Introduction.

This report documents the design, operation, maintenance and environmental issues related to the proposal to install an "Innoflow Advantex AX10-R" wastewater treatment and disposal system on the Hewitt property in Kumutoto Bay.

The property has no mains electrical supply therefore the Innoflow system has been identified as the most appropriate system due to the very low power requirement to operate the plant.

The total system will be contained within the confines of the 4.17 hectare property. The site layout is included in Appendix 1.

Design.

The design of the system is based on the following:

- 3 bedrooms
- 6 occupants
- 180 litres/occupant/day (note; water reduction fixtures will be included in the design of the house but the water treatment facility design will be based on conservative figures)
- Soil category 5 – light clays, moderately structured (K_{sat}:0.06 to 0.12) Refer to geotechnical engineer's letter of 03 November 2005 in Appendix 2.
- Innoflow Advantex AX10-R, recirculating textile packed bed reactor treatment plant.
- Drip irrigation with 600mm spacing between drippers.
- The land is sloping with no ground water identified.

The heart of the design is the Innoflow Advantex AX10-R, recirculating textile packed bed reactor treatment plant. Details of the equipment and the specifications from the New Zealand supplier are included in Appendix 3. It should be noted that the expected effluent quality is as follows:

- <15 mg/ltr BOD (5mg/ltr average)
- <15 mg/ltr SS (5mg/ltr average)

against the figures of <20 mg/ltr BOD and <30 mg/ltr SS given in the guidelines for a secondary treated effluent.

The total sewerage treatment takes place in a single fiberglass tank with segregated compartments. The primary septic tank chamber has a capacity of 3785 litres and the recirculation chamber, a volume of 1890 litres. The recycle ratio is 4:1.

Land Application Area.

Using the input data above and the requirements for "Drip line irrigation of secondary treated effluent" the area required is 378 m^2. (A=Q/(DIR/7). The total area of the

property is 4.17 hectares. There is 100% reserve area directly above the proposed land application area.

The drip lines will be spaced at 1 metre intervals with the drippers spaced at 600mm. The length of the drip lines will be 35 metres resulting in 11 lines. The total number of drippers will be 35x11/0.6=640.

Installation, Commissioning and Maintenance.

Simcox Construction are registered drainlayers in Marlborough. As agents for Innoflow Technologies Limited, they will be contracted to install and commission the system. As part of the installation, an agreement will be signed with Simcox Construction to carry out annual inspection and maintenance of the total system.

Environmental Impact Assessment.

The effluent treatment system is an essential part of the infrastructure of the dwelling on the site. The proposed system from Innoflow Technology uses the most efficient technology available to treat sewage using the minimum of power. The effluent quality from the treatment unit exceeds the definition of secondary treated effluent;

- <15 mg/ltr BOD (5mg/ltr average)
- <15 mg/ltr SS (5mg/ltr average)

against the figures of <20 mg/ltr BOD and <30 mg/ltr SS.

This application proposes to discharge the treated effluent in an area 15 metres from the nearest land boundary and a minimum of 40 metres from the MHWM. It is not envisaged that any other parties will affected by the proposal. The land application area where the drip lines will be installed is not considered to be an area with outstanding features. The site is primarily scrubland with predominately manuka of various ages across the slope with emerging broadleaf species. It is unlikely that any of these tress will need to be removed or disturbed to install the drip lines. It is envisaged that the effluent discharge will benefit the flora in the area and enhance the growth rates and hence the stability of the land.

Appendix 1. Site Layout

Appendix 2. Geotechnical Assessment of Site

GHD CLIENTS|PEOPLE|PERFORMANCE

03 November 2005

Our ref: 51/20205/00/Lot 16 DP3580 - Effulent Letter

486 Manchester Street
St Albans Christchurch

Attn: Anthony Hewitt

Dear Sir

Lot 16 DP3580 - Kumutoto Bay, Queen Charlotte Sound - Proposed House Site Effluent Disposal

Opinion as to Suitability of Site for Effluent Disposal

A geotechnical assessment was carried out in July 2004 at the proposed house site of Anthony and Susan Hewitt, at Kumutoto Bay, Queen Charlotte Sound, being Lot 16 DP 3580.

As part of the assessment recommendations for effluent disposal were made. Further to those recommendations we offer the following to aid in the design of an appropriate effluent disposal system.

