

# **Joseph Robert Kasprzyk**

## **I. Personal Information**

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## **II. Academic and Professional Background**

### **Education**

Ph.D., Civil Engineering, Pennsylvania State University, 2013.  
M.S., Civil Engineering, Pennsylvania State University, 2009.  
B.S., Civil Engineering (with Honors) Pennsylvania State University, 2007.

### **Professional Experience**

Assistant Professor, University of Colorado Boulder, Boulder, CO.	9/2013 – Present
My research uses multiobjective evolutionary algorithms, high performance computing, and interactive visualizations to transform management of environmental problems. Focus areas include (i) water resources planning and management, (ii) decision making under uncertainty, and (iii) improving management of environmental systems. I teach courses including hydrology, water resources engineering, and water resources systems analysis.	
Adjunct Assistant Professor, University of Colorado Boulder, Boulder, CO	8/2012 – 9/2013
After being hired at CU, I took an adjunct position in the department before finishing my doctoral degree at Penn State. In this time, I developed research proposals and teaching materials for my transition to the assistant professor position.	
Research Assistant, Pennsylvania State University, University Park, PA	5/2006 – 5/2013
My doctoral research developed a set of risk-based planning frameworks for MOEAs in water resources planning and management, focusing on the impacts of uncertainty in optimization problem formulations. The dissertation was funded by an EPA STAR graduate research fellowship. While at Penn State I served as a teaching assistant (for 2 semesters) and an instructor (for 1 semester) of an undergraduate course in water resources engineering. I also performed master's and undergraduate research at Penn State.	
Intern, AECOM, State College, PA	12/2009 – 5/2013
I performed technical analysis for a FEMA-supported study on the impact of climate change and population growth on the National Flood Insurance Program. This was a part time position of approximately 5 hours / week.	

During term breaks, I performed stormwater management calculations, prepared reports, and performed surveying fieldwork for residential and small commercial land development projects.

### III. Publications

*Statistics as of February, 2019: Google Scholar H-Index: 14; Total Citations: 1511; Web of Science H-Index: 12; Total Citations: 953. Notation: Underline denotes CU graduate student author, italics indicate CU undergraduate student author. The **author order** that is typical in my field is that authors are listed in order of importance, with the authors that have contributed the most to the paper near the front of the author list. Graduate students are the first author when appropriate.*

#### III.A Peer-Reviewed Journal Articles

1. Maier, HR, S Razavi, Z Kapelan, LS Mattot, **JR Kasprzyk**, BA Tolson. “Introductory Overview: Optimization using Evolutionary Algorithms and other Metaheuristics” *Environmental Modelling and Software*. In Press. <https://doi.org/10.1016/j.envsoft.2018.11.018>
2. Wheeler, KG, JW Hall, GM Abdo, SJ Dadson, **JR Kasprzyk**, RM Smith, EA Zagona. 2018. “Exploring Cooperative Transboundary River Management Strategies for the Eastern Nile Basin” *Water Resources Research*. vol 54 (11): 9224-9254. <http://dx.doi.org/10.1029/2017WR022149>
3. Barnhart, BL, HE Golden, **JR Kasprzyk**, JJ Pauer, CE Jones, KA Sawicz, N Hoghooghi, M Simon, RB McKane, PM Mayer, AN Piscopo, DL Ficklin, JJ Halama, PB Pettus, B Rashleigh. 2018. “Embedding co-production and addressing uncertainty in watershed modeling decision-support tools: Successes and challenges” *Environmental Modelling and Software*. vol 109: 368-379. <http://dx.doi.org/10.1016/j.envsoft.2018.08.025>
4. **Kasprzyk, JR**, RM Smith, AS Stillwell, K Madani, D Ford, D McKinney, S Sorooshian. 2018. “Defining the role of water resources systems analysis in a changing future” *Journal of Water Resources Planning and Management*. vol 144(12). [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0001010](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0001010)
5. DeRousseau, MA, **JR Kasprzyk**, WV Srubar III. 2018. “Computational Design Optimization of Concrete Mixtures: A Review” *Cement and Concrete Research*. vol 109: 42-53. <http://dx.doi.org/10.1016/j.cemconres.2018.04.007>
6. Smith, R, **JR Kasprzyk**, L Basdekas. 2018. “Experimenting with water supply planning objectives using the Eldorado Utility Planning Model multireservoir testbed” *Journal of Water Resources Planning and Management*. vol 144(8). [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0000962](https://doi.org/10.1061/(ASCE)WR.1943-5452.0000962)
7. Clarkin, TJ, WJ Raseman, **JR Kasprzyk**, JD Herman. 2018. “Diagnostic Assessment of Preference Constraints for Simulation-Optimization in Water Resources” *Journal of Water Resources Planning and Management*. vol 144(8). [https://doi.org/10.1061/\(ASCE\)WR.1943-5452.0000940](https://doi.org/10.1061/(ASCE)WR.1943-5452.0000940)
8. Stewart, JR, B Livneh, **JR Kasprzyk**, B Rajagopalan, JT Minear, WJ Raseman. 2017. “A multi-algorithm approach to land surface modeling of suspended sediment in the Colorado Front Range” *Journal of Advances in Modeling Earth Systems*. vol 9: 2526-2544. <http://dx.doi.org/10.1002/2017MS001120>
9. Rosenberg, DE, M Babbar-Sebens, E Root, JD Herman, A Mirchi, M Giacomoni, **JR Kasprzyk**, K Madani, D Ford, L Basdekas. 2017. “Towards More Integrated Formal Education and Practice in Water

Resources Systems Analysis” *Journal of Water Resources Planning and Management*. vol 143(12): 02517001. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000847](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000847)

10. **Smith, R, JR Kasprzyk**, L Dilling. 2017. “Participatory Framework for Assessment and Improvement of Tools (ParFAIT): Increasing the impact and relevance of water management decision support research” *Environmental Modelling and Software*. vol 95: 432-446. <http://dx.doi.org/10.1016/j.envsoft.2017.05.004>
11. **Watson, AA, JR Kasprzyk**. 2017. “Incorporating deeply uncertain factors into the many objective search process” *Environmental Modelling and Software*. vol 89: 159-171. <http://dx.doi.org/10.1016/j.envsoft.2016.12.001>
12. **Houle, E, JR Kasprzyk**, BL Livneh. 2017. “Exploring Snow Model Parameter Sensitivity Using Sobol’ Variance Decomposition” *Environmental Modelling and Software*. vol 89: 144-158. <http://dx.doi.org/10.1016/j.envsoft.2016.11.024>
13. **Raseman, WJ, JR Kasprzyk**, FL Rosario-Ortiz, **J Stewart**, B Livneh. 2017. “Emerging Investigators Series: A critical review of decision support systems for water treatment: Making the case for incorporating climate change and climate extremes” *Environmental Science: Water Research and Technology*. vol 3: 18-36. <http://dx.doi.org/10.1039/c6ew00121a>
14. **Yanto, R Balaji, B Livneh, JR Kasprzyk**. 2017. “Hydrological Model Application Under Data Scarcity for Multiple Watersheds, Java Island, Indonesia” *Journal of Hydrology: Regional Studies*. vol 9: 127-139. <http://dx.doi.org/10.1016/j.ejrh.2016.09.007>
15. **Huskova, I, ES Matrosov, JJ Harou, JR Kasprzyk, C Lambert**. 2016. “Screening robust water infrastructure investments and their trade-offs under global change: A London Example” *Global Environmental Change*. vol 41: 216-217. <http://dx.doi.org/10.1016/j.gloenvcha.2016.10.007>
16. **Piscopo, A, R Neupauer, JR Kasprzyk**. 2016. “Optimal design of active spreading systems to remediate sorbing groundwater contaminants in situ” *Contaminant Hydrology*. vol 190: 29-43. <http://dx.doi.org/10.1016/j.jconhyd.2016.03.005>.
17. **Smith, R, JR Kasprzyk**, E Zagona. 2016. “Many Objective Analysis to Optimize Pumping and Releases in a Multi-Reservoir Water Supply Network” *Journal of Water Resources Planning and Management*. vol. 142, no. 2. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000576](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000576).
18. **Kasprzyk, JR**, PM Reed, D Hadka. 2016. “Battling Arrow’s Paradox to Discover Robust Water Management Alternatives” *Journal of Water Resources Planning and Management*. vol 142, no. 2. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000572](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000572).
19. **Matrosov, E, I Huskova, JR Kasprzyk, JJ Harou, C Lambert, PM Reed**. 2015. “Many-Objective Optimization and Visual Analytics Reveal Key Trade-offs for London’s Water Supply” *Journal of Hydrology*, vol 531, part 3: 1040-1053. <http://dx.doi.org/10.1016/j.jhydrol.2015.11.003>.
20. **Piscopo, AN, JR Kasprzyk**, RM Neupauer. 2015. “An Iterative Approach to Multi-Objective Engineering Design: Optimization of Engineered Injection and Extraction for Enhanced Groundwater Remediation” *Environmental Modelling and Software*, vol 69: 253-261. <http://dx.doi.org/10.1016/j.envsoft.2014.08.030>.
21. **Maier, HM, Z Kapelan, JR Kasprzyk, JB Kollat, LS Mattot, MC Cunha, GC Dandy, MS Gibbs, E Keedwell, A Marchi, A Ostfeld, D Savic, DP Solomatine, JA Vrugt, AC Zecchin, BS Minsker, EJ Barbour, G Kuczera, F Pasha, A Castelletti, M Giuliani, PM Reed**. 2014. “Evolutionary Algorithms and Other Metaheuristics in

