauer*, J. Robles, A. Venegas*, D. Goorahoo, A. Mele*, A. Garcia*. 2020. Comparing yield, nutritional quality, water and nitrogen use efficiencies of deficit drip and flood irrigated sorghum (Sorghum bicolor) and corn (Zea mays) subjected to different nitrogen rates. Accepted for oral presentation at the 2020 International Nitrogen Initiative (INI2020) Conference scheduled for May 4th -7th 2020 in Berlin, Germany. †Conference postponed to 2021 due the COVID 19 Pandemic restrictions. • Brar R. K.* §, V. Saldena*§, L. Reyes-Solorio*, C. Muraka*, T. Frnzyan*, F. Cassel S., T. Jacobson, K. Steinhauer*, J. Robles, A. Venegas*, D. Goorahoo, and A. Garcia*. 2019. Evaluating water use efficiency of corn and sorghum irrigated under drip and flood irrigation in a sandy loam soil. IA conference, Las Vegas, NV. Dec. 4- 7th 2019.
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	<p>(§Received 2nd place award for undergraduate student poster presentation)</p> <ul style="list-style-type: none"> • Brar R.K.* , T. Frnzyan* , L. Reyes-Solorio* , F. Cassel S., T. Jacobson, C. Muraka* , K. Steinhauer* , J. Robles, A. Venegas* , D. Goorahoo, A. Mele* , and A. Garcia* . 2019. Comparing yield and water use efficiency of drip and deficit drip irrigated sorghum (<i>Sorghum bicolor</i>) and corn (<i>Zea mays</i>) subjected to varying nitrogen fertilizer rates. Third ARI PI meeting, Sacramento, CA. Oct. 25th 2019. • Brar R.K.*§ , T. Frnzyan* , L. Reyes-Solorio* , C. Muraka* , K. Steinhauer* , J. Robles, A. Venegas* , A. Garcia* , T. Jacobsen, D. Goorahoo, and F. Cassel S. 2020. Response of furrow, drip, and deficit drip-irrigated sorghum (<i>Sorghum bicolor</i>) to varying nitrogen rates, in comparison with corn (<i>Zea mays</i>). Annual meetings, California Chapter of the Am. Soc. of Agronomy, Fresno, CA (Feb 4-5). (§Received 2nd place award for graduate student poster presentation). • Cassel S. F., J. Samano-Monroy* and D, Goorahoo. 2020. Nitrate Leaching Potential for Drip Irrigated Cauliflower (<i>Brassica oleracea</i> var. <i>Botrytis</i>) Grown on a Sandy Loam Soil. Accepted for poster presentation at the 2020 International Nitrogen Initiative (INI2020) Conference scheduled for May 4th -7th 2020 in Berlin, Germany. †Conference postponed to 2021 due the COVID 19 Pandemic restrictions. • Cassel S. F., S. Ashkan, T. Thao* , T. Wang, F. Melton, A. Mele* , A. Garcia* , D. Goorahoo, J. Robles, R. Hutmacher, and L. Johnson. 2019. Developing crop coefficient (Kc) for sub-surface drip irrigated onions (<i>Allium cepa</i>) using weighing lysimeter and fractional ground cover (Fc). Third ARI PI meeting, Sacramento, CA. Oct. 25th 2019. • Cassel S., F., O. Flores* , J. Cardona* , L. Reyes Solorio* , T. Frnzyan* , P. Yadav, J. Robles, and D. Goorahoo. 2019. Soil sensor and climate based technology to improve irrigation efficiency in vegetables. IA conference, Las Vegas, NV. Dec. 4- 7th 2019 • Diaz, J.* , Hutmacher, R.B., and Ellis, M.L. 2019. Study of potential interactions between two cotton pathogens, <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> and <i>Rhizoctonia solani</i>. California Plant and Soil Conference. Fresno, CA, USA. February 5-6, 2019. • Diaz, J.* , Hutmacher, R.B., Ulloa, M., and Ellis, M.L. 2019. Phenotypic and genotypic characterization of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> isolates as seedling and wilt disease pathogens of cotton. California Plant and Soil Conference. Fresno, CA, USA. February 5-6, 2019. • Ellis, M.L., Diaz, J.* , Hutmacher, R.B., and Ulloa, M. 2019. Disease development in cotton when co-inoculated with the soil borne fungi <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> race 4 and <i>Rhizoctonia solani</i>. Plant Health. Cleveland, OH. August 4-5, 2019.
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	<ul style="list-style-type: none"> • Ellis, M.L., Diaz, J.*, Hutmacher, R.B., and Ulloa, M. 2019. Genotypic and phenotypic evaluation of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> race 4 isolates collected from cotton in California. Plant Health. Cleveland, OH. August 4-5, 2019. • Garcia A.*, N. Toribio*, A. Solorio*, J. Robles, B. Sethuramasamyraja, F. Cassel S., and D. Goorahoo. 2020. Fertigation strategy for optimizing water and nitrogen use efficiency in processing tomatoes grown on a sandy loam soil. Annual meetings, California Chapter of the Am. Soc. of Agronomy, Fresno, CA (Feb 4-5). • Garcia, A. *, N. Toribio*, A. Solorio*, J. Robles, B. Sethuramasamyraja, D. Goorahoo, and F. Cassel S. 2019. Assessing fertigation strategies for nitrogen use efficiency (NUE) and soil nitrate levels in processing tomatoes. IA conference, Las Vegas, NV. Dec. 4-7th 2019. • Garcia, A.*, B. Sethuramasamyraja, D. Goorahoo, and F. Cassel S. 2019. Soil monitoring and fertigation strategies for mitigating nitrate leaching in tomato production. 33rd West Indies Agricultural Economic Conference Caribbean Agro-Economic Society, Tobago (Aug 4-9). • Garcia, J.*, Lara, C.*, Diaz, J.*, Hutmacher, R.B., Ulloa, M., Nichols, R.L., and Ellis, M.L. 2020. Genotypic characterization of <i>Fusarium oxysporum</i> f. sp. <i>vasinfectum</i> isolates from current field populations in California. California Plant and Soil Conference. Fresno, CA, USA. February 4-5, 2020. • Goorahoo D., F. Cassel S., C.L Muraka*, A. Unc, and G. Seepersad. 2020. Optimizing Water and Nitrogen Use Efficiency (WUE & NUE) with Airjection® Irrigation. Accepted for oral presentation at the 2020 International Nitrogen Initiative (INI2020) Conference scheduled for May 4th -7th 2020 in Berlin, Germany. †Conference postponed to 2021 due the COVID 19 Pandemic restrictions. • Goorahoo, D., F. Cassel S., and G. Seepersad. 2019. Economic and environmental benefits of Airjection® irrigation. 33rd West Indies Agricultural Economic Conference Caribbean Agro-Economic Society, Tobago (Aug 4-9). • Goorahoo, D., F. Cassel S., P. Yadav, T. Thao*, A. Mele*, A. Garcia*, J. Robles, L. Reyes-Solorio*, and T. Frnzyan*. 2019. Evapotranspiration and soil sensor-based technology to improve irrigation and water use efficiency in vegetables. Third ARI PI meeting, Sacramento, CA. • Muraka C. *, T. Frnzyan*, L. Reyes-Solorio*, A. Venegas*, A. Mele, K. Steinhauer*, A. Garcia*, L. Dejean, F. Cassel S., and D. Goorahoo. 2019. Quantifying the oxidative stress in tomatoes subjected to Airjection® irrigation. Third ARI PI meeting, Sacramento, CA. Oct. 25th 2019. • Reyes-Solorio, L.*, T. Frnzyan*, A. Garcia*, N. Toribio*, A. Solorio*,
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	<p>C. Muraka*, J. Robles, B. Sethuramasamyraja, F. Cassel S., and D. Goorahoo. 2020. Evaluating the effects of various irrigation and nitrogen application methods on the yield and quality of processing tomatoes. Annual meetings, California Chapter of the Am. Soc. of Agronomy, Fresno, CA (Feb 4-5).</p> <ul style="list-style-type: none"> • Reyes-Solorio, L.*, T. Frnzyan*, A. Mele*, F. Cassel S., D. Goorahoo, C. Cochran*, and J. Robles. 2019. Nitrogen use efficiency and water use efficiency of automated drip irrigated tomatoes subjected to four fertilizer rates. IA conference, Las Vegas, NV. Dec. 4- 7th 2019. • Robles J., A. Mele*, D. Goorahoo, F. Cassel S., P. Yadav, T. Thao*, C. Cochran*, A. Garcia*, L. Reyes-Solorio*, and T. Frnzyan*. 2019. Nitrogen use efficiency and water use efficiency of broccoli irrigated with evapotranspiration- and soil sensor- based scheduling technology. Third ARI PI meeting, Sacramento, CA. Oct. 25th 2019. • Robles, J., C. Cochran*, F. Cassel S., and D. Goorahoo. 2019. Optimizing nitrogen and water use Efficiency in lettuce production. 33rd West Indies Agricultural Economic Conference Caribbean Agro-Economic Society, Tobago (Aug 4-9). • Sharon E. Benes*, DH Putnam, Singh Simarjeet, Galdi Giuliano, Anderson Aaron, and RB Hutmacher (2019) Field Trials Evaluating Salinity Tolerance in Alfalfa (Medicago Sativa L.): how to deal with spatial variability in the salinity imposed? Agricultural Research Institute Annual PI Meetings, Oct. 25, 2019, Hyatt Regency, Sacramento, CA. • Singh Simarjeet*, SE Benes, DH Putnam, RB Hutmacher, and F Cassel (2019) Response of Alfalfa Cultivars to Saline, Subsurface Drip Irrigation: Uniformity of salinity Imposed & spatial analysis between drip lines and amongst variety plots. 2019 ASA-CSSA-SSSA International Annual Meetings, Nov. 9-13, 2019, San Antonio, TX. • Singh Simarjeet*, SE Benes, DH Putnam, RB Hutmacher, and F Cassel (2019) Response of Alfalfa Cultivars to Saline, Subsurface Drip Irrigation: Uniformity of salinity Imposed & spatial analysis between drip lines and amongst variety plots. 2019 Western Alfalfa & Forage Symposium, Nov. 19-21, Grand Sierra Resort, Reno, NV. • Singh Simarjeet*, SE Benes, DH Putnam, RB Hutmacher, Isaya Kisekka and F Cassel (2019) Response of Alfalfa Cultivars to Saline, Subsurface Drip Irrigation: Uniformity of salinity Imposed & spatial analysis between drip lines and amongst variety plots. California Plant & Soil Conference, Feb 4-5, 2020, DoubleTree Hiton, Fresno, CA. • Steinhauer K. *, J. Robles, D. Goorahoo, F. Cassel S., P. Yadav, A. Garcia*, L. Reyes-Solorio*, T. Frnzyan*. 2019. Automated irrigation using weather and sensor data for optimizing broccoli production. IA conference, Las Vegas, NV. Dec. 4- 7th 2019. • Syverson, D*., Khezri, M., Bushoven, J., Ferguson, L., Brar, G. (2019)
