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Engineering Report

D & R White

On-Site Wastewater Disposal

at

Lot 10 DP 2219
Ruakaka Bay
Queen Charlotte Sound

Dave Dravitzki
Engineering Geologist
Smart Associates Ltd
20 December 2006

Job No W06-1761

Table of Contents

1. *Introduction*

2. *Description*

3. *Site Evaluation*

4. *Assessment of Environmental Effects*

5. *Recommendations*

6. *Limitations*

7. *References*

8. *Appendices*

A Site Plan

B Wastewater Design Sheets

C Innoflow System Specification

1. Introduction

1.1 D & R White are constructing a proposed residential dwelling on their property situated at Lot 10, DP 2219, Ruakaka Bay, Queen Charlotte Sound. It is understood that the dwelling will comprise three buildings: the living tent, the sleeping tent, and the outhouse.

1.2 The purpose of this report is to present the results of site investigations carried out in relation to onsite wastewater treatment and disposal. The site investigation was carried out on 9 August 2006.

2. Description

2.1 The legal description of the property is Lot 10 DP 2219 and the land area is 0.14 ha. The site is located in the northern end of Ruakaka Bay.

2.2 It is understood that in addition to the living tent the main area may be used as temporary bedrooms for up to four people.

3. Site Evaluation

3.1 The proposed land application area is positioned to the north and east of the proposed buildings at the site, as indicated on the attached site plan presented in Appendix A of this report.

3.2 The proposed land application area is on a linear planar landform located on valley side slopes that lead into Ruakaka Bay. The slopes relating to the land application area are generally southwest facing and range between approximately 5° to 15°. The depth to the water table is expected to be over 1.5m.

3.3 The edge of the foreshore is located approximately 20m to the southwest of the proposed land application area. A stream is also located approximately 20m to the west of the proposed land application area, as shown on the site plan. An assessment of effects on the environment is included in Section 4 of this report.

3.4 The proposed application area is covered in medium-sparse regenerating native bush with generally thin bracken and undergrowth.

3.5 Three test pits were dug at the site in the proposed effluent disposal area and their locations are shown on the site plan. Based on the soil assessment carried out, an average drainage category of 3 has been adopted. The representative soil properties are:

W 1

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.25	A	Topsoil	Dark brown	Sandy loam	None	Loose	Soft	Moderate	Moist	2
0.6	B	Colluvial	Pale brown	Loam	10%	Medium dense	Stiff	Moderate	Moist	3

W 2

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.25	A	Topsoil	Dark brown	Sandy loam	None	Loose	Soft	Moderate	Moist	2
0.6	B	Colluvial	Pale brown	Loam	10%	Medium dense	Stiff	Moderate	Moist	3

W 3

(m)	Horizon or Layer and boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture condition	
0.35	A	Topsoil	Dark brown	Sandy loam	None	Loose	Soft	Moderate	Moist	2
0.6	B	Colluvial	Pale brown	Loam	10%	Medium dense	Stiff	Moderate	Moist	3

3.6 In accordance with Plan Change 7 Rule 27.2.4.5.5 an assessment of the best practical option has determined that secondary treatment and drip irrigation wastewater disposal is the most practical option for this property, when soil drainage characteristics and proximity to the foreshore and stream are taken into account.

3.7 A secondary treatment system involves aerobic biological processing and settling or filtering of effluent received from a primary unit. As the dwelling is understood to be used intermittently, an Innoflow AdvanTex treatment system coupled with a drip irrigation system is recommended.

A secondary treatment system such as the system proposed will normally produce average effluent quality equal to or better than:

BOD after 5 days (average) $< 15\ g/m^3$
Suspended solids (average) $< 15\ g/m^3$

An Innoflow AdvanTex system specification is attached (Appendix C).

3.8 The completed dwelling proposed for the site will have a living tent, a sleeping tent, and an outhouse. For design purposes it has been assumed that the living tent may potentially occupy four people. Additional accommodation for up to 6 people is planned as the next stage of development and therefore to allow for this a permanent occupancy of 10 people (as per MDC Guidelines for new on-site wastewater management systems) has been used to calculate the design flow of 1800 litres/day. A design allowance of 180 litres/person/day has been used with this allowance being in accordance with Appendix 4.2D of AS/NZS 1547:2000. The dwelling will utilise a rainwater supply water source augmented by the existing stream. A minimum wastewater storage capacity of 4,500 litres is required. The length of drip line required is 471m (refer wastewater design sheets Appendix B).