Water Resources: Current Status, Research Challenges, and Future Directions” *Environmental Modelling and Software*, vol. 62: 271-299. <http://dx.doi.org/10.1016/j.envsoft.2014.09.013>

22. Zeff, HB, **JR Kasprzyk**, JD Herman, PM Reed, GW Characklis. 2014. “Navigating Financial and Supply Reliability Tradeoffs in Regional Drought Management Portfolios.” *Water Resources Research*, vol. 50, no. 6: 4906-4923. <http://dx.doi.org/10.1002/2013WR015126>.
23. Fu, G, Z Kapelan, **JR Kasprzyk**, PM Reed. 2013. “Optimal design of water distribution systems using many-objective visual analytics.” *Journal of Water Resources Planning and Management*, vol. 139, no. 6: 624-633. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000311](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000311). **Awarded Quentin Martin Best Practice-Oriented Paper from Journal of Water Resources Planning and Management.**
24. **Kasprzyk, JR**, S Nataraj, PM Reed, RJ Lempert. 2013. “Many objective robust decision making for complex environmental systems undergoing change.” *Environmental Modelling and Software*, vol. 42: 55-71. <http://dx.doi.org/10.106/j.envsoft.2012.12.007>.
25. Reed, PM, D Hadka, JD Herman, **JR Kasprzyk**, JB Kollat. 2013. “Evolutionary Multiobjective Optimization in Water Resources: The Past, Present, and Future.” *Advances in Water Resources*. vol. 51: 438-456 <http://dx.doi.org/10.1016/j.advwatres.2012.01.005>. *Invited article for 35th anniversary issue.*
26. Kollat, JB, **JR Kasprzyk**, WO Thomas, AC Miller, and D Divoky. 2012. “Estimating the Impacts of Climate Change and Population Growth on Flood Discharges in the United States.” *Journal of Water Resources Planning and Management*, vol. 138, no. 5: 442-452. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000233](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000233). *Special section on climate change and water resources.*
27. **Kasprzyk, JR**, PM Reed, GW Characklis, BR Kirsch. 2012. “Many-Objective de Novo Water Supply Portfolio Planning Under Deep Uncertainty.” *Environmental Modelling and Software*, vol. 34: 87-104. <http://dx.doi.org/10.1016/j.envsoft.2011.04.003>. *Issue: Emulation techniques for the reduction and sensitivity analysis of complex environmental models.*
28. **Kasprzyk, JR**, PM Reed, BR Kirsch, GW Characklis. 2009. “Managing population and drought risks using many-objective water portfolio planning under uncertainty.” *Water Resources Research*, vol. 45, W12401. <http://dx.doi.org/10.1029/2009WR008121>
29. Reed, PM, **JR Kasprzyk**. 2009. “Water Resources Management: The Myth, the Wicked, the Future” *Journal of Water Resources Planning and Management*, vol. 135, no. 6: 411-413. [http://dx.doi.org/10.1061/\(ASCE\)WR.1943-5452.0000047](http://dx.doi.org/10.1061/(ASCE)WR.1943-5452.0000047)
30. Kollat, JB, PM Reed, **JR Kasprzyk**. 2008. “A New Epsilon-Dominance Hierarchical Bayesian Optimization Algorithm for Large Multi-Objective Monitoring Network Design Problems.” *Advances in Water Resources* vol. 31: 828-845. <http://dx.doi.org/10.1016/j.advwatres.2008.01.017>

#### Journal impact factors (as of 2017) and number of papers published per journal

Journal Name	Number of Papers	Impact Factor
Global Environmental Change	1	6.37
Cement and Concrete Research	1	5.43
Water Resources Research	3	4.36
Environmental Modelling and Software	9	4.18
Journal of Advances in Modeling Earth Systems	1	3.97

Journal of Hydrology	1	3.73
Environmental Science: Water Research and Technology	1	3.65
Journal of Water Resources Planning and Management	9	3.54
Advances in Water Resources	2	3.51
Journal of Contaminant Hydrology	1	2.28
Journal of Hydrology: Regional Studies	1	N/A

### III.B Peer-Reviewed Conference Papers

(in the following sections, \* denotes presenter, underline denotes CU graduate student presenter, *italics* denotes undergraduate student)

1. **Kasprzyk, JR\***, JB Kollat, C Danilo, “Balancing Conflicting Management Objectives Using Interactive, Three-Dimensional Visual Analytics” iEMSs, San Diego, CA, June 2014.
2. Houle, E\*, **JR Kasprzyk**, “Investigating Parameter Sensitivity for Management in Snow-Driven Watersheds” iEMSs, San Diego, CA, June 2014.
3. **Kasprzyk, JR**, JHA Guillaume\*, JB Kollat, C Danilo, “Hypothesis testing for management: Evolving and answering closed questions using multiobjective visualization” iEMSs, San Diego, CA, June 2014.
4. Reed, PM, D Hadka, JD Herman, **JR Kasprzyk\***, JB Kollat, “Evolutionary Multiobjective Optimization in Water Resources: The Past, Present, and Future” iEMSs, Leipzig, Germany. July 2012
5. **Kasprzyk, JR\***, S Nataraj, PM Reed, RJ Lempert. “Many-Objective Robust Decision Making for Water Supply Portfolio Planning Under Deep Uncertainty.” iEMSs, Leipzig, Germany. July 2012. **Received Student Presentation Award.**
6. Reed, PM\*, **JR Kasprzyk**, BR Kirsch, GW Characklis. “Many-objective Management of Population and Drought Risks: A Case for De Novo Programming.” iEMSs, Ottawa, Canada. 2010.

### III.C Journal Articles Submitted

1. Smith, RM, **JR Kasprzyk**, L Dilling. “Testing the potential of Multiobjective Evolutionary Algorithms (MOEAs) with Colorado water managers” *Environmental Modelling and Software*. Originally submitted March 2018. Revisions submitted January 2019.
2. Smith, RM, **JR Kasprzyk**, R Balaji “Combining Multivariate Regression Trees and multiobjective tradeoff sets to reveal fundamental insights about water resources systems” *Environmental Modelling and Software*. Submitted January 2019.
3. Raseman, WJ, R Balaji, **JR Kasprzyk**, W Kleiber. “Nearest neighbor bootstrap for generating influent time series for water treatment” *Stochastic Environmental Research and Risk Assessment*. Submitted October 2018.

### III. D Journal Articles In Preparation

1. Raseman, WJ, *J Jacobson*, **JR Kasprzyk**. “An open source, interactive parallel coordinates library for multi-objective decision making” *Environmental Modelling and Software*. Finalizing submission; planning for February 2019 submission.

2. Purcell, B, ZA Barker, JR Kasprzyk, AS Stillwell. “Linking reclaimed water consumption with quantitative downstream flow impacts” *Journal of Water Resources Planning and Management*. In review with co-authors.
3. Estep, MA, J Delorit, JR Kasprzyk, P Block. “Many-objective analysis of water rights allocation and trading alternatives for the agriculture-dominated Elqui River Basin” In preparation, manuscript being written.
4. Raseman, WJ, JR Kasprzyk, RS Summers. “Multi-objective optimization of water treatment plant operations” In preparation; results being completed.
5. DeRousseau, MA, El Laftchiev, JR Kasprzyk, WV Srubar. “Improved compressive strength modeling for concrete” In preparation; results being completed.
6. O’Donnell, M, JR Kasprzyk, B Livneh, JT Minear. “Exploring regional rates of reservoir sedimentation” In preparation; results being completed.

