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Watering for Community Gardens

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George D. Ricco is an assistant professor of engineering and first-year engineering coordinator at the University of Indianapolis. He focuses his work between teaching the first two years of introductory engineering and engineering design and research in student progression. Previously, he was a special title series assistant professor in electrical engineering at the University of Kentucky, and the KEEN Program Coordinator at Gonzaga University in the School of Engineering and Applied Science. He completed his doctorate in engineering education from Purdue University's School of Engineering Education. Previously, he received an M.S. in earth and planetary sciences studying geospatial imaging, and an M.S. in physics studying high-pressure, high-temperature FT-IR spectroscopy in heavy water, both from the University of California, Santa Cruz. He holds a B.S.E. in engineering physics with a concentration in electrical engineering from Case Western Reserve University. His academic interests include longitudinal analysis, visualization, semantics, team formation, gender issues, existential phenomenology, and lagomorph physiology.

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Watering Solutions for Community Gardens

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The University of Indianapolis (UIndy) has partnered with the Community Health Network (CHNw) to address the food insecurity related issues among the residents of the South Indy Quality of Life Plan (SoIndy) in two community organic gardens. The goal of the Watering for Community Gardens project is to design and construct a watering system for the University Heights community garden. Employing a Design for Six Sigma framework (DFSS) under the DesignSpine™ design model at UIndy, the team began the process by conducting interviews with the client and interns who work in the garden. The Voice of the Customer DFSS tools that were utilized in this project, includes translation worksheets and KJ Analysis. These were used to help solicit and evaluate requirements that were most important to the user. There are four "stage-gate" checkpoints during this process. Our team has completed the first two. The first stage involves interviews with our client to determine functional and non-functional requirements. In the second stage, our team began to ideate and develop designs. After some preliminary designs, the team was able to narrow down to one design. The team decided on 3 designs to present for Gate Review 2. Each of the 3 designs was given design descriptions, and they were a gravity-fed drip irrigation system, an in-soil watering system, and a water pump fed system. Calculations were performed to determine the velocity of fluid flow, the volumetric flow rate, the gallons per day required for the garden beds, the height required for a gravity-fed tank, and the prospective amount of gallons that can be collected from the roof to assist in choosing a suitable design. After calculating that 57.82ft of height was needed for the gravity-fed drip irrigation system, it was determined that this option would not be best. The in-soil watering system design is composed of a solar panel connected to a battery that powers a pump. The pump takes water from a tank and pushes it out to a drip irrigation system in the beds. The tank gets filled with rainwater or hose water. The client chose this design over the others due to the extensive research done and the in-soil watering system meeting the requirements better than the other designs. The testing plan validates the pump, rain barrel, spigot, hose, tubing, solar panel, battery, and controller components through stress, leak, filter, pressure, delivery, power, and display tests. This garden consists of a total of 9 raised beds: 4 smaller beds (9.83ft x 5.25ft); and 5 larger beds (17ft x 5.25ft). Using the area of the garden, the total amount of water per day was calculated to be 57.455 gallons for all the beds. The current setup for watering at University

Heights is a hose that is connected to the University Heights United Methodist Church with another hose attached to it in order to reach the beds. The average flow rate from those hoses was 5.17 gallons per minute. The beds in the garden have started to become dehydrated, and this has caused the vegetation to decrease in size. It requires seven working hours by the student interns daily to completely water these two gardens (more than half an acre) in the peak summer months.