Smart Water Management

Taking a Bird's Eye View

La Rinconada Country Club Changes Course and Uses a Drone to Deliver Savings

Project Summary

Located south of San Jose, California, La Rinconada Country Club had several reasons to want to get its water use under control. California had suffered its share of droughts and corresponding water restrictions, and in 2013 the club reached a peak of 121 million gallons of annual water use. La Rinconada took water savings to new heights by instituting regular landscape water audits, creating a water management plan, replacing unused areas of turf with native plants, and using a drone to survey the landscape and better target its daily watering needs.

Background

There are many benefits to conducting regular landscape irrigation audits to check for leaks, broken sprinkler heads, and other issues with the system. Most golf course managers know the value of a good irrigation audit, and many use professionals certified by a program that has earned the WaterSense label. Taking photos from a drone provides the added benefit of an overhead view of the landscape on any given day. Replacing turf with low-water-use species rounds out a water-smart landscape. La Rinconada Country Club used a combination of water-saving techniques and modern technology to develop a landscape water management plan that prioritized areas of the course that need water the most—greens, tees, fairways, and roughs—and replaced turf in areas where native plants would be more appropriate.

Case Study Highlights

- **Property:** La Rinconada Country Club
- **Location:** Santa Clara Valley, California
- **Landscape size:** 110 acres
- **Water savings:** Reduced peak water use by 54 million gallons
- **Cost savings:** Approximately $160,000 per year

Here's how the drone worked: A camera attached to the device took hundreds of images of the golf course, then those images were processed and stitched together so the maintenance staff could identify areas of the landscape that needed immediate attention. Using a contractor to operate the drone for a year cost La Rinconada approximately $6,000, which covered the technology, maintenance, insurance, and compliance with federal aviation requirements.

To get a complete view of the landscape with the drone, first a flight plan was developed based on the cargo load, battery life, area to be covered, and the number of photos needed by determining the area visible to the camera on each pass. La Rinconada's drone flew over the 110-acre property each day at noon for about 19

minutes—snapping more than 400 images—to provide a complex view of the landscape and help simplify watering solutions.

Getting the Picture

The photos taken by the drone were actually three different types of images:

- *Visible light images*, taken with an RGB camera, provided an overall view of the landscape.
- *Near-infrared images* could detect observable changes in the landscape such as plant disease and stress.
- *Thermal images* picked up on temperature and estimated evapotranspiration (ET).

Each type of image was useful in its own way. In the near-infrared images, plants that were experiencing stress from water loss or disease stood out. Knowing the ET rate based on the results from the thermal images was critical, since areas with higher ET needed more water to maintain a healthy landscape. And the RGB images provided supplemental information on plant health and water stress.

In this infrared image provided by Kevin Breen, the colors show plant health and degree of moisture (bright colors are unhealthy, green colors are healthy).

After each flight, it took the drone-operating contractor about four hours to process the images into a full map of the landscape that illuminated which areas of the landscape were too dry or too wet, as well as those areas with plant stress and higher ET levels. Using this information, grounds maintenance staff could adjust the nightly runtimes of the irrigation zones or examine problematic areas up close and make adjustments to sprinkler heads. In some cases, a zone would reach its total water requirement, but a small section of the zone would still be underwatered; in those instances, staff could spot-water one small area, rather than increasing the total irrigation for the zone.

To supplement the drone images, the team at La Rinconada used Google Earth to view an overhead map of the course and post "pins" to identify areas where rodents had been found, beds needed mulch, or sections of landscape were dried up. Because the map was saved on their mobile devices, staff could retrieve it while walking through the landscape to inspect the grounds and pin additional areas for improvement.

Going Native

La Rinconada's water management plan also included native grasses, woody plants, and chipped beds; staff used the Santa Clara Valley Water District (SCVWD) plant list and chose plants that would be most appropriate for the local climate. To identify areas where golfers didn't play or walk, course management consulted with the Greens and Grounds Committee and received recommendations from an architect. As an added incentive, SCVWD offered rebates to La Rinconada for removing areas of the landscape that previously required irrigation.

Native plants were introduced into out-of-play sections, areas adjacent to trees were mulched, and the maintenance staff reduced watering in those areas. Over the course of seven years, the property converted more than 10 acres of unused turf area to drought-tolerant, native plants.

Lessons Learned

- ***Make a plan.*** Conducting regular audits and creating a water management plan helped La Rinconada Country Club identify irrigation best practices and plants appropriate for the local climate, as well as prepare for any possible droughts or water shortages.
- ***Do it every day (and night).*** Because the drone flew daily, staff could quickly identify areas of the golf course that received too much or too little water and make corrections within the same day. And since the irrigation system ran at night, staff could revise the runtime for each zone into the controller by the end of the day.
- ***The sky isn't the limit.*** If time, cost, or access is an issue with using a drone to survey the landscape daily, Google Earth can be a simple solution for conducting a virtual "fly-over," walking the course, and "pinning" areas for improvement.

Drone used to take daily images of the La Rinconada course.

- ***Stay on course.*** La Rinconada management communicated with golfers about the effort and solicited feedback about areas that were not regularly in play, to ensure that any changes to the landscape would not impact their comfort or performance.

Results

By incorporating native species, implementing items from its landscape irrigation audit, and quickly addressing issues found in the drone images, La Rinconada was able to significantly reduce its outdoor water use. Compared to its peak water use of 121 million gallons in 2013, in 2017 the country club used 67 million gallons of water, or a 44 percent savings.

Acknowledgements

The U.S. Environmental Protection Agency's WaterSense program would like to thank Certified Golf Course Superintendent Kevin Breen of La Rinconada Country Club for providing images and information for this case study.

Learn More

To read other case studies on outdoor water use, visit https://www.epa.gov/watersense/case-studies. For more information about *WaterSense at Work*, a best management practices guide for commercial and institutional facilities, visit https://www.epa.gov/watersense/commercial.