3.9 The irrigation system design requires 1.6 litre/hr emitters with lines laid at 1.0m spacing and at 100mm below ground level. As per Council guidelines, irrigation lines should be set back a minimum distance of 2m from the property boundaries. The installation of the irrigation system is to be in accordance with the product installer guide supplied by the manufacturer.

3.10 Prior to the proposed system becoming operational the system designer must inspect and certify that the system has been installed according to the design. This certification must then be forwarded to Council.

3.11 The Marlborough District Council requires that the owner of any advanced wastewater treatment system enters into and retains a maintenance contract with the supplier of the system, or with a recognised maintenance contractor, for maintenance to be carried out at yearly intervals. Records of the maintenance should be forwarded to the Council as soon as practicable following the completion of the inspection or, in the case of remedial works being required, on completion of those remedial works.

3.12 Vehicle access to the system from the foreshore for maintenance will be available via the existing track to the proposed buildings.

4. *Assessment of Environmental Effects:*

Activity - Install Effluent Disposal Field Within 30 metres of a watercourse and the Marlborough Sounds Foreshore

4.1 Effects

It is proposed to install a Innoflow AvanTex secondary treatment system and drip irrigation effluent disposal system, with the effluent disposal system being less than 30 metres from the foreshore and less than 30 metres from the stream to the west of the property.

A possible environmental effect resulting from this proposed activity is the contamination of the stream, and ultimately the Ruakaka Bay foreshore through the vertical movement of secondary-treated effluent, that is not treated or consumed in the soil.

The proposed irrigation system will be located amongst thin regenerating bush and scrub.

4.2 Mitigation Measures

Treatment

The treatment system proposed is an Innoflow AdvanTex secondary treatment system, which produces a high quality effluent (refer 3.7 above), and therefore has a minimum impact on the environment.

Established vegetation on the property will assist with the breakdown of the effluent entering the soil.

Coliform numbers, the indicators used to measure the various pathogens present in sewage effluent, are initially very low in the secondary-treated effluent. These will not be a concern for it is well established that bacterial, (and viral etc), numbers are reduced exponentially with passage of effluent, whether primary-treated or secondary-treated, through mid-range textured soils.

This is evidenced by Note 1 in Table 4.2B1 of NZS 1547:2000 where it is noted that a "path length of 0.3 – 0.4 metres would be sufficient to reduce (bacterial) numbers to insignificant levels in normal soils i.e. soils that are of a mid-range texture, not too sandy or too clayey, and not saturated all the time".

We are of the opinion that the soil on the property (refer 3.5 above) falls into this mid-range soil category.

5. *Recommendations*

It is recommended that an Innolflow Advantex treatment system coupled with a drip irrigation system be installed to service the dwelling at the site. Installation is to be in accordance with requirements and recommendations of NZS1547:2000.

6. Limitations

This report is valid for two years from the date of issue and covers the design of a wastewater treatment and disposal system for D & R White at Lot 10 DP 2219, Ruakaka Bay, Queen Charlotte Sound. Any other areas are outside the scope of this report.

The reliance by other parties on the information or opinions in the report shall, without our prior review and agreement in writing, be at such parties' sole risk.

7. References

1. NZS 1547:2000 On-site Domestic Wastewater Management
2. Marlborough District Council Guidelines for new on-site wastewater management systems.