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	<p>Efficacy trials of dormancy breaking treatments in pistachio. CA Plant and Soil Meeting, American Society of Agronomy, Fresno, CA.</p> <ul style="list-style-type: none"> • Syverson, D*., Khezri, M., Ferguson, L., Brar, G. (2019) Late Dormancy Application of Ethephon and GA3 Affect Bud Respiration and Bloom Uniformity in Pistachios. ASHS Annual Meetings, Las Vegas, NV • To, M.*., Westphal, A., Wenger, J.A., and Ellis, M.L. 2020 Development of a DNA extraction method from epidemiologically meaningful amounts of soil for quantification of nematodes using quantitative PCR. California Plant and Soil Conference. Fresno, CA, USA. February 4-5, 2020. (§Received 1st place award for graduate student poster presentation) • Vizcarra, A*., Yeasmin, D., Bushoven, J.T. and C. Krauter (2020) The Hidden Half - Use of Ground Penetrating Radar in Assessing Tree Root Architecture, CA Plant and Soil Meeting, American Society of Agronomy, Fresno, CA • Woods, T., and G. Brar (2019) Interaction of the Plant Growth Regulator, AVG, with Varying Nitrogen Application Rates in Relation to Yield and Quality in Almonds. ASHS Annual Meetings, Las Vegas, NV • Jiang. Yue, H. Li, D. Zhang and B. Sethuramasamyraja. 2019. Experimental and Numerical Investigations of Breakup Characteristics of Low-pressure Jet with Different Nozzle Parameters. Poster Presentation. St. Joseph, Michigan: ASABE. • Devasurendra S., B. Liu, R. Wolski, C. Krintz and B. Sethuramasamyraja. 2019. Future of Smart Farming with Internet of Things (IoT) and Data Analytics for Irrigation Management. Poster Presentation. St. Joseph, Michigan: ASABE. <ol style="list-style-type: none"> 1. Bañuelos, G. S. 2019. Alternative crops with poor quality waters. UC Davis Extension, Sacramento, California 2. Bañuelos, G. S. 2019. Selenium accumulation in alternative crops. International Selenium Conference, Xi'an, China 3. Bañuelos, G. S. 2020. Use of saline waters in pistachios. Pistachio Conference, Fresno, California 4. Bañuelos, G. S. 2020. Using poor quality waters in pistachio production. Panoche Drainage District, Firebaugh, California CA 5. Bañuelos, G. S. 2020. Biochemistry responses in pistachios irrigated with saline waters. USDA-ARS, Parlier, California <ul style="list-style-type: none"> • Green, S. J. 2019. Panel member presentation on the Sustainable Groundwater Management Act (SGMA) technology opportunities. Madera County Farm Bureau. July 9, 2019.
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	<ul style="list-style-type: none"> • Green, S. J. 2019. Presentation to Republic of Georgia Agriculture delegation on California water system and issues. Fresno State. August 1, 2019. • Green, S. J. 2019. Presentation to California Board of Food and Agriculture on the Sustainable Groundwater Management Act and technologies for agriculture to meet goals. September 5, 2019. • Green, S. J. 2019. CDFG Sacramento staff visit to Fresno State, presentation on CIT and programs. September 11, 2019. • Green, S. J. 2019. Meeting and tour with multiple water district managers from Salado River Basin Authority, Argentina. September 19, 2019. • Green, S. J. 2019. San Joaquin Valley Resource Conservation Districts annual meeting,. Presentation on the Sustainable Groundwater Management Act. October 11, 2019. • Green, S. J. 2019. Presentation on water uncertainty for Soil and Water lower division course. Dr. Sharma. November 19, 2019. • Green, S. J. 2019. Helena Chemical Annual Training Conference. Presentation on the Sustainable Groundwater Management Act. December 5, 2019. • Green, S. J. 2019. Presentation on water uncertainty in California for Soil and Water lower division course. Dr. Sharma. November 19, 2019. • Green, S. J. 2020. Presentation on water uncertainty in California for EES 266. Dr. Benes. February 5, 2020. • Green, S. J. 2020. Presentation on California water for the State of Maryland Ag Leaders Group. February 10, 2020. • Green, S. J. 2020. Presentation on California water uncertainty for the US Department of Commerce, International Group. February 14, 2020. • Green, S. J. 2020. Video call with Calaveras Grape Grower Alliance covering irrigation management, soil health and groundwater management. April 3, 2020. • Yeasmin, D., Bushoven, J., Mucciardi, A., Chellemi, D., Vizcarra, A., and Xiong, T. (2020). A Novel Approach for Long-Term Non-Destructive Monitoring of Root Growth by Ground Penetrating Radar (GPR) in Agriculture. ASA section: Agronomic Production System poster presentation for ASA, CSA, SSSA annual meeting. November 8 – 11, Phoenix, Arizona. Abstract submitted. • Vizcarra, A., Yeasmin, D., Bushoven J. T. and Krauter, C. (2020). The “Hidden Half” - Use of Ground Penetrating Radar in Assessing Tree Root Morphology. Poster presented at 2020 California Plant and Soil Conference. American Society of Agronomy California Chapter. • Yeasmin, D., Pasha, M.F.K., Singh, Dayadeepak and Xiong, T. (2019). Smart Data Utilization in the Ag Field: A Compare and Contrast
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	<p>Analysis. Poster presented at the Agricultural Research Institute Principal Investigator Meeting at Sacramento CA. October 25, 2019.</p> <ul style="list-style-type: none"> • Vizcarra, A., Yeasmin, D., Bushoven, J., Krauter, C., and Mucciardi, A. (2019). Mapping and Evaluation of Permanent Crop Root Systems by Ground Penetrating Radar. Poster presented at the Agricultural Research Institute Principal Investigator Meeting at Sacramento CA. October 25, 2019. • Pasha, M. F. K., Srinivasamurthy, N., Singh, D., Yeasmin, D., and Valenzuela, G. (2020). “An Artificial Intelligence Model to Predict Crop Water Requirement Using Weather, Soil Moisture, and Plant Health Monitoring Data.” World Water and Environmental Resources Congress, ASCE, May 17-21, 2020, Henderson, NV. • Pasha, M. F. K., Srinivasamurthy, N., Yeasmin, D., and Valenzuela, G. (2020). “Numerical Techniques to Analyze Crop Water Requirement Using Weather and Soil Moisture Data.” World Water and Environmental Resources Congress, ASABE, July 13-15, 2020. • Melton F., D. Goorahoo, T. Wang, F. Cassel-Sharma, M. Cahn, A. Garcia**, L. Johnson, I. Zaragosa, J. Robles, and C. Muraka**. 2019. Quantifying the benefits of on-farm best management practices: managing nitrate leaching using evapotranspiration-based irrigation scheduling. Third ARI PI meeting, Sacramento, CA (Oct 25). • Goorahoo, D., F. Cassel S., P. Yadav, T. Thao**, A. Mele**, A. Garcia**, J. Robles, L. Reyes-Solorio*, and T. Frnzyan*. 2019. Evapotranspiration and soil sensor-based technology to improve irrigation and water use efficiency in vegetables. Third ARI PI meeting, Sacramento, CA (Oct 25).
<p>Water, Energy and Technology Center</p>	<ul style="list-style-type: none"> • Petersen, Helle. 2019. Kern Capital Summit. Presentation on the BlueTechValley Innovation Cluster, CalSEED, and Small Business Innovation Research (SBIR). Bakersfield, CA. August 21, 2019. • Petersen, Helle. 2019. Emerging Technologies Coordinating Council (ETCC) 2019 Summit. Presented and participated in a panel session on incubators and accelerators. Sacramento, CA. October 20-22, 2019. • Petersen, Helle. 2019. Central Valley Clean Tech Showcase. Presentation about the BlueTechValley Innovation Cluster at this BTV and CleanStart hosted event to bring companies and partners in the Central Valley Region together with policymakers, regulators, funders, and investors. Sacramento, CA. October 9, 2019. • Green, Sarge. 2019. American Pistachio Growers. Made a presentation on the Sustainable Groundwater Management Act (SGMA) at the SGMA Tool Kit event. Tulare, California. November 12, 2019. • Green, Sarge. 2019. 13th Annual Kern County Energy Summit. Presentation on the Sustainable Groundwater Management Act (SGMA) as part of the Leadership in a Carbo and Water Managed Future panel. Bakersfield, CA. November 12, 2019.