## IV. Presentations

### IV.A Presentations at National and International Meetings

*Peer-reviewed conference papers (section III.B) and poster presentations (section IV.B) not included in this section.*

1. O’Donnell, MC\*, JR Kasprzyk, B Livneh, L Bensching “Exploring Hydrologic Sensitivity Analysis to Improve Reservoir Management” Submitted to ASCE Environmental Water Resources Institute (EWRI), June 2019.
2. Raseman, WJ\*, J Jacobson, RS Summers, R Balaji, FL Rosario-Ortiz, JR Kasprzyk “Multi-objective optimization and visual analytics to support drinking water decision making” Submitted to American Water Works Association Annual Conference and Exposition (AWWA ACE) 2019.
3. Alexander, E\*, JR Kasprzyk, EA Zagona, JR Prairie, C Jerla, A Butler “Generating and Identifying Robust Lake Mead Operating Policies Using Many Objective Robust Decision Making” Fall Meeting of the American Geophysical Union (AGU) 2018.
4. Wheeler, KG\*, JW Hall, G Abdo, SJ Dadson, JR Kasprzyk, R Smith, EA Zagona “Negotiating coordination within transboundary rivers: The Nile and Grand Ethiopian Renaissance Dam” Fall Meeting of AGU 2018.
5. Kasprzyk, JR\*. “Using multi-objective optimization to improve water treatment plant operations under extreme events” AWWA ACE, Las Vegas, NV, June 2018.
6. DeRousseau, MA\*, JR Kasprzyk, WV Srubar III. “Incorporating artificial neural network models into multi-objective optimization: an approach for mixture proportioning of sustainable and durable concrete mixtures” International Environmental Modelling and Software Society (iEMSs) meeting, Fort Collins, CO, June 2018.
7. Kasprzyk, JR\*. “Toward Improved Reservoir Management via Hydrologic Uncertainty Quantification” iEMSs, Fort Collins, CO, June 2018.
8. Raseman, WJ\*, JR Kasprzyk, W Kleiber, R Balaji. “Uncertainty in drinking water supplies: exploring stochastic source water quality generation methods” iEMSs, Fort Collins, CO, June 2018.

9. **Kasprzyk, JR\***, AS Stillwell “Tradeoffs of Alternate Water Resources for Thermoelectric Power Plant Cooling” ASCE EWRI, Minneapolis, MN, June 2018.
10. **Estep, M\***, JD Delorit, P Block, **JR Kasprzyk** “Many-objective analysis of water rights allocation and trading alternatives for the agriculture-dominated Elqui River Basin” ASCE EWRI, Minneapolis, MN, June 2018.
11. Neupauer, RM, *S Waers*, **JR Kasprzyk**, DC Mays “Monitoring Design for Groundwater Remediation Using Engineered Injection and Extraction” ASCE EWRI, Minneapolis, MN, June 2018.
12. **Alexander, E\***, **JR Kasprzyk**, EA Zagona, J Prairie, C Jerla, A Butler “Using Multi-Objective Optimization to Explore Robust Policies in the Colorado River Basin” ASCE EWRI, Minneapolis, MN, June 2018.
13. **Raseman, WJ\***, **JR Kasprzyk**, FL Rosario-Ortiz, RS Summers, AK Hohner “Development of a Water Treatment Decision Support System for Utilities Facing Wildfire Risks” American Water Works Association Sustainable Water Management Conference, Seattle, WA, March 2018.
14. **Greene, JA\***, RM Neupauer, M Ye, **JR Kasprzyk**, DC Mays, GR Curtis “Bioremediation of Uranium-Contained Groundwater using Engineered Injection and Extraction” Fall Meeting of AGU 2017.
15. **Smith, R\***, **JR Kasprzyk**, R Balaji “Using multiobjective tradeoff sets and Multivariate Regression Trees to identify critical and robust decisions for long term water utility planning” Fall Meeting of AGU 2017.
16. **Estep, M\***, JD Delorit, P Block, **JR Kasprzyk** “Integrating hydroclimatic prediction and many-objective risk management to foster optimal water allocation” ASCE EWRI, May 2017
17. **Greene, J\***, RM Neupauer, M Ye, **JR Kasprzyk**, DC Mays “Engineered Injection and Extraction for Remediation of Uranium-Contaminated Groundwater” ASCE EWRI, May, 2017
18. **Kasprzyk, JR\***, TJ Clarkin, WJ Raseman, JD Herman “Exploring the Effects of Constraints on Multiobjective Evolutionary Algorithm Performance in Water Resources” ASCE EWRI, May, 2017
19. Srubar, WV\*, **JR Kasprzyk** “Design Optimization of Sustainable and Multi-Hazard Resilient Concrete Mixtures” ASCE Structures Congress, April, 2017
20. Srubar, WV\*, **JR Kasprzyk** “Multi-Criteria Design Optimization of Sustainable and Resilient Concrete” ASCE Architectural Engineering Institute Conference, April 2017
21. **Smith, R\***, **JR Kasprzyk**, L Basdekas, L Dilling “Producing regionally-relevant multiobjective tradeoffs to engage with Colorado water managers” Fall Meeting of AGU 2016
22. Srubar, WV\*, **JR Kasprzyk** “Multi-objective, Multi-Hazard Design Optimization of Sustainable and Durable Concrete Mixtures” American Concrete Institute, Philadelphia, PA, October 2016
23. **Piscopo, A\***, RM Neupauer, **JR Kasprzyk** “Guidelines for active spreading during in situ chemical oxidation to remediate contaminated groundwater” ASCE Environmental Water Resources Institute (EWRI) congress, West Palm Beach, FL, May 2016.
24. Srubar, WV\*, **JR Kasprzyk**, “Design of Sustainable and Resilient Concrete Mixtures via Multi-Objective Optimization” International Concrete Sustainability Conference, Washington, DC, May 2016
25. **Smith, R\***, **JR Kasprzyk**, L Dilling, ES Gordon “Co-Production with Water Managers to Improve Applicability and Adoption of an Emerging Decision Support Tool” Fall Meeting of AGU 2015
26. **Piscopo, A**, RM Neupauer, **JR Kasprzyk\*** “Effects of heterogeneity on active spreading strategies to remediate contaminated groundwater” Fall Meeting of AGU 2015

27. *Greene, J\**, *A Piscopo*, R Neupauer, **JR Kasprzyk** “Optimal well placement for enhanced degradation during in situ groundwater remediation” Fall Meeting of AGU, December 2015
28. Huskova, I\*, ES Matrosov, JH Kwakkel, JJ Harou, **JR Kasprzyk**, PM Reed “Adaptive planning for the flexible expansion of London’s water supply system” 3<sup>rd</sup> annual workshop on decision making under deep uncertainty, Delft, Netherlands, 2015.
29. **Kasprzyk, JR\***, JN Ryan, “Tradeoff analysis of setback distance and density for oil and natural gas development” American Water Resources Association (AWRA) 2015 meeting, Denver, CO, November 2015.
30. *Smith, R\**, **JR Kasprzyk**, L Dilling “Co-Producing a Many Objective Water Supply Optimization Experiment to Support Management on the Front Range,” AWRA 2015 meeting, Denver, CO, November 2015
31. *Smith, R\**, **JR Kasprzyk**, E Zagona “Many Objective Analysis to Optimize Pumping and Releases in a Multi-Reservoir Water Supply Network”, AWRA 2015 meeting, Denver, CO, November 2015.
32. **Kasprzyk, JR\***, *R Pence*, B Livneh, F Rosario-Ortiz, “Coupling between hydrologic processes and water quality to enhance resilience of potable water systems under extreme events” Association of Environmental Engineering and Science Professors (AEESP) 2015 meeting.
33. *Piscopo, AN\**, R Neupauer, **JR Kasprzyk**, “Multi-Objective Optimization of Engineered Injection and Extraction with Simultaneous Well Operation for In Situ Groundwater Remediation” MODFLOW and More 2015.
34. *Smith, R\**, **JR Kasprzyk**, L Dilling, E Gordon, “Co-Producing a Many Objective Problem Formulation to Support Water Management in the Front Range” ASCE EWRI 2015.
35. **Kasprzyk, JR\***, *E Houle*, B Livneh, “Diagnostic analysis of multiple snow models across the Western US” ASCE EWRI 2015.
36. **Kasprzyk, JR\***, *Watson, A*, “Incorporating Deeply Uncertain Factors into the Many Objective Search Process” ASCE EWRI 2015.
37. *Piscopo, AN\**, R Neupauer, **JR Kasprzyk**, “Developing design guidelines to remediate contaminated groundwater via Engineered Injection and Extraction based on insights from multi-objective optimization” ASCE EWRI 2015.
38. *Piscopo, AN\**, R Neupauer, **JR Kasprzyk**, “Multi-Objective Optimization of Engineered Injection and Extraction to Remediate Sorbing Contaminants in Homogeneous and Heterogeneous Aquifers” Fall Meeting of AGU, December 2014.
39. **Kasprzyk, JR\*** “Many objective water resources planning and management given deep uncertainties, population pressures, and environmental change” Universities Council on Water Resources (UCOWR) meeting, Boston, MA, June 2014.
40. *Piscopo, AN\**, **JR Kasprzyk**, RM Neupauer, and DC Mays “An Iterative Approach to Many Objective Engineering Design: Balancing Conflicting Objectives for Engineered Injection and Extraction” ASCE EWRI 2014, Portland, OR.
41. *Smith, R\**, **JR Kasprzyk**, E Zagona, J Carron, and N Mander “Many Objective Analysis to Optimize Energy Costs for Water Pumping and Regional Planning” ASCE EWRI 2014, Portland, OR.