Report prepared by:

Dave Dravitzki, Engineering Geologist

20 December 2006

Report reviewed by:

Jan Dimmendaal, Chartered Engineer

Appendix A

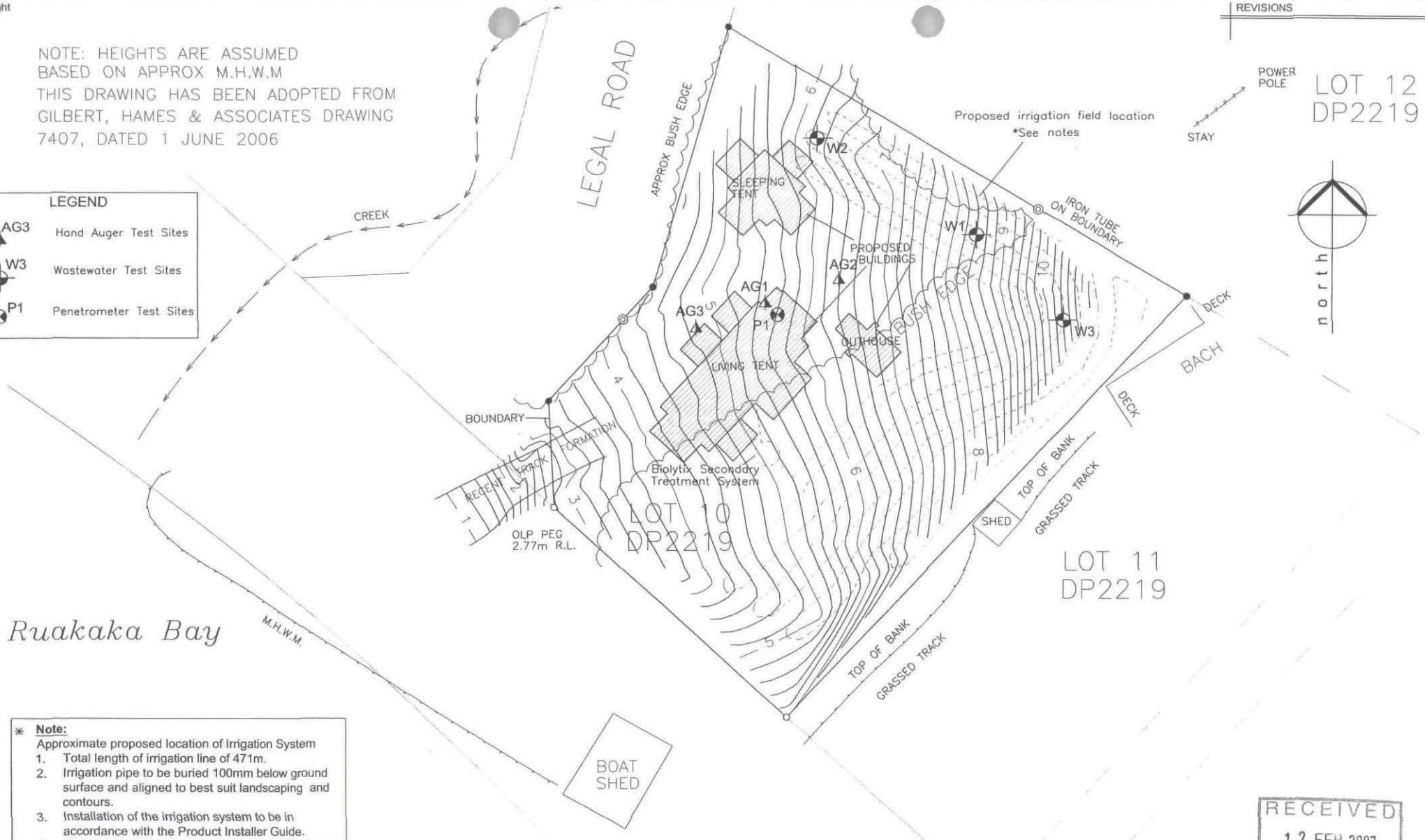
Location and Site Plan

REVISIONS

NOTE: HEIGHTS ARE ASSUMED
BASED ON APPROX M.H.W.M
THIS DRAWING HAS BEEN ADOPTED FROM
GILBERT, HAMES & ASSOCIATES DRAWING
7407, DATED 1 JUNE 2006

LEGEND

- AG3 — Hand Auger Test Sites
- W3 — Wastewater Test Sites
- P1 — Penetrometer Test Sites



* **Note:**
Approximate proposed location of Irrigation System

1. Total length of irrigation line of 471m.
2. Irrigation pipe to be buried 100mm below ground surface and aligned to best suit landscaping and contours.
3. Installation of the irrigation system to be in accordance with the Product Installer Guide.
4. Detailed design of the irrigation system is to be the responsibility of the installer.

