

CASE STUDY

A Sustainable Wastewater Collection and Treatment Solution for New Developments

JACK'S POINT, NEW ZEALAND

Problem

The expansive Jack's Point development outside Queenstown, New Zealand, needed a wastewater collection and treatment system that could meet strict nitrogen-reduction limits. But local sewer service was over 8 km (5 mi.) away, and the municipal wastewater treatment plant would require an upgrade to accommodate the additional flow.

Solution

Considering the pumping distance to the nearest sewer and the capacity issues of the area wastewater plant, developers pursued a decentralized wastewater plan. The design would need to minimize visual impact, allow for modular development, and be capable of reducing nutrients to low levels. Following a lengthy bid process, a design-build-operate contract was awarded to Innoflow Technologies, whose design incorporated an Orenco liquid-only sewer, AdvanTex® secondary wastewater treatment, and subsurface drip irrigation.

New Zealand's Largest Subdivision

At the time of its conception in 2002, Jack's Point subdivision was set to become the largest planned residential community in New Zealand, with developers envisioning approximately 900 luxury homes. The selected location was just outside Queenstown, a resort community on the shores of Lake Wakatipu with a view of the snow-capped Southern Alps.



The developers of Jack's Point envisioned a subdivision of 900 luxury homes. They needed an affordable wastewater collection system that could handle variable terrain, followed by a reliable treatment system that would produce high-quality effluent and could be installed in stages.

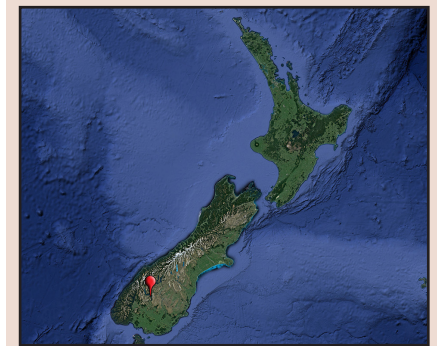
Photo courtesy of Innoflow Technologies.

The development would include a clubhouse (with a restaurant, pro shop, and offices), a golf course, and 25 km (15 mi.) of walking and biking trails. Every detail of construction would be focused on maintaining and enhancing the naturally breathtaking environment, while offering the comforts and conveniences of city living.

New Development Market

Project Overview

QUEENSTOWN, NEW ZEALAND



Design Parameters

- 750 homes (484 currently built), plus a clubhouse
- 728 m³/day (191,500 gpd) peak capacity

Actual Flow (October 2017-April 2020)

- Actual Ave. Flow: 245 m³/day (64,700 gpd)
- Actual Peak Flow: 460 m³/day (121,500 gpd)

Resource Consent Limits

- 15 mg/L cBOD₅
- 20 mg/L TSS
- 20 mg/L TN*
- 12 mg/L TP
- 10,000 cfu/100mL E. coli

Collection

- A 3800-L (1000-gallon) tank at each home
- Orenco liquid-only sewer

Treatment

- Orenco AdvanTex AX100 Treatment Systems

Monitoring and Control

- Orenco TCOM™ telemetry panel

Equipment Supplier

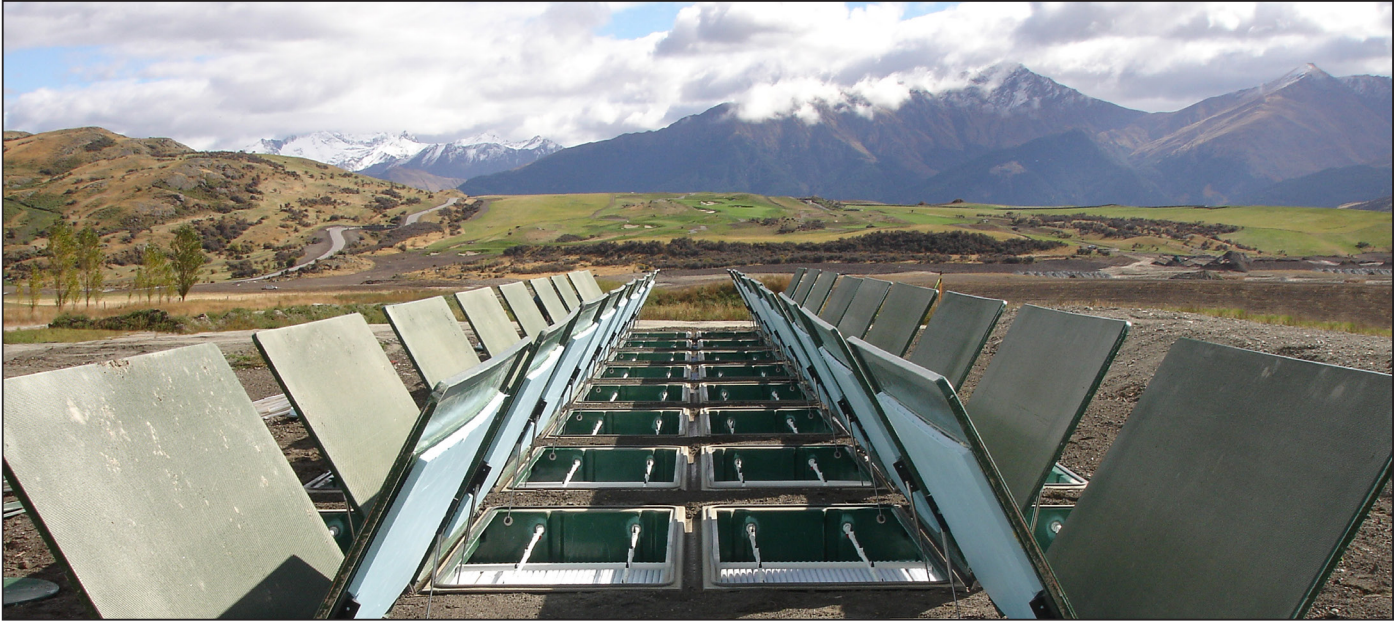
- Innoflow Technologies NZ Ltd.