EVENTS AND ACTIVITIES

In FY19/20, CIT hosted 10 educational events, with a total of 627 participants (592 attendees; 35 live views via webinars), primarily through the Advanced Pumping Efficiency Program (APEP) attracting attendees from the agricultural sector. The attendance for these educational events ranged from 13 to 193 participants. The average event drew approximately 63 attendees. Events were funded either by grants, contracts or attendance fees.

Education and technology transfer are recognized as important roles for both CIT and the WET Center, however the impact of restrictions on in-person events due to COVID-19 have hit CIT especially hard since most of the educational events are hands-on, demonstrations. WET Center events are structured to reach as wide an audience as possible in order to cover the 39 counties of the Central Valley Innovation Cluster-BTV area. Many of the events are (or will be at some point again in the future) available to attend in person (attendees), via webinar (live views), and/or available on demand at <http://bluetechvalley.org/resources/video-library/>.

In FY19/20, the WET Center hosted or co-hosted 57 educational events, with a total of 1,609 attendees, 1095 live views, 1075 on demand for a total of 3779 participants. The attendance for these educational activities ranged from 4 to 374 for in-person events and 2 to 490 for live view event. The average in-person event drew approximately 48 attendees with approximately 28 per live view event. Events were funded either by grants, contracts or attendance fees.

Center for Irrigation Technology

- October 17, 2019. The Latest on Sustainable Groundwater Management Act (SGMA), Irrigated Lands Regulatory Program (ILRP) and Nitrogen Management Plans (NMPs) held at Fresno State to kick off the Food, Family and Farm month. Fresno State- CIT-APEP. 42 attendees
- October 23, 2019. San Jose, CA. Municipal Pump Efficiency and Variable Frequency Drives (VFDs). Fresno State-CIT-APEP-San Jose Municipal Water. 25 attendees
- November 7, 2019. Tulare, CA. Pumps and Variable Frequency Drives (VFDs). Southern California Edison-Pacific Gas and Electric Company Annual Water Conference. Fresno State-CIT-APEP-SCE-PG&E. 90 attendees
- November 8, 2019. Fresno, CA. Pumps and Variable Frequency Drives (VFDs). Fresno State-CIT-APEP. 44 attendees
- November 12, 2019. Madera, CA. Nitrogen Movement in Soils and Advanced Pumping Efficiency Program outreach. Fresno State-CIT-APEP-Madera Farm Bureau. 13 attendees
- November 15, 2019. Fresno, CA. Center for Irrigation Technology Innovations in Agriculture Technology Showcase at Fresno State. Fresno State-CIT-Water, Energy and Technology Center (WET). 193 attendees
- November 21, 2019. Selma, CA. USDA Farm Workshop and Ag Show at Sikh Temple. Advanced Pumping Efficiency Program outreach. APEP-USDA/NRCS. 35 attendees

	<ul style="list-style-type: none"> • February 11, 2020. Tulare, CA. World Ag Expo Pacific Gas and Electric Company Pavilion. Advanced Pumping Efficiency Program outreach. Fresno State-CIT-APEP-PG&E. 150 attendees • May 13, 2020. Fresno, CA. Fresno State PG&E account executives. APEP outreach. Fresno State-CIT-APEP-PG&E. Webinar. 20 live views • June 26, 2020. Fresno, CA. Advanced Pumping Efficiency Program (APEP) Pump Efficiency Testing. CIT-APEP-WET-Valley Ventures. Webinar. 15 live views <p style="margin-left: 40px;"> Number of attendees 592 Number of live views 35 Total number of participants 627 </p>
Water, Energy and Technology Center	<ul style="list-style-type: none"> • July 1, 2019. It's the Law - Mandatory Retirement Savings. Webinar. 15 live views. • July 3, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with GeoVisual Analytics to assess their technological and commercial readiness. • July 10, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with T3DP Enterprises to assess their technological and commercial readiness. • July 16, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with SwirlTex to assess their technological and commercial readiness. • July 17, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Air Battery to assess their technological and commercial readiness. • July 19, 2019. Are You Ready to Comply with the Americans with Disabilities Act (ADA)? Webinar. 5 live views. 20 on demand. • July 19, 2019. Fresno, CA. Conducted Technical Advisory Committee (TAC) Meeting. • July 22, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Minevera Kingdom to assess their technological and commercial readiness. • July 24, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Anything that Makes US to assess their technological and commercial readiness. • August 7, 2019. Financing Your Veteran-Owned Business. Webinar. 22 live views. • August 16, 2019. How to BECOME a Successful Business. Webinar. 3 live views.

