IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of an application by Property Seven Limited for subdivision at Pukehina Beach Road

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STATEMENT OF EVIDENCE OF TERENCE NORMAN LONG

ON BEHALF OF BAY OF PLENTY REGIONAL COUNCIL

DATED 24 JUNE 2019

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1. INTRODUCTION

1.1. My full name is Terence Norman Long. I am a Senior Regulatory Project Officer with the Bay of Plenty Regional Council (BOPRC). I have been employed by BOPRC since March 2012.

1.2. I hold a Royal Society of Health Diploma in Public Health Inspection and a New Zealand Certificate in Science with a post graduate Diploma in Food Science.

1.3. I have more than 20 years experience in the design, consenting and inspection of on site wastewater systems.

1.4. I have contributed to the development of the On-Site Effluent Treatment (OSET) Regional Plan 12 August 2014.

2. CODE OF CONDUCT

2.1. I have read and am familiar with the Code of Conduct for Expert Witnesses in the current Environment Court Practice Note. I have complied with it in the preparation of my evidence and agree to comply with it when I give oral evidence or respond to any questions during the course of the hearing to be held on 1 and 2 July 2019.

2.2. I also confirm that the matters addressed in this Statement are within my area of expertise, except where I state I am relying on the information and opinions of others. I have not knowingly omitted facts or information that might alter or detract from the opinions I express.

3. SCOPE OF EVIDENCE

3.1. My evidence will address the following topics:

- Outline of the proposal
- OSET Regional Plan and s92 request for further information
- The applicant's response
- Meeting with the applicant's agents
- The Technology Works report dated 17 May 2019; and
- Conditions of consent.

4. OUTLINE OF PROPOSAL

4.1. The applicant proposes to convert an existing dairy grazing operation to a wetland. As part of the proposal 137 residential properties will be created.

5. OSET REGIONAL PLAN AND S92 REQUEST FOR FURTHER INFORMATION

5.1. I was asked to provide technical review of the application in terms of the requirements of the OSET Regional Plan.

5.2. The OSET Regional Plan contains the following Policies relevant to this application.

Policy 13 reads as follows;

To enable the use of on-site primary treatment, and community schemes for secondary (and tertiary) treatment, in communities where full on-site treatment is not viable.

Policy 13 anticipates the use of decentralised wastewater systems to treat wastewater. Decentralised wastewater is also known as Septic Tank Effluent Pump or Septic Tank Effluent Gravity or STEP/STEG. Each property has a septic tank and the resulting effluent is pumped or flows by gravity to a community system for secondary (or tertiary) treatment. This system is able to used where on-site treatment is not viable. Later in this evidence I will explain why the proposal to use on-site systems in this subdivision is not viable. In my opinion, for a large scale subdivision of this nature, the onus sits with the applicant to show that a decentralised community scheme has been considered. The application has made no attempt to consider the viability of a decentralised reticulated community wastewater treatment system.

Policy 14 reads as follows;

To ensure that developers detail in their land use consent applications, how the transition from on-site effluent treatment to community wastewater collection and treatment schemes will be made to ensure that future reticulation is feasible.

Aerated wastewater systems need to be serviced on a regular basis. This is generally every six months. The cost of this is around $200 and is borne by the home owner. Many owners resent both the cost and the intrusion of a contractor visiting their property. On-site wastewater systems have an expected life of about 15 years. Beyond that timeframe drip lines become clogged, percolation rates reduce and pumps begin to fail. These failures can be repaired at a cost which is in addition to the regular service calls. At this point communities agitate for connection to a community wastewater reticulation system. An example of this is the widespread failure of on-site systems in the Te Puna Village and the community pressure on WBOPDC to provide a community solution. The obligation to demonstrate how the transition from on-site systems to community systems will occur is for the developer to demonstrate. To satisfy this requirement, I would expect an applicant to discuss various wastewater collection and treatment options and to outline how and when they may be implemented.

Policy 15 reads as follows;

To apply a cost and benefit evaluation to any proposed wastewater servicing options prior to any medium or large scale subdivision, or high density development proceeding.

There are a number of ways in which wastewater generated by a development can be dealt with. In general terms there are three options;

- On-site wastewater treatment and land application
- Decentralised wastewater refer s 3.3.4 of OSET Regional Plan; and
- Reticulation to an existing sewer network.

Policy 15 expects a developer to consider each of these options as part of their design and decision making process to determine which option will be used.

Method 1 reads as follows;

Encourage the reticulation of unsewered communities throughout the region especially those where degraded water quality is of particular concern as a matter of priority.

BOPRC does not own or operate any wastewater reticulation infrastructure. So, it is not in a position to require communities to be reticulated. It can however encourage communities to be reticulated because it provides a better environmental and public health outcome for those communities. This is particularly relevant in a catchment such as the Waihī Estuary where water quality issues are widely known and acknowledged. BOPRC encourages reticulation by advocacy and has provided subsidies for many communities to move to reticulation.

5.3. The OSET Regional Plan contains the policy settings with respect to wastewater treatment and disposal. It also contains Rules for the design, installation and operation of on-site systems. The fact this Plan does not provide Rules for reticulated community systems should not be misinterpreted as enabling developers to ignore relevant OSET Regional Plan provisions in preference to installing on-site wastewater treatment and disposal systems.

5.4. An application for a Resource Consent to discharge treated wastewater from a reticulated community system would be dealt with under the Natural Resources Regional Plan.

5.5. Given the OSET Regional Plan provisions outlined above, the applicant was asked to specifically address the community reticulation option in BOPRC's submission dated 14 November 2018. A copy of the request for further information dated 14 November 2018 is attached to the WBOPDC planners report. Section 3.2 of the BOPRC's submission relates to the wastewater disposal issues.

5.6. I have also seen the submission of Bay of Plenty District Health Board dated 15 November 2018. I am supportive of the views expressed in section 2 of that submission. There is a focus in that submission on pathogens which may be present in domestic wastewater. Because wastewater is discharged into the near surface soils on a portion of each of the proposed sites there is the prospect that residents will come into contact with treated wastewater and the remaining pathogens.

5.7. Treated wastewater does contain pathogens and this is sufficient reason to "separate people from waste". However, treated wastewater also contains a range of other materials which can contaminate the environment and may affect a person's health. These are briefly;

Category	Examples
Prescription medicines	Oestrogen, chemo-therapy drugs
Illicit drugs	Methamphetamine
Beauty Products	Hair dye, toothpaste
Cleaning Products	Hypochlorite bleach
Preservatives	Paraben

5.8. All of these products pass through wastewater treatment systems and then enter the environment. Some of these products and their metabolites are acknowledged carcinogens while others have a demonstrated effect on aquatic species and may affect humans. Wastewater is the principle source of endocrine disruptors in the environment.

5.9. Where these products and metabolites are discharged onto a portion of a small site there is an increased risk of residents coming into contact with these compounds.

5.10. The best way to minimise the potential effects of these materials is to restrict the use of on-site wastewater treatment to large rural sites and to use reticulation for smaller (<3300 m^2) urban sites. While the lots in this subdivision are referred to as rural lifestyle lots they are very small at 2000 m^2.

5.11. For the above reasons I am of the opinion that on-site wastewater systems are unsuitable for the proposed development. Without wanting to resile from this position, the balance of this evidence will deal with the proposal to use on-site systems.

6. THE APPLICANT'S RESPONSE

6.1. The applicant responded by letter dated 22 February 2019. This is Attachment 1 to this evidence. The letter indicates that on-site systems will be used and at the foot of page 1 incorrectly states that a communal wastewater system is "not supported or required by the Regional Plans rules".

6.2. The applicant's response does not adequately address the issues raised by Policies 13, 14 and 15 and Method 1 of the OSET Regional Plan.

7. MEETING WITH THE APPLICANT

7.1. There were subsequent exchanges of emails and a meeting between BOPRC and Aurecon staff for the applicant.

7.2. Subsequently, there was further correspondence dated 21 March 2019 from Luke Balchin that suggests once constructed there will be category 3 soil available for each site's land application area. The letter goes on to conclude that an area of 204 m^2 would be required. This is not consistent with the standard NZS 1547:2012 On-site domestic wastewater management. None of the people involved in the calculation were appropriately qualified to design on-site wastewater systems.

7.3. There was a further discussion about the design of the wastewater system and the skills required to undertake the design. The applicant then offered to engage Grant Hammond of Technology Works who is suitably qualified and experienced to undertake wastewater designs. The applicant was encouraged by BOPRC to take this course of action.

8. THE TECHNOLOGY WORKS REPORT

8.1. BOPRC was provided with a copy of the Grant Hammond Technology Works report on 22 May 2019. It is understood this report forms part of the application and it is not necessary to attach to my evidence.

8.2. Mr Hammond's report does not address the option of a reticulated community wastewater treatment system nor the issues raised in Policies 13, 14 and 15 and Method 1 of the OSET Regional Plan. It simply repeats statements previously made by Aurecon on this matter on behalf of the applicant.

8.3. The Hammond report shows that it may be possible to use site won materials (i.e. sourced from other portions of the property) to construct each of the elevated house sites. The viability of this approach will depend on the type of material used and the methods used to place it. It may have a category 3 soil and that the sites may be able to accommodate a 3 or 4 bedroom home and garage.

8.4. It is clear Mr Hammond holds some concerns that the development may not occur in the way intended. There is tension between a requirement to create safe and stable building sites and a land application area of suitable porosity. If the land application area is compacted to the same extent as would be required for the building platform then it is probable that the soil will not be a category 3 soil. In the same way, if the soils are compacted less to meet the category 3 soil requirements then there is a risk that the soils will not meet the requirement to be "good ground" under the Building Code. Mr Hammond has therefore suggested a number of consent conditions which should ensure that the development proceeds as intended and that if the assumptions that have been used are not valid, that this can be detected early in the development process.