Operation and Maintenance

- S3 Ltd. (a subsidiary of Innoflow)

*Limit drops to 5 mg/L TN if total flows are greater than 425 m³/day five times in a calendar year.

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JACK'S POINT, NEW ZEALAND

Primary-treated effluent is pumped from each home through small-diameter, liquid-only sewer lines to one of the subdivision's three AdvanTex wastewater treatment facilities, which operate efficiently with minimal odor or sound. Photo courtesy of InnoFlow Technologies.

One of those conveniences is reliable wastewater treatment. But local sewer service was over 8 km (5 mi.) away, and the municipal wastewater treatment plant would require an upgrade to accommodate the additional flow generated by Jack's Point.

With these circumstances in mind, developers looked for more adaptable wastewater collection and treatment solutions. They needed an economically sustainable collection system that could handle variable terrain, followed by a reliable treatment system that would produce high-quality effluent and could be installed in stages, with minimal visual impact on the community.

A Winning Combination

During the bidding process, InnoFlow Technologies put forth a design-build-operate proposal that incorporated an Orenco® liquid-only sewer, AdvanTex® secondary wastewater treatment, and subsurface drip irrigation. This proposal was ultimately accepted by the developer and later approved by the Otago Regional Council, which issued the Resource Consent (discharge permit).

Rob Potts of Lowe Environmental Impact, one of the project engineers, says, “[We] undertook an options assessment for Jack's Point sewerage systems and considered at least three package plant options and

three reticulation options. The effluent [liquid-only] sewer option was selected due to the shallow depth to bedrock and undulating nature of the terrain, as it allowed the sewer to follow the contour of the land. It was selected above a pressure sewer [grinder collection] system due to the lower overall whole-of-life operating costs.”

Other unique advantages of a liquid-only sewer included the following:

- Watertight collection, with no need for manholes or expensive lift stations
- No minimum flushing velocity requirements
- Low capital expenses, with on-lot tanks installed only as each home is built
- Passive, on-lot primary treatment
- Ability to expand in stages
- Reduced size, complexity, and cost of the treatment system¹

In a paper presented at the 2006 Annual Conference of the New Zealand Land Treatment Collective, Potts and his fellow project engineer, Ken Gousmett, wrote, “Use of interceptor tanks at individual residential lots has advantages over traditional raw sewage gravity flow and pump station systems, which are

more difficult to engineer over undulating ground, with shallow bedrock (as is the case at Jack's Point). Effluent is pretreated and can be easily pumped through small diameter pipes installed in a common service trench to the wastewater treatment plant. Sludge production at the treatment plant is reduced and there is greater capacity in the system to store wastewater if a breakdown occurs."²

Regarding the chosen treatment – Orenco's AdvanTex AX-100 technology – the paper continued, "Recirculating packed bed reactor technology is robust to varying inflows and provides high quality effluent, using simple systems that require low operation and maintenance requirements. The textile treatment system is modular and can be installed incrementally as development within the residential zones progresses. Other technologies considered (sequencing batch reactors, other aerated systems) require higher levels of operator input, produce significant quantities of sludge that requires disposal and are not as robust with regard to treating varying hydraulic loadings."³

Before the regional council would grant the Resource Consent, it wanted assurance that post-development nutrient content (particularly nitrogen) would be significantly less than it was pre-development. Innoflow was able to demonstrate through effluent testing at similar sites that the AdvanTex system could meet the required nitrogen limits.