	<ul style="list-style-type: none"> • August 16, 2019. Stockton, CA. CEO Crash Course Boot Camp Day One. In-person. 15 attendees. • August 21, 2019. Grant Writing Workshop - Fresno. Webinar. 16 live views. • August 21, 2019. Bakersfield, CA. Kern Capital Summit. Participated in and Peterson presented on the BlueTechValley Innovation Cluster, CalSEED, and Small Business Innovation Research (SBIR). 8 attendees. • August 22, 2019. Bakersfield, CA. Grant Writing Workshop. In-person. 22 attendees. • August 23, 2019. Stockton, CA. CEO Crash Course Boot Camp Day Two. In-person. 15 attendees. • August 28, 2019. Ridgecrest, CA. Winning Money SBIR/STTR Day One. In-person. 12 attendees. • September 3, 2019. Nevada City, CA. Grant Writing Workshop. In-person. 14 attendees. • September 4, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Barracuda Labs to assess their technological and commercial readiness. • September 6, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Wind Harvest to assess their technological and commercial readiness. • September 6, 2019. Stockton, CA. CEO Crash Course Boot Camp. In-person. 15 attendees. • September 9, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with The Salt Miner to assess their technological and commercial readiness. • September 10, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with InSight to assess their technological and commercial readiness. • September 11, 2019. Ridgecrest, CA. Winning Money SBIR/STTR Day Two. In-person. 12 attendees. • September 16, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Zero Mass Water to assess their technological and commercial readiness. • September 18, 2019. Humboldt, CA. Grant Writing Workshop. In-person. 30 attendees. • September 20, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Precision XYZ to assess their technological and commercial readiness. • September 20, 2019. Advertising and Marketing Law. Webinar. 6 live views.
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	<ul style="list-style-type: none"> • September 23, 2019. Tulare, CA. Open Farm. Fourth annual event focused on automation, featuring hands-on demonstrations, peer-reviewed presentations and industry panels. Collaborators were BlueTechValley, Southern California Edison, Powwow Energy, Western Growers, West Hills Community College Coalinga and UC Agriculture and Natural Resources. 100 attendees. • September 23, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 1. In-person. 15 attendees. • September 23, 2019. Fresno, CA. CEO Crash Course Boot Camp Day One. In-person. 4 attendees. • September 24, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 1 - Day Two. In-person. 15 attendees. • September 24, 2019. Fresno, CA. CEO Crash Course Boot Camp Day Two. In-person. 4 attendees. • September 25, 2019. Fresno, CA. CEO Crash Course Boot Camp Day Three. In-person. 4 attendees. • September 26, 2019. Fresno, CA. Hosted a meeting with the California Energy Commission and BlueTechValley and Fresno State to provide an overview, results, and impacts of the BlueTechValley Innovation Cluster, as well as discuss research and development needs for the regions and projects that potentially could be supported by the CEC. • September 27, 2019. Tehachapi, CA. East Kern Capital Summit. Event to present unique funding opportunities for businesses. • September 30, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Brimstone Energy to assess their technological and commercial readiness. • October 7, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 2 - Day One. In-person. 13 attendees. • October 8, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 2 - Day Two. In-person. 15 attendees. • October 9, 2019. Sacramento, CA. Clean Tech Showcase. BlueTechValley and CleanStart hosted this event to bring companies and partners in the Central Valley Region together with policymakers, regulators, funders, and investors. In-person. 150 attendees. • October 18, 2019. Demystifying Contracts: How to Write, Review and Enforce Them. Webinar. 2 live views. 6 on demand. • October 18, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Waterhound Futures to assess their technological and commercial readiness. • October 21, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 3 - Day One. In-person. 13 attendees.
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	<ul style="list-style-type: none"> • October 22, 2019. Fresno, CA. Valley Ventures Accelerator Workshop 3 - Day Two. In-person. 15 attendees. • October 20-22, 2019. Sacramento, CA. Emerging Technologies Coordinating Council (ETCC) 2019 Summit. Petersen attended and participated in a panel session on incubators and accelerators from October 20-22, 2019. • October 22, 2019. Davis, CA. BigBang! Launch. In-person/live stream/on demand event conducted with UC Davis. 374 attendees. 59 live views. 95 on-demand. • October 23, 2019. Clovis, CA. Central Valley Innovations and Entrepreneurship Forum. In-person. 174 attendees. • October 30, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Verifi H2O to assess their technological and commercial readiness. • October 30, 2019. Davis, CA. Starting Something That Matters + Contestant Mixer. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 83 attendees. 19 live views. 49 on demand. • November 6, 2019. Fresno, CA. Conducted the Water, Energy and Technology Center-BlueTechValley portion of the Fresno State tour offered as a pre-event activity of the 2019 California Economic Summit program. • November 7, 2019. Davis, CA. Making the Leap – Moving from Idea to Business. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 90 attendees. 12 live views. 76 on demand. • November 12, 2019. Tulare, CA. Attended and presented on the Sustainable Groundwater Management Act at the American Pistachio Growers SGMA Tool Kit event. • November 12-13. Bakersfield, CA. Cosponsored the annual Kern County Energy Summit and VIP Reception. Sarge Green was one of the speakers and the BlueTechValley used its booth to promote the Innovation Cluster. 150 attendees • November 14, 2019. Davis, CA. Defining the Problem and Solution. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 53 attendees. 36 live views. 52 on demand. • November 15, 2019. The Legal Tailor: Fitting your business for the right entity. Webinar. 3 live views. 6 on demand. • November 18, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Fox Teck to assess their technological and commercial readiness.
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	<ul style="list-style-type: none"> • November 20, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Autonoblox to assess their technological and commercial readiness. • December 4, 2019. Sacramento, CA. Connex Investor Night. In collaboration with CleanStart and the New Energy Nexus, the networking event provided a platform to hear what startups are doing and introducing them to a broad range of potential investors, supporters, and peers. • December 4, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Plastic 2 Life to assess their technological and commercial readiness. • December 5, 2019. Davis, CA. Write to Win – Developing Your Executive Summary. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 42 attendees. 11 live views. 37 on demand. • December 11, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with WinWerks to assess their technological and commercial readiness. • December 13, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Blowlight to assess their technological and commercial readiness. • December 18, 2019. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with APD Clean Water Technologies Group LLC to assess their technological and commercial readiness. • January 15, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Musole to assess their technological and commercial readiness. • January 16, 2020. Davis, CA. Define and Validate Your Business Model. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 19 attendees. 13 live views. 23 on demand. • January 27-28, 2020. Sacramento, CA. California Irrigation Institute (CII) Symposium. BlueTechValley had a booth at the event, and participants were introduced to the services and success stories of BlueTechValley. • February 4, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with TeloFarm to assess their technological and commercial readiness. • February 6, 2020. Davis, CA. Define Your Customer and the Market + Customer Calls. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 23 attendees. 2 live views. 44 on demand.
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	<ul style="list-style-type: none"> • February 6, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Verifi H2O to assess their technological and commercial readiness. • February 7, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with ReLocate LLC to assess their technological and commercial readiness. • February 11-13, 2020. Tulare, CA. World Ag Expo. Attended expo for outreach and networking. • February 12, 2020. Tulare, CA. World Ag Expo. On February 12, 2020, BTV conducted pitch competition, where five Valley Ventures alumni ventures pitched their technologies and businesses. • February 25, 2020. Long Beach, CA. Attended California Energy Commission Electric Program Investment Charge (EPIC) Symposium. • February 13, 2020. Davis, CA. Show Me the Money: Seeking Funding + Presenting Financials. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 17 attendees. 10 live views. 45 on demand. • February 18, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with inHouse Produce, Inc. to assess their technological and commercial readiness. • February 20, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Hydroside to assess their technological and commercial readiness. • February 20, 2020. Fresno, CA. CalSEED informational workshop/webinar held at the Center for Irrigation Technology. Direct and personal communication to eligible entrepreneurs and startups about CalSEED. 15 attendees. 19 live views. 23 on demand. • February 24, 2020. Helle Petersen and Jeff Macon were named as Technical Advisory Committee members for the newly launched CalTestBed. • February 27, 2020. Davis, CA. Developing your Startup Slide Deck. In-person/live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 14 attendees. 25 on demand. • March 3, 2020. Chico, CA. Conducted an in-person BlueTechValley informational event and grant writing workshop. Momentum conducted the grant writing workshop. 42 attendees. • March 3, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Off the Wall Energy to assess their technological and commercial readiness. • March 5, 2020. Davis, CA. Pitching like a Pro—Presenting Your Startup Slide Deck + Past BB! Winners Pitch. In-person/live stream/on
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	<p>demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. 25 attendees. 1 live views. 52 on demand.</p> <ul style="list-style-type: none"> • March 16, 2020. Orders are issued for most CIT-WET employees to shelter-in-place due to the COVID-19 pandemic. • March 17, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Solar Frame Solutions, Inc. to assess their technological and commercial readiness. • March 24, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Fungirofoam to assess their technological and commercial readiness. • March 26, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Helios Altas to assess their technological and commercial readiness. • April 9, 2020. Davis, CA. Intellectual Property. Live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. • April 9, 2020. Valley Ventures Founder’s Forum. The inaugural event. The objective of the monthly Zoom forum is to provide a virtual platform where founders exchange experiences and challenges. The first events focused on discussions to help startups survive the challenges in a COVID-19 business world. Virtual. 14 live views. • April 9, 2020. Davis, CA. Intellectual Property. Live stream/on demand event conducted with UC Davis Mike and Renee Child Institute for Innovation and Entrepreneurship. • April 17, 2020. Building a Professional Online Presence and Where to Start with Alexis Ford. WET Webinar Series. Webinar. 20 live views. 14 on demand. • April 24, 2020. Zoom 101. WET Webinar Series with Courtney Meinhold. Webinar. 9 live views. • May 1, 2020. The Business Development Athlete with Scott Peterson. WET Webinar Series. Webinar. 18 live views. 9 on demand. • May 7, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with SEAAMP to assess their technological and commercial readiness. • May 8, 2020. How to Tell a Compelling, Data-Driven Story about Your Business with John Selep. WET Webinar Series. Webinar. 15 live views. 3 on demand. • May 13, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with We Think Global to assess their technological and commercial readiness.
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- May 15, 2020. The Keys to Building Your Pipeline in 90 Days with Dale Bierce of Sandler Training. WET Webinar Series. Webinar. 19 live views. 15 on demand.
- May 20, 2020. Finalists Presentations and Awards Ceremony. Due to COVID-19, no in-person event was held; event was live streamed. 490 live views. 510 on demand.
- May 21, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Biocolumn to assess their technological and commercial readiness.
- May 22, 2020. Failure and Prototyping for Customer Desire Lonny Grafman. WET Webinar Series. Webinar. 12 live views.
- May 26, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with SweetSense to assess their technological and commercial readiness.
- May 28, 2020. Valley Ventures Founder's Forum. Focused discussions to help startups survive the challenges in a COVID-19 business world. Virtual. 14 live views.
- May 29, 2020. Finding the Right Market - Insight into the Entrepreneurial Journey with Chris Peacock. WET Webinar Series. Webinar. 15 live views. 5 on demand.
- June 4, 2020. CEO Crash Course Boot Camp Session One. Virtual. 19 live views.
- June 5, 2020. Plugging In: How Your Startup Can Benefit by Being a part of the California Energy Commission's Innovation Ecosystem with Eric Stokes. WET Webinar Series. Webinar. 20 live views.
- June 8, 2020. CEO Crash Course Boot Camp Session Two. Virtual. 19 live views.
- June 11, 2020. CEO Crash Course Boot Camp Session Three. Virtual. 19 live views.
- June 11, 2020. The BTV Technology Innovation Evaluation (TIE) Committee conducted a meeting with Renewell Energy to assess their technological and commercial readiness.
- June 12, 2020. How to Create Strategic Partnerships That Lead to Growth and Acquisition with Geoff Dillon. WET Webinar Series. Webinar. 17 live views.
- June 15, 2020. CEO Crash Course Boot Camp Session Four. Virtual. 19 live views.
- June 18, 2020. CEO Crash Course Boot Camp Session Five. Virtual. 19 live views.
- June 19, 2020. How To Get Your Venture "Investment Ready" with Winston Alder. WET Webinar Series. Webinar. 9 live views.