42. **Kasprzyk, JR\***, and Guillaume, J “Iterative Closed Question Methodology for Improving the Flexibility of Many Objective Decision Aiding” ASCE EWRI 2014, Portland, OR.
43. Huskova, I\*, ES Matrosov, JJ Harou, **JR Kasprzyk**, and PM Reed “Many Objective Robust Optimization of London’s Regional Water Infrastructure Systems Under Climate Change” ASCE EWRI 2014, Portland, OR.
44. **Kasprzyk, JR\***, PM Reed, DM Hadka. “Battling Arrow’s Paradox to Discover Robust Water Management Alternatives” Fall Meeting of the American Geophysical Union (AGU), December 2013.
45. Guillaume, J\*, **JR Kasprzyk** “Improving the Flexibility of Optimization-Based Decision Aiding Frameworks for Integrated Water Resource Management” Fall Meeting of AGU, December 2013.
46. **Kasprzyk, JR\***, S Nataraj, PM Reed, RJ Lempert. “Many-Objective Robust Decision Making for Water Supply Portfolio Planning Under Deep Uncertainty.” Invited minisymposium talk at SIAM Conference on Computational Science and Engineering, Boston, MA. February 2013
47. **Kasprzyk, JR\***, D Hadka, P Reed, “Diagnostic Evaluation of Many Objective Search for Water Supply Portfolio Planning” ASCE World Water and Environmental Resources Congress. Cincinnati, OH. May 2013.
48. Matrosov, ES, I Huskova, **JR Kasprzyk\***, J Harou, P Reed, “A Many-Objective Analysis of Supply and Demand Management Options for the Thames Basin” ASCE World Water and Environmental Resources Congress. Cincinnati, OH. May 2013.
49. **Kasprzyk, JR\***, S Nataraj, PM Reed, RJ Lempert. “Many objective robust decision making for complex environmental systems undergoing change” Fall Meeting of the American Geophysical Union (AGU). San Francisco, California. December 2012.
50. Reed, PM\*, D Hadka, JD Herman, **JR Kasprzyk**, JB Kollat, “Evolutionary Multiobjective Optimization in Water Resources: The Past, Present, and Future” European Geophysical Union. April 2012
51. **Kasprzyk, JR\***, S Nataraj, PM Reed, RJ Lempert. “Many-Objective Robust Decision Making for Water Supply Portfolio Planning Under Deep Uncertainty.” ASCE World Water and Environmental Resources Congress. Albuquerque, NM. May 2012.
52. Matrosov, ES\*, **JR Kasprzyk**, J Harou, PM Reed. “Many-objective infrastructure capacity optimization – Application to the Thames Basin.” Computing and Control for the Water Industry. Exeter, UK. September 2011.
53. **Kasprzyk, JR\***, JB Kollat, WO Thomas, AC Miller, D Divoky. “Estimating the Impacts of Climate Change and Population Growth on Flood Discharges in the United States.” ASCE World Water and Environmental Resources Congress. Palm Springs, CA. May 2011.
54. **Kasprzyk, JR\***, PM Reed, GW Characklis, BR Kirsch. “What is the Nondominated formulation? A Demonstration of de Novo Water Supply Portfolio Planning Under Deep Uncertainty.” ASCE World Water and Environmental Resources Congress. Palm Springs, CA. May 2011.
55. **Kasprzyk, JR\***, PM Reed, GW Characklis, BR Kirsch. “What is the Nondominated formulation? Demonstration of de Novo Water Supply Portfolio Planning Under Deep Uncertainty.” European Geophysical Union. April 2011.
56. Reed, PM\*, **JR Kasprzyk**, GW Characklis. “Many-objective Risk-based Planning within Complex Engineering Systems: An Urban Water Planning Example.” International conference on vulnerability

and risk analysis and management (ICVRAM) and Fifth international symposium on uncertainty modelling and analysis (ISUMA). Hyattsville, MD. April 2011.

57. **Kasprzyk, JR\***, PM Reed, BR Kirsch, GW Characklis. "Managing population and drought risks using many objective water portfolio under uncertainty." Invited participant to Technology Management and Policy Consortium. Cambridge, UK. 2010.
58. **Kasprzyk, JR\***, PM Reed, BR Kirsch, GW Characklis. "Managing population and drought risks using many objective water portfolio under uncertainty." ASCE World Water and Environmental Resources Congress. Providence, R.I. 2010.
59. Kollat, JB\*, **JR Kasprzyk**, WO Thomas. "Using Uncertain Projections of Extreme Climate Indicators to Quantify the Effects of Climate Change on Extreme Event Flooding in the United States." American Water Resources Association Conference, Seattle, Washington. November 2009.
60. Reed, PM\*, **JR Kasprzyk**, "Do we understand how to use urban water markets to address population and drought risks?" Invited Conference Paper for the World City Water Forum 2009. Songdo Convensia, Incheon, Korea. August 2009.
61. **Kasprzyk, JR\***, Reed, P. M., Kirsch, B. R., Characklis, G. W. "Gaming Change: A Many-Objective Analysis of Water Supply Portfolios under Uncertainty" Fall Meeting of the American Geophysical Union (AGU). San Francisco, California. December 2008.

#### IV.B Poster Presentations

1. Raseman, WJ\*, **JR Kasprzyk**, RS Summers, R Balaji, FL Rosario-Ortiz, W Kleiber, B Livneh "Advancing Stochastic Water Quality and Simulation-Optimization Techniques for Potable Water Systems Facing Source Water Quality Degradation" Fall Meeting of AGU 2018
2. Purcell, B\*, ZA Barker, **JR Kasprzyk**, AS Stillwell "Scenario analysis of downstream flow impacts from reclaimed water consumption in two distinct regions" Fall Meeting of AGU 2018
3. Estep, MA\*, JD Delorit, **JR Kasprzyk**, PJ Block "Informing many-objective decision-making for water rights allocations and trading dynamics conditioned on a streamflow prediction regime in the Elqui River Basin" Fall Meeting of AGU 2018
4. Baker, KA, **JR Kasprzyk** "A guide to the use of internet memes in engineering education" American Society for Engineering Education Zone IV Conference, Boulder, CO, 2017
5. **Kasprzyk, JR\***, R Smith, WJ Raseman, MA DeRousseau, L Dilling, K Ozekin, RS Summers, R Balaji, B Livneh, FL Rosario-Ortiz, L Sprain, WV Srubar "Collaborative Workshops for Assessment and Creation of Multi-Objective Decision Support for Multiple Sectors" Fall Meeting of AGU 2017.
6. Alexander, E\*, **JR Kasprzyk**, EA Zagona, J Prairie, C Jerla, A Butler "Using Multi-Objective Optimization to Explore Robust Policies in the Colorado River Basin" Fall Meeting of AGU 2017.
7. Raseman, WJ\*, **JR Kasprzyk**, FL Rosario-Ortiz, RS Summers, AK Hohner "Multiobjective Optimization of Water Treatment Operations for Seasonally Varying Source Water Quality and Extreme Events" Water Quality Technology Conference, November 2017, Portland, OR
8. Smith, R\*, **JR Kasprzyk**, "Using multiobjective tradeoffs sets and Multivariate Regression Trees to identify critical and robust decisions for long term water utility planning" Submitted to Decision Making under Uncertainty Conference, Oxford, UK, November 2017