As per the recommendations of the July 2004, GHD report entitled "Lot 16 DP3580 – Kumutoto Bay, Queen Charlotte Sound"

- "That effluent discharge is carried well clear of the building site. This will require it to be pumped upslope and laterally away from the site to a suitably placed disposal field"

We offer the following comments and recommendations:

- The underlying geology is that of well-foliated schist, with the overlying soils consisting of bouldery schist derived colluvium. In this respect we are of the opinion that the site is unsuitable for subsurface absorption, and would be more suitable for disposal systems that minimise introduction of effluent into the ground, such as systems incorporating evapo-transporation beds, or surface drip-irrigation systems.
- For design purposes a soil category of 5 – Light clays, Moderately structured, as per Table 4.1.1, Part 4, AS/NZS 1547:2000, may be adopted for the site, giving an indicative permeability of K_{sat}: 0.06-0.12, and an indicative drainage class of poorly drained.
- Attention should be paid during design and construction to ensure that the absolute minimum amount of vegetation be removed, due to the potential slope instability in the area.

Yours faithfully
GHD Limited

Bob McKelvey
Geotechnical Manager
09 261 1551

03/11 2005 13:55 FAX 64 9 2625341 GHD LTD 002

Appendix 3. Innoflow Process Details and Specifications.

REMOTE ADVANTEX®
AX10-R

Recirculating Textile Packed Bed Reactor
for Alternative Power applications

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 has 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.

SPECIFICATION DATA SHEET

1) GENERAL

LOCATION	Kumutoto Bay
WASTEWATER SOURCE	3 bedroom dwelling
WATER SUPPLY	Spring water
MAX DAILY FLOW	1080 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 ➢ 378 m^2 Pressure Compensating Subsurface Drip Irrigation Disposal Field

2) TANKAGE

Tank Manufacturer	Innoflow Technologies Ltd.
Tank Operating Volume	5,678litres (nominal)
No. of Compartments	Three
Septic Chamber Operating Vol.	3,785 litres
Detention @ Design Flow	*Septic stage only – 3.5 days (approx)*
Construction	Fibreglass FRP
External Dimensions	Oval 1.83 m wide 4.29 m long x 1.64 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.	1,892 litres
Detention @ Design Flow	*Recirc stage only ~ 2 days (approx)*
Recirculating Pump Model	**Destaged Scuba 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	1.00 hrs/day (60 mins/day)
Daily Power Consumption	1.00 **hours x 0.39 kW = 0.39 kW per day (Run = 2.4 A Start = 12.0 A)**
Pump Discharge Size	25 mm BSP
Control Panel Model	**Modified Quantum (pump lock-out)**
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)*