<ul style="list-style-type: none"> • June 22, 2020. CEO Crash Course Boot Camp Session Six. Virtual. 19 live views. • June 25, 2020. Valley Ventures Founder’s Forum. The objective of the forum is to develop and continue a virtual open forum where founders exchange experiences and challenges. Virtual. 10 live views. • June 25, 2020. CEO Crash Course Boot Camp Session Seven. Virtual. 19 live views. • June 26, 2020. PG&E's Advanced Pumping Efficiency Program with Bill Green. WET Webinar Series. Webinar. 16 live views. • June 29, 2020. CEO Crash Course Boot Camp Session Eight. Virtual. 19 live views. 								
<table> <tr> <td>Number of attendees</td> <td>1,609</td> </tr> <tr> <td>Number of live views</td> <td>1,095</td> </tr> <tr> <td>Number of on demand</td> <td>1,075</td> </tr> <tr> <td>Total number of participants</td> <td>3,779</td> </tr> </table>	Number of attendees	1,609	Number of live views	1,095	Number of on demand	1,075	Total number of participants	3,779
Number of attendees	1,609							
Number of live views	1,095							
Number of on demand	1,075							
Total number of participants	3,779							

OTHER ACTIVITIES

CIT Additional FY19/20 Highlights

- The Center for Irrigation Technology received \$\$3,061,042 in funding for FY19/20. The funding covers a wide range of new and ongoing activities including conducting third-party testing in three laboratories and ongoing and expanded applied research and field testing.
- CIT continues its efforts to address the agriculture/water/energy nexus through its Advanced Pumping Efficiency Program (APEP). The current funding cycle runs through 2020 with funding expected through 2021.
 Energy used to pump water for irrigation has been a major concern for growers, especially during periods of drought when surface water supplies are not available. From 2002 through 2018, CIT has operated APEP with funding from the CPUC and provided benefits to California water pumpers including 322 educational seminars; 55,000+ subsidized pump efficiency tests; 3,000+ pump retrofit/repair rebates with over \$14,000,000+ for incentive rebates.
- Approximately 46 students are employed through research grants managed by CIT. This provides needed work experience to students as well as financial support. The positions range from office support to research assistants. The undergraduate and graduate students come from a diverse group of majors across the campus. Each year, CIT provides field research experience to graduate and undergraduate students for thesis and/or class project work.
- In FY19/20, graduate student awards included:
 - **Ramandeep Brar** – 2nd place award, student poster competition at the 2020 California Chapter of the American Society of Agronomy, Fresno, CA. Presentation