Initially, developers had been concerned about the visual impact of the treatment facilities. But once they saw how low to the ground the first AdvanTex units were installed, their concerns were put to rest. AdvanTex facilities are also known to minimize odor and sound. Steve Murch, the operations manager at Jack's Point, says, "These plants are located in close proximity to dwellings and other recreational facilities and we have not received any complaints from homeowners."

Treated effluent from the AdvanTex units is used to irrigate nearby fields, some of which are used for

grazing sheep. The fields are also cropped at least once a year, and the hay is used as fodder. Because of the strict limits on nitrogen, the number of bales produced each year is used in nitrogen mass-balance calculations.

Jack's Point Today

The community is roughly divided into seven neighborhoods (N1-N7). The clubhouse has a 9000-L (2400-gallon) on-lot tank, while each house has a 3800-L (1000-gallon) tank. Primary-treated effluent is pumped from these tanks through small-diameter, liquid-only sewer lines to one of the subdivision's three AdvanTex wastewater treatment facilities. Treated effluent is dispersed through subsurface, pressure-compensating driplines into the irrigation fields.



Treated effluent is dispersed through subsurface, pressure-compensating driplines into irrigation fields. The Resource Consent requires the effluent to meet strict requirements. Photo courtesy of Innoflow Technologies.

The development is still growing, with a current total of 484 connections. The total treatment capacity is 750 homes, but if additional treatment capacity is added, the Resource Consent allows for up to 1430 homes. As of May 2020, this is the breakdown:

- Facility #1 (serving N1 and 4, plus the clubhouse): 258 homes completed, 382 possible connections
- Facility #2 (serving N2 and 3): 93 homes completed, 164 possible connections
- Facility #3 (serving N5, 6, and 7): 133 homes completed, 182 possible connections

JACK'S POINT, NEW ZEALAND



Using a liquid-only sewer at Jack's Point has reduced upfront capital expenses, because on-lot tanks are installed only as each home is built. Photo courtesy of InnoFlow Technologies.

The three treatment systems are being upgraded one by one to enhance nutrient reduction. In 2017, facility #3 serving N5/6/7 was the first to be upgraded, and the details are shown in the sidebar at right.

Jack's Point has the largest liquid-only sewer system in the Southern Hemisphere that uses Orenco Systems on-lot tanks followed by AdvanTex wastewater treatment. And further development is planned that would connect to one of the existing treatment facilities. According to Potts, "The selected system is still considered the optimal type of system for this development, as it is still progressing, some 20 years later ... If we had to redo the option assessment, we believe that we would still arrive at the same solution."

¹ As seen in the Montesano, WA (USA), sewer system.

² Rob Potts, Ken Gousmett, "Wastewater treatment and land treatment at Jack's Point Development, Queenstown," New Zealand Land Treatment Collective: Proceedings for the 2006 Annual Conference, 105.

³ Ibid.

"The selected system is still considered the optimal type of system for this development, as it is still progressing, some 20 years later."

– Rob Potts, Senior Principal
Lowe Environmental Impact

Data used by Orenco to derive the representations and conclusions contained within this Case Study were current as of August 2020.

New Development Market

All figures below pertain only to the 2017 upgrade of the N5/6/7 treatment facility.

Design Parameters

- 182 homes
- 175 m³/day (46,150 gpd) peak capacity

Installation Date

- 2006 (upgrade to two-stage AdvanTex treatment in 2017)

Actual Flow (October 2017-April 2020)

- Actual Ave. Flow: 55 m³/day (14,500 gpd)
- Actual Peak Flow: 100 m³/day (26,400 gpd)

Liquid-Only Sewer Effluent Quality**

- 199 mg/L cBOD₅
- 65 mg/L TSS
- 64 mg/L TKN
- 10 mg/L TP
- 613,000 cfu/100 mL E. coli

AdvanTex® Effluent Quality**

- 3 mg/L cBOD₅
- 5 mg/L TSS
- 13 mg/L TN
- 9 mg/L TP
- 280 cfu/100 mL E. coli

Stage 1 Treatment

- Two 18-m³ (4755-gallon) and two 23-m³ (6075-gallon) pre-anoxic tanks
- Three 55-m³ (14,500-gallon) recirculation tanks with dosing pumps
- Twelve AdvanTex AX100 units

Stage 2 Treatment

- Four 23-m³ (6075-gallon) post-anoxic tanks
- One 55-m³ (14,500-gallon) recirculation tank with dosing pumps
- Four AdvanTex AX100 units

Treated Effluent Storage

- Four 23-m³ (6075-gallon) tanks with discharge pumps
- Two pulse water meters

Land Treatment System

- 14,560 meters (47,800 feet) of subsurface drip line

***Samples collected and analyzed by a third party between 7 November 2017 and 18 March 2020.*

For information about Prelos™ Sewer, AdvanTex® Wastewater Treatment, or Orenco Controls™, contact Orenco Systems®, Inc.



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