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D & R WHITE
LOT 10 DP 2219
RUAKAKA BAY

PROJECT No. **W06-1761**

NOTES
Do not scale from this drawing. Only figured dimensions are to be taken from this drawing. The contractor must verify all dimensions on site before commencing any ordering of materials, work or shop drawings. The contractor must report any discrepancies to the Engineer before commencing work. If this drawing exceeds the quantities taken in any way, the Engineer is to be informed before the work is started. This drawing is Copyright and must not be reproduced without the consent of Smart Associates Ltd. The Engineer is to be given at least 2 weeks notice of the beginning of construction works, and at least 48 hours notice of critical items (eg concrete pours, prelining etc). The Engineer reserves the right to alter the design in light of site circumstances including previously unforeseen design issues.

SITE PLAN			DRAWING No. 1761/1
DRAWN DD	CHECKED JIS	SCALE (A3) 1:300	DATE 20.12.06
COMPUTER FILE: drawings\			REVISION B

Appendix B

Wastewater Design Sheets

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WASTEWATER SYSTEM DESIGN SHEET

To AS/NZS 1547:2000

Client: D & R White **File No: W06-1761**

Intended water Supply:

~~*Public Supply*~~ ~~*Rain water (roof collection)*~~ *Bore/Well/Dam*

Local experience with existing on-site systems:

Septic Tank or similar (Primary treatment): *OK when installed properly with a correctly sized level drainage area and maintained.*

Secondary treatment: *Produce high quality effluent suitable for irrigation.*

Recommendation for this site: *Secondary treatment system utilising irigation system effluent disposal (Innoflow System)*

DRAINAGE CONTROLS:

Need for surface water collector / cut-off drains?

AVAILABILITY OR RESERVE / SETBACK AREAS

Reserve area available for extensions, % of design area: *100%*

Setback distance? (between development and disposal system): *Min. as required by Resource Management Act*

Ksat, (m/day): ESTIMATED SOIL CATEGORY: *Category 3 - Moderately well drained loam*

Design

RECOMMENDED D.I.R. *28* mm/week

(NOTE: Where DIR is 10mm/week or less, ETA/ETS trenches to Fig 4.5A7 NZS1547:2000 should be specified to enable the utilisation of such soils)

10 Permanent People At 180L/person/day: *1800* L/day from Appendix 4.2D AS/NZS 1547:2000

DESIGN WEEKLY FLOW: *12600* L/week

Septic tank size (min): *4500* (Table 4.3A1)

AREA REQUIRED: *450.0* m²

LENGTH REQUIRED: *471.2* m . **(Refer Irrigation System Calculation sheet)**

RESERVE AREA REQUIRED: *100%* of specified drainage area

RECOMMENDATION :

Innoflow Secondary treatment with dripper line irrigation.
Min 4500 litre capacity treatment and irrigation lines to be a minimum total length of 471m using 1.6 l/hr emitters Lines to be laid at 1.0m spacing to follow contours (when possible), at 100mm below ground level. Installation of the irrigation system to be in accordance with the product Installer Guide. Detailed design of the irrigation system is to be responsibility of the installer.

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Irrigation System Calculation

Project Title: D & R White — Date: 13.10.06

File Ref: W06-1761 — Operator:

Acceptable daily loading rate (mm/day)	4
Daily influent (l/day)	1800
Emitter type	Raam 17
Emitter flow rate (l/h)	1.6
Emitter Spacing (m)	1
Dripline Spacing (m)	1
Distance from Treatment system to Irrigation Field (m)	5
Field Size (m^2)	450
Field length assuming square area	21
Number of lines	22
Total Dripline Length (m)	471
Total flow Rate Required (l/h)	754

Pump Duty

Flow (l/h)	754
Head (m)	12

Head-Loss Table		
Item	**Head loss (m)**	**Comments**
Emitter	5	Minimum pressure required
Lateral	0	Head loss insignificant
Submain	1	Using Netafim Raam 17 as a submain
Main	0.06	Using 25mm LDPE x main length
Water meter	0	For a 15mm Multijet Turbine Water Meter
Filter	3	For a Semi blocked filter
Tank Depth	2	
Elevation	0	
Sub Total	11.06	
Total	12	including 10%

NOTE:
This design is indicative only and detailed design is the responsibility of the installer.