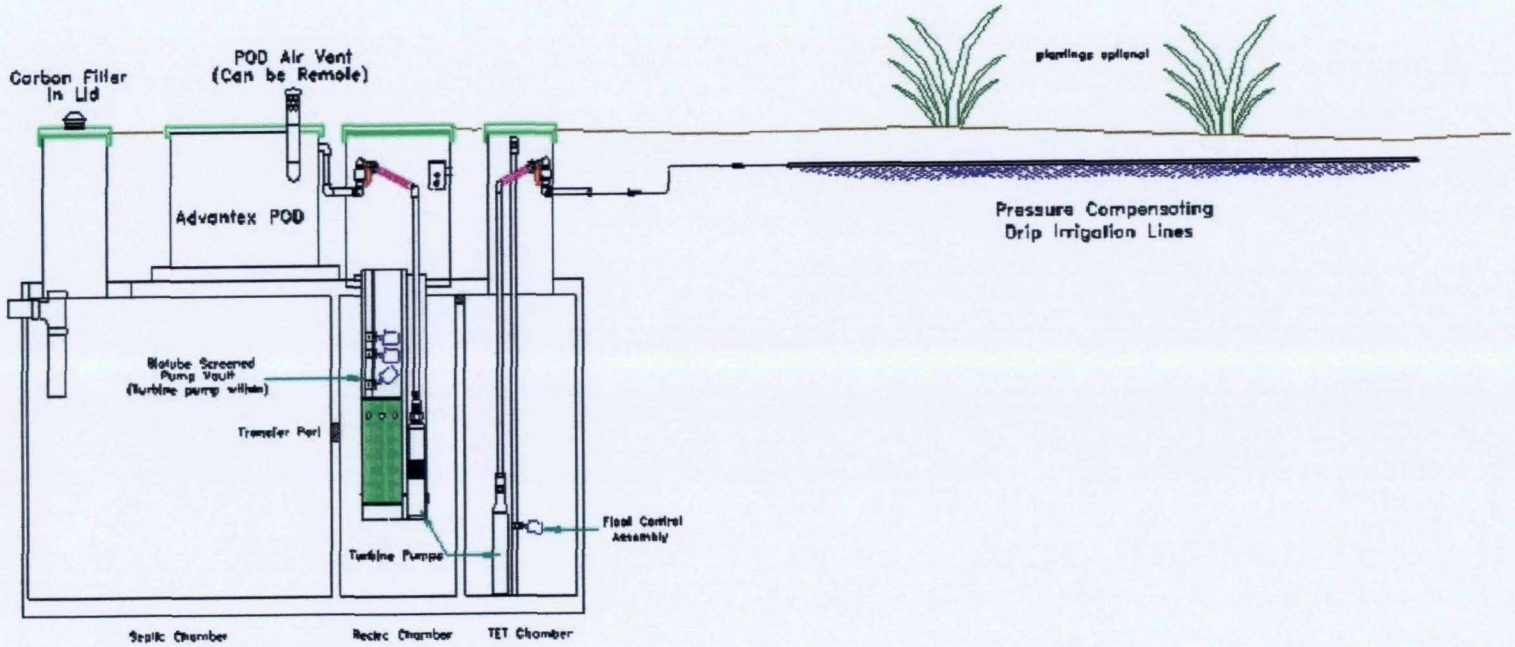
5) RECIRCULATING PACKED BED REACTOR

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	Fibreglass reinforced tank, 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 (5 mg/ltr average)
SS	<15 mg/ltr (5 mg/ltr average)

6) DISPOSAL FIELD

Soil Category	5
Disposal Type	Pressure Compensating Surface Laid Drip Irrigation
Areal Loading Rate	3.0 mm (3.0 ltrs/m^2)
Area Required	380 m^2
Dripline Lateral Spacing	1 m
Dripline Orifice Spacing	0.6 m
Lineal Length Required	380 m
Total Number of Drippers	380 m/0.6 m spacing = 640
Number of Disposal Sectors	1
Number of Drippers per Sector	640
Flow Required to Pressurise each Sector	640 x 1.6 ltrs/hr per dripper = 1024 ltrs/hr
Longest Dripline Run	35 m
Header Pipe Size	32 mm (greenline)
Header Pipe Length	14 m
Headloss Calculation	
Discharge Assembly	0.5 m
Header Pipe	0.03 m
Headloss Thru Longest Dripline	0.04m
Height from Effluent Tank to Top Disposal Lateral (Static Head)	15.00 m
Activation Pressure for Dripline	05.00 m

TDH	20.57 **m**
Pump Model	**Destaged Scuba 2SC5**
Pump Flow	800 ltrs/hr (restricted by emitters)
Pump Flow at TDH (check)	2,280 ltrs/hr
Pump Run Time @ Design Flow	1.00 hrs/day (60 mins/day)
Daily Power Consumption	1.00 **hours x 0.39 kW = 0.39 kW per day (Run = 2.4 A Start = 12.0 A)**



Advantex riPBR Unit

KUMUTOTO BAY

BOATHOUSE

JETTY
(EXISITNG)