- titled “Response of furrow, drip, and deficit drip-irrigated sorghum (*Sorghum bicolor*) to varying nitrogen rates, in comparison with corn (*Zea mays*)“. **ARI project conducted at CIT.**
- **Ramandeep Brar** – 2nd place award, student poster competition at the 2019 CDFA Fertilizer Research and Education Program (FREP) and Western Plant Health Association (WPHA) Nutrient Management Conference, Fresno, CA. Presentation titled “Comparing yield and water use efficiency of drip and deficit drip irrigated sorghum (*Sorghum bicolor*) and corn (*Zea mays*) subjected to varying nitrogen fertilizer rates” by Brar R K., T. Frnzyan, L. Reyes-Solorio, F. Cassel S., T. Jacobson, C. Muraka, K. Steinhauer, J. Robles, A. Venegas, D. Goorahoo, A. Mele, and A. Garcia. 019. **ARI project conducted at CIT.**
 - **Ramandeep Brar** – Graduate Student Research Awards, CSU Fresno (Fall 2019 and Spring 2020)
 - **Aldo Garcia** – Received award for graduate student poster presentation at the Irrigation Association Conference, Las Vegas, NV. Presentation titled” Assessing fertigation strategies for nitrogen use efficiency (NUE) and soil nitrate levels in processing tomatoes” by Garcia, A., N. Toribio, A. Solorio, J. Robles, B. Sethuramasamyraja, D. Goorahoo, and F. Cassel S. **ARI project conducted at CIT.**
 - In FY19/20, graduate scholarships included:
 - **Ramandeep Brar** – Irrigation Association E3 scholarship (2019)
 - **Aldo Garcia** – Scholarship recipient, 2020-2021
 - **Jonathon Hubble** – Scholarship recipient, 2020-2021
 - In FY19/20, undergraduate student awards included:
 - **Vladimir Saldena** – Received award for undergraduate student poster presentation at the Irrigation Association conference, Las Vegas, NV. Presentation titled “Evaluating water use efficiency of corn and sorghum irrigated under drip and flood irrigation in a sandy loam soil”, by Brar R., V. Saldena, L. Reyes-Solorio, C. Muraka, T. Frnzyan, F. Cassel S., T. Jacobson, K. Steinhauer, J. Robles, A. Venegas, D. Goorahoo, and A. Garcia.
 - In FY19/20, undergraduate scholarships included:
 - **Aaron Black** – Jordan College of Agricultural Sciences and Technology Honors recipient
 - **Lizbeth Cordova** – Irrigation Association E3 scholarship (2019)
 - **Liliana Reyes Solorio** – California Seed Association (CSA) scholarship (2020)
 - **Anthony Venegas** – Irrigation Association E3 scholarship (2019)

In FY19/20, Dr. Dave Goorahoo was recognized with:

- Provost Excellence in Teaching Award, California State University, Fresno. 2020.
- Outstanding Advisor Award- Campus Advising Network (CAN), California State University, Fresno. 2020.
- Faculty Mentor, Jordan College of Agricultural Science & Technology (JCAST) Honors Program, California State University, Fresno. 2020.

WET Additional FY19/20 Highlights

- The Water, Energy and Technology Center received \$1,521,145 in funding for FY19/20. Additional income includes profit from the annual Central Valley Innovation and Entrepreneurship Forum, as well as program income from the WET Center offices lease agreements and memberships. The WET Center primarily receives funding from grants from the California Energy Commission and the Economic Development Agency. The funding covers a range of ongoing activities including managing the BlueTechValley Innovation Cluster and the Valley Ventures Accelerator, evaluating new products and enterprises and conducting the annual Central Valley Innovation and Entrepreneurship Forum.
- A significant portion of the WET Center effort and resources are dedicated to the two main programs – the BlueTechValley Innovation Cluster and the Valley Ventures Accelerator program. The BlueTechValley Innovation Cluster provides key services, infrastructure, and resources to entrepreneurs in 39 of California’s 58 counties with the goal of successfully deploying and commercializing technologies and innovations in water, agriculture and energy. Fresno State has partnered with five other CSU campuses (Bakersfield, Chico, Humboldt, Monterey Bay and Sacramento) and the Sierra Small Business Development Center in Truckee to provide local services throughout the region. The University of California Davis and University of California Berkeley provide additional support for the project. Since the inception of the program, 328 inquiries have been processed, resulting in 121 Technology Innovation Evaluation meetings. In FY19/20, 75 inquiries were processed resulting in 35 TIE meetings.
- In response to COVID 19 restrictions, the WET Center established a series of webinars to help startups use the “shelter-in-place” time to work on basic aspects of their businesses beginning with upgrading their business’ website and how to conduct a professional Zoom meeting. A monthly Valley Ventures Founder’s Forum was also created with the objective to provide a virtual platform where founders can exchange experiences and challenges.
- The WET Center has, throughout the year, been host and participant in multiple events. In September, the WET hosted a meeting with the California Energy Commission R&D department, BlueTechValley and Fresno State to provide an overview, results, and impact of the BlueTechValley Innovation Cluster, as well as to discuss research and development needs for the region. In November 2019, the WET worked with Fresno State to conduct a tour of the campus, which was a pre-event activity of the 2019 California Economic Summit program. Guests visited the WET Center with the BlueTechValley programs featured.
- In December, the WET Center concluded \$500,000 grant after three years of programming. The grant funded the establishment and operation of the Valley Ventures Accelerator, the only accelerator in the Central Valley. During the three-year grant, 54 ventures participated in the program and raised a combined \$25,566,000 in investment funding and \$6,988,000 in loans and grants. Other impact metrics include 247 new jobs created, 28 new products launched and the facilitation of three joint research projects. Throughout the project, more than 1800 hours of mentoring and coaching were provided to ventures. While still evaluating the sustainability model for the program, the Valley

Ventures Accelerator will enroll Cohort V in the Fall of 2020. The program will be conducted virtually.

- In January 2020, the WET conducted a full-day facilitated strategic retreat. The goal of the retreat was to ‘kick-off’ the planning of the WET’s 2020 Strategic planning process. The outcome of the retreat let the WET to focus on three areas – Programming, Sustainability and Branding. Over the last six months, the WET team has worked diligently towards the strategic goals for 2020 and beyond.

THE UNIT'S FINANCIAL STATEMENT

CIT CATI Financial Statement 2019-2020

Fund Fdescr	Account Fdescr	Current Budget	Actuals	Encumbrances	Balance Available	
90000 - TF-CSU Operating Fund	601921 - Management & Supervisory Sals	102,475.00	66,801.02	0.00	35,673.98	
	601931 - Regular Staff Salaries	85,212.00	68,941.51	0.00	16,270.49	
	601933 - Overtime		500.29	0.00	(500.29)	
	601961 - Temporary Help	36,806.00	22,083.84	0.00	14,722.16	
	601981 - Student Assistant		0.00	0.00	0.00	
	604812 - Cellular Telephones		590.00	0.00	(590.00)	
	604813 - Telephone Equipment Charges		1,069.22	0.00	(1,069.22)	
	604814 - Telephone Line Charges		2,742.49	0.00	(2,742.49)	
	6048C2 - Telephone Other (contra)		(6,480.00)	0.00	6,480.00	
	613001 - Contractual Services	136,002.00	147,661.88	0.00	(11,659.88)	
	619802 - Cap-Equip/Furn>\$5000/item		6,373.20	0.00	(6,373.20)	
	619807 - Computer Equip<\$5,000/item		3,031.70	0.00	(3,031.70)	
	660001 - Postage and Freight		1,079.93	0.00	(1,079.93)	
	660002 - Printing		9,482.92	0.00	(9,482.92)	
	660003 - Supplies and Services	(69.00)	0.00	0.00	(69.00)	
	660815 - Plant Operation Services		1,357.74	0.00	(1,357.74)	
	660898 - Prior Year Budget Carry Forward	88,282.00	0.00	0.00	88,282.00	
	6608C3 - Printing (contra)		(5,777.92)	0.00	5,777.92	
			448,708.00	319,457.82	0.00	129,250.18
	90000 - TF-CSU Operating Fund Total		448,708.00	319,457.82	0.00	129,250.18
Grand Total		448,708.00	319,457.82	0.00	129,250.18	