Appendix C

Innoflow System Specification

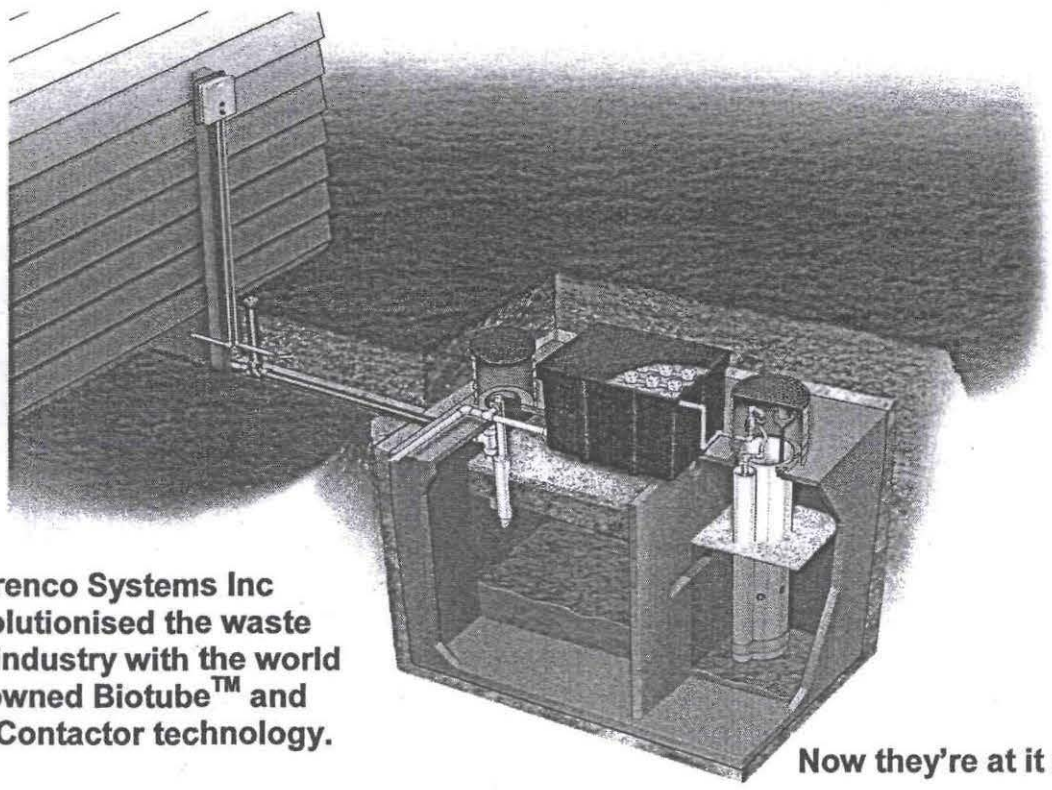
INNOFLOW TECHNOLOGIES LIMITED

INNOVATIVE WASTE WATER TREATMENT AND DISPOSAL SOLUTIONS

ADVANTEX™

Affordable Advanced Textile PBR Wastewater Treatment

The latest technology from the USA has taken the wastewater world by storm. Now its here to turn New Zealand's wastewater treatment industry on it's head.



Orenco Systems Inc revolutionised the waste water industry with the world renowned Biotube™ and Sand Contactor technology.

Now they're at it again!

Five years of intensive research and development has culminated in the Development of the Advantex™ recirculating textile packed bed reactor (rtPBR).

CONSIDER THE ADVANTAGES

QUALITY BUILT IN

- *High Quality effluent - out performs aerobic package plants.*
- *High Quality corrosion free components throughout.*
- *Suitable for intermittent use applications such as holiday homes.*
- *No discharge of untreated effluent during peak flow periods or power cuts.*
- *Purpose built 'SMART' control panel.*
- *36 month warranty.*

LOW COST INSTALLATIONS

- *Compact design reduces installation costs and on-site disruption during installation.*
- *The Advantex™ comes as a pre-assembled package ensuring minimal installation time.*
- *Light weight and easily transportable.*