8.5. The ability to achieve category 3 soil for the parts of each site proposed to be used for wastewater treatment and land application is of critical importance in order to achieve the permitted standards relied upon in the OSET Regional Plan. I am of the opinion there is a level of uncertainty category 3 soils can be obtained or constructed on site. Regardless of where these soils are sourced from, there is still the challenge of transferring these to site, forming and compacting each of the elevated platforms. It is possible the soil characteristics will change through this process. If the deposited and compacted soils are category 4 (or 5) then larger land application areas will be required. The sites are already confined and a change to category 4 (or 5) will mean that there is insufficient space for a land application area. It is therefore important that there is a process of thoroughly investigating each finished platform to confirm that there is a category 3 soil for the entire

dedicated wastewater treatment and land application areas for each site. This will rely on enforceable consent conditions and that investigation being undertaken and signed off by someone with appropriate expertise and experience as part of the section 224(c) sign certification process.

9. SUGGESTED CONDITIONS OF CONSENT

9.1. The following draft conditions of consent have been taken from the Technology Works report and adjusted to suit. Some additional conditions have been included that help mitigate BOPRC's OSET Regional Plan concerns.

9.2. A Consent Notice must be registered on the title to each of the 137 residential lots requiring the installation of an Innoflow Advantex AX20 Aerated Wastewater Treatment system to treat and discharge all wastewater generated on the site.

9.3. Each lot shall be limited to one dwelling not exceeding 200 m² in gross floor area and one non-habitable garage or shed not exceeding 60 m². No other buildings shall be constructed on the site. The design occupancy for the wastewater system shall be 9 persons.

9.4. Each lot is provided with a wastewater land application area of at least 145 m² plus a 75 m² reserve area where conventional trenches dosed with secondary treated effluent through LPED are to be used. If drippers are to be used a land application area of 450m² plus a 225 m² reserve area must be provided.

9.5. Earthworks compaction trials shall be undertaken during the design phase of the subdivision to ensure that the soil within the land application area to be provided on each site is Category 3 soil (or Category 2). This will require the measurement of permeability in accordance with NZS 1547:2012 Appendix G by an independent laboratory or technician and a textural and colour assessment of the soil in accordance with the provisions of NZS 1547:2012 Appendix E by a BOPRC approved wastewater system designer.

9.6. The results of the compaction trials, permeability and textural soil assessment shall be discussed with BOPRC before full scale earthworks are commenced. When BOPRC are satisfied with the information provided they shall advise WBOPDC accordingly.

9.7. Should the results of the permeability tests result in a soil which is less permeable than 1.5 m/d the subdivision shall be subject to a re-design which will provide larger land application areas for each residential lot.

9.8. The wastewater land application area for each residential lot shall be located in accordance with the table of horizontal and vertical setback distances set out in the Technology Works report dated 17 May 2019.

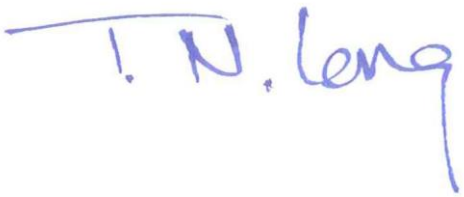
9.9. A Site and Soil Evaluation (SSE) shall be prepared by a suitably qualified and experienced wastewater system designer for each residential lot which shall be supplied in support of

the application for section 224(c) certification. The SSE will cover all of the matters set out in NZS 1547:2012 Appendix D.

10. CONCLUSION

10.1. I have carefully considered the proposed use of on-site wastewater treatment and land application systems for each of the 137 residential lots. I am of the opinion that the use of on-site systems is less preferable to a decentralised reticulated community wastewater treatment system for a large scale residential subdivision of this nature. Particularly in an area subject to flood hazard and sea level rise. It is accepted that there is no reticulated system in the vicinity at the present time. The applicant has not considered a decentralised system but prefers separate wastewater treatment and disposal systems for each site. The applicant has provided information to support this approach.

10.2. There are risks associated with creating raised platforms for the treatment and land application of waste including whether the appropriate soil can be sourced on site or off site and if sourced whether its characteristics can be retained through the process of constructing each raised treatment and land application area. It is therefore critical that if resource consent were to be granted, that robust and enforceable consent conditions are imposed to ensure Category 3 (or better) type soil can be achieved for each site's land application and treatment area and that a suitably qualified and experienced person is able to determine those standards have been met. I have suggested conditions of consent that aim to address these concerns in the event consideration is given to granting consent.



Monday 24 June 2019

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22 February 2019

Terry Long
Senior Regulatory Project Officer
Bay of Plenty Regional Council
Whakatane 3158
Via Email

Dear Terry

On-Site Wastewater Treatment - Bay of Plenty Regional Council
Submission on Application for Resource Consent by Property Seven Limited at 259, 295 and 307 Pukehina Beach Road

1 Introduction

The following information is provided in response to Section 3.2 of the Bay of Plenty Regional Council's submission on the above application and following our meeting held at your offices on 14 November 2018.

As agreed at the meeting, the applicant has considered the matters raised in your submission which were as follows;

> *"It is proposed that each lot will use on-site effluent systems. No documentation is provided to support this.*
>
> *On-site systems are unsuitable for a development of his scale. High groundwater will preclude individual on-site systems or a community wastewater system on the larger property.*
>
> *The applicant will need to design and develop a suitable reticulation system."*

The relief sought by the Regional Council is that the proposed subdivision is reticulated. The applicant's response to the matters you have raised is outlined below.

2 Proposed On-site Wastewater Treatment

As described in the application, a system which complies with OSET will be installed on each of the lots. The application (as notified) did not commit to a specific system because at the time the applicant wished to install the best performing and most technologically advanced system available at the time of development of the lots. This would have enabled further changes to technology to be considered and incorporated based on the fact that the timeframe for the construction of dwellings may be 2-5 years away.

However, to address the Regional Council's concerns the applicant is happy to propose the use of a single OSET system that will meet the applicant's objectives and will exceed the Regional Council's standards under the Regional Plan for a permitted system for the Pukehina area.

The applicant does not agree that a communal wastewater system is necessary for the following reasons:

- It is not supported nor required by the Regional Plans rules;
- The subdivision is not an urban activity (as each of the lots is 2000m2 of greater);

- A communal system may lead to future pressure and demands for further subdivision and development which may be inappropriate;
- Failure or problems with a communal system will have the potential to create adverse effects in a catchment which already has significant degraded water quality issues. The Council is aware of these;
- Existing areas which have been developed in and around Pukehina have not been required to connect to a communal wastewater system by the Council;
- Any such system would require the agreement of the Western Bay of Plenty District Council and a separate resource consent process.

3 The Advantex AX20 System from Innoflow Technologies Technilogies Wastewater specialists (Innoflow)

Following research (including discussions with a number of suppliers) into the systems available, the applicant proposes to utilise the Advantex AX20 System from Innoflow.

We have met with Innoflow to discuss the project and the feasibility of the use of their system throughout the subdivision. Innoflow will be contracted to maintain their system in perpetuity and we propose that the requirements in relation to instillation and an ongoing maintenance contract will be included as a consent notice on the certificates of title of the lots. The proposed system and method of maintenance is considered to have a number of advantages which include:

- Any operational failure will likely only impact one lot at any one time before the maintenance contractor is able to attend the site and address the problem (as opposed to a communal system);
- The level of treatment would exceed that associated with a communal treatment plant system;
- The system is acceptable on cultural grounds;
- The liquefaction and lateral spread hazards onsite which would damage a reticulated wastewater system even in what is considered to be a relatively minor earthquake event are avoided;
- The landform and lot layout is designed to provide for an efficient onsite wastewater treatment;
- On site wastewater treatment aligns better with the applicant's sustainability objectives having a reduced ecological footprint when compared to the construction and operation of a communal treatment system;
- The proposed wetland and planting, including Manuka and Kanuka species will help to naturally manage nitrates discharged to ground;
- The Advantex AX20 system is highly regarded by a number of Councils and has performed well under robust testing.
- The building platforms and effluent disposal fields are elevated to at least RL 3.5m which is at least 2.5m above the anticipated ground water levels and operation wetland level. This provides the necessary separation from groundwater.
- The sandy soils that will be used to create the elevated building and effluent disposal areas is hostile to bacterial organisms and therefore the combination of soil types and depth to groundwater result in a very low risk of bacterial contamination and associated public health risks.

4 Statutory Planning Framework

The following details the statutory requirements for on-site wastewater treatment within the Pukehina area.

4.1 On-Site Effluent Treatment Regional Plan

The subject site is located outside of the Rotorua Lakes Catchments, outside the Tauranga City Urban Area and outside of an Operating Reticulation Zone. Any wastewater system proposed for each of the proposed 137 lots will therefore be subject to Rule 3 of the Councils On-Site Effluent Treatment Plan. Following a review of Rule 3 the use of the Advantex AX20 system is permitted under the BOPRC On-Site Effluent Treatment Plan.

We enclose certification material from the supplier (Innoflow) which confirms that the system complies with Rule 3 of the plan and the associated permitted criteria/standards.

The Regional Council's Website (Approved OSET effluent systems page) lists the proposed wastewater treatment system as compliant for all of Bay of Plenty catchments (including the Rotorua Lakes). The Rotorua Lakes catchment has much more stringent requirements than the rest of the Bay of Plenty due to the catchments sensitivity to nitrogen inputs. It is also noted that the system is also approved within the Lake Taupo catchment in the Waikato region (which demands an even higher-level compliance).

4.2 Western Bay of Plenty District Plan

Under the requirements of Section 12.4.6 of the Western Bay of Plenty District Plan, on site wastewater treatment is a permitted activity when located within a Rural Zone. Performance standards need to be met by the system proposed, specifically those prescribed by the Regional Council described above, of which the proposed Advantex AX20 exceeds.

5 Conclusions

The applicant is unable to meet the relief sought by the Regional Council, which is that the subdivision is reticulated to a communal system. However, the proposed wastewater treatment solution is a permitted activity and the Advantex system proposed not only has a number of benefits but also significantly exceeds the Regional and District OSET performance standards for the particular area. The wastewater solution chosen provides a high level of treatment, such that it is suitable for use in sensitive Rotorua and Taupo Lakes catchments.

The system can and will meet the requirement for a permitted activity under the Regional Plan and does not trigger the requirement for a resource consent.

Yours faithfully

Luke Balchin
Planner

Enc: Innoflow information and certification

AdvanTex® Treatment Systems

AX20

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AdvanTex® is one of the most sustainable wastewater treatment systems available for household use. The filter unit is flush to the ground and blends into landscaping.