CIT Grant and Contract activity for 2019-2020

	Project Name	P.I.	Funding Agency	FY 19-20
1	ARI - Managing Deep Percolation in Drip Irrigation Systems	Ashkan	CSU ARI	\$35,991
2	ARI Development of Precision Variable Rate Irrigation Systems to Optimize Application of Water and Nutrients	Ashkan	CSU ARI	\$35,988
3	ARI - Pistachio Plant Based Irrigation Scheduling	Ashkan	CSU ARI	\$38,562
4	CDFA - Precision Irrigation Pistachio	Ashkan	CA Dept. Food & Ag	\$87,233
5	ARI - Identification of Guayule as a viable economical drought	Banuelos/Lone	CSU ARI	\$84,839
6	ARI - Irrigation & Soil Mgmt. Tools for Saline Irrigation Alfalfa	Benes	CSU ARI	\$85,527
9	Interaction of Retain (Plant Growth regulator) with foliar Nitrogen application at different rates in relation to yield and quality in Almonds	Brar	Valent USA	\$47,518
10	ARI - Threshold for Using Saline Water on Pistachio	Brar/Banuelos	CSU ARI	\$72,957
11	ARI - Determination of Long Term Threshold Limit for Using Saline Water on Pistachio	Brar/Banuelos	CSU ARI	\$102,538
12	ARI Project Title: Overcoming citrus nursery growth issues by using Smart Lighting with Different Photoperiods	Brar	CSU ARI	\$22,063
13	ARI - New Almond production systems research at CSU Fresno: High-density planting, rootstock evaluation and pruning responses trials	Brar	CSU ARI	\$40,401
14	Dormancy Breaking Pistachio	Brar	CA Pistachio Research Board	\$43,900
15	Cracking the black box of dormancy	Brar	CA Pistachio Research Board	\$87,788
16	Advanced Pumping Efficiency Program VI	Canessa	PG&E	\$408,000
17	Advanced Pumping Efficiency Program VI Pump Testers	Canessa	PG&E	\$297,000
18	ARI - DNA Extraction Method from epidemiologically meaningful amounts of soil	Ellis	CSU ARI	\$22,064
19	ARI Identification and assessment of Fusarium oxysporum f. sp. vasinfectum populations in cotton fields for sustainable production in California	Ellis	CSU Fresno	\$37,688
20	Benefits of on farm BMP	Goorahoo	CSU ARI (Sub from CSU Monterey Bay)	\$65,000
21	ARI - Airjection Irrigation Impact on Oxidative Stress in Vegetables and on Soil Nitrogen Cysel Gene Communities	Goorahoo	CSU ARI	\$61,995
22	Water Use & Drought Resistance Test	Jacobsen	US Dept. of Agriculture	\$2,816

23	ARI Automating the Pistachio Canopy Temperature Identification: A Machine Learning Approach	Panagopoulos	CSU ARI	\$31,984
24	ARI - An Integrated Management Model to Operate a Farm at Peak Efficiency	Pasha	CSU ARI	\$36,000
25	AI Model for Estimating Crop Water Demand: An Artificial Intelligence (AI) Model to Improve Agricultural Water Use Efficiency Using Field, Plant, and Weather Data – Case Study	Pasha	Colorado State	\$49,333
26	ARI- Cutting Edge Field-Scale Technologies and Soil-Water-Plant Continuum Approach for the Optimum Use of Agricultural Water and Energy – Pilot Study	Pasha	CSU ARI	\$43,428
27	ARI Evaluation of Exogenous Application of Gibberellic Acid	Riar	CSU ARI	\$10,000
28	Fababean Germplasm '21	Riar	UC Davis	\$13,635
29	NIFA Plan for Groundwater Management	S. Green	Dept. Water Resources	\$30,000
30	Nile Garden Drinking Water '19	S. Green	Dept. Water Resources	\$174,999
31	USDA RSA - Andriesen 58-2034-9-018	S. Green	US Dept. of Agriculture	\$29,986
32	ARI - Evaluation of Sorghum Tolerance	Sharma	CSU ARI	\$42,034
33	ARI - Physiological performance and nutritional quality of forages	Sharma	CSU ARI	\$150,000
34	ARI - Crop Water Requirement for Onion	Sharma	CSU ARI	\$49,469
35	ARI - Lysimetric determination of ET coefficients for drip-irrigated vegetables	Sharma	CSU ARI	\$149,975
36	ARI - Utilizing Real Time Plant Stress Indicator to Improve Water Use Efficiency in Almonds.	Vang	CSU ARI	\$66,778
37	ARI - Developing a Mobile Decision Support Nitrate Sampling and Monitoring System	Vang	CSU ARI	\$42,432
38	Long Term Saline Irrigation Strategies for Pistachios on PGI Rootstock	Vang	CA Pistachio Research Board	\$60,000
39	Development of Low Pressure and Low Flow Water and Energy Efficient Mediat Filtration System	Vang	Colorado State	\$44,000
40	ARI- he organic production of agretti in poor-quality soils with poor quality water.	Vang	CSU Fresno	\$65,520
41	Strategic collaborative partnerships developing new synergies to create water productivity innovation in agriculture and the irrigated landscape	Vang	Colorado State	\$60,000

42	ARI - Population Structure, gene flow, and movement of navel orangeworm (<i>Amyelois Transitella</i>) in CA	Wenger	CSU ARI	\$10,000
43	ARI - Development of CRISPR/Cas9 for Genome Editing in Navel Orangeworm	Wenger	CSU ARI	\$10,000
44	ARI Establish an insect genetic technologies program capable of performing knock-out and knock-in gene transformations in the navel orangeworm (NOW)	Wenger	CSU ARI	\$25,000
45	ARI - Smart Data Utilization in the Ag Field: A Compare and Contrast Analysis	Yeasmin	CSU ARI	\$36,473
46	ARI - Almond water stress and yield analysis through soil, plant and image based technologies for sustainable Almond Production	Yeasmin	CSU ARI	\$51,577
47	ARI- A Ground Penetrating Radar (GPR) Based Evaluation of Rootstock Response to the Application of Fertilizer of Natural Origin in Orchards and Vineyards to Promote Root Vigor for Long Term Economic Viability	Yeasmin	CSU ARI	\$59,488
48	ARI- Water-Smart Planning: A Satellite Imagery based Remote Sensing Approach to Evaluate Crop Water Status in California Orchards for Future Sustainability	Yeasmin	CSU ARI	\$39,063
	CIT Lab Testing			\$30,704
				\$3,061,042

WET Grant and Contract Activity 2019-2020

	CC#	Project Name	Start Date	P.I.	Co-PI	FY2 Budget	ARI No.	Funding Agency	TOTAL
1	350507	DOC - i6 Regional Innovative	1/1/2017	Petersen	S. Green	171,189		Dept. of Commerce	171,189
2	350454	CV Energy Innovation Cluster : BTV	5/1/2016	Petersen	Macon	1,144,847		CA Energy Commission	1,144,847
3	350613	BTV Ecosystems	1/1/2018	Petersen		50,000		Wells Fargo	39,649
4	350694	EDA- CV Reg Innov Invest Fund'21	1/1/2019	Petersen	Francis	100,510		Dept. of Commerce	100,510
5		WET- Stateside		Petersen					64,950
									1,521,145

A DESCRIPTION OF SPACE AND EQUIPMENT UTILIZATION

CIT manages three hydraulic laboratory facilities designed to provide a range of testing capabilities including sprinkler testing, drip/micro testing, valve and filter testing, pump testing, and custom testing and performance certifications. CIT operates a fleet of seven pickup trucks, one car, and three mobile education trailers used to support educational program delivery. The CIT Director's office got a long overdue upgrade with new furniture, paint, and blinds.

