

Peter King

**Proposed Dwelling, Lot 1, DP368219, Wither Road
Extension, Blenheim**

▪ **Engineering Report**

05 May 2014

Our ref: 4225

Peter King
 Proposed Dwelling
 Lot 1, DP368219
 Wither Road Extension
 Blenheim

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Date	09.05.14					
Prepared By	JH					
Approved By	RE					

1 Executive Summary

With respect to the proposed residential development at Lot 1, DP368219, Wither Road Extension, Blenheim for Peter King (the client), Smart Alliances Ltd have carried out an engineering appraisal of the foundation conditions, site excavation, filling, access tracks, the removal or retention of vegetation, stormwater management, on-site wastewater treatment and land application and the supply and storage of potable water for the development, and it is recommended that:

- (a) The site is suitable for the proposed residential development and for construction on conventional foundations designed and constructed in accordance with NZS 3604:2011.
- (b) To prevent tunnel erosion developing along reinstated trenches from percolating rainwater or surface water, it is recommended that all pipe trenches be backfilled using 3% cement stabilized material and trench dams used on slopes exceeding 15°.
- (c) Any exposed surfaces are retained and planted as soon as possible after excavation. Surface run off from the proposed cuts should be intercepted and removed to protect cut faces. The cut material is not considered suitable for use in areas proposed for the siting of foundations. Only approved fill placed under the supervision of a suitably qualified engineer should be used under building foundations.
- (d) The softer topsoil layer to be removed in forming the access track, with a new gravel surfaced shaped to shed water to the edges. Shallow table drains should be formed to the road verge on slopes to maintain the track condition in wet periods. Protection of the channel surface with rock armouring should be provided in problem areas.
- (e) Stormwater from roofed and paved areas is to be disposed of via the open drain adjoining Wither Road at the boundary.
- (f) An assessment of the best practical option has determined that secondary treatment and drip irrigation land application is appropriate and the most practical option to service the proposed dwelling at the site when average site topography, soil conditions and groundwater levels are taken into account.
- (g) The total area of drip line required for any new wastewater system is 413m² (433 lineal metres). The irrigation system design requires 1.6 litre/hr emitters at 0.6m spacing with lines laid at 1.0m intervals. To provide adequate treatment, it is recommended that the irrigation lines be placed 150mm below the ground surface within the topsoil profile. To assist with the uptake of effluent it is recommended that the land application area be planted to provide additional evapotranspiration benefits.

The foregoing recommendations cannot be taken in isolation and must be read with respect to the balance of this report and the context of the proposed residential development at the site.

2 Introduction

The client proposes to construct a new three bedroom dwelling on their property located at Lot 1, DP368219, Wither Road Extension, Blenheim.

The purpose of this report is to present the results of site investigations carried out in relation to the foundation conditions, site excavation, filling, access tracks, the removal or retention of vegetation, stormwater management, on-site wastewater treatment and land application and the supply and storage of potable water for the new dwelling. The site investigation was carried out on 1 April 2014.

3 Location & Site Description

The subject property is located on the south side of the Wither Road Extension on the lower slopes of the Wither Hills. It has been converted from farmland by a relatively recent subdivision and is still predominantly vegetated in pasture grasses. It is a moderately sloping site, with a significant flat area at the base of slope adjoining the road where a new shed has been constructed. The proposed building site is located mid slope towards the southern boundary.

An open drain flows between the road and its northern boundary. A concrete channel culvert bridges the drain to provide access to the property.

The legal description of the property is Lot 1 DP 368219 and the land area is 0.4497 ha.

The property borders the road reserve and four (4) privately owned neighbouring properties to the North and West.

Locations of all the main features of the property are shown on the site plan attached in Appendix A.

4 Foundation Conditions

The site has been investigated by a total of five scala penetrometer tests, numbered P1 to P5. The test results for P1 to P5 are provided in Appendix B and the test locations are shown on 4225-G10.

The attached test results of P1 to P4 indicate that the subsoils generally have a soil bearing resistance in excess of 300 kPa (ultimate bearing capacity). On the basis of the foregoing it is considered that the site is suitable for the proposed residential development and for construction on conventional foundations designed and constructed in accordance with NZS 3604:2011.

5 Site Excavation and Filling

The earthworks to be undertaken on the property include:

- Formation of an access track
- Trenching of water, power and telecom services to building site
- Trenching of the stormwater disposal
- Construction of the building platform.

From the site investigation no evidence of tunnel erosion or significant areas of soil creep were found. However, the loess soils encountered on site are prone to erosion and suitable mitigation measures should be adhered to when exposing soils.

It is recommended that any exposed surfaces are retained and planted as soon as possible after excavation. Surface run off from the proposed cuts should be intercepted and removed to protect cut faces. This is especially important on the cut face upslope of the house platform.

The excavation required to form the access track will generally involve the removal of softer top soil layers and the placing of river run material. Any softer areas encountered in track construction should be removed to depth before the placing of gravel. Deeper excavations will be required at the top of slope leading to the building site. Here, cut slopes of 2V:1H are considered acceptable with use of the mitigation measures outlined above. If this grade cannot be achieved then retainer walls are recommended.

The trenching of services to site is not expected to cause any problems provided trenches are not left open for long periods and vegetative cover is re-established as soon as practical.

To prevent tunnel erosion developing along reinstated trenches from percolating rainwater or surface water, it is recommended that all pipe trenches be backfilled using 3% cement stabilized material and trench dams used on slopes exceeding 15°. Two trench dams are recommended for the stormwater pipe that traverses the site slope, their location is shown in drawing 4225-G10.

Pipe trench details are attached in drawing 4225-G11.

A level building platform will be formed with excavation on slope. A masonry foundation system is proposed and a block retainer will be integral to the ground floor foundations. It is expected that the cut will be made to good ground. The cut material is not considered suitable for use in areas proposed for the siting of foundations. Only approved fill placed under the supervision of a suitably qualified engineer should be used under building foundations.

It is proposed to use Gabion baskets to retain land in front of the house. The Gabions should be benched a minimum of 300mm into the ground to ensure lateral stability.

The proposed building site is stable and suitable for construction subject to the requirements of NZS3604 and the NZ building code.

6 Access

The site is currently open pasture and an all weather track will be formed to provide access from the road to the building site. Removal of the top softer soil layer and formation of a gravel surface with introduced river run is recommended. The gravel surface should be shaped to shed water to the edges and remain trafficable in high rainfall events.

Access off Wither Road has been formed with a boxed culvert and is deemed suitable to service the site.

The proposed access track will follow the flat land immediately adjoining the road to the west and switch back to the east to enter the building curtilage. Gradients not exceeding 1:6 appear feasible which will be easily maintained if constructed appropriately with drainage provisions.

Shallow table drains should be formed on the road verge to maintain the track condition in wet periods. Protection of the channel surface with rock armouring should be provided in problem areas. It is recommended that a sump be placed at the base of the channel where the slope reduces to collect the runoff and direct it to the open drain in a controlled manner.