9. Raseman, WJ\*, **JR Kasprzyk**, *JP Vernon*, RS Summers, FL Rosario-Ortiz “Long-Term Planning for Potable Water Systems under Climate Change and Extreme Weather Events: Translating Stakeholder Feedback into Modeling and Optimization” Association of Environmental Engineering and Science Professors meeting, Ann Arbor, MI, June 2017
10. Smith, R\*, **JR Kasprzyk**, L Dilling, L Basdekas, L Kaatz “Improving the relevance and impact of decision support research: A co-production framework and water management case study” Fall Meeting of AGU 2016
11. Stewart, JR\*, B Livneh, **JR Kasprzyk**, WJ Raseman “Ensemble Modeling of Suspended Sediment in Steep Mountain Catchments” Fall Meeting of AGU 2016
12. Yanto, **JR Kasprzyk\***, B Rajagopalan, B Livneh “Multi-objective Optimization Based Calibration of Hydrologic Model and Ensemble Hydrologic Forecast for Java Island, Indonesia” Fall Meeting of AGU 2016
13. Alongi, M\*, **JR Kasprzyk**, J Milford, JN Ryan, M Estep “Multiobjective Policy Analysis to Evaluate Air Quality Impacts of Oil and Gas Regulations” Fall Meeting of AGU 2016
14. Raseman, WJ\*, **JR Kasprzyk**, FL Rosario-Ortiz, RS Summers, JR Stewart, B Livneh “Multi-objective Optimization for the Robust Performance of Drinking Water Treatment Plants under Climate Change and Climate Extremes” Fall Meeting of AGU 2016
15. **Kasprzyk, JR\***, WJ Raseman, FL Rosario-Ortiz, JR Stewart, B Livneh “Decision support framework for potable water systems under climate extremes” Decision Making under Uncertainty Conference, Washington, DC, November 2016
16. Smith, R\*, **JR Kasprzyk**, L Dilling “How can we improve decision support research and increase its impact on resource management? A co-production framework and water management case study” Decision Making under Uncertainty Conference, Washington, DC, November 2016
17. Smith, R\*, **JR Kasprzyk**, EA Zagona “Improving the Performance of Highly Constrained Water Resource Systems using Multiobjective Evolutionary Algorithms and RiverWare” Fall Meeting of AGU, December 2015
18. Yanto\*, B Livneh, B Rajagopalan, **JR Kasprzyk** “Hydrologic Modeling and Parameter Estimation Under Data Scarcity for Java Island, Indonesia” Fall Meeting of AGU, December 2015.
19. Alongi, M\*, *C Howard*, **JR Kasprzyk**, JN Ryan “Toward a multi-objective decision support framework to support regulations of unconventional oil and gas development” Fall Meeting of AGU, December 2015.
20. Huskova, I\*, ES Matrosov, JJ Harou, **JR Kasprzyk**, and PM Reed “Scheduling interventions within water resource systems under deep uncertainty” Fall Meeting of AGU, December 2015.
21. Clarkin, TJ\*, WJ Raseman, **JR Kasprzyk**, JD Herman “How do severe constraints affect the search ability of multiobjective evolutionary algorithms in water resources?” Fall Meeting of AGU, December 2015.
22. Huskova, I\*, ES Matrosov, JJ Harou, **JR Kasprzyk**, and PM Reed “Scheduling and adaptation of London’s future water supply and demand schemes under uncertainty” European Geosciences Union (EGU) General Assembly 2015.
23. **Kasprzyk, JR\***, AA Watson. “Incorporating Deeply Uncertain Factors into the Many Objective Search Process: Improving Adaptation to Environmental Change” Fall Meeting of AGU, December 2014.

24. Houle, ES\*, BL Livneh, **JR Kasprzyk**. “Inter-Model Diagnostics for Two Snow Models Across Multiple Western U.S. Locations and Implications for Management” Fall Meeting of AGU, December 2014.
25. Huskova, I\*, ES Matrosov, JJ Harou, **JR Kasprzyk**, PM Reed. “Scheduling Future Water Supply Investments Under Uncertainty” Fall Meeting of AGU, December 2014.
26. Smith, R\*, JR Kasprzyk, EA Zagana. “Combining Interactive Infrastructure Modeling and Evolutionary Algorithm Optimization for Sustainable Water Resources Design” Fall Meeting of AGU, December 2013.
27. Piscopo, A\*, **JR Kasprzyk**, R Neupauer, D Mays. “Many-Objective Design of Engineered Injection and Extraction Sequences for In Situ Remediation of Contaminated Groundwater” ASCE World Water and Environmental Resources Congress, Cincinnati, OH. May 2013.
28. Zeff, HB\*, **JR Kasprzyk**, PM Reed, GW Characklis. “A Many-Objective Approach to Developing Adaptive Water Supply Portfolios in the ‘Research Triangle’ Region of North Carolina” AGU Fall Meeting, San Francisco, California, December 2012.
29. Huskova, I\*, ES Matrosov, **JR Kasprzyk**, JJ Harou, PM Reed. “A Many-Objective Analysis of Supply and Demand Management Options for the Thames Basin” AGU Fall Meeting, San Francisco, California, December 2012.
30. **Kasprzyk, JR\***, PM Reed, GW Characklis, BR Kirsch. “What is the Nondominated Formulation? A Demonstration of de Novo Water Supply Portfolio Planning Under Deep Uncertainty” Fall Meeting of the American Geophysical Union. AGU Fall Meeting. San Francisco, California. December 2010.
31. **Kasprzyk, JR\***, PM Reed, BR Kirsch, GW Characklis. “Sensitivity-Informed De Novo Programming for Many-Objective Water Portfolio Planning Under Uncertainty.” AGU Fall Meeting. San Francisco, California. December 2009.

#### IV.C Other Presentations

- **Kasprzyk, JR\***, “Toward Improved Reservoir Management via Hydrologic Uncertainty Quantification” CU Hydrologic Sciences Symposium, 2018.
- **Kasprzyk, JR\***, JR Stewart, B Livneh, B Rajagopalan “Improving the holistic calibration of simulated hydrologic processes using multiple objectives” CU Hydrologic Sciences Symposium, 2017.
- Estep, M\*, **JR Kasprzyk** “Comparison of Water Markets in Multiple Countries and the Potential for Multi-Objective Optimization in the Chilean Elqui Valley” CU Hydrologic Sciences Symposium, 2017.
- Greene, JA\*, RM Neupauer, M Ye, **JR Kasprzyk**, DC Mays “Remediation of Uranium-Contaminated Groundwater Using Engineered Injection and Extraction” CU Hydrologic Sciences Symposium, 2017.
- Smith, RM\*, **JR Kasprzyk** “Connecting Water Managers, Multiobjective Evolutionary Algorithms, and Multivariate Regression Trees to Support Water Utility Planning on the Front Range” CU Hydrologic Sciences Symposium, 2017.
- Vernon, JP\*, WJ Raseman, **JR Kasprzyk**, FL Rosario-Ortiz, AK Hohner, RS Summers “Multi-Objective Optimization Using Water Treatment Plant Simulation Model for Wildfire Conditions” Poster Presentation at CU Hydrologic Sciences Symposium, 2017.
- Invited presentation for University of California Berkeley Environmental Engineering seminar, April 2016
- **Kasprzyk, JR\*** “Many Objective Decision Support for Water and Environmental Problems Under Deep Uncertainty” CU Hydrologic Sciences Symposium, 2016.

- Clarkin, T\*, W Raseman, **JR Kasprzyk**, J Herman “Exploring the effects of constraints on multiobjective evolutionary algorithm optimization efficiency and effectiveness in water resources” CU Hydrologic Sciences Symposium, 2016.
- Participated in panel discussion at EWRI 2015 on improving systems education in water resources
- Watson, A\*, **JR Kasprzyk** “Incorporating Deeply Uncertain Factors into the Many Objective Search Process” CU Hydrologic Sciences Symposium, 2015.
- Smith, R\*, **JR Kasprzyk**, E Zagona, L Blaylock, J Carron, N Mander “Many Objective Analysis to Optimize Pumping and Releases in a Multi-Reservoir Water Supply Network.” RiverWare User Group Meeting, Boulder, CO, January 2015.
- Invited presentation for the Van Tuyl hydrologic seminar series, Colorado School of Mines, January 2015
- Invited presentation, “Introduction to Water Resources Engineering” for University of Colorado International English Center’s Go English! program for international students
- Invited Presentation, University of Illinois Urbana Champaign, October 2014
- Invited Presentation, Imperial College London, March 2014
- **Kasprzyk, JR\*** and R Smith, “Framing Energy and Environmental Planning Problems Using Many Objective Robust Decision Making,” Presentation at IQ SCENE: Innovative techniques for Quantitative Scenarios in Energy and Environmental Research, a workshop at the University College London Energy Institute, London, UK, March 2014.
- **Kasprzyk, JR\*** “Balancing cost, performance, and efficiency for complex water problems: A many objective approach to sustainability.” Invited presentation to the Center for Science and Technology Policy Research, CIRES, University of Colorado, October 2013
- Invited Presentation, Colorado State University, October 2013
- CEAE Department Seminar, September 2013.
- **Kasprzyk, JR\*** and R Smith, “What are the tradeoffs? A many objective approach to water resources planning”. RiverWare User Group Meeting, Boulder, CO, August 2013.
- Invited Panelist at Association of Environmental Engineering and Science Professors (AEESP) Conference Workshop, *Increasing the Role of Economics in Environmental Research*, July 2013, Golden, CO
- “Improving Water Supply Sustainability Using Many-Objective Water Portfolio Planning,” Invited presentations at Oregon State University, University of Colorado Boulder, March 2012
- “Many-Objective Visual Analytics: Participatory Decision Support in Water Resources and Beyond”: with Pat Reed and Shanthi Nataraj, RAND National Security Research Division Briefing, February 2012
- “Many-Objective de Novo Water Supply Portfolio Planning Under Deep Uncertainty”: Penn State (PSU) Environmental Economics seminar Fall 2010; PSU Student chapter of INFORMS Spring 2011; PSU Water Resources Engineering seminar Spring 2011

