

TROJAN UV™ CASE STUDIES

Municipal Wastewater



Trojan UV Solutions: Closed Vessel Wastewater Reuse

UV Disinfection – LAKE ARROWHEAD, California

PROJECT BACKGROUND

Lake Arrowhead, California is a resort community of approximately 10,000 permanent residents. During the peak summer holiday season, the population often increases to 30,000.

In 2000, the district's average water demand was 2.3 million gallons per day (MGD) (363 m³/hr) and was estimated to grow over 20% by 2030. Unfortunately, there was not a sufficient or permanent reliable source of supply to meet future demands.

During a multi-year drought that started in 2000, Lake Arrowhead started looking at ways to further protect, preserve and supplement their water resources. After successfully lobbying the State Water Quality Control Board (SWQCB), an amendment was made within the Lahontan Region Basin Plan to allow the use of recycled water for outdoor irrigation at elevations above 3,200 feet (975 m).

Located in the San Bernardino Mountains with elevations ranging from just below 5,000 feet (1524 m) above sea level to 6,000 feet (1829 m) above sea level, elevation had been the main challenge facing Lake Arrowhead when trying to effectively reuse its treated wastewater.

With the means to conserve water and the approval to now reuse water for irrigation purposes, Lake Arrowhead needed to upgrade disinfection technologies at the Grass Valley Wastewater Treatment Plant (WWTP) to comply with California Water Recycling Criteria (Title 22). As Title 22 places strict limits on disinfection by-products and residuals, ultraviolet (UV) disinfection was selected for Grass Valley.

UV disinfection is a physical process and does not generate any carcinogenic disinfection by-products nor does it impart a chemical residual.

Treatment at the Grass Valley WWTP consists of screening, primary clarification, trickling filters, secondary clarification, membrane filtration, and

UV disinfection. Reuse water would be piped along 15,000 feet (4572 m) and boosted up a total of 470 feet (143 m) from the Grass Valley WWTP to a local golf course at an elevation of 5,280 feet (1609 m) above sea level. As membrane technology is being utilized upstream of disinfection, to avoid breaking head, a closed vessel UV system was selected.

SYSTEM DESIGN PARAMETERS

- **DESIGN FLOW:**
1.25 MGD (197 m³/hr)
- **ULTRAVIOLET TRANSMITTANCE (UVT):**
>65% at 254nm
- **TOTAL COLIFORM:** 2.2 MPN/100ml
- **DESIGN UV DOSE:**
80 mJ/cm² MS2 RED
- **NUMBER OF UV REACTORS:**
4 (2 duty, 2 redundant)

CASE STUDIES

THE TROJANUV SOLUTION

The closed-vessel, TrojanUVFit™ was selected by Grass Valley because it carried the lowest cost of ownership in the evaluation. The TrojanUVFit 32AL50 reactor is approved for Title 22 applications by the California Department of Public Health (CDPH). The reactor was validated in accordance to the Ultraviolet Disinfection Guidelines for Drinking Water and Water Reuse (NWRI/AwwaRF, May 2003). This provided Grass Valley with further confidence in sizing and disinfection performance. Non-economic criteria such as experience in reuse and proven installations were also deciding factors and Trojan Technologies ranked highest in this category.

The TrojanUVFit utilizes low-pressure, high output (LPHO) lamps that are NWRI-validated. The lamp aging factor accounts for the reduction in UV output over the life of the lamp. A high lamp aging factor was attained with the TrojanUVFit lamp and was validated by a third party over the guaranteed lamp life of 12,000 hours. Systems are sized to account for the validated lamp aging factor to guarantee disinfection performance at end of the lamp life (EOLL).

For closed-vessel reactors in wastewater reuse, LPHO lamps have significant advantages compared to medium pressure lamps. Medium pressure lamps are polychromatic, generating more visible light and heat. When combined with the high nutrient loading in wastewater, these factors lead to increase algae production which ultimately hinders disinfection performance and increase maintenance required for closed vessel reactors. Quartz sleeve fouling rates are accelerated and operator involvement is required to remove debris and stubborn fouling - even with an automated wiping system.

The TrojanUVFit also comes with a highly accurate UV intensity sensor. This sensor monitors the UV output of the lamp to ensure adequate UV dose is being delivered within the reactor, thus optimizing energy usage.

With safety being of paramount importance, the TrojanUVFit also utilizes end caps on each reactor to fully isolate the lamp wires from the environment. In addition, a safety switch disconnects power if the end cap is removed.



Figure 1. Four TrojanUVFit 32AL50 reactors (2 duty, 2 redundant) installed at Lake Arrowhead's Grass Valley WWTP

CUSTOMER TESTIMONIAL

"2011 was the second year our recycled water system has been in operation in Lake Arrowhead. The TrojanUVFit system has performed well for the District and consistently met our permit requirements."

Ryan Gross, P.E., BCEE
District Engineer, Lake Arrowhead CSD

Table 1. Comparison of UV System Options for Lake Arrowhead's Grass Valley WWTP

SYSTEM FEATURES	TROJANUVFIT	ALTERNATIVE CLOSED VESSEL UV SYSTEM
LAMP LIFE	12,000 hours (1.5 years)	12,000 hours (1.5 years)
MAXIMUM POWER CONSUMPTION PER LAMP	250 W	360 W
TOTAL LAMPS REQUIRED (DUTY + REDUNDANT)	128 (for Lake Arrowhead)	160 (for Lake Arrowhead)
REACTOR MODELS	Six (6) UVFit models are validated in accordance with NWRI protocols.	Three (3) reactors are validated in accordance with NWRI protocols.
FOOTPRINT	Six (6) UVFit models ranging from 4 to 144 lamps provide more options to match project requirements and reduce physical footprint.	Largest reactor holds 40 lamps. Limited number of reactor models becomes a design constraint and increases footprint.
BOTTOM LINE	Trojan provides the lowest cost of ownership with fewer lamps and a more efficient reactor. For Lake Arrowhead, the fewer number of lamps (128 vs. 160) with the UVFit enabled the smallest physical footprint and greater installation flexibility. With the largest installed base of UV systems in the world, Trojan offers lasting solutions that build the level of confidence people have in their water.	

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