7 The Removal or Retention of Vegetation

The subject site is predominantly vegetated in grass and very few trees exist on the property. Minimal vegetation cover will be removed in construction of the proposed dwelling, access track and associated services. It is recommended that any exposed surfaces are retained and planted as soon as possible after excavation to limit the incidence of erosion.

8 Stormwater Management

It is recommended that all stormwater from roofed, paved and retained areas be directed to discharge via sealed pipes into the drain that follows Wither Road along the northern boundary of the property. The discharge outlet is to be protected by concrete to prevent undermining of the pipe.

An assessment of site soils has found them not suitable for the disposal of stormwater by way of ground soakage, such as that utilised in soak pits.

9 Wastewater Assessment

The site investigation identified that a suitable wastewater disposal area exists to the north of the proposed new house site. An assessment of the best practical option has determined that secondary treatment and drip irrigation land application is appropriate and the most practical option to service the proposed dwelling at the site when average site topography, soil conditions and groundwater levels are taken into account.

Three hand augured boreholes, numbered AG 1 to AG 3, were put down at the site in the proposed land application area. The test locations are shown on the appended site plan and photographs of the subsoils are provided in Appendix B. Based on the soil assessment carried out, an average drainage category of 5 has been adopted. With this considered, a maximum design loading rate of 3mm/day is considered appropriate. Logs of the representative soil properties are provided in Appendix B.

Appendix B5.2 and Appendix F of AS/NZS 1547:2012 require that dispersive soils within a land application area be reclassified as category 6. Although the loess underlying the proposed land application area is considered potentially dispersive, no evidence of pipe erosion or dispersion was evident within this area. The low irrigation rate associated with Category 5 soils is considered conservative enough when average soil permeability and site topography considerations are taken into account.

The emitter flow rate of 1.6 litres/minute over a 413m² area is unlikely to cause a level of saturation (or accumulation of salts) where clay particles would disseminate. To assist with the uptake of effluent it is recommended that the land application area be planted to provide additional evapotranspiration benefits. A list of suitable plant species is provided in Appendix D. Although this list is from TP58 and specific to the Auckland area, some of the more dry tolerant species, such as the Carex's, would do well in Wither Hill conditions. Guidance should be sought from a local nursery for suitable species from this list.

Groundwater was not encountered within the subsurface investigation reported herein, and is expected to be generally located at a depth greater than one metre beneath the existing ground surface.

There are no bores within 30m of the wastewater field.

The closest point of the open drain edge is approximately 30m from the wastewater field.

The site is exposed to both wind and sun.

A secondary treatment system involves aerobic biological processing and settling or filtering of effluent to equal or better the following standards:

BOD after 5 days (average) < 20 g/m³
Suspended solids (average) < 30 g/m³

Any system that has been tested and meets the above standard is satisfactory, such systems include (but are not limited to) Oasis Clearwater 2000, Biolytix, or RX Airtech 9000.

A wastewater design sheet is provided in Appendix B with the design calculation based on the following criteria for the proposed development:

- 6 person occupancy
- Loading of 990 litres/day (6 people @ 165 litres/day)
- Soil category 5
- Design irrigation rate of 3mm/day
- Standard water reduction fixtures installed.

Standard water reduction fixtures are to be installed in accordance with Table H3 of AS/NZS 1547:2012 to assist in minimising water usage, such fixtures include:

Dual flush 11/5.5 litre water closets, shower-flow restrictors, aerator faucets (taps) and water conserving automatic washing machines.

The design irrigation rate (DIR) for category 5 soil is 3mm/day as set out in AS/NZS 1547:2012. The area identified as suitable for the wastewater field is subject to a reduction in DIR due to sloping ground, as outlined in Table M2 of AS/NZS 1547:2012. To account for the 10-20% slope encountered within the wastewater field a 20% reduction in the DIR to 2.4mm/day has been adopted.

A site plan outlining the area concerned is contained in drawing 4225-G10 in Appendix A.

The total area of drip line required for any new wastewater system is 413m² (433 lineal metres). The irrigation system design requires 1.6 litre/hr emitters at 0.6m spacing with lines laid at 1.0m intervals. To provide adequate treatment, it is recommended that the irrigation lines be placed 150mm below the ground surface within the topsoil profile.

Irrigation lines should not be located within 2m of any boundary. The installation of the irrigation system is to be in accordance with the product installer guide supplied by the manufacturer.

10 Assessment of Environmental Effects

An onsite wastewater system is required as there is no reticulation in the area.

Because of the following reasons we do not envisage the wastewater becoming an environmental risk:

- Treated effluent pumped to subsurface drip irrigation to ensure even distribution

- Restrictive soil qualities (Clay)
- No ground water in the vicinity of the wastewater field

The risk from the wastewater system contaminating drinking water is negligible. Set back distances are favourable, soil classification has been conservative and a large disposal area has been designed.

The category 5 Clay soil identified at depth has limitations for on-site disposal due to a low percolation rate. The shallow disposal field over a large area provided in a secondary treatment design assists in overcoming these limitations by allowing effluent uptake by grass and vegetation cover. A higher quality effluent is also produced reducing the risk of groundwater contamination.

The effect of a failed system will primarily affect the applicant's property. If this was to occur wastewater is likely to accumulate at the base of slope on the property. Infiltration into the topsoil layers and the environmental buffering capacity of the land will ensure surface water within the Lake is protected.

The effects will be easily identifiable, inhibit the applicant's use of the land and be generally unpleasant. The owner will want to address the failure and repair / install a new wastewater system.

The land application field is sited on elevated ground and not within any ground depressions that are prone to flooding.

Prior to the proposed system becoming operational the system installer must certify that the system has been constructed according to the design. This certification must then be forwarded to Council.

As the design satisfies G13/VM4 of the NZ Building Code, a PS1 and monitoring schedule for the wastewater installation at the site is not required. Vehicle access to the system for maintenance will be available.

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 are required to 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.

11 Water Supply

The supply of water to the property will be by way of community supply. A minimum 5,000 litre water tank will be provided as required by consent notice attached to the property. The water is treated to a potable standard.

12 Conclusion

The site is suitable for the proposed residential development and for construction on conventional foundations designed and constructed in accordance with NZS 3604:2011.

It is recommended that any exposed surfaces are retained and planted as soon as possible after excavation. Surface run off from the proposed cuts should be intercepted and removed to protect cut faces. The cut material is not considered suitable for use in areas proposed for the siting of foundations.

Gradients not exceeding 1:6 appear feasible for the proposed access track. The track will be easily maintained if constructed appropriately with the recommended drainage provisions.

Stormwater is to be disposed of via the open drain adjoining Wither Road at the boundary to the property.

An assessment of the best practical option has determined that secondary treatment and drip irrigation land application is appropriate and the most practical option to service the proposed dwelling at the site when average site topography, soil conditions and groundwater levels are taken into account.