## V. Proposals for Research

### V.A Current and Past Funded Grants at CU Boulder

#### 1. Center for Effective Abatement of Nutrients (CLEAN)

*Subaward to CU from Colorado State University*

CU Investigators: Rajagopalan Balaji, JoAnn Silverstein, Joseph Kasprzyk

Funding Agency: Environmental Protection Agency

Total Award: \$2,220,150

Award Period: 9/1/2013-8/1/2017

Kasprzyk Support: 1 month summer salary and student co-advised with R. Balaji, both in years 3-4

Description: The mission of the CLEAN center is to create knowledge, build capacity, and forge collaboration to develop sustainable solutions for reduction of nutrient pollution in the nation's water resources. My task in the project creates a decision support system to demonstrate how to reduce nutrients across the different domains within the broader project.

#### 2. Balancing Severe Decision Conflicts Under Climate Extremes in Water Resource Management

Investigators: Lisa Dilling, Joseph Kasprzyk, Kristen Averyt, Eric Gordon, Imtiaz Rangwala (CU Boulder); Leon Basdekas (Colorado Springs Utilities); Lurna Kaatz (Denver Water)

Funding Agency: National Oceanic and Atmospheric Administration

Total Award: \$276,064

Award Period: 8/1/2014-7/1/2016

Kasprzyk Support: 1 month summer salary and support for one graduate student through project duration

Description: The project seeks to improve water management under climate change in the Front Range of Colorado by (i) holding a series of workshops with six Front Range water utilities to understand best practices for using MOEA-based decision support and (ii) co-producing a water management test bed, which combines MOEAs, water system infrastructure models, and plausible climate change projections.

#### 3. An integrated modeling and decision framework to evaluate adaptation strategies for sustainable drinking water utility management under drought and climate change

Principal Investigator: Kenan Ozekin (Water Research Foundation)

Investigators: Balaji Rajagopalan, Scott Summers, Fernando Rosario-Ortiz, Ben Livneh, Joseph Kasprzyk

Funding Agency: Environmental Protection Agency

Total Award: \$1,250,000

Award Period: 3/1/2015 – 2/28/2018

Kasprzyk Support: 1 month summer salary and support for one graduate student through project duration

Description: The project seeks to understand how drought due to climate change and other extreme events challenge drinking water utilities' ability to treat water to meet regulatory and public health protection goals, focusing on water quality. Objectives are: (i) connect watershed processes with sediment generation and water quality, (ii) understand the mobilization and transport of organic matter, sediments, and nutrients through the watershed and eventually to the water treatment plant, (iii) develop source water quality thresholds at the water treatment plant and use stream water quality information to predict threshold exceedance, and (iv) evaluate a suite of adaptation and operation strategies (e.g., watershed management, wild fire mitigation, treatment plant modifications) along with their economic, societal and policy implications with multi-objective optimization tools. My main contribution is in activity (iv) as well as supporting the hydrologic modeling aspects of the project.

4. Routes to Sustainability for Natural Gas Development and Water and Air Resources in the Rocky Mountain Region  
Investigators: Joseph Ryan, Mark Williams, and Michael Hannigan, as well as a network of researchers at Colorado State University, Colorado School of Mines, and other institutions.  
Funding Agency: National Science Foundation  
Total Award: \$11,999,328  
Award Period: 10/01/2012 – 9/30/2017  
Description: The broader project is an NSF Sustainability Research Network that seeks to provide better scientific understanding of unconventional oil and gas development in the Rocky Mountain region. In April 2015, I was added to the project to aid in decision support for the project. I advise one graduate student starting in April 2015 through the duration of the project and receives 1 month of summer salary per year. For more on the project see <http://www.airwatergas.org/>
5. Collaborative Research: Multi-Model Bayesian Data-Worth Analysis for Groundwater Remediation Design  
Investigators: Roseanna Neupauer, Joseph Kasprzyk (CU Boulder); Ming Ye (Florida State)  
Funding Agency: National Science Foundation  
Amount: \$183,760  
Period: 8/2016 – 7/2019  
Support: 1 co-advised graduate student for duration of project, 1 month summer support per year  
Description: The project addresses the challenge that groundwater remediation strategies often fail because they ignore model uncertainty. The proposed research uses a multi-model data-worth analysis to improve groundwater remediation design. The project also involves creating model surrogates to improve computational efficiency.
6. Design Optimization of Sustainable and Resilient Concrete Mixtures  
Investigators: Wil Srubar, Joseph Kasprzyk, Leah Sprain  
Funding Agency: National Science Foundation  
Amount: \$598,745  
Period: 7/2016 – 6/2019  
Support: 1 graduate student for duration of project, 1 month summer support per year  
Description: The project addresses the challenge that conventional design of concrete mixtures employs time-intensive, trial-and-error approaches that do not offer optimal performing designs. We will define, formulate, and link mathematical models that relate concrete mixture proportions to concrete performance, linking the models with multi-objective optimization. The project will involve industry professionals in the development and testing of the methodology through interactive workshops, taking advantage of a collaboration with a communication sciences professor.
7. Colorado River Basin Decision Making Under Deep Uncertainty  
Investigators: Joseph Kasprzyk, Edie Zagona  
Funding Agency: Bureau of Reclamation  
Amount: \$57,557  
Period: 9/2017 – 9/2018  
Support: Salaries and wages  
Description: The project will explore the application of decision making under deep uncertainty (DMDU) for the Colorado River Basin, in order to expand the Bureau of Reclamation's capabilities with respect to DMDU frameworks. The work will be completed in four phases: literature review of DMDU frameworks,

synthesis and testing of a new DMDU framework to be used for Colorado River Basin planning, design of the final framework, and demonstration of its capabilities to support decision making in the basin.

8. Water Treatment Plant (WTP) Model Software Development

Investigators: Joseph Kasprzyk, R Scott Summers

Funding Agency: Subcontract to Cadmus, Inc.

Amount: \$88,000

Period: 1/2018 to 4/2018 with extensions to present

Support: Salaries and wages

Description: The project supports modernization of the WTP model to support modern operating systems, including the addition and testing of new prediction algorithms and functionality. It provides partial support for Billy Raseman’s doctoral degree.

V.B Computational allocations

- NSF Extreme Science and Engineering Discovery Environment (XSEDE). Startup allocation of 50,000 service units, project number TG-ENG150007, “Parallel Multi-Objective Optimization for Contamination Remediation in Heterogeneous Aquifers.” 3/3/2015-3/3/2016

V.C Other Support

- Department of Education Graduate Assistantships in Areas of National Need (GAANN) fellowship program awarded to CU Boulder starting Summer 2016. I am an associated researcher with the project and maintains the website, <http://engresilience.wordpress.com/>. The program supports approximately 8 graduate doctoral research assistantships for a period of up to 5 years. PhD student Melissa Estep is working with me as a result of this project.
- Water-Energy Nexus Interdisciplinary Research Theme Seed Grant, \$11,177
- Department of Education Graduate Assistantships in Areas of National Need (GAANN) fellowship awarded to CU Boulder starting Summer 2019. I am Co-Project Director with the project and maintain the website, <https://www.colorado.edu/gaann-infrastructure/>. The program supports approximately 8 graduate doctoral research assistantships, and I am currently recruiting for the project with doctoral students starting in Fall 2019.