REDUCED ON-GOING COSTS

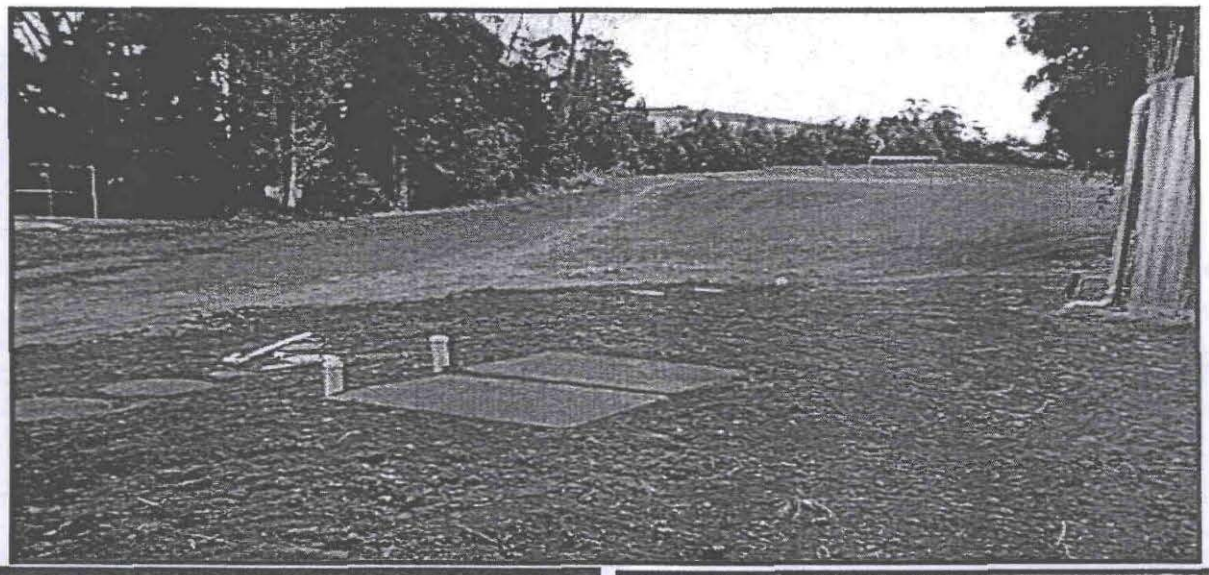
- *No activated sludge to manage or dispose of.*
- *Low power consumption.*
- *No Power hungry noisy blowers.*
- *Low maintenance requirements.*

LOW PROFILE

- *Amazingly compact—each 1.2m x 0.75m module treats up to 1500 litres per day.*
- *Attractive green non-slip access lids finish at ground level, and bolt down for safety.*
- *The Submersible pumps that operate the system are located underground in concrete tanks, ensuring silent operation.*
- *Odour free.*
- *High quality effluent is suitable for irrigating gardens and lawns.*

INNOFLOW TECHNOLOGIES LIMITED

ADVANTEX™ a low profile textile rPBR treatment plant, utilising the latest in technological advances to provide low cost, high quality wastewater treatment.



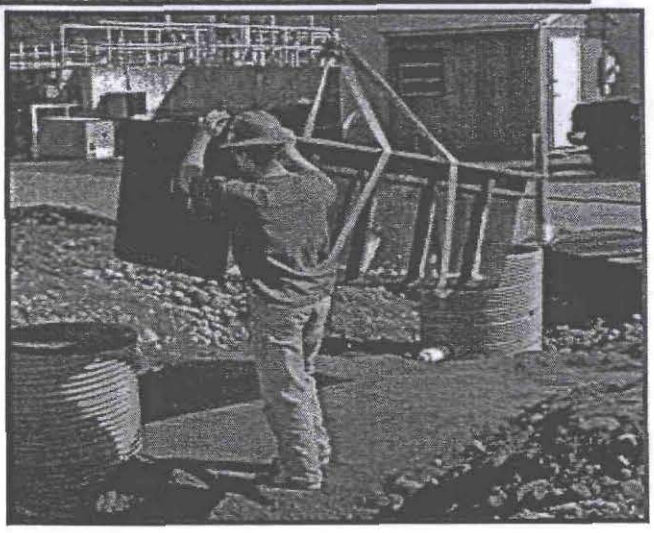
INNOFLOW TECHNOLOGIES

Purchasing a Advantex™ treatment plant from Innoflow Technologies will provide you with the latest technology in recirculating textile PBR wastewater treatment plants.