13 Limitations

This report is valid for five years from the date of issue and covers the foundation conditions, site excavation, filling, access tracks, the removal or retention of vegetation, stormwater management, on-site wastewater treatment and land application and the supply and storage of potable water for the proposed residential development by Peter King at Lot 1 DP 368219, Wither Road Extension, Blenheim. 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.

The conclusions and recommendations expressed herein have been prepared with respect to the proposed development at the site, and should not be taken out of context from the proposed development discussed herein or the remainder of this report.

14 References

1. NZS 1547:2012 On-site Domestic Wastewater Management.
2. Begg, J.G. and Johnston, M.R. (compilers) 2000. New Zealand Geological Map 10: Geology of the Wellington area, 1:250,000
3. Marlborough District Council Guidelines for New On-site Wastewater Management Systems, July 2005.
4. Crites, R.W. and Tchobanoglous. Small and Decentralised Wastewater Management Systems. WCB/McGraw-Hill, 02/04/1998
5. Liping Pang (ESR Christchurch). Microbial removal rates in subsurface media estimated from published studies of field experiments and large intact soil cores. J.of Environmental Quality. Vol 38. July-Aug 2009. pp 1531-1559.

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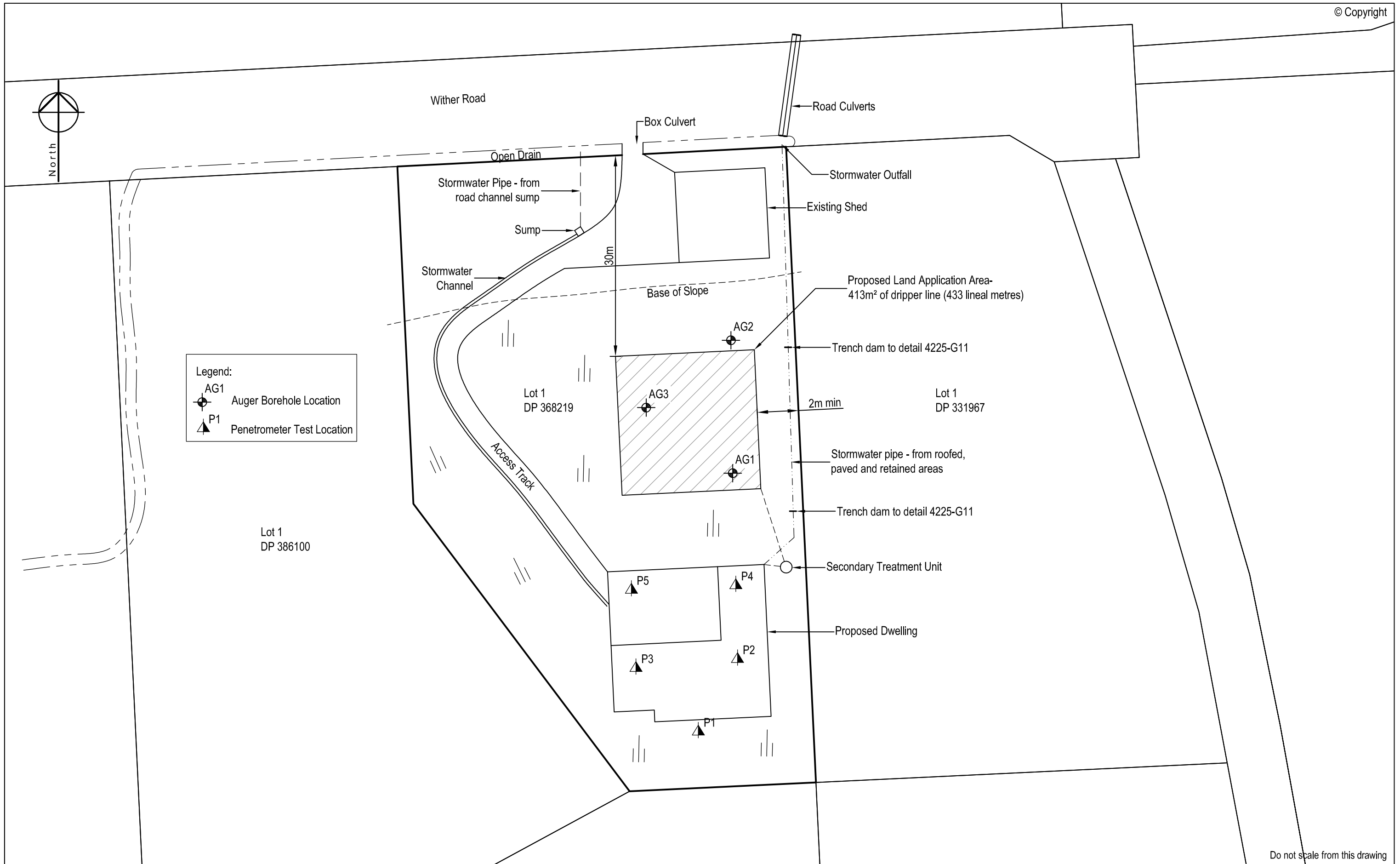
Jeremy Harnett
Environmental Scientist
09 May 2014

SMART ALLIANCES LTD



Richard Evans
Chartered Professional Engineer
09 May 2014

Appendix A – Site Plan: Drawing 4225-G10
Drainage Details for Loess Soils: Drawing 4225–G11

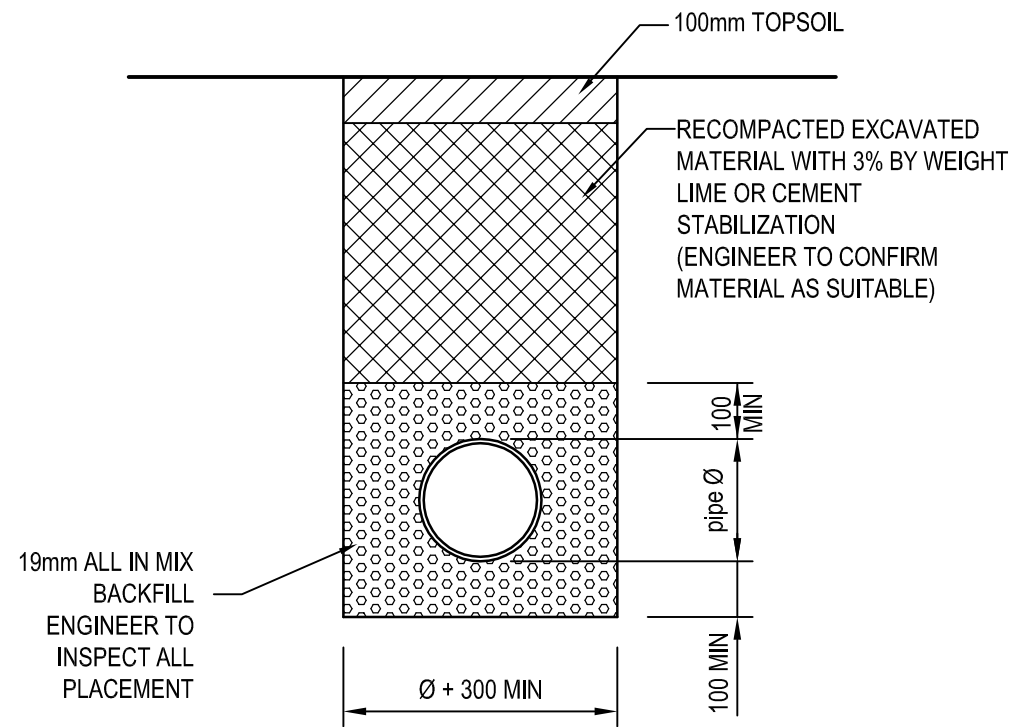


Legend:

- AG1 Auger Borehole Location
- P1 Penetrometer Test Location

Do not scale from this drawing

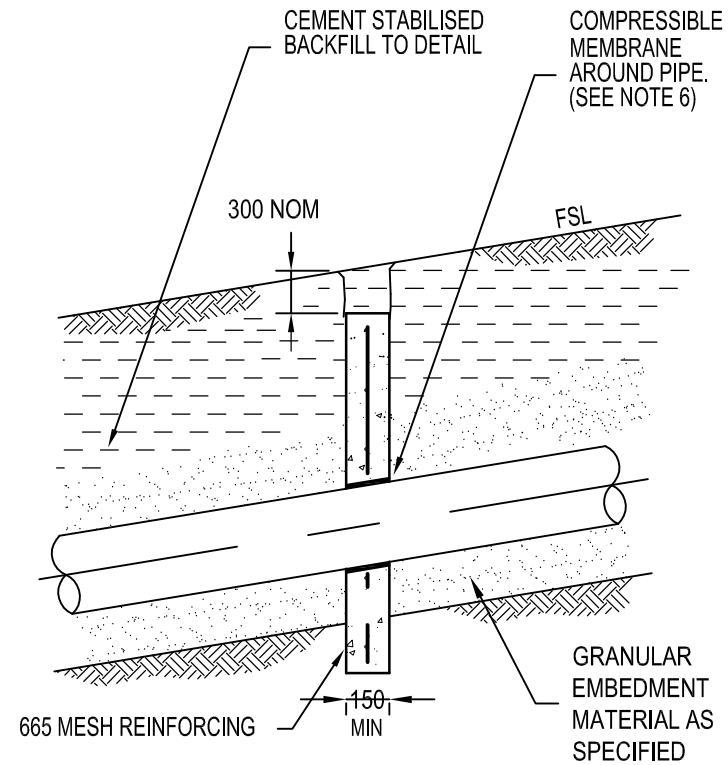
01 05-05-14 REPORT			 <p>ENGINEERING / RESOURCE MANAGEMENT / ARCHITECTS</p> <p>1st Floor - River View House - 10 High Street - Blenheim - New Zealand T: 03 579 6211 F: 03 579 6233 PO Box 546 - Blenheim - 7240 E: Info@smartalliances.co.nz Website: www.smartalliances.co.nz</p>			CLIENT PETER KING			PROJECT KING HOUSE WITHER ROAD EXTENSION			DATE 05-05-14		SCALE (A3) 1:500	
REV DATE DETAILS			REV DATE DETAILS			ISSUE REPORT			DRAWING SITE PLAN			DRAWN JH		REVISION 01	
									APPROVED RE			DWG NO. 4225-G10			



NOTES:

1. ALL EXCAVATION BACKFILL FOR PIPES AND FOUNDATIONS TO BE BACKFILLED USING 3% CEMENT STABILISED MATERIAL
2. TRENCH DAMS TO BE INSTALLED ON PIPE TRENCHES WHERE SLOPE EXCEEDS 15°

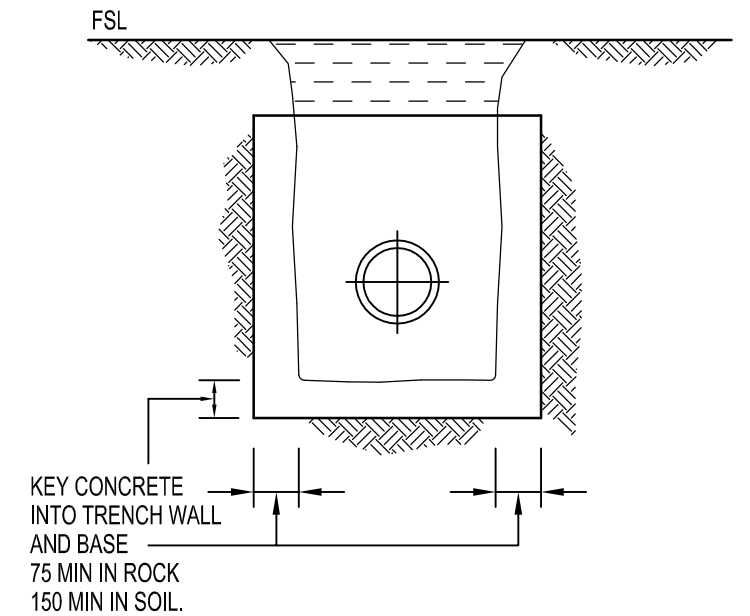
PIPE TRENCH DETAIL
 Scale 1:10



NOTES:

1. ALL DIMENSIONS IN MILLIMETRES.
2. CONSTRUCT CONCRETE BULKHEADS AT 20m CENTRES ALONG SLOPE
3. KEY CONCRETE BULKHEADS INTO SIDES AND BOTTOM OF TRENCH AGAINST A BEARING SURFACE OF UNDISTURBED SOIL.
4. CONCRETE TO BE 17.5 MPa.
5. DO NOT DEFORM PIPES DURING PLACEMENT OF CONCRETE OR BAGS.
6. COMPRESSIBLE MEMBRANE AROUND PIPE TO BE 3 THICK RUBBER

TRENCH DAM DETAIL
 Scale 1:10



Do not scale from this drawing

01 05-05-14 REPORT		<small>ENGINEERING / RESOURCE MANAGEMENT / ARCHITECTS</small> 1st Floor · River View House · 10 High Street · Blenheim · New Zealand T: 03 579 6211 F: 03 579 6233 PO Box 546 · Blenheim · 7240 E: info@smartalliances.co.nz Website: www.smartalliances.co.nz	CLIENT PETER KING ISSUE REPORT	PROJECT KING HOUSE WITHER ROAD EXTENSION DRAWING DRAINAGE DETAILS FOR LOESS SOILS	DATE 05-05-14 DRAWN JH APPROVED RE	SCALE (A3) AS SHOWN REVISION 01 DWG NO. 4225-G11
REV DATE DETAILS	REV DATE DETAILS					