V.D Pending and Declined Proposals

Year	Title	PIs, Co-PIs, and Collaborators	Funding Agency	Funding Level	Status
2016	INFEWS/T1: Water and Energy Resilient Protein (WERP): Developing a Global Framework for Understanding Food System Resilience	PI: Sherri Cook. Co-PIs: Peter Newton, Ben Livneh, <b>Joseph Kasprzyk</b> , Kristen Averyt	NSF EAR	\$1,999,998	Declined
2016	Collaborative Research: Resilient Potable Water Systems: The Role of Public and Decision-maker Core Beliefs, Risk Perceptions, and Policy Preferences	PI: Katie Dickinson Co-PIs: <b>Joseph Kasprzyk</b> , Deserai Crow  Collaborative with Duke University	NSF SES	\$497,742	Declined
2015	CNH-L: Coupling among climate change, water quality, and decision-making to enhance	PI: <b>Joseph Kasprzyk</b> Co-PIs: Fernando Rosario-Ortiz, Katie Dickinson	NSF DEB	\$1,799,931	Declined



	resilience of potable water systems	With subawards to Duke University, Columbia University, Water Research Foundation			
2015	Collaborative Research: Resilient Potable Water Systems: The Role of Public and Decision-Maker Risk Perceptions, Beliefs, and Values	PI: Katie Dickinson Co-PIs: <b>Joseph Kasprzyk</b> , Deserai Crow  Collaborative with Duke University	NSF SES	\$459,429	Declined
2014	CNH-L: Coupling among climate change, water quality, and decision-making to enhance resilience of potable water systems	PI: <b>Joseph Kasprzyk</b> Co-PIs: Fernando Rosario-Ortiz, Katie Dickinson  With subawards to Duke University, Columbia University, Water Research Foundation	NSF AGS	\$1,799,481	Declined
2014	Quantifying the Multiscale Environmental Benefits of Geopolymer-based Pervious Pavement Materials	PI: Wil Srubar, co-PI <b>Joseph Kasprzyk</b>	NSF CBET	\$299,505	Declined
2014	Collaborative Research: Toward Optimal Water Allocation in Drought-prone Regions Through Hydroclimatic Prediction and Many-objective Risk Management	Lead institution University of Wisconsin, PI: Paul Block  CU-Boulder collaborative: PI <b>Joseph Kasprzyk</b>	NSF CBET	\$149,996	Declined
2014	RSB: Toward More Sustainable Residential Building Systems: A Multi-Objective Decision-Making Framework for Homeowners and Communities	PI Abbie Liel; Co-PI <b>Joseph Kasprzyk</b>	NSF CMMI	\$1,199,980	Declined
2013	Collaborative Research: WSC-Category 3 Collaborative: Designing Robust Institutions and Adaptation Strategies for Competing Water Uses Given Climate Change Uncertainty	Lead institution University of Colorado Denver, PI: Tanya Heikkela  CU-Boulder collaborative: PI Rajagopalan Balaji; Co-PIs Ben Livneh, <b>Joseph Kasprzyk</b> , Roseanna Neupauer	NSF EAR	\$1,124,767	Declined
2013	Quantifying the Environmental Benefits of Resilient Pervious Cement-based Infrastructure Materials	PI Wil Srubar, Co-PI <b>Joseph Kasprzyk</b>	NSF CBET	\$299,976	Declined
2013	Collaborative Research: Quantifying the Depths of Uncertainty in Extreme Atmospheric-Hydrologic Events for Improved Understanding of Flooding Processes	CU-Boulder is lead institution. PI Ben Livneh; Co-PIs <b>Joseph Kasprzyk</b> , Rajagopalan Balaji  With collaborative institution University of Colorado Denver	NSF EAR	\$490,979	Declined
2013	Multi-scale water supply and demand outlooks: Development and application for optimal	Lead institution University of Wisconsin, PI: Paul Block	NASA	\$235,882 (sub award)	Declined

	water allocation in drought-prone regions	CU-Boulder subaward, lead PI: <b>Joseph Kasprzyk</b>			
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*Note: For NSF proposals above, division acronyms are: AGS: Atmospheric and Geospace Sciences, CBET: Chemical, Bioengineering, Environmental, and Transport Systems, CMMI: Civil, Mechanical, and Manufacturing Innovation, DEB: Environmental Biology, EAR: Earth Sciences, SES: Social and Economic Sciences*

## **VI. Distinctions**

- Young Researcher Award, CEAE Department, 2017
- Early Career Research Excellence Award of the International Environmental Modelling and Software Society (iEMSs). Awarded at iEMSs meeting in Toulouse, France, July 2016.
- University Council on Water Resources (UCOWR) Ph.D. Dissertation Award in Natural Science and Engineering, Awarded at UCOWR Conference, June 2014.
- Quentin Martin Best Practice-Oriented Paper, ASCE Journal of Water Resources Planning and Management, for Fu et al. (2013) "Optimal Design of Water Distribution Systems Using Many-Objective Visual Analytics" Awarded at EWRI 2014 in Portland, OR.
- Reviewing awards: Environmental Modelling and Software (2014); Journal of Water Resources Planning and Management (Best Reviewer, 2014; Outstanding Reviewer; 2011); Water Resources Research (2014)
- Student Presentation Award, International Environmental Modelling and Software Society Meeting, July 2012
- US Environmental Protection Agency Science to Achieve Results (STAR) Graduate Fellowship, 2010-2013
- NSF Graduate Research Fellowship Program Honorable Mention, 2009
- First Place Technical Paper/Presentation Competition, ASCE Mid-Atlantic regional student competition, 2007
- Member, Chi Epsilon Civil Engineering Honor Society

## **VII. Professional Affiliations**

American Society of Civil Engineering

American Geophysical Union

Association of Environmental Engineering and Science Professors

American Water Resources Association

## **VIII. National and International Service**

### **Moderated Sessions at Professional Conferences**

- Convener of a session at AGU 2018
- Co-convener of a session at AGU 2017
- Session organizer and co-convener for 3 sessions at AGU 2016
- Co-convener of session at iEMSs 2016, Toulouse, France.

- Moderator of session at AEESP 2015, New Haven, CT
- Co-convenor of “Water Resources Management and Planning – Modeling and Software for Improving Decisions and Engaging Stakeholders” at iEMSs 2014, San Diego, CA.
- Reviewed abstracts and moderated water management sessions for EWRI 2014, Portland, OR; EWRI 2015, Austin, TX; EWRI 2016, West Palm Beach, FL
- Moderated sessions at AGU Fall Meeting 2013-2015, San Francisco, CA.
- Served on Planning Committee and moderated “Professional Development” panel discussion at EPA STAR Graduate Fellowship Conference, September 2011

### **External Service**

- Associate Editor of Journal of Water Resources Planning and Management, August 2016 - Present.
- Member of control group of Environmental Water Resource Systems (EWRS) committee of ASCE EWRI, 2016-2020 (a four year term that includes serving as Secretary, Vice Chair, Chair, and Past Chair). The EWRS committee includes over 100 researchers and practitioners in the field of water resources systems.
- Member of Water and Society, and Uncertainty technical committees at AGU
- Guest Editor for Thematic Issue “Evolutionary Algorithms and Other Metaheuristics in Water Resources: Research Challenges and Future Directions”, *Environmental Modelling and Software* with Holger R Maier (University of Adelaide), Zoran Kapelan (University of Exeter) and L Shawn Matott (University at Buffalo)
- Vice Chair of a task committee sponsored by EWRS within EWRI: ECSTATIC: Excellence in Systems Analysis Teaching and Innovative Communication. The committee is headed by Prof. David Rosenberg, Utah State. Our objectives are to create an interactive website with course materials, prepare a manuscript that reviews the state of systems analysis education, propose sessions at the EWRI conference focused on systems analysis education, and create a technical publication that presents a community-oriented curriculum to improve education.
- Reviewer (listed in order of frequency): Journal of Water Resources Planning and Management, Water Resources Research, Environmental Modelling and Software, Advances in Water Resources, Journal of Hydroinformatics, Journal of the American Water Resources Association, Geoscientific Model Development, Water Management, Journal of Environmental Management, IEEE Transactions on Evolutionary Computation.
- Volunteer judge for Penn State Undergraduate Exhibition, spring 2013

### **Outreach**

- From 2014-present, gave presentations at several sessions within CU’s International English Center (IEC), that seeks to provide English language and college preparation skills to incoming international students. Topics include Introduction to Water Management and Study Skills to Succeed in College. Seeking to build further collaboration on course material and mentorship with IEC faculty.
- Held workshop in 2015 that brought together a set of Front Range water management agencies to discuss multi-objective water resources planning under climate change. As part of our NOAA-funded project, we seek to help improve managers’ ability to cope with supply-demand imbalances as well as improve the sustainability of public water supply.
- Participated in workshops at University of California, Davis that interfaced academics with water utilities to discuss new methods for improving water management

- Disseminating research insights through web publishing. Water Programming, a collaborative blog with researchers at Cornell University and elsewhere, provides tips on simulation, optimization, Linux programming and high performance computing, at <http://waterprogramming.wordpress.com>.
- Presented water management research to state high school science fair competition students, spring 2011
- Volunteer judge at Pennsylvania Junior Academy of Science (PJAS) competition (science fair for middle school and high school students), summer 2009

## IX. University Service

### Department Service

- Graduate committee, 2013-2014, 2014-2015, 2016-2017, 2017-2018. Responsible for coordinating graduate applications for the Hydrology, Water Resources, and Fluid Mechanics group within CEAE, communicating with students, and acting as the de facto advisor for incoming students. As part of my committee work, I was also responsible for updating the CEAE department website with information about groups' research. For 2016-2017 and 2017-2018 recruiting seasons, I also coordinated the Civil Systems group admissions.
- Curriculum committee, 2015-2016. We review new course proposals as well as coordinate the undergraduate course offerings for civil and architectural engineering majors in the department.