Innoflow Technologies has years of experience in the wastewater industry, all our products are engineered using Orenco pump-vaults & Biotubes™.

Orenco are world leaders in On-Site treatment technologies, so you will be rewarded with many years of satisfactory system performance.

We not only manufacture Advantex wastewater treatment systems, please consider Quantum Aerated & Pro-Tech Packed Bed Reactor Systems.



WHO WE SERVE

Innoflow Technologies specialise in the design, supply, installation and servicing of wastewater collection, treatment and disposal systems for:

- ***Single households***
- ***Commercial facilities such as camping grounds, schools, public toilets, resorts, ...***
- ***Small communities and subdivisions***

INNOFLOW'S GOAL

To provide affordable, long-term environmentally sustainable solutions that meet or exceed the requirements of each and every project we are involved in.

There is NO similar

For further information contact Innoflow Technologies Ltd:
PO Box 300-572 Albany, Auckland, New Zealand, Ph (64 9) 4155880 Fax (64 9) 4155889, innoflow@xtra.co.nz

INNOFLOW TECHNOLOGIES LIMITED
INNOVATIVE WASTEWATER MANAGEMENT SOLUTIONS

ADVANTEX® AX10

Recirculating Textile Packed Bed Reactor
Process Details and Specifications

RECIRCULATING PACKED BED REACTORS

The Advantex® is a recirculating textile packed-bed reactor (rtPBR). Recirculating packed bed reactors are well recognised as the most stable treatment process, able to produce a consistently high quality effluent, even under widely varying loads. Most people are familiar with the sand contactor rPBR process of which we have hundreds of installations throughout out NZ. However, our parent company, OSI's dedication to research and development have further refined the rPBR processes to produce a design that is unsurpassed for efficiency, reliability, future expansion capabilities, and maintenance requirements.

The sand and pebble aggregates used in sand contactor rPBR's have been replaced by an internationally patented textile media that can accept a loading rate up to 9 times higher than the sand contactor. This produces a reactor basin with a foot print only a fraction of the size of conventional systems.

Where a high quality effluent is required, the use of packed bed reactors is recommended. The Advantex® is a high performance system that consistently produces a high quality effluent, even under varying load conditions. It is particularly suitable for problem sites, sloping sites, bush-clad sites, sites with greatly varying wastewater flows and sites that are environmentally sensitive (eg. high groundwater). The use of sub-surface drip irrigation ground disposal or treated effluent re-use means that it is commonly used in sites that need to optimise ground usage.

PROCESS OVERVIEW

1. Raw wastewater from the complex flows by gravity to the septic tank. All effluent to be treated is fed to this tank.

2. Effluent from the septic tank feeds into a recirculation tank adjacent to the septic tank. This chamber is fitted with an Orenco screened pump vault and turbine pump.

3. From the recirculation tank, the effluent is dose loaded over an Advantex® recirculating textile packed bed reactor, with a minimum 4:1 recirculation flow.

4. The treated effluent is then gravity fed back to a splitter valve in the recirculation tank. Here, depending on flows, either the effluent is returned to the recirculation tank or split off to the treated effluent tank for disposal.

5. Effluent is pumped by a high quality stainless steel pump to the irrigation disposal field.

NOTE: This is a generic system specification for a domestic AdvanTex® created for a client in the absence of a site visit. This specification is therefore not site specific.