Appendix B – Penetrometer Test Results

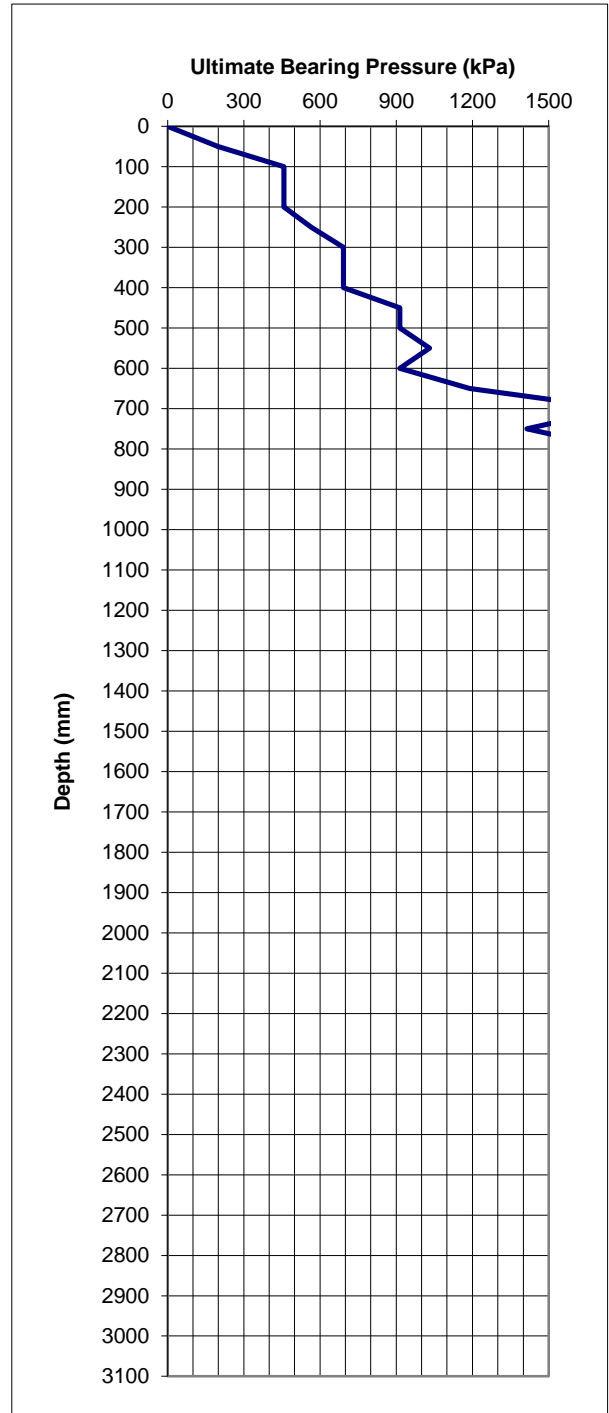
Project:	King New House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	20/02/2014	Sheet:	1 of 5

PENETROMETER TEST RESULTS

Notes: No groundwater encountered

P1

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
3	17	458	100
3	17	458	150
3	17	458	200
4	13	565	250
5	10	693	300
5	10	693	350
5	10	693	400
7	7	915	450
7	7	915	500
8	6	1031	550
7	7	915	600
10	5	1189	650
15	3	1769	700
14	4	1414	750
16	3	1769	800
16	3	1769	850



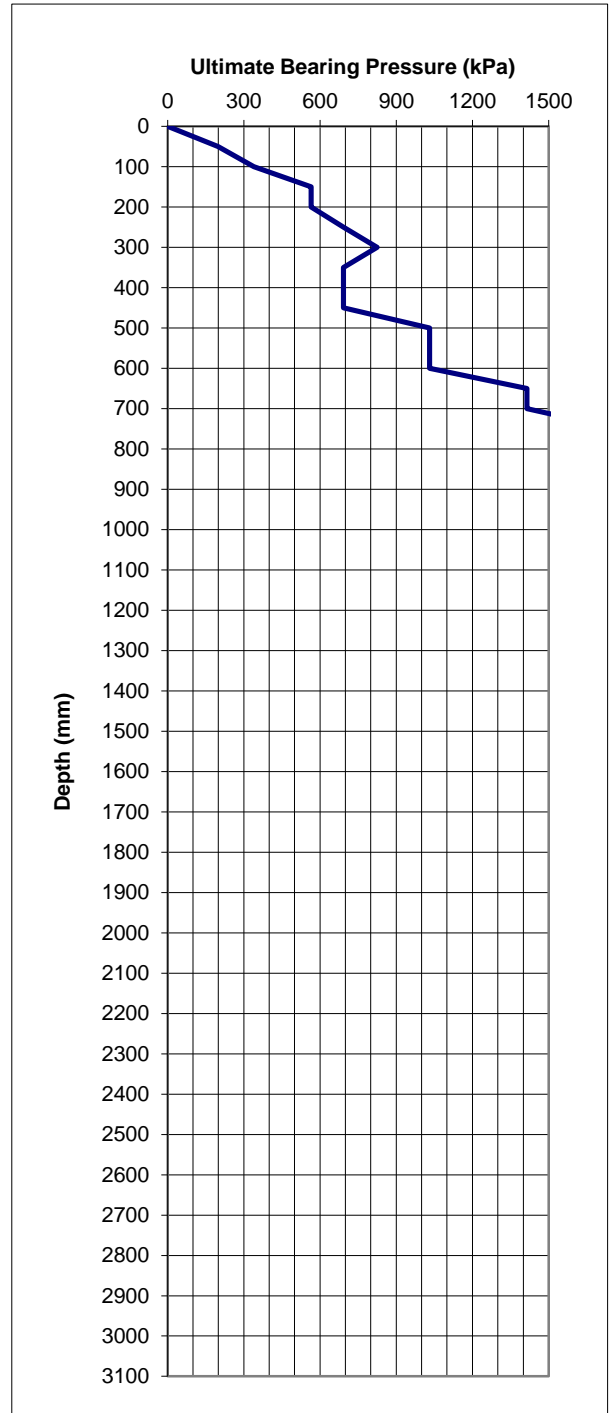
Project:	King New House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	20/02/2014	Sheet:	2 of 5

PENETROMETER TEST RESULTS

Notes: No groundwater encountered

P2

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
2	25	339	100
4	13	565	150
4	13	565	200
5	10	693	250
6	8	824	300
5	10	693	350
5	10	693	400
5	10	693	450
8	6	1031	500
9	6	1031	550
8	6	1031	600
12	4	1414	650
12	4	1414	700
15	3	1769	750
16	3	1769	800
16	3	1769	850