### Graduate Student Committees

*Italics* denotes degrees still in progress. See more information about my advised students below this section.

#### Advisor/Co-Advisor (total: 13):

Rebecca Smith (MS, Spring 2014; PhD, Fall 2017), Liz Houle (MS, Spring 2015), Abigail Watson (MS, Summer 2015), Amy Piscopo (PhD, Fall 2015), Timothy Clarkin (MS, Spring 2016), Matthew Alongi (MS, Spring 2017), Nathan Stambaugh (MS, Spring 2017), Elliot Alexander (MS, Summer 2018), Leah Bensching (MS, Spring 2019), William Raseman (*PhD, expected Fall 2018*), Melissa Estep (*PhD, expected Spring 2020*), Mikaela DeRousseau (*PhD, expected Spring 2020*), Brendan Purcell (*MS, expected Spring 2019*), Michelle O'Donnell (*MS, expected Spring 2020*)

Committee Member: Neil Stewart (*MS, passed oral exam*), Pablo Mendoza (PhD, Spring 2015), Farrokh Shoaie (PhD, Spring 2015), Jeff Walters (PhD, Spring 2015), Todd Bergman (MS, Spring 2015), Antoine Tixier (PhD, Spring 2015), Emily Gill (PhD, Summer 2015), Solomon Erkyihun (PhD, Summer 2015), Mary Jean O'Hair (MS, Summer 2015), Xavier Alegre (PhD, Fall 2015), Andrew Verdin (PhD, Summer 2016), Cameron Bracken (PhD, Summer 2016), Yanto (PhD, Summer 2017), Sarah Welsh-Huggins (PhD, Spring 2017), Bihu Suchetana (PhD, Summer 2017), Jenna Stewart (MS, Spring 2017), Jack Greene (MS, Fall 2017), Sarah Goldstein (MS, Spring 2018), Eric Roth (PhD, Fall 2018), Peter Van Dusen (MS, Spring 2019), Topher Jones (*PhD, expected Spring 2019*),

## X. Students Mentored

### Current Graduate Student Advising

- **William Raseman.** Doctoral student, passed preliminary and comprehensive exams, expected graduation date Spring 2019. Mr. Raseman's dissertation advances techniques for analysis of water quality extremes, multi-objective visualization, and optimization of water treatment plant operations.
- **Melissa Estep.** Doctoral student, passed preliminary exam, expected graduation date Spring 2021. Ms. Estep participates in the GAANN fellowship program that affords training for research and teaching for

doctoral students. Her project analyzes water marketing and hydrologic forecasting in the Elqui Basin in Chile.

- **Mikaela DeRousseau.** Doctoral student, passed preliminary exam, expected graduation date Spring 2020. Ms. DeRousseau's dissertation is creating a multi-objective optimization framework for sustainable materials design, including improved life cycle assessment and machine learning for predicting concrete compressive strength.
- **Brendan Purcell.** Master's student, expected graduation Spring 2019. Mr. Purcell is creating a framework for analyzing downstream impacts of reclaimed water consumption.
- **Michelle O'Donnell.** Master's student, co-advised by Ben Livneh, expected graduation Spring 2020. Ms. O'Donnell is analyzing regional rates of reservoir sedimentation.
- **Fall 2013 – Spring 2015, Fall 2016 – present:** As the graduate committee representative for the Hydrology, Water Resources and Environmental Fluid Mechanics group, I have served as the initial advisor for all new students in the group. Students mentored: Eric Peterson, Rachel Pence, Sarah Baker, Syed Zafar, Garret Sprouse, Stephanie Warren, Zac Kannan, Thaddeus Webb, Elizabeth Jefferson, Alex Bauch.

### Former Graduate Student Advising

- **Liz Houle (MS, Spring 2015).** Currently at Lynker Consulting. Ms. Houle performed a project investigating model parameter uncertainty for snow and hydrological models, with the ultimate goal of improving water supply planning especially under conditions of environmental change.
- **Abigail Watson (MS, Summer 2015).** Currently at Riverside Technologies. Ms. Watson performed a study that investigated incorporating deeply uncertain factors (e.g., population growth and changes to hydrology) into the many objective search process, to aid water supply portfolio management.
- **Dr. Amy Piscopo (PhD, Fall 2015).** Currently at EPA Research and Development, Rhode Island. Co-advised with Prof. Roseanna Neupauer. Dr. Piscopo developed an iterative multi-objective design approach for engineered injection and extraction of contaminated groundwater, advancing techniques for active spreading of groundwater contamination for multiple contamination scenarios.
- **Timothy Clarkin (MS, Spring 2016).** Currently with US Army Corps of Engineers. Mr. Clarkin's project explored the effect of constraints on MOEA problem formulations, in order to determine how an analyst's assumptions affect the optimization and decision support process. The project was in collaboration with William Raseman and Prof. Jon Herman (UC Davis).
- **Matthew Alongi (MS, Spring 2017).** Currently with ICEM (International Centre for Environmental Management) in Hanoi, Vietnam. Mr. Alongi worked on the NSF-funded sustainability research network on unconventional oil and gas development, creating a simulation-model based framework to calculate potential air quality outcomes of different setback regulations.
- **Nathan Stambaugh (MS, Spring 2017).** Currently with the US Navy. Co-advised by Prof. Wil Srubar. Mr. Stambaugh improved models of service life for concrete, and using MOEAs to optimize concrete mix design properties.
- **Dr. Rebecca Smith (MS, Spring 2014; PhD, Fall 2017).** Currently with the US Bureau of Reclamation. Dr. Smith's masters research advanced large scale water resources infrastructure planning using multiobjective evolutionary algorithms and RiverWare simulations, exploring new management strategies for the Tarrant Regional Water District in Texas. Her doctoral research provided best practices for incorporating MOEA decision support into water management, using a combination of engineering and social science

approaches. This was done through co-producing a decision support testbed through a series of workshops with 6 water utilities in the Front Range of Colorado, in collaboration with Western Water Assessment at CU.

- **Elliot Alexander (MS, Summer 2018).** Currently with the US Bureau of Reclamation. Co-advised by Prof. Edith Zagona in collaboration with CU's Center for Advanced Decision Support for Water and Environmental Systems (CADSWES) and the Bureau of Reclamation. Mr. Alexander investigated the use of robust decision making techniques for water resources in the context of Colorado River Basin planning.
- **Leah Benschung (MS, Spring 2019).** Master's student, advised by Ben Livneh and co-advised by Kasprzyk. Ms. Benschung performed a sensitivity analysis of sediment prediction, to support better methods of predicting reservoir sedimentation.

## **XI. Courses Taught**

### *Colorado*

- CVEN 4323/5423: Water Resources Engineering (Fall term: 2013-2018)  
Description: Topics include rainfall-runoff modeling, flood control, design of drainage systems, uncertainty analysis. The course includes an end-of-term project.  
Average enrollment: 20 (10 undergraduate, 10 graduate students)  
Note: In Fall 2016, the course was slightly modified to be solely a graduate offering (5423); many advanced undergrads are still enrolled.
- CVEN 4333: Engineering Hydrology (Spring term: 2014-2018).  
Description: The course covers descriptions and numerical calculations of hydrologic processes as well as unit hydrograph theory, routing, and frequency analysis.  
Average enrollment: Up to and including Spring 2016: 90-110 students. Prof. Ben Livneh started offering 4333 in the fall term and enrollment fell to 59 students in Spring 2017
- CVEN 5393: Water Resource Systems and Management (Spring term: 2015-2017, 2019).  
Description: Topics include optimization, simulation modeling of reservoir systems using RiverWare, and water resources planning and management. The course includes an end-of-term project.  
Average enrollment: 15-20 students.

### *Penn State*

- CE 461: Water Resources Engineering, Instructor (Spring 2011), Teaching Assistant (Fall 2008 – Spring 2009)