Reliable, Sustainable Treatment For Residential Wastewater

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In the patented* AdvanTex Treatment System, household sewage flows into the processing tank, where it separates into scum, sludge, and liquid effluent. Filtered effluent is dosed to the AdvanTex filter pod, where it trickles through sheets of a synthetic textile. There, naturally occurring microorganisms remove impurities from the effluent. After recirculating between the tank and the AdvanTex filter, the effluent is discharged to the soil via irrigation or a drainfield.

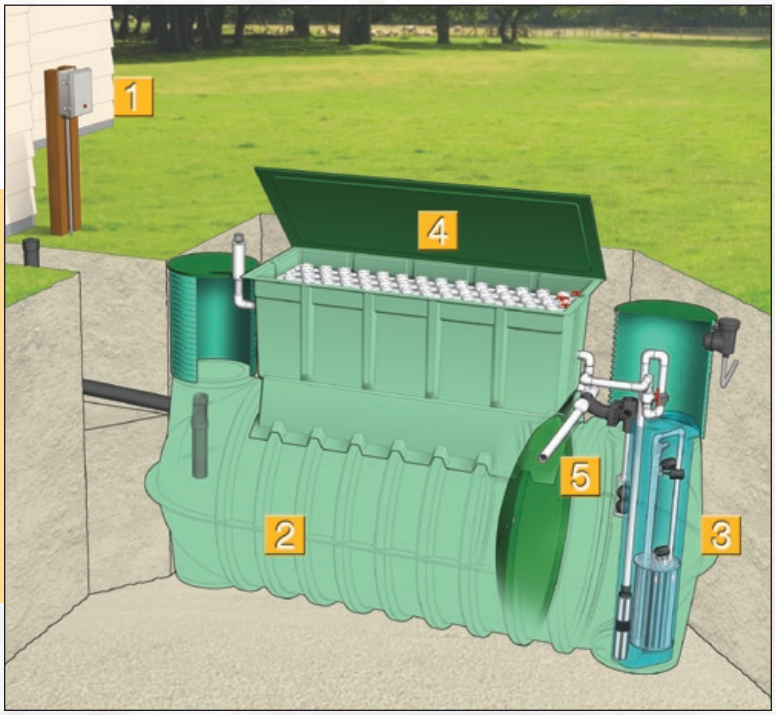
The system's pump runs only a few minutes an hour, using just a few cents worth of electricity a day. Because solids decompose in the tank, the tank requires pumping only every 8–12 years, under normal use. Using little energy, generating a minimum of sludge, and purifying wastewater for beneficial reuse, AdvanTex Systems are one of the most environmentally sustainable technologies for home wastewater treatment.

More than 25,000 of Orenco's textile filters have been installed at homes, businesses, and community treatment systems throughout the United States, Canada, Europe, and Australasia. Third-party testing shows that AdvanTex Treatment Systems do a better job of treating wastewater than most municipal sewers. And field testing shows that AdvanTex Treatment Systems work under real-world conditions.

textile filters

"The effluent from the filter units typically was clear with no odor . . . the increased loading rate allows for a decrease in the footprint required by filter units (compared to sand and gravel filters) . . . in an onsite treatment scenario, textile filter effluent could be utilized for landscape irrigation . . ."

Leverenz, Darby, and Tchobanoglous, "Evaluation of Textile Filters for the Treatment of Septic Tank Effluent," University of California at Davis, October 2000.



Typical backyard configuration of an AdvanTex® Treatment System.

The system has five main functional parts:

1. *VeriComm® Web-based monitoring system†*
2. *Processing tank*
3. *Biotube® pumping package*
4. *AdvanTex filter*
5. *Recirculating splitter valve*

† MVP digital programmable panels available as an option in some markets.

Other configurations and models available.

NOTE: * Covered by U.S. patent numbers 6,372,137; 5,980,748; 5,531,894; 5,480,561; 5,360,556; 5,492,635; 4,439,323; D461,870; and D445,476. Additional patents pending.

AdvanTex® – Treatment Systems

Finally! Residential Wastewater Treatment — That Works!

AX20 shown here.
In addition to being compact, AdvanTex® Treatment Systems are easier to operate and maintain than other wastewater technologies. No odors. No power-hungry, noisy blowers. No activated sludge to manage or pump. No discharge of untreated sewage during peak flows or emergencies.

Orenco's AdvanTex® Treatment Systems are the ideal solution for environmentally sustainable treatment of residential wastewater flows.

Outstanding Wastewater Treatment

Unlike other onsite wastewater treatment technologies, AdvanTex provides consistent, reliable treatment under real-world conditions. Other systems work OK in a controlled testing environment, but don't hold up to normal household use. AdvanTex does. AdvanTex Treatment Systems process and discharge small amounts of treated wastewater throughout the day. Water so clean it can be reused for drip or subsurface irrigation, or discharged to shallow, inconspicuous trenches.

Fits Small Yards

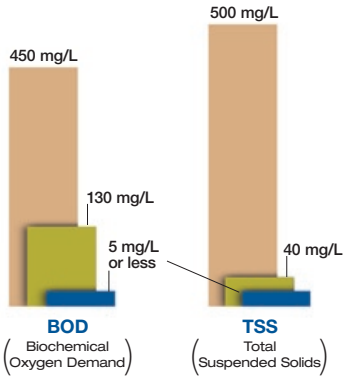
AdvanTex Treatment Systems require very little space. The filter unit is 7.5 ft × 3 ft × 2.5 ft (2286 mm × 914 mm × 762 mm), small enough to fit under a deck or on top of the processing tank. And some jurisdictions allow a reduction in drainfield area with AdvanTex. So AdvanTex is ideal for small sites, or for homeowners who simply want more use of their yard.

Low Lifetime Cost

AdvanTex Treatment Systems may cost a little more up front than other systems, but, thanks to low maintenance requirements, they cost much, much less over time. Power costs, pumping costs, and equipment replacement costs are a fraction of those for other technologies. Plus, AdvanTex filters protect your drainfield.

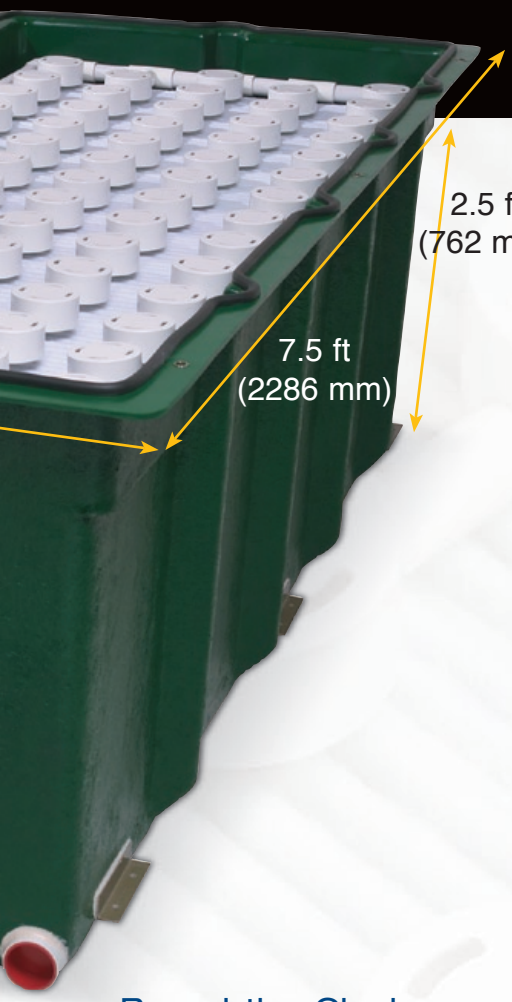
AdvanTex turns household wastewater into clear, odorless effluent you can reuse for subsurface irrigation.

AdvanTex® Treatment Systems make raw wastewater up to 98% cleaner ... consistently producing effluent in the 5/5 mg/L range



1 Source: Derived from *Small and Decentralized Wastewater Management Systems*, Crites & Tchobanoglous, McGraw-Hill, 1998, p. 183.

2 Actual performance results, based on a six-month accumulative average from NSF (National Sanitation Foundation) testing on the AX20N at 500 gpd (1900 L/d), using composite sampling.



AdvanTex®
Gives You Peace of Mind

Orenco's AdvanTex Treatment Systems are not just a product. They are part of a comprehensive program, for homeowners' peace of mind.

Authorized Dealers and Trained Installers

AdvanTex Treatment Systems are sold by authorized Dealers, who provide ongoing support and warranty service. Dealers ensure that AdvanTex Treatment Systems are set in place by trained installers, following Orenco's instructions.

Trained Service Providers

Like any onsite technology, your AdvanTex Treatment System benefits from regular maintenance by a trained service provider, following Orenco's instructions. Field maintenance report forms are digitally archived for future reference.

Complete, Carefully Engineered Package

Your AdvanTex Treatment System comes as a totally pre-manufactured package, including AdvanTex textile filter, Biotube® pumping package, and "smart" control panel. AdvanTex can be installed on most lots in less than a day.

Low Routine Maintenance Costs

AdvanTex Treatment Systems are easy to service, easy to clean, and generate no troublesome activated sludge. Since maintenance is minimal, so are the long-term costs. Each system comes with a Homeowner's Manual, with tips for preventive maintenance.

Low Power Costs

AdvanTex uses very little power… an average of $1.75–$2.00 per month (based on the national average of ten cents per kilowatt-hour). Compare that to the average power cost of $30.00–$60.00 per month (depending on your area) for many "activated sludge" aerobic treatment units!

Safe in Emergencies

AdvanTex Treatment Systems that are equipped with VeriComm® Control Panels automatically notify service providers of irregular conditions. And all systems are sized to allow for a minimum of 24 hours of wastewater storage, at average daily flows. So operators can provide "emergency" service during normal working hours, keeping service costs down.

Child-Proof

The lid of the AdvanTex filter is affixed with recessed bolts, making it very tamper-resistant.

Warrantied

Orenco Systems®, Inc. provides a limited, multi-year warranty on all materials and workmanship. Length of warranty varies by region but is at least three years.

Round-the-Clock Monitoring

Your AdvanTex Treatment System may include a control panel with a remote telemetry unit and a round-the-clock, Web-based monitoring system, supervised by your service provider. You'll have even more peace of mind, knowing that the VeriComm® Monitoring System is continually and automatically verifying the operation of your system. For more information, go to **www.orenco.com** or **www.vericomm.net** and click on the icon for VeriComm's "On-Line Demo." (Non-telemetry control panels also available.)