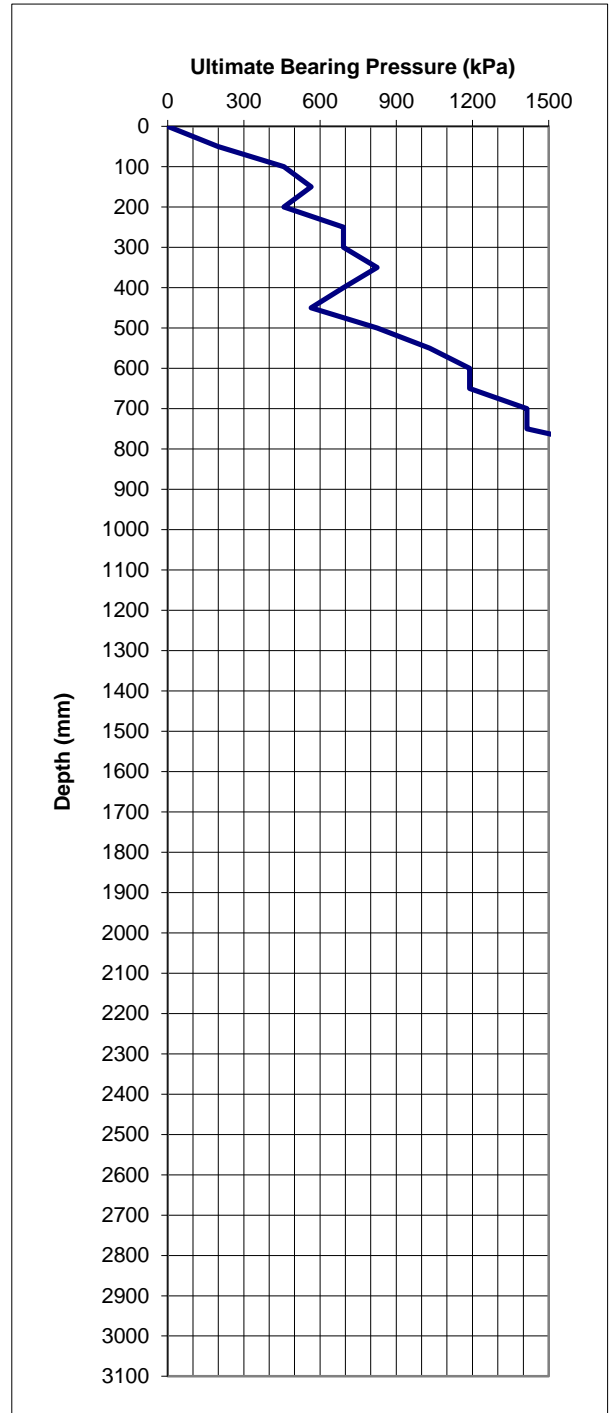
Project:	King New House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	20/02/2014	Sheet:	3 of 5

PENETROMETER TEST RESULTS

Notes: No groundwater encountered

P3

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
3	17	458	100
4	13	565	150
3	17	458	200
5	10	693	250
5	10	693	300
6	8	824	350
5	10	693	400
4	13	565	450
6	8	824	500
8	6	1031	550
10	5	1189	600
11	5	1189	650
12	4	1414	700
14	4	1414	750
16	3	1769	800
15	3	1769	850



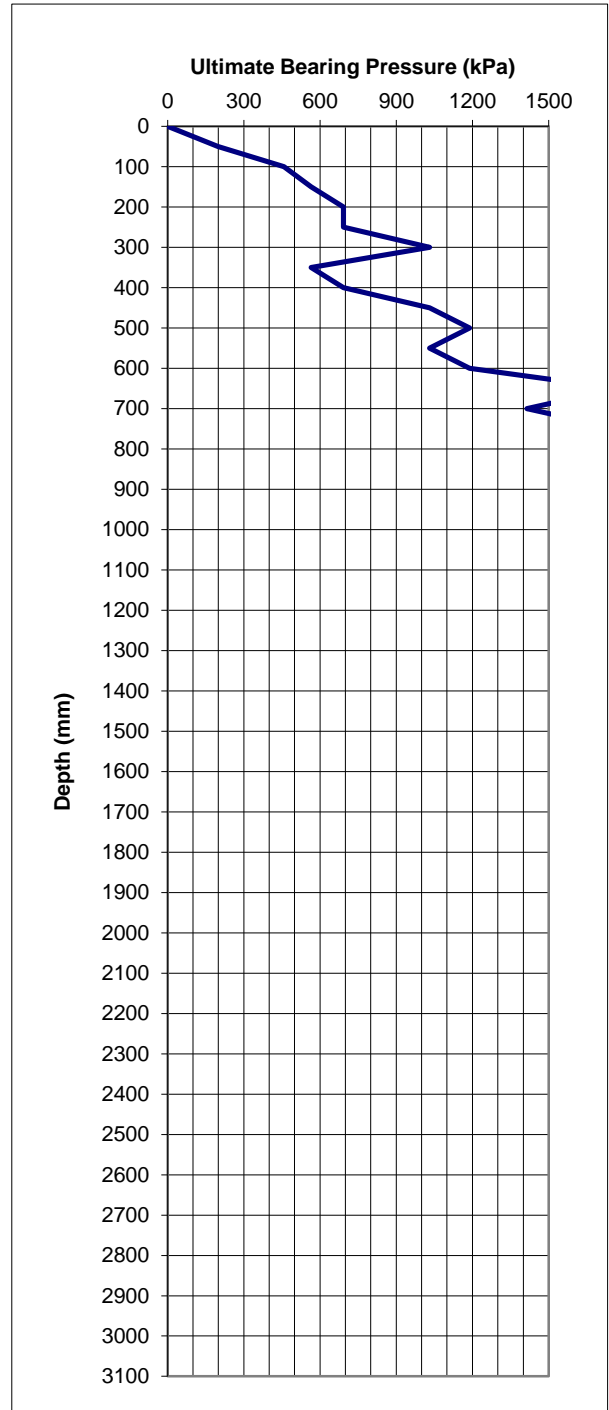
Project:	King New House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	20/02/2014	Sheet:	4 of 5

PENETROMETER TEST RESULTS

Notes: No groundwater encountered

P4

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
3	17	458	100
4	13	565	150
5	10	693	200
5	10	693	250
8	6	1031	300
4	13	565	350
5	10	693	400
8	6	1031	450
11	5	1189	500
9	6	1031	550
10	5	1189	600
15	3	1769	650
14	4	1414	700
15	3	1769	750
16	3	1769	800
16	3	1769	850