SPECIFICATION DATA SHEET

1) GENERAL

LOCATION	
WASTEWATER SOURCE	**4** bedroom dwelling
WATER SUPPLY	**Roof water collection**
MAX DAILY FLOW	**1,020** ltrs/day (As Specified from TP58)
TREATMENT OVERVIEW	➢ Innoflow Technologies Ltd Septic Tank ➢ Recirculation Tank with Pump Vault and Splitter Valve ➢ Advantex® Recirculating Textile Packed Bed Reactor ➢ Treated Effluent Tank ➢ **340 m²** Pressure Compensating Subsurface Drip Irrigation Disposal Field

2) TANKAGE

Tank Manufacturer	Innoflow Technologies Ltd.
Tank Operating Volume	7,200 litres (nominal)
No. of Compartments	Three
Septic Chamber Operating Vol.	4,000 litres
Detention @ Design Flow	*Septic stage only – 4 days (approx)*
Construction	Precast Mortar
External Dimensions	Oval 1.75 m wide x 3.50 m long x 1.94 m high (approx)
Inlet Invert	1,600 mm (internal)
Operating Level	1,400 mm (internal)
Alarm Level	1,600 mm

3) RECIRCULATION TANK

Tank Manufacturer	Innoflow Technologies Ltd.
Recirc Chamber Operating Vol.	2,000 litres
Detention @ Design Flow	*Recirc stage only ~ 2 days (approx)*
Recirculating Pump Model	PA1005 High Head Turbine Submersible Pump
Screened Pump Vault Type	Orenco PVU57-24
Materials of Construction	Moulded Plastic Vault with Polypropylene Screen
Screen Area	2.1 m^2
Cleaning Frequency	Annually (or as per site tests)
Pump Flow at TDH	2,700 ltrs/hr (refer pump curve)
Pump Run Time @ Design Flow	1.50 hrs/day (90 mins/day)
Daily Power Consumption	1.50 hours x 0.375 kW x $0.14 ¢/kWhr = $0.08 per day ($2.43 per month)
Pump Discharge Size	25 mm BSP
Control Panel Model	AXPTRO V4
Electrical Panel Rating	IP56 – NEMA4X Suitable for outside use
Electrical Controls and Protection	Manual/Off/Auto Switch, Motor Contactors, Circuit Breakers, High and Low Level Audible and Visual Alarms, Timer Control of Pump
Recycle Ratio	4:1
Splitter Valve Size	50 mm
Access Manhole Type	630 mm ∅ PVC Riser with Locking Fibreglass Lid

4) TREATED EFFLUENT TANK

Tank Manufacturer	Innoflow Technologies Ltd
TET Chamber Operating Vol.	1,200 litres
Detention @ Design Flow	*TET stage only ~ 1 day (approx)*
High Level Alarm Indication	Audible and Visual

5) RECIRCULATING PACKED BED REACTOR

Dimensions	1,240 mm x 900 mm x 900 mm (POD = l x w x h) approx
Type	Orenco Advantex® Recirculating Textile Packed Bed Reactor
Materials of Construction	Ferro-cement container, Fibreglass reinforced access lids, patented Orenco textile media
Number of Pods	1
Maximum Capacity	**1,100 litres per day**
Effluent Quality	
BOD	**<15 mg/ltr**
SS	**<15 mg/ltr**

6) DISPOSAL FIELD

Soil Category	**6**
Disposal Type	Pressure Compensating Surface Laid Drip Irrigation
Areal Loading Rate	**3.0 mm** (3.0 ltrs/m^2)
Area Required	**340 m^2**
Dripline Lateral Spacing	1 m
Dripline Orifice Spacing	1 m
Lineal Length Required	340 m
Total Number of Drippers	340 m/1 m spacing = 340
Number of Disposal Sectors	1
Number of Drippers per Sector	340
Flow Required to Pressurise each Sector	340 x 3.5 ltrs/hr per dripper = 1,190 ltrs/hr
Longest Dripline Run	50 m
Header Pipe Size	32 mm (greenline)
Header Pipe Length	50 m
Headloss Calculation	
Discharge Assembly	00.48 m
Header Pipe	00.02 m
Headloss Thru Longest Dripline	00.02 m
Height from Effluent Tank to Top Disposal Lateral (Static Head)	10.00 m (based on a typical scenario)
Activation Pressure for Dripline	05.00 m
TDH	**15.52 m**
Pump Model	Tesla Diver75
Pump Flow	1,190 ltrs/hr (restricted by emitters)
Pump Flow at TDH (check)	3,600 ltrs/hr
Pump Run Time @ Design Flow	0.86 hrs/day (52 mins/day)
Daily Power Consumption	0.86 hours x 0.55 kW x $0.14 ¢/kWhr = $0.07 per day ($1.98 per month)
Pump Discharge Size	25 mm BSP