For Every Residential Site

There's a standard AdvanTex Treatment System model for every site condition, design flow, and regulatory requirement.

AdvanTex Treatment Systems are particularly well suited for . . .

- small sites
- failing systems
- poor soils
- nitrogen reduction
- environmentally sensitive sites
- stringent treatment standards
- pretreatment of moderately high-strength waste

Alberta, Canada

"We've installed about 500 AdvanTex Treatment Systems for all sizes of homes, and, typically, the treated wastewater looks just like water. Our winter temperatures can be as low as –38˚ F (–39˚ C). In the middle of December, we started up an AdvanTex Treatment System on a 13,000 ft² (1200 m²) home that averages 1200 gpd (4500 L/d). Two weeks after start-up, the owners entertained 30 family members and guests for a full week. It worked great!"

Bruce Silvester, Onsite Specialties, Inc.

"It worked great!"

Deschutes County, Oregon

"I specified an AdvanTex Treatment System for a cluster of 12 luxury homes in the Metolius River Resort, along a premier trout stream in eastern Oregon. AdvanTex worked well because the site has an extremely small footprint and the system was easy to install. Also, the treatment unit is right in front of the Resort's office, so it was super important that there be absolutely no smell, and there isn't. Plus, we didn't have to search for the right treatment media, since it's all included. I would use AdvanTex any place you'd use a conventional recirculating filter."

Steve Wert, CPSS, WWS
Wert & Associates, Bend, Oregon

Tucson, Arizona

"Nearly 1,000 AdvanTex Treatment Systems have been installed in Arizona, primarily due to poor soils, seasonal high water tables and/or nitrogen in the groundwater. In Tucson, homeowners and their treatment system designers have also had to deal with limiting site constraints, shallow rock shelves, and small building envelopes. The AdvanTex system, followed by a subsurface drip system, was the answer. Plus, the installed systems go almost unnoticed in yards and landscaping."

Todd Christianson,
Premier Environmental
Products, LLC

Newport, Rhode Island

"I spent six years looking for the right wastewater system for my second home, which is on a small island. Even with seasonal flows, our AdvanTex Treatment System is working great . . . so great, I decided to become a dealer! We entertain often, so we use a lot of water, but we've never had a problem. And the system was easy to transport and install."

Peter Kent, Atlantic Solutions, Ltd.

AdvanTex® – Treatment Systems

Orenco Systems is owned and managed by engineers who develop wastewater systems that work — systems based on sound science.

Clockwise from left: Eric Ball, P.E., Jeff Ball, P.E., Hal Ball, P.E., (front) Terry Bounds, P.E.

AdvanTex® Treatment System AXN Models meet the requirements of NSF-ANSI Standard 40 for Class I Systems.

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Orenco maintains an environmental lab and employs dozens of scientists and engineers. Orenco's systems are based on sound scientific principles of chemistry, biology, mechanical structure, and hydraulics. As a result, our research appears in numerous publications, and our engineers are regularly asked to give workshops and offer trainings.

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21 February 2019
Aurecon Group
247 Cameron Rd,
Tauranga, 3110

Attention: Mr. Luke Balchin

RE: ADVANTEX AX20 ONSITE RESIDENTIAL UNITS FOR MATUKU MOANA

Introduction

This letter presents key details about the AdvanTex AX20 residential onsite wastewater units, manufactured by Orenco Systems Incorporated (Oregon, USA) and distributed by Innoflow Technologies NZ Ltd (Auckland, New Zealand) to be utilised for a proposed 137 lot subdivision at Pukehina.

Specifically, this letter references the Bay of Plenty On-Site Effluent Treatment Regional Plan (7 August 2006) and addresses how the AdvanTex AX20 complies to relevant points, including;

- AdvanTex AX20 system capacity design and effluent quality
- AdvanTex AX20 performance certificate from the Rotorua OSET Trial
- AdvanTex AX20 ongoing maintenance requirements

In summary, the installation of an AdvanTex AX20 on to each of the 137 proposed lots would comply with the relevant rules within the On-Site Effluent Treatment Regional Plan (the OSET Plan). We understand that it is the applicants intention to adopt a system which will meet the requirements listed under Rule 3 of the OSET Plan. Confirmation of this is provided as follows:

OSET Regional Plan Rule	AdvanTex AX20	Compliance
3(c)-complies with the requirements of NZS 1546.1:2008	Complies with the requirements of NZS 1546.1:2008	Yes. Refer to appended StandardsMark Licence certifying the AdvanTex AX20 aerated wastewater treatment system is manufactured to the standards of

		AS/NZS 1546.1:2008. Certificate No: SMKH21649
3(e)-septic tank shall be fitted with an outlet solids filter with service access at ground level.	Includes an outlet Biotube effluent filter and has PVC access risers and lids that allow access at ground level	Yes. Refer to appended system drawings and specification papers

AdvanTex AX20 System Capacity Design and Effluent Quality

Appended to this report is the residential design criteria, Orenco pumps technical data sheets and detailed drawings of the proposed AdvanTex AX20 (Mode 3B). To summarise the detailed information within these documents, the system design, capacity and expected effluent quality is as follows;

Influent Parameters

Peak flow: 1,900 L/day

Average Influent BOD_5: 150 mg/L

Average Influent TSS: 50 mg/L

Average Influent TKN: 65 mg/L

Expected Effluent Quality

cBOD5: <15 mg/L

Influent TSS: <15 mg/L

Influent TKN: <20 mg/L

Septic Tank Volume & Biotube Effluent Filter

Volume: 4,000 L (2 x peak design flow)

Effluent filter model: Orenco Systems Incorporated Biotube outlet filter, with screened mesh, filtering solids greater than 3mm in size.

Recirculation Tank Volume & Pump

Volume: 2,000 L (1 x peak design flow)

Recirculation pump model: PF(50Hz)300512, 30 gallon/min, 0.5 horsepower, 650 watts

Recirculating Textile Filter & Loadings

Area of textile: 20 square feet or approximately 2 square meters

Design hydraulic average flow loading on textile: $1m^3/m^2/day$

Design hydraulic peak flow loading on textile: $2m^3/m^2/day$

Design organic average flow loading on textile: $0.2kg/m^2/day$

Design organic peak flow loading on textile: $0.4kg/m^2/day$

Design nitrogen average flow loading on textile: $0.07kg/m^2/day$

Design nitrogen peak flow loading on textile: $0.14kg/m^2/day$

Treated Effluent Tank Volume, Pump & Emergency Storage Volume

Treated Effluent Storage Volume: 1,000 L (~0.5 x peak design flow)

Treated Effluent Tank pump model: PF(50Hz)100512, 30 gallon/min, 0.5 horsepower, 650 watts

Emergency Storage Volume: >2,000 L (1 x peak design flow) in freeboard space above high water levels throughout system

Controls, Alarms & Monitoring Systems

The standard panel for the AX20 units are the Orenco Systems Incorporated MVP Panel. This panel operates the plant, has an internal daily pump run time counter which can be downloaded, and produces visual and audible high and low level alarms. There is an option for a 'Vericomm Panel' which allows the system to send alarm notifications in the event of excessively high pump run times (indicating effluent filter clogging), high and low level alarms. This level of notification, and subsequent investigative measures, is managed by S3. Technical data sheets and brochures for the panels and Vericomme monitoring system is appended to this document.

AdvanTex AX20 System OSET Performance Certificate & International Accreditation

The proposed AX20 has underwent many internationally accredited testing programmes. It has also gone through the OSET testing facility in Rotorua (Trial 5, 2009/10). Across all these test, the AdvanTex AX20 has shown to consistently perform effluent quality that meets and exceeds what is required in the regional plan. A copy of testing summaries and performance certificates are appended to this report.

AdvanTex AX20 System Maintenance Requirements

The recommended start up, routine maintenance and advanced service tips are detailed in the appended operation and maintenance manuals. We have also included a home owner manual which guides homeowners on how to take care of the system. In summary, the AX20 units require preventative maintenance 1 x per year, and the servicing tasks include the following;

- Visually inspect plant for obvious faults
- Inspect and clean septic tank effluent filters
- Check sludge and scum levels in the septic tank
- Inspect and clear textile filter surface
- Check operating pressure in laterals
- Check operation of septic tank floats and alarms
- Check operating pressure in disposal field laterals
- Inspect disposal field
- Written report outlining conditions found and actions taken

Innoflow has a subsidiary maintenance servicing company, S3 Ltd that exclusively provides maintenance services to AdvanTex systems throughout New Zealand, Australia and the Pacific Islands. It is expected that homeowners will enter an ongoing service contract with S3. Other services like effluent sampling and arranging sludge pump outs can form part of these contracts too.

Summary and Statement of Limitations

The treatment capacity of the proposed residential AdvanTex onsite systems are limited by the influent hydraulic, organic and nutrient load described in this document. Innoflow Technologies NZ Ltd have not been involved in determining the wastewater loads generated from the proposed development, nor the land application soil type and properties and therefore total environmental impact. As such, Innoflow Technologies NZ Ltd does not take responsibility for the determination and effect of these aspects.

Being a supplier and service provider of onsite wastewater treatment plants and land application systems in New Zealand and greater Australasia since 1994, Innoflow Technologies NZ Ltd has the capacity to viably provide the supply and ongoing maintenance of these systems should the development be successful.

On-site Effluent Treatment National Testing Programme (OSET NTP)

PERFORMANCE CERTIFICATE
AdvanTex® AX-20 Mode 3 On-site Domestic Wastewater Treatment System, OSET NTP Trial 5, 2009/2010

System Tested

AdvanTex® AX-20 Mode 3 recirculating textile packed bed reactor treatment unit. Rated design capacity 2,000 litres/day. Total liquid volume 7,200 litres (primary treatment 4,000 litres; aeration treatment textile surface area 5,019 m^2; recirculation 2,000 litres; pump chamber 1,200 litres). Emergency storage 2,000 litres. No tertiary treatment (such as UV disinfection) is incorporated. Testing was undertaken November 2009 to August 2010

Test Flow Rate

The **AdvanTex® AX-20 Mode 3** was tested at a flow rate of 1,000 litres/day (equivalent to servicing a 3-bedroom 5 to 6 person household) over an 8 month (35 week) period followed by a 5 week high load effects period involving 5 days at 2,000 litres per day then 1,000 litres/day over the following 4 weeks.