11

SECONDARY SEWAGE TREATMENT TANK

PRIMARY SEWAGE TREATMENT TANK

MHWM

40

HOUSE

4

35

11

EFFLUENT DISPOSAL AREA

RESERVED AREA

PRELIMINARY

No	Revision Note: * Indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date

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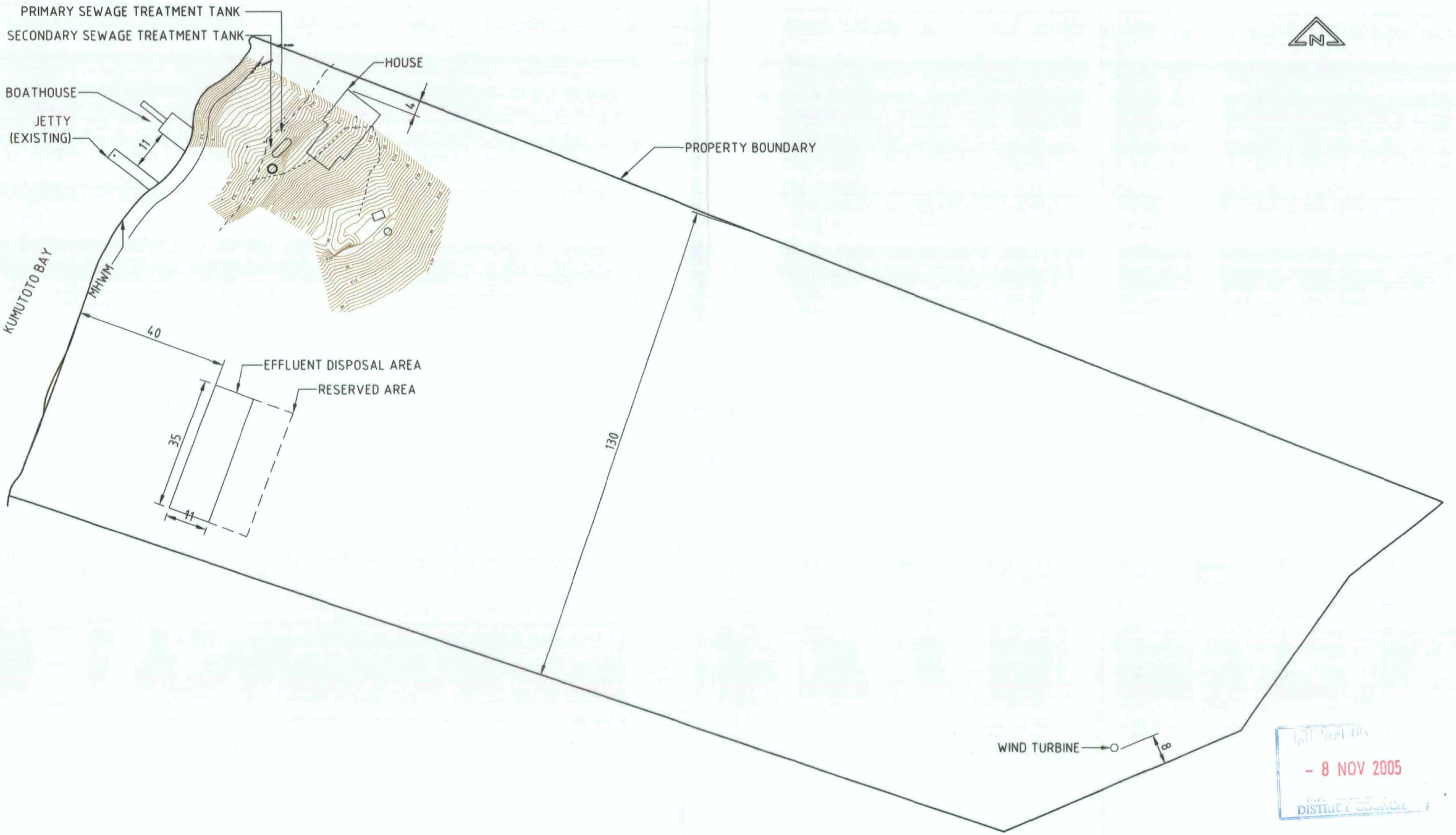
Scale	1:250 (A1), 1:500 (A3) DO NOT SCALE
Drawn	D HENDERSON
Designed	
Drafting Check	
Design Check	
Approved	
Date	

This Drawing must not be used for Construction unless signed as Approved

Client	TONY HEWITT
Project	KUMUTOTO BAY HOUSE
Title	SITE PLAN
Original Size	A1
Drawing No:	51-23028-SK003
Rev:	A

Cad File No: G:\51\23028\CADD\Drawings\51-23028-SK003.dwg

Plot Date: 06 November, 2005 - 1:53 PM



PRELIMINARY

No	Revision Note: * indicates signatures on original issue of drawing or last revision of drawing	Drawn	Checked	Approved	Date

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Drawn D HENDERSON	Designed
Drafting Check	Design Check
Approved	
Date	

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Client **TONY HEWITT**
Project **KUMUTOTO BAY HOUSE**
Title **SITE PLAN**

Original Size **A1**
Drawing No: **51-23028-SK002**
Rev: **A**

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