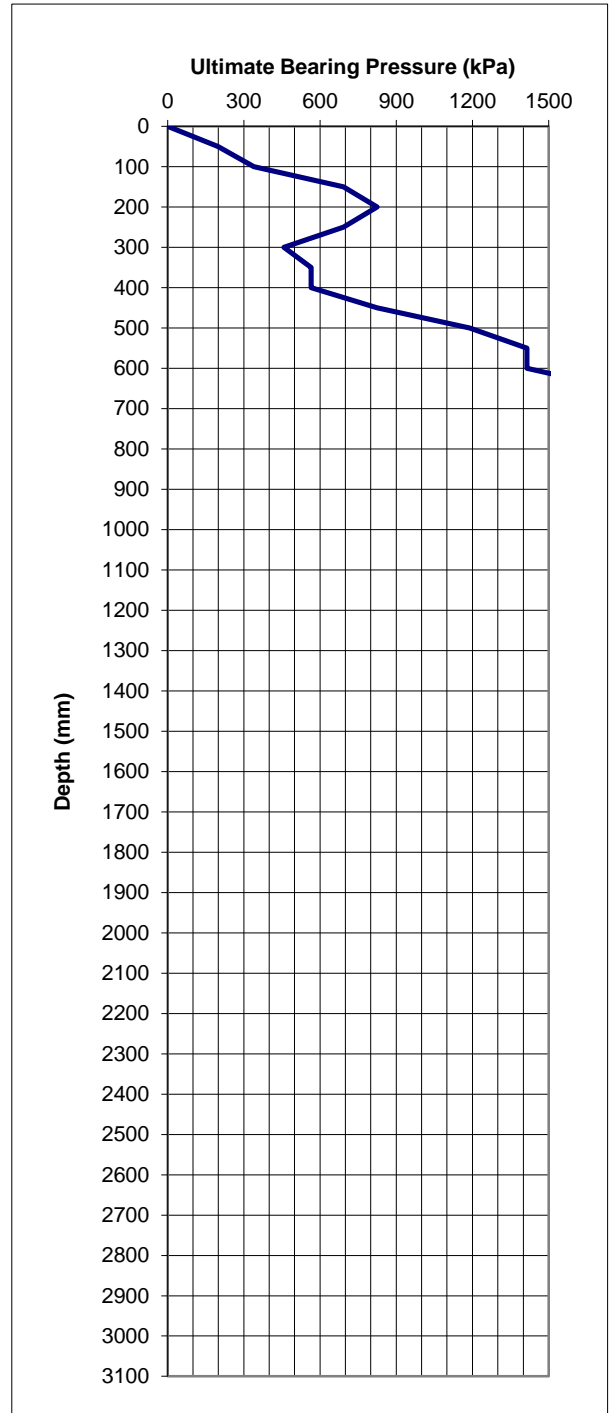
Project:	King New House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	20/02/2014	Sheet:	5 of 5

PENETROMETER TEST RESULTS

Notes: No groundwater encountered

P5

No. of Blows	e (mm/blow)	Soil bearing resistance (kPa)	Depth (mm)
0	0	0	0
1	50	198	50
2	25	339	100
5	10	693	150
6	8	824	200
5	10	693	250
3	17	458	300
4	13	565	350
4	13	565	400
6	8	824	450
10	5	1189	500
13	4	1414	550
13	4	1414	600
16	3	1769	650
15	3	1769	700
16	3	1769	750
17	3	1769	800
15	3	1769	850



Appendix C – Wastewater logs, design sheet

Wastewater Logs - 4225

Three hand augered borehole, numbered AG1 to AG3, were put down at the site in the approximate area of the proposed land application area and their locations are shown on the site plan in Appendix A. The representative soil properties are:

AG1

Lower Depth (m)	Horizon or Layer Boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.25	A	Topsoil	Brown	Loam	None	Loose	Firm	Moderate	Slightly Moist	3
0.5	B	Loess	Yellow/Brown	Clay Loam	<5%	Loose	Stiff	Weak	Dry	4-5
0.9	B1	Loess	Yellow Brown	Light Clay	None	Medium	Stiff	Weak	Dry	5

AG2

Lower Depth (m)	Horizon or Layer Boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.05	A	Topsoil	Light Brown	Silt loam	None	Loose	Soft	Strong	Slightly Moist	3
0.2	B	Topsoil	Brown	Silt loam	None	Loose	Stiff	Weak	Slightly Moist	3
0.6	B1	Loess	Yellow/Brown	Clay Loam	<5%	Loose	Stiff	Weak	Dry	4-5
0.9	B2	Loess	Yellow/Brown	Light Clay	None	Medium	Very Stiff	Weak	Dry	5

AG3

Lower Depth (m)	Horizon or Layer Boundary	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.20	A	Topsoil	Brown	Loam	None	Loose	Firm	Moderate	Slightly Moist	3
0.5	B	Loess	Yellow/Brown	Clay Loam	<5%	Loose	Stiff	Weak	Dry	4-5
0.9	B1	Loess	Yellow Brown	Light Clay	None	Medium	Stiff	Weak	Dry	5



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Project:	King House		
Client:	Peter King		
Ref:	4225	Eng:	JH
Date:	05/05/2014	Sheet:	1 of 1

WASTEWATER SYSTEM DESIGN SHEET

To AS/NZS 1547:2012 & MDC Guidelines for New Onsite Wastewater Management Systems

Number of Proposed Bedrooms: 3

Intended water Suppl Community Scheme

Soil Category Determined on Site Category 5

DRAINAGE CONTROLS:

Need for surface water collector / cut-off drains? *No*

AVAILABILITY OR RESERVE / SETBACK AREAS

Reserve area available for extensions, % of design area: *100%*
Setback distance? (between development and disposal system):

DESIGN

Daily Loading Rate: **2.4** mm/day

(with 20% Reduction)

Occupancy: **6** *Persons*

L/person/day: **165** L/p/d **990** L/day from Table M1 in AS/NZS1547:2012

DESIGN DAILY FLOW: **990** L/day

AREA REQUIRED: **413** m²

LENGTH REQUIRED: **433** m

RESERVE AREA REQUIRED: *100%* of specified

Irrigation Design

Acceptable daily loading rate (mm/day)	2.4
Daily influent (l/day)	990
Emitter type	Raam 17
Emitter flow rate (l/h)	1.6
Emitter Spacing (m)	0.6
Dripline Spacing (m)	1
Distance from Treatment system to Irrigation Field (m)	5
Field Size (m ²)	413
Field length assuming square area	20
Number of lines	21
Total Dripline Length (m)	433

Appendix D – Plants Suitable For Wastewater Land Application Areas

Auckland Regional Council Technical Sheet G-1

LIST OF WATER TOLERANT PLANTS SUITABLE FOR ON-SITE WASTEWATER DISPOSAL SYSTEMS

GENERAL MATTERS TO CONSIDER WHEN PLANTING A LAND DISPOSAL AREA:

Plants that are suitable for planting in moist conditions, such as those associated with wastewater land disposal fields need to be selected on the basis of both their tolerance for such moist conditions and for their potential for high level of growth/high transpiration of moisture in such conditions.

Standard lawn grass is a proven effective high transpiration plant species in such conditions, as are a large number of other plant species seen in typical domestic gardens.

Consideration needs to be given to effects of roots from plants and from trees in particular on wastewater distribution pipe networks/emitter lines in land application systems. Potential for root intrusion/disruption to the pipe system must be considered prior to selection and planting of a plant or tree species.

Advice on such matters for particular plant species can be obtained from garden centre specialists and landscaping consultants.

NATIVE PLANTS SUITABLE FOR MOIST CONDITIONS IN THE AUCKLAND REGION:

The following list covers native plant species are considered to be suitable for planting in moist conditions, such as those associated with wastewater disposal fields in Auckland situations. They are all tolerant or fond of moist conditions and all are native to the Auckland region. Much of this information has been adapted from one of the ARC Botanic Gardens advisory leaflets; "14 – New Zealand plants for wet places" and the list edited and reviewed by Dr. Rhys Gardner Consulting Botanist, Auckland War Memorial Museum (August 2004).