Testing and Evaluation Procedures

A total of 16 treated effluent samples of organic matter (BOD_5), suspended solids (TSS), total nitrogen (TN) and ammonia nitrogen (NH_4-N) at generally six day intervals during weeks 23 through 40 were benchmarked and rated on their median values. In addition, the energy used by the treatment and effluent pumping system was assessed on the mean of consumption levels over the 16 sample days, weeks 23 to 35.

Meeting AS/NZS 1547:2000 Secondary Effluent Quality Requirements

These requirements are that 90% of all test samples must achieve a BOD_5 of $\leq$ 20 g/m^3 and TSS of $\leq$ 30 g/m^3 with no one result for BOD_5 being >30 g/m^3 nor no one result for TSS being >45 g/m^3. The **AdvanTex® AX-20 Mode 3** already holds a performance certificate issued on 9 April 2010 under Trial 3 (2007/2008) which states that the system **achieved** a performance level of **100%** for both BOD_5 and TSS.

Benchmark Ratings

The **AdvanTex® AX-20 Mode 3** system **achieved** the following effluent quality ratings:

Indicator Parameters	Median	Std Dev.	Rating	Rating System				
				A+	A	B	C	D
BOD_5 (g/m^3)	2.0	0.7	A+	<5	<10	<20	<30	≥30
TSS (g/m^3)	2.5	4.1	A+	<5	<10	<20	<30	≥30
Total nitrogen (g/m^3)	12.3	1.3	A	<5	<15	<25	<30	≥30
NH_4-Nitrogen (g/m^3)	0.6	0.21	A+	<1	<5	<10	<20	≥20
Energy (kWh/d) (mean)	0.92	--	A	0	<1	<2	<5	≥5

This Performance Certificate is specific to the **AdvanTex® AX-20 Mode 3** as specified above when operated at a flow rate of 1,000 litres/day, and is valid for 5 years from the date below. The Trial 3 Performance Certificate of 9 April 2010 includes effluent quality ratings for TP (total phosphorus) and FC (faecal coliforms).

For the full OSET NTP Trial 5 report on the performance of the **AdvanTex® AX-20 Mode 3** system contact Innoflow Technologies Ltd at Dairy Flat, Auckland, on *0800innoflow*.

Authorised By:

Ian Gunn, Technical Manager, OSET NTP
22 March 2011

On-site Effluent Treatment National Testing Programme
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PERFORMANCE RANKING of ON-SITE DOMESTIC WASTEWATER TREATMENT PLANTS

Ian Gunn, On-Site NewZ[1]

Background

The Bay of Plenty Regional Council (BOPRC), Waikato Regional Council (WRC) and Rotorua District Council (RDC) began testing ex-factory on-site domestic wastewater treatment units in 2005 to assess their total nitrogen reduction performance. The objective was to certify treatment performance capabilities for systems to be installed in the Rotorua Lakes (15g/m^3 Tot-N) and Lake Taupo (25g/m^3 Tot-N) catchments. Manufacturers were making unproven claims as to Tot-N reduction performance and with over 30 plus systems on the market the councils needed to be certain that treatment units installed in developments around the lakes would achieve their effluent quality requirements.

Early Testing Trials under BOPRC Management

The first two testing trials [Trials 1 and 2 (2005 to 2007)] were carried out at an unsecured testing facility set up at Rotorua Wastewater Treatment Plant (Figure 1). However, problems with the dosing system and the lack of site security initiated a re-design of the testing facility at the end of Trial 2. Following a major upgrade carried out by RDC in 2007 (Figure 2) a new on-site effluent treatment testing facility (OSET TestFac) was commissioned for Trial 3 (2007/2008).

The OSET NTP

During 2008 SWANS-SIG (the Small Wastewater and Natural Systems Special Interest Group of Water NZ) negotiated with BOPRC and RDC to utilise the new TestFac for an On-site Effluent Treatment National Testing Programme (OSET NTP). Funding grants from the Ministry for the Environment and the Water Managers Group of Water NZ facilitated the development and publication of testing procedures. An approach was then made to all local government authorities throughout New Zealand for funding grant support during which some 13 Regional and Territorial Councils were recruited as Funding Partners. OSET NTP operations then commenced with Trial 4 (2008/2009).

Manufacturers/suppliers pay a testing fee, and funding grants cover management and audit costs. The oversight and management structure is shown in Figure 3. SWANS-MAG is the specialist Management and Audit Group appointed by SWANS-SIG which provides oversight of the operations team and audits and reports on all testing results.

Systems Tested

Twenty companies and one council agency (BOPRC) have participated in Trials 1 to 8 from 2005 through to 2013. Some 35 OSET systems have been tested (Figure 4)

- 18 during Trials 1 to 3 under BOPRC oversight and
- 17 during Trials 4 to 8 under OSET NTP oversight.

BOPRC Trial 3 testing results were used to prove the OSET NTP auditing and reporting methods. The OSET NTP has audited and reported on test results for 21 systems over Trials 3 to 8 (see Table 1 below).

Testing Procedures

Trial 4 testing procedures (the first under OSET NTP oversight) involved:

- 2 month settling in period (biological media development);
- 3 month pre-benchmarking period (nitrification and denitrification development period);
- 3 month benchmarking period; and
- 1 month high flow test period (with a doubling of flow over one week followed by three weeks recovery).

[1] On-Site NewZ is an Information Service for the NZ On-site Domestic Wastewater Industry
www.onsitenewz.wordpress.com

Samples are taken on a six day cycle so as to cover all days of the week. Dose loading is a 1,000L/day controlled discharge to represent daily flow increments from a typical household.

Table 1: OSET Units Tested Trials 3 to 8 (2007 to 2013)

Company	OSET Unit	Treatment Process	Abbreviation
Trial 3 (2007/2008)			
Biocycle Holdings, Napier	Biocycle 6300 [development model not available commercially]	SAF	**Biocycle**
Innoflow Technologies Ltd, Auckland	AdvanTex AX-20 Mode 3	rPBR-T	**AdvanTex**
Oasis Clearwater Systems, Christchurch	Oasis Clearwater S 2000	SAF	**Oasis**
Waipapa Tanks, Kerikeri	Waipapa Tanks Maxi-Treat MV-C 3000 (superseded by Econo-Treat)	SAF	**Maxi-Treat**
Trial 4 (2008/2009)			
Humes Pipeline Systems, Auckland	Humes FR1 [model not currently available commercially]	SAF	**Humes**
Hynds Environmental, Auckland	Hynds Advanced Lifestyle	SAF	**Hynds**
WaterGurus (NZ) Ltd, Christchurch	WaterGurus NovaClear	MBR	**NovaClear**
Waipapa Tanks, Kerikeri	Waipapa Tanks Econo-Treat VBB C-2200 2	SAF	**Econo-Treat**
Trial 5 (2009/2010)			
Devan Group, Tauranga	Devan Green [model not available commercially]	SAF	**Devan**
RX Plastics Ltd, Ashburton	Airtech 7000	SAF	**Airtech**
Innoflow Technologies Ltd, Auckland	AdvanTex AX-20 Mode 3	rPBR-T	**AdvanTex**
Trial 6 (2010/2011)			
Bay of Plenty Regional Council, Whakatane	BOPRC AWTS NI [Council evaluation of bark-bed denitrification system]	AWTS-NI	**AWTS-NI**
Quantum Waste Water Systems, Levin	Quantum Eco System	SAF	**Quantum**
Trial 7 (2011/2012)			
Allflow Equipment Ltd, Nelson	Allflow Klaro 9000 10PE	SBR	**Klaro**
Trial 8 (2012/2013)			
Aqua Nova NZ Ltd Auckland	Aqua-nova	SAF	**Aqua-nova**
Aqua Nova NZ Ltd Auckland	Aqua-nova NR	SAF-NR	**Aqua-nova NR**
TechTreat Ltd Kerikert	TechTreat SS10	SAF	**TechTreat**
Ecological Technologies Auckland	BIOROCK-S	Passive Media	**BIOROCK**
Findlater Construction Ltd nelson	Findlater PA 5x5	SAF	**Findlater**
Super-Treat Systems NZ Ltd, Kerikeri	Super-Treat NZ12	SAF	**Super-Treat**
EcoSewerage, Coromandel	Eco Sewerage	Worm-Wetland	**EcoSewerage**

Treatment Process Key:

SAF	Submerged aerated filter	AWTS-NI	Submerged aerated filter & bark bed denitrification
SAF-NR	Submerged aerated filter & nitrogen reduction	Passive media	Gravity dosed patented media layers
MBR	Membrane aerated bioreactor		
SBR	Sequencing batch reactor	Worm-Wetland	Worm based primary treatment & wetland cells secondary treatment
rPBR-T	Textile recirculating packed bed reactor		

Performance Evaluation
There are two phases to performance evaluation. First, BOD and TSS results are assessed against AS/NZS 1547 secondary effluent quality requirements [90% samples <20/30g/m^3 BOD/TSS]

Second is benchmarking involving 16 test results from 3 months operation for six effluent quality parameters plus power consumption. Benchmark letter grade ratings are based on median values for effluent quality as per Table 2 below:

Table 2: Benchmark Rating Indicators

Rated indicators for median value	Rating letters and corresponding effluent quality				
	A+	A	B	C	D
BOD (g/m^3)	<5	<10	<20	<30	≥30
TSS (g/m^3)	<5	<10	<20	<30	≥30
Total nitrogen (g/m^3)	<5	<15	<25	<35	≥35
Ammonia nitrogen (g/m^3)	<1	<5	<10	<20	≥20
Total phosphorus (g/m^3)	<1	<2	<5	<7	≥7
Faecal coliforms (cfu/100ml)	<10	<200	<10,000	<100,000	≥100,000
Energy (kWh/d)	0	<1	<2	<5	≥5

Test Results
Of the 21 systems Trials 3 to 8 which the OSET NTP has audited and reported on, three have been withdrawn from the market, one has been superseded by a new model and a fifth is a non-commercial system (BOPRC bark filter unit). Reports are provided to individual manufacturers and Funding Partner Councils and one page "performance certificates" are posted on the OSET NTP web-pages on the SWANS-SIG website for use by members of the public.