Office and meeting space for CIT staff is located in the main office building (southeast corner of Chestnut and Barstow) and the WET laboratory (southwest corner of Chestnut and Barstow). CIT staff housed in the former CWI building (renamed the FAR building on the northeast corner of Cedar and Bullard where IFA is now housed) will be relocated. Some staff have been relocated to the former IFA building (now CIT Research); the moves of two CIT staff have been put on hold until renovations are made to the CIT Research building. Under the present circumstances, there is no timetable set for these renovations to be completed.

The WET Center building (on the southwest corner of Chestnut and Barstow) has facilities used for incubation, acceleration, including seven tenant offices and one of CIT's hydraulics laboratories. As of June 1, 2018, the newly renovated WET North (directly across the street from the WET Center) added an additional 2,700 sq.ft. including six tenant offices, a WET Center staff office, plug-and-play, meeting, and educational space.



Figure 2 An aerial view of the of the CIT & WET physical facilities

STAFFING

Changes in CIT staffing in 2019-20 include:

- Dr. Charles Hillyer became CIT's fourth appointed director in October 2019 taking over for Sarge Green who served as acting director since January 2018.
- Pete Canessa retired in February 2020 after 20+ years, primarily running CIT's energy efficiency programs including the Advanced Pumping Efficiency Program (APEP).
- Bill Green has taken over Canessa's role in APEP and continues as our Education Specialist.
- Belinda Munoz joined CIT at the end of June 2020 as the new Administrative Support Coordinator II.
- Eileen Torres retired in November of 2019. Eileen provided support for the APEP program for many years.
- Valdemar Cerna is a full time employee who is assisting in CIT's APEP program and as a testing technician in the hydraulics lab.
- CIT employed 46 students: two assisted in the office, two assisted in the CIT laboratory, and 42 assisted with applied/field research projects.

Changes in WET staffing in 2019-20 include:

- In early May 2020, Courtney Meinhold left the WET to become the Communications Specialist for the Craig School of Business. The Marketing and Outreach Manager position has not been filled.
- Alexis Ford joined the WET team in February 2020 as Communication and marketing assistant. Ford, a Fresno State graduate, has previously worked at the WET as an intern during her senior year.
- Four student assistants graduated in Spring 2020; three students have been hired to replace the graduates. A total of six student assistants are currently working with WET programs and projects.

LISTING OF THE ADVISORY COMMITTEE MEMBERSHIP

CIT Advisory Committee

CIT developed a plan to constitute and recruit an advisory committee. Recruitment has been severely hampered by the COVID-19 pandemic. We plan to have the first board meeting in January of 2021 but this goal is now questionable because of the pandemic. We expect the committee will have the following composition:

- Ag Producer: one or more grower in the SJV
- Industry: one or more person from an irrigation manufacturing company with a significant presence in the SJV
- Retail/Distributor: one or more person from retail or distribution outlet
- State Government: or more persons from DWR and CEC
- Federal Government: or more persons from NRCS or USBR
- Academic: one or more researcher, active in irrigation, from outside the CSU system

Term limits: 2 years

WET Technical Advisory Committee

The WET Center will not have an Advisory Committee focusing solely on WET activities. Representatives from the Advisory Committee for the Center for Irrigation Technology will encompass activities related to the WET Center.

The scope of work for the BlueTechValley Innovation Cluster, funded by the California Energy Commission (CEC), mandates the creation of a Technical Advisory Committee (TAC). The objective of the committee is to provide guidance in project direction that may include scope, methodologies, timing, and coordination with other projects and programs. The TAC committee is being restructured partly in response to the expansion of the CEC Ecosystem, which now includes a few new programs. To date, the following individuals have agreed to serve on the new TAC:

- Gary Simon, CEO, CleanStart
- Eva Shepard, Executive Director of Chicostart and Director of the Center for Entrepreneurship at CSU Chico
- Richard Chapman, President and CEO, Kern Economic Development Agency

ANY CHANGE IN GOVERNING POLICIES

CIT Change in Governing Policies

No significant governing policy changes were made during the fiscal year, however as a result of eliminating ICWT, operational procedures were developed to integrate the common goals of CIT and the WET Center. The strategic planning sessions held in January 2020 were instrumental in getting this process started. Modifications will be made moving forward as needed and/or based on Advisory Committee recommendations.

WET Change in Governing Policies

Changes in the governing policies of the WET Center reflect its incorporation into the Center for Irrigation Technology and the Jordan College of Agricultural Sciences and Technology. Refer to the FY18/19 Center for Irrigation Technology Annual Report for details.

FY20/21 GOALS AND OBJECTIVES

CIT Goals and Objectives

Goals & Objectives for FY20-21 reflect a refinement of FY19-20 goals and addition of new goals focused on improving overall effectiveness of the CIT organization and expanding into a new area of irrigation testing.

1. Continue to strive for organizational Excellence
This goal reflects the need for better communication and coordination within CIT/WET and across JCAST, better project management where shared CIT resources are utilized across research teams, greater fiscal efficiency of operations across all four branches of CIT, and continued execution on strategic plans.

2. Develop a software testing service for irrigation-related applications that support goals of the agriculture and landscape community in California particularly and the US generally.
3. Maintain engagement in standards development bodies.
4. Continue to reinvigorate industry relationships.
5. Continue staff training on water issues in California.
6. Pursue large grants and contracts that provide support across CIT and WET
7. Continue to produce results in testing, research, and business development.

WET Center Goals and Objectives

1. Continue to strategically position the WET as a center of excellence for water, energy and ag technology startup enterprises. With strong positioning, successful ventures will provide jobs and opportunities to Fresno State students and graduates and to the community as a whole.
2. Create a three-year plan for a sustainable funding model for the WET, including a diversified revenue model balanced between state and federal grants, fee for service and private funding.
3. Continue to develop connections to industry, investors, academic institutions and other relevant stakeholders to further the robustness of the ecosystem.

Position BlueTechValley Innovation Cluster for refunding by the California Energy Commission. With the COVID 19 pandemic predicted to influence much of our society in the remaining 2020 and into 2021, the WET will strive to continuously provide high-impact services and programs to ventures, host virtual events and expand its network of stakeholder and connections.

Center for Irrigation Technology

7/29/2020

* People shown with green background have cross-cutting roles

Dennis Nef
Dean, JCAST

Charles Hillyer
Director

Helle Petersen
Assistant Director

Ben Francis

Jeff Macon

Grace Manley

Vacant

Alexis Ford

Students

WET Center

Florence Cassel
Assistant Director

Karl Longley

Dilruba Yeasmin

Sarge Green

Shawn Ashkan

Janet Robles

CSU Faculty

Students

Research

Kaomine Vang
Assistant Director

Ed Norum

Pete Canessa

Jorge Ramirez Moreno

Bill Green

Rafael Allende

Valdemar Cerna

Tim Jacobsen

Students

Hydraulics Laboratory

Kate Norum
Assistant Director

Yvette Archuleta

Belinda Munoz

Students

CIT Operations

**REQUEST FOR RENEWAL OF THE CENTER FOR IRRIGATION TECHNOLOGY
FOR FY20/21**

(APM 110 form) is appended.