Grasses, ground covers, and other plants

***Astelia grandis* (swamp astelia)**

Large clump forming plant with bright green, flax-like foliage. Female plants produce upright panicles of orange berries in the centre of the plant. This endemic species will not tolerate eutrophic conditions and prefers peat soils.

***Blechnum novaezealandiae* (kiokio)**

Large, robust fern growing to 1 or even 2m, Hardy species that tolerates most conditions, but does best in well drained, shady areas.

Carex

There are many members of this genus which grow naturally in damp to wet areas. They all have quite fine drooping foliage and are vigorous in moist conditions. Most prefer very light shade. The following species have been identified for their suitability:

Carex dissita

Endemic species with dull green to reddish tufts often 0.5m tall (although this can vary). Tolerates a range of swampy habitats, but is also noted to grow on drier soils under forest cover.

Carex flagellifera

Endemic species with dense spreading reddish-brown tufts to 0.5m tall. Prefers damp soil and full sun, but is noted to thrive in a variety of habitats including boggy pasture.

Carex geminata

Robust and vigorous endemic species that grows to 1.5m tall. Thrives in a range of wet habitats. Suitable for a larger area.

Carex lessoniana

Robust and vigorous endemic species that grows to 1.5m tall. Similar to *C.geminata* in that the species is spreading and suitable for a larger wet area.

***Carex secta* (purei, makura)**

Endemic species that exhibits tall spreading tussocks. Has been noted to grow to 3m tall, widespread in swampy areas. Useful in the creation of bird habitat.

Carex virgata

Endemic species that forms dense, light green tussocks up to 1m tall. Thrives in a variety of habitats including swamps, drain margins, seepages and wet pastures. Useful in the creation of bird habitat.

***Cortaderia fulvida* (toetoe)**

Branching from the base and forming a clump to 4m high. Long strap-shaped leaves with red-orange coloured veins, flower heads cream yellow. New shoots exhibit pale waxy cover on lower parts (unlike pampas grass) Prefers good drainage and semi-shade. Will struggle to compete if dried out in summer.

***Cyperus ustulatus* (toetoe upoko-tangata, giant umbrella sedge)**

Vigorous leafy sedge growing to 1m in open damp places. Tolerates immersion in standing water within a range of habitats from seepages to wetlands.

***Dicksonia squarrosa* (wheki, tree fern)**

Tree fern up to 7m tall that exhibits tolerance of wet open ground, and floods. Found to shelter and accumulate with other native plants. The base of the fern attracts biodiversity. Useful application to streambank and seepage habitats.

***Elatostema rugosum* (parataniwha)**

Herbaceous plant up to 0.5m tall that spreads by rhizomes. Bronze coloured foliage with serrated edge. Grows on moist sites in light to heavy shade. Intolerant of dry habitats.

Hypolepis dicksonioides

Large fern that prefers fertile moist, but well-drained ground, grows vigorously and spores into planted areas with abundance. Does however, die back during winter.

***Phormium tenax* (harakeke, flax)**

Fast growing clump-forming flax with large stiff leaves, to 3m. Full exposure and sun. Moist to wet conditions. Does not have deep or wide roots. Easily propagated from split fans or grown from seed. Attracts birds, especially Tui.

Trees and shrubs

Consideration needs to be given to the effects of roots land application on wastewater distribution pipe networks. This problem can be more significant for large tree species.

***Carpodetus serratus* (putaputaweta, marbleleaf)**

Lowland forest tree up to 7m tall. Large bunches of cream coloured flowers appear in spring followed by black berries.

Coprosma areolata

Species that grows to 4m tall. Low tolerance to drought, with medium to high fertility.

***Coprosma robusta* (karamu, shining karamu)**

Shrubs or small trees growing to 3m+, with glossy green leaves. Masses of orange-red fruit in autumn are attractive to birds. Hardy plant.

***Coprosma tenuicaulis* (swamp coprosma)**

Endemic species that grows to 3m tall. Leaves pale green with slender branches. Will tolerate a range of swampy to boggy habitats including standing water.

***Cordyline australis* (ti kouka, cabbage tree)**

Palm-like in appearance with large heads of linear leaves and panicles of scented flowers. Sun to semi-shade. Prefers damp to moist soil. Grows eventually to 12m+ height.

***Dacrycarpus dacrydioides* (kahikatea, white pine)**

Tree that grows to 40m. Moderately growing species, which prefers wetland and boggy environments. Application of this species must consider the possible impact of its root systems on the wastewater disposal field.

***Geniostoma rupestre* (hangehange)**

Common forest shrub with pale green glossy foliage, growing to 2-3m. Tiny flowers give off strong scent in spring. Looks best in sunny position where it retains a bushy habit, and prefers well-drained soil.

***Hebe stricta* (koromiko)**

Shrub or small tree growing to 2-5m in height. Natural forms have white to bluish flowers. Plant in full sun. Tolerates exposure. (NB Many cultivars and hybrids are available commercially, but these are all unsuitable for use near existing natural vegetation.)

***Laurelia novae-zelandiae* (pukatea)**

Large upright tree (to 30m) with attractive bright green foliage and distinctive whitish bark. Fast growing and able to handle a wide variety of soils. It will tolerate periodic flooding, breathing roots develop in water logged soils. Can be grown from seed. Tolerant of some sun and frost. Not tolerant of wind.

***Leptospermum scoparium* (manuka)**

Shrub or small tree growing to 4m+ in height. Ubiquitous shrub varying in form throughout New Zealand. Ideal to provide shelter for other plants as it is quick growing and hardy. Requires full sun and. Hardy and tolerant of difficult conditions, including waterlogging and drought.

***Melictyus ramiflorus* (mahoe)**

A fast growing yet long lived tree to 7m height. Prefers well drained fertile soils. Tolerates some frost, wind and sun Birds are attracted to the blue berries.

***Pennantia corymbosa* (kaikomako)**

Slow growing species that will reach 12m in moist, fertile sites. Useful species application in bank stabilisation or wetland habitats.

***Plagianthus betulinus* (ribbonwood)**

Fast growing species to 15m. Similar application to that of *Pennantia corymbosa*.

***Rhopalostylis sapida* (nikau)**

New Zealand's only native palm, with red berries attractive to birds. Requires light shade, plenty of moisture and protection from wind when young. Grows well in areas of permanent dampness.

***Syzygium maire* (maire tawake)**

Attractive and moderately growing wetland tree to 15m with bronze foliage, large bunches of reddish fruit and distinctive whitish bark. Requires a sheltered sunny position. Tolerates some frost.

***Vitex lucens* (puriri)**

Fast growing to 20m in fertile, open but sheltered conditions. Will struggle with poor drainage during adolescence.

Appendix E – Site Photographs



Looking south across the proposed land application area to the proposed building site.



Looking west across the box culvert at the property entrance.



Looking up the line of the proposed access track to the building site left of picture



Auger 3