Meeting AS/NZS 1547 Requirements
Of the 17 commercially available systems audited and reported on during Trials 3 to 8, only 47% met 100% of the BOD_5 and TSS requirements (that is 8 treatment units out of 17) with the other 53% (9 treatment units) meeting only the 90% requirements. This demonstrates that treatment systems at the scale required to handle daily household wastewater flows can exhibit variable performance, even under controlled conditions as at the testing facility.

Two of the 4 commercially withdrawn systems did not meet the AS/NZS requirements and one system did not submit for AS/NZS review

Performance Ratings under Benchmark Testing
The following Charts are derived from the rating tables within the performance certificates available from the website.

Aggregated benchmark rating
The aggregated benchmark rating overall comparison (Chart 1) is based on scoring A+ at 5, A at 4, B at 3, C at 2 and D at 1. For example the sample rating table below (Table 3) has a score of 24.

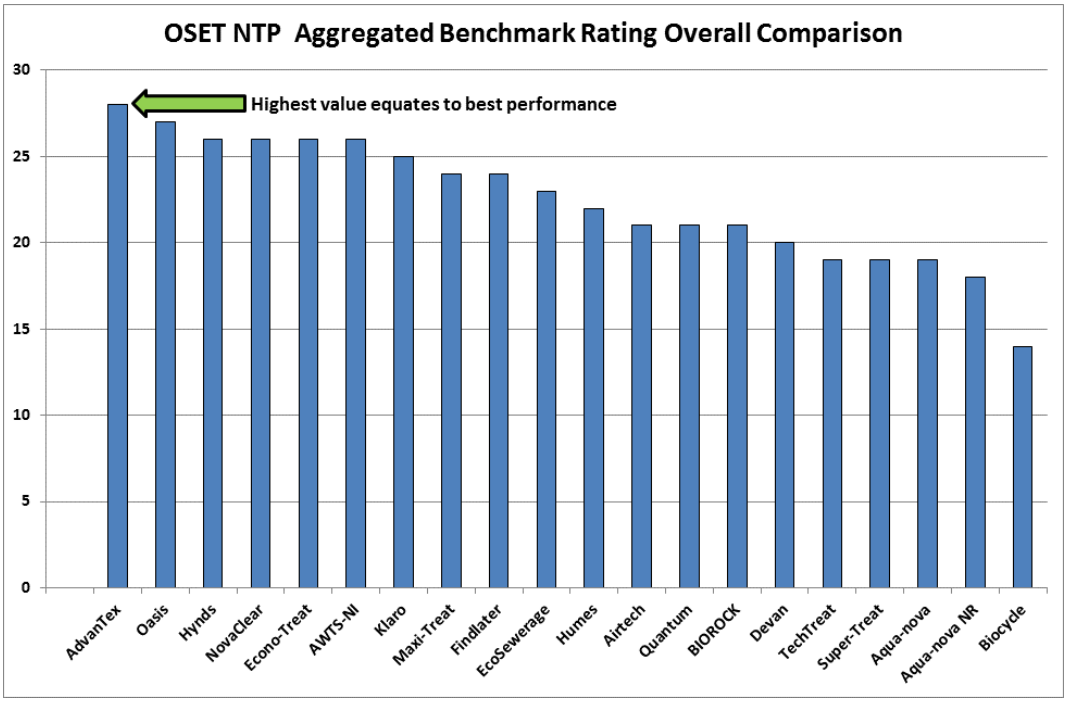
This aggregated benchmark rating can also be converted to a "Performance Star Rating" as set out in Chart 2.

Chart 2 shows that the AdvanTex recirculating packed bed reactor textile filter and the Oasis submerged aerated filter are the top performing treatment units at a Five Star Plus rating.

Table 3: Sample Rating Table

Indicator Parameters	Median	Std Dev	Rating	Rating System				
				A+	A	B	C	D
BOD (g/m^3)	**7.2**	4.7	**A**	<5	<10	<20	<30	≥30
TSS (g/m^3)	**4.5**	7.2	**A+**	<5	<10	<20	<30	≥30
Total nitrogen (g/m^3)	**18.4**	2.5	**B**	<5	<15	<25	<30	≥30
NH_4- Nitrogen (g/m^3)	**2.91**	1.14	**A**	<1	<5	<10	<20	≥20
Total phosphorus (g/m^3)	**4.23**	0.55	**B**	<1	<2	<5	<7	≥7
Faecal Coliforms (cfu/100mL)	**75,500**	29 x 10^3	**C**	<10	<200	<10,000	<100,000	≥100,000
Energy (kWh/d) (mean)	**1.55**	--	**B**	0	<1	<2	<5	≥5

Chart 1:



Treatment performance stability

The median values of benchmarked parameters have been used in Chart 1 to rank the aggregated performance. However it is the standard deviation which indicates the variability of results. The higher the standard deviation the less stable the treatment performance related to an individual parameter. If the standard deviation values are summed for each of the five chemical parameters then a comparison between the summed values can be made. This comparison is set out in Chart 3.

Chart 2:

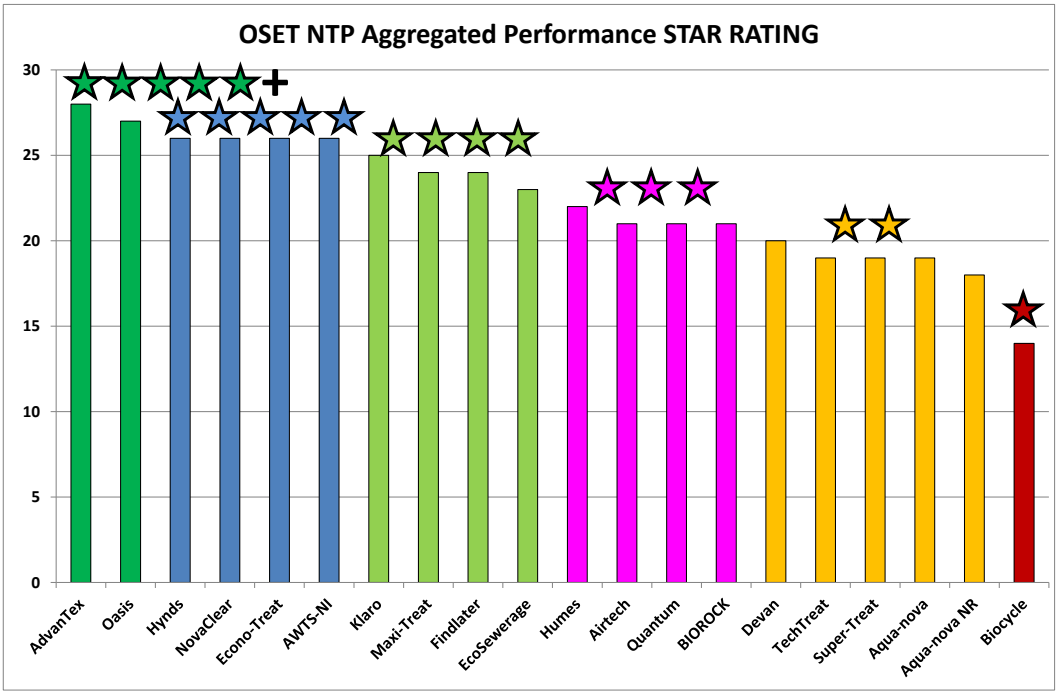
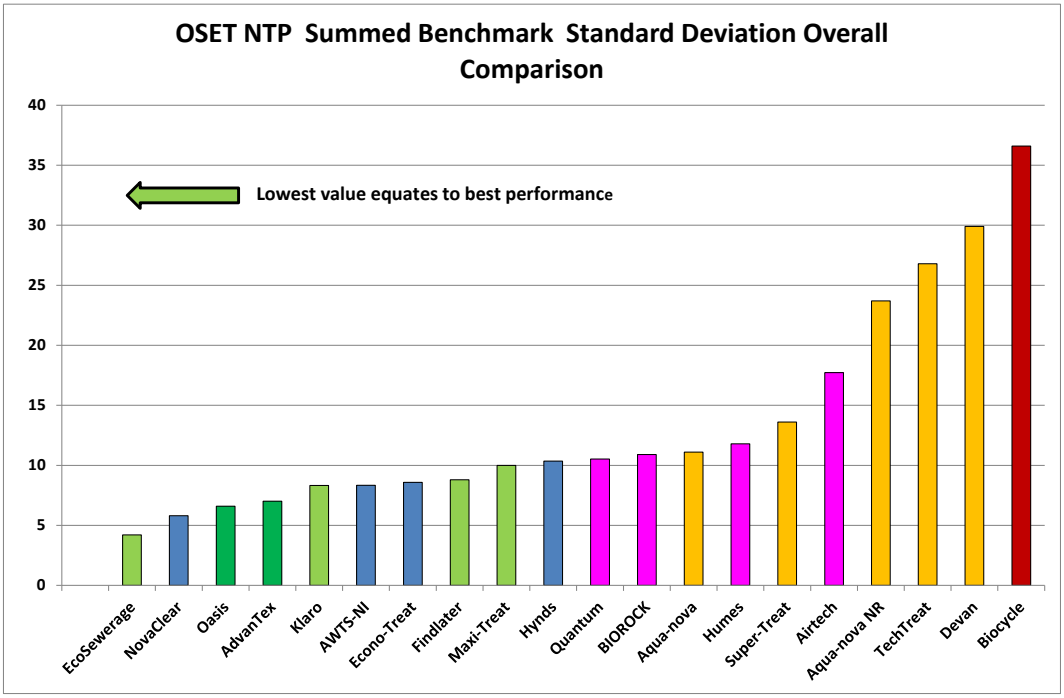


Chart 3:



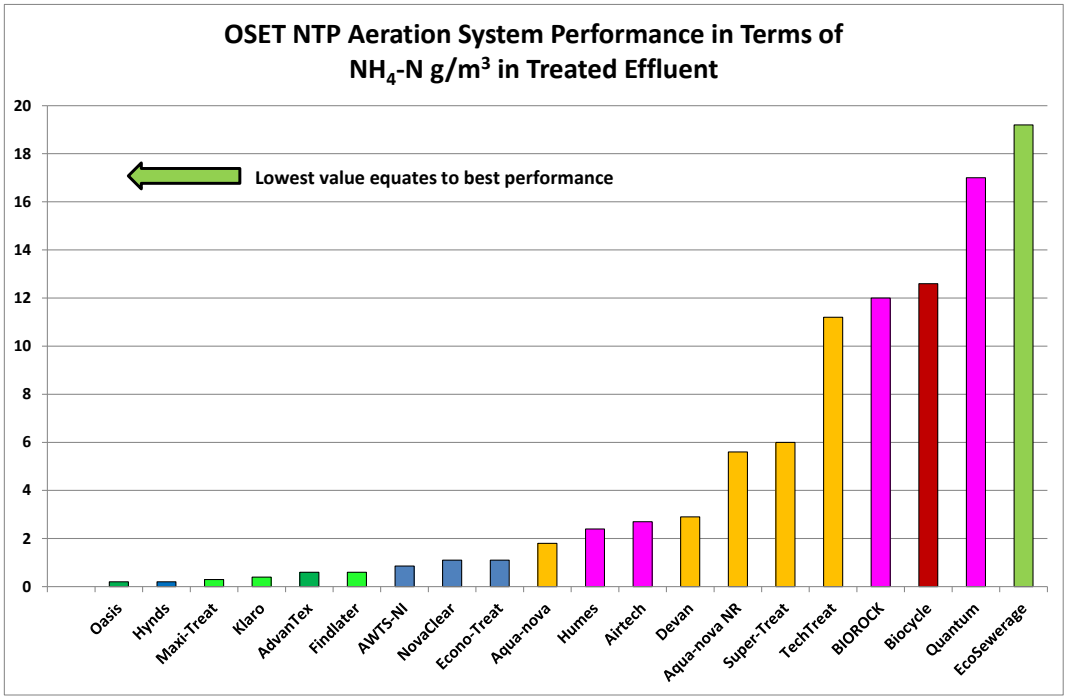
The EcoSewerage worm-wetland and the NovaClear membrane bioreactor are the most stable ahead of the two Five Star Plus treatment units.

Aeration performance

The effectiveness of aerobic treatment (as supported by the aeration system) is best assessed via the ammonia oxidation (nitrification) performance of a treatment unit. This is indicated by the treated effluent ammonia concentration, with low NH_4-N values indicating high aeration performance. Chart 4 compares the benchmark effluent NH_4-N values for each treatment unit.

The six best aeration performance systems in terms of ammonia reduction involve four submerged aeration filter units (Oasis; Hynds; Maxi-Treat; Findlater), a sequencing batch reactor (Klaro) and a textile recirculating packed bed reactor (AdvanTex).

Chart 4:

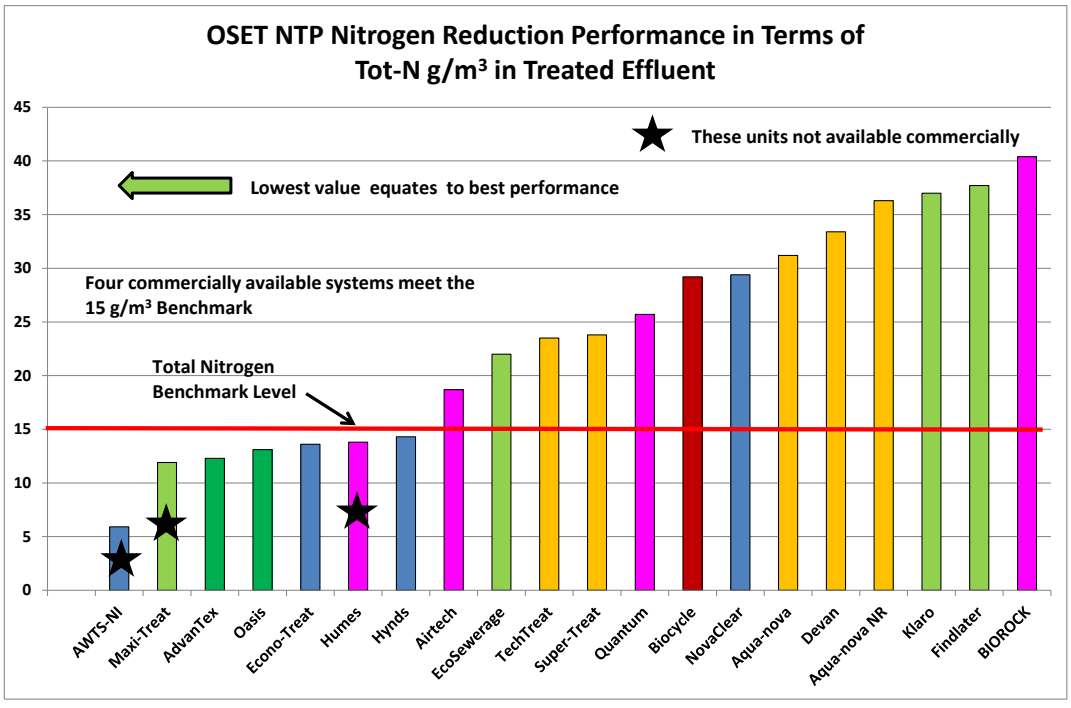


Those treatment units with very high aeration performance need to be checked out as to their energy use as they may in practice be "over-treating".

Nitrogen reduction performance

The nitrogen reduction performance is important for some councils in implementing nutrient management practices for rural residential development. For example only those treatment units with a total nitrogen rating of A or A+ meet the BOPRC 15g/m^3 TN limit for installation of OSET units in the Rotorua Lakes areas. Currently only four commercially available systems achieve this treatment level (as shown in Chart 5 for Advantex, Oasis, Econo-Treat and Hynds).

Chart 5:



Energy use

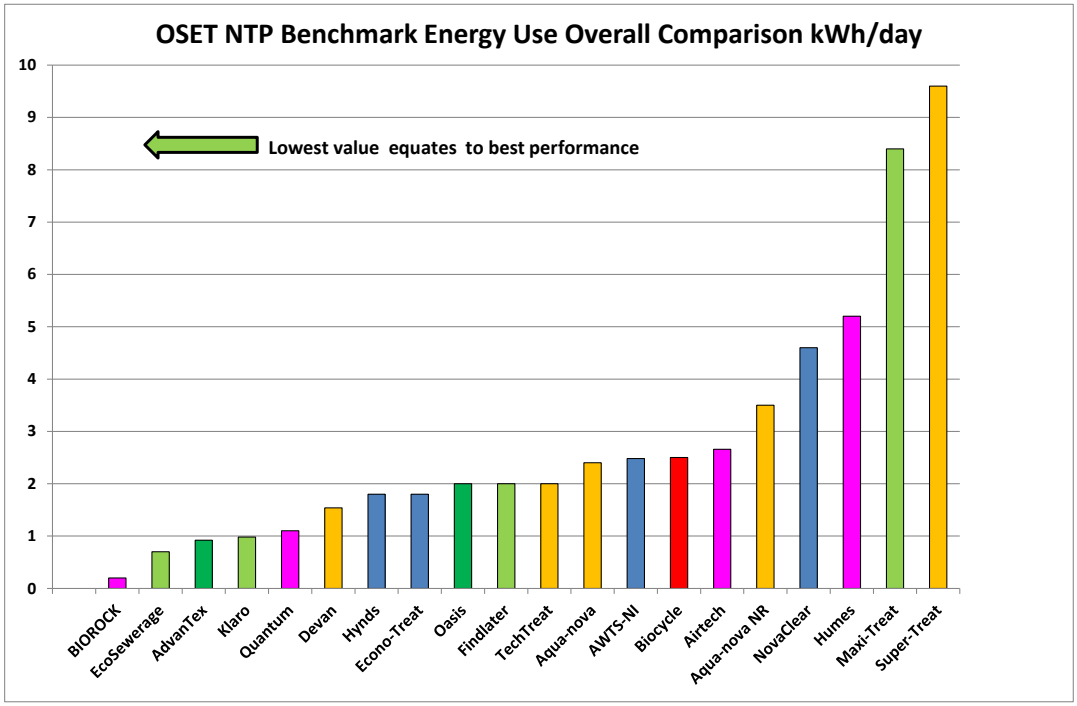
In selecting an OSET system for their property a key element in homeowner evaluation of alternative treatment systems will be capital cost, along with running cost. The OSET NTP testing results assist in evaluating running costs via the average daily energy benchmark value. It is important to recognise that the kWh/day benchmark values do not indicate likely field performance. The overall energy rating of a treatment unit reflects conditions at the test facility – power consumption for effluent pumping under field conditions will be specific to the irrigation distribution system as installed.

Chart 6 compares the benchmark kWh/day average daily energy use for each system. The five lowest energy use units include two with passive ventilation systems (BIOROCK and EcoSewerage) a textile recirculating packed bed reactor (AdvanTex), a sequencing batch reactor (Klaro) and a submerged aerated filter (Quantum).

Overall energy consumption needs to be compared to aeration performance since over-aeration will result in high consumption without necessarily achieving the most appropriate effluent quality level. Chart 6 shows that of the two Five Star Plus units, Oasis (the SAF system) uses twice as much energy as the AdvantTex (textile filter). The Five Star AWTS-NI has high energy use due to the aeration system over-treating to achieve high nitrification (ammonia reduction) prior to nitrogen stripping in the bark filter. The other Five Star high energy use system is the NovaClear MBR unit.

The lowest energy use systems are the BIOROCK passive media system and the EcoSewerage worm-wetland which use gravity flow through media to achieve treatment. Their energy use relates mainly to the irrigation pump for treated effluent.

Chart 6:

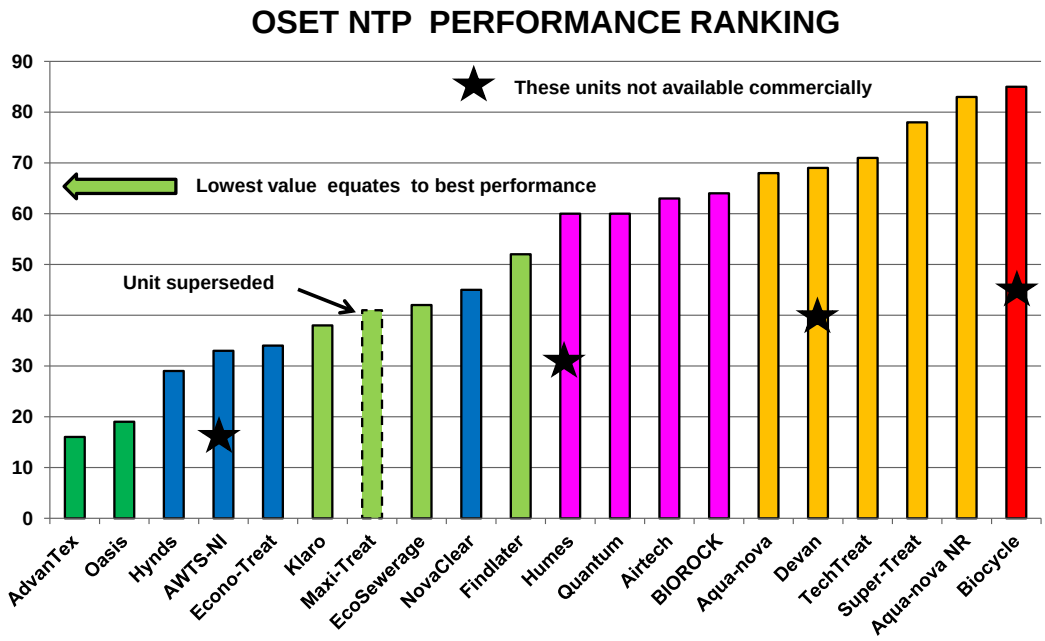


Overall Performance Ranking

It is not feasible to say which of the tested units is the “best” as many factors will influence overall selection for a specific application. Cost is important to homeowners who want to ensure a durable system which provides consistent treatment performance throughout the life of the unit. Lifecycle cost including for capital, operating and maintenance expenditure is important, but it must be recognised that the overall performance of the on-site wastewater system includes not only the treatment unit but the land application system into which the treated effluent is distributed.

However, an overall performance ranking can be derived based on scoring the individual units for each of the parameters in Charts 2 to 6 (aggregated benchmark rating; treatment stability; aeration performance; nitrogen reduction; energy use) by taking the place in each chart and scoring a 1 for first place down to 20 for last place, and summing the place scores for each unit. The result is an OSET NTP Performance Ranking as in Chart 7 below.

Chart 7:



The Five Star Plus units confirm AdvanTex as highest performance ranking over Oasis due to the Oasis higher energy use. The Five Star NovaClear has moved to a much lower ranking due to the high energy use inherent in this MBR process.

Conclusion

The operational procedures and benchmark auditing processes of the OSET NTP are proving most valuable in evaluating the performance of ex-factory and custom built on-site domestic wastewater treatment units available in New Zealand.

The current success of the NTP is due to the voluntary input of the SWANS-SIG members participating in the operations team and the management and auditing group. The whole OSET NTP programme is a “bottom-up” process driven by members of SWANS-SIG with no funding base other than the testing fees paid by manufacturers and the voluntary contributions from council Funding Partners.

The key to the future success of the testing programme lies in recruitment of more Regional and District Council funding partners. The information coming out of the testing programme as made available to funding partners is invaluable to council consenting officers in assisting their evaluation of treatment units for which consent is required, and assessing what monitoring and maintenance conditions need to be set on specific units relevant to their OSET NTP performance outcomes.

Ideally if all councils throughout NZ with significant numbers of on-site domestic wastewater systems join up as Funding Partners adequate funds would be available to move the OSET NTP operations to a secure professional basis and enable development of additional programmes including field testing, holiday load testing and product integrity testing.

Figure 1: Trials 1 and 2 Testing Platforms (2005 to 2007)

Figure 2: New Testing Facility from Trial 3 (2007/2008)

Figure 3: OSET NTP Management Structure

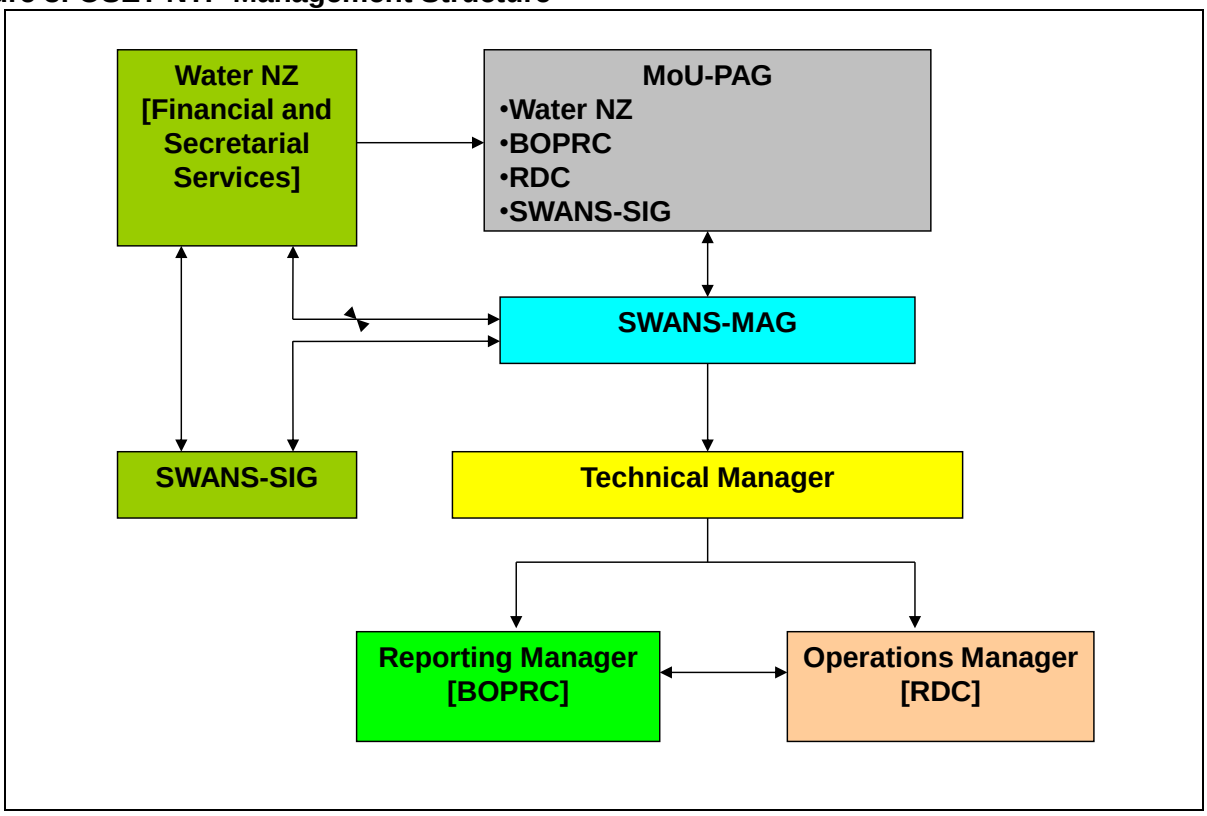


Figure 4: Systems Tested Trials 1 to 8, 2005 to 2013

Company [and number of units tested]	BOPRC Management			OSET NTP Management				
	Trial 1 2005/06	Trial 2 2006/07	Trial 3 2007/08	Trial 4 2008/09	Trial 5 2009/10	Trial 6 2010/11	Trial 7 2011/12	Trial 8 2012/13
Allflow Equipment [1]							1	
Aqua Nova [2]								2
Biocycle Systems [1]			1					
Biolytix [1]	1							
Bio-Microbics – Smith & Loveless [2]	1	1						
BIOROCK – Ecotechnologies [1]								1
Devan Plastics [3]	1	1			1			
Eco Sewerage [1]								1
Findlater Construction [1]								1
Humes Pipeline Systems [1]				1				
Hynds Environmental [3]	1	1		1				
Innoflow Technologies [3]	1		1		1			
Oasis Clearwater Environmental [2]	1		1					
Quantum Waste Water Systems [1]						1		
Reflection Treatment Systems [1]		1						
RX Plastics [3]		2			1			
Super-Treat Systems NZ Ltd [1]								1
Tech Treat Ltd [1]								1
Waipapa Tanks & Waste Treatment [4]	1	1	1	1				
Water Gurus NZ Ltd [1]				1				
BOPRC [1]**						1**		
Total [35]	**7**	**7**	**4**	**4**	**3**	**2**	**1**	**7**
** BOPRC is not included as a "Manufacturer/Supplier" in the NZ Directory of commercial systems.								

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AX20 - C Pumpwell/Treatment Pod/Collection Well	Rectanglar Axis Type - Section 3, 4 & 8 of AS/NZS1546.1:2008 Glass Fibre - Reinforced Plastic Construction	1000L	Treatment Pod - Mimimum Burial Depth - 0 metre. Certification applies only to construction of the pod and lid. It does not include the internal components and fittings.	27 Mar 2009
PBAX2472 Pumpwell/Basin	Vertical Axis Type - Plastic Polyolefin. Section 3, 4 & 9 of AS/NZS1546.1:2008	670L	Pump Basin - Minimum Burial Depth - 0 metre. Certification applies only to construction of the basin, pipe, base, and lid.	27 Mar 2009
T1000 Septic Tank/Collection Well	Horizontal Axis Type - Section 3, 4 & 8 of AS/NZS1546.1:2008 Glass Fibre - Reinforced Plastic Construction	4000L	Septic Tank/Collection Well Minimum Burial Depth - 1 metre. Certification applies only to the construction of the septic tank, access cover and partition. It does not include the internal components or fittings.	27 Mar 2009
T1500 Septic Tank/Collection Well	Horizontal Axis Type - Section 3, 4 & 8 of AS/NZS1546.1:2008 Glass Fibre - Reinforced Plastic Construction	6400L	Septic Tank/Collection Well Minimum Burial Depth - 1 metre. Certification applies only to the construction of the septic tank, access cover and partition. It does not include the internal components or fittings.	27 Mar 2009

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Brand Name	Model Name / Number	No. of Persons	System Capacity	Date Endorsed
ORENCO	AdvanTex AX20N	10	6400/1000	11 Feb 2011

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