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Ling Hai Group Ltd

Proposed Castle Road Tourist Development
Castle Road, Awatere Valley

- Engineering Report

25 January 2016 **Our ref: 5249**

Ling Hai Group Ltd,
Lot 3, DP440416 and Lot 2, DP440416
Castles Road, Awatere Valley

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Issue No.	1	2	3	4	5	6
Date	25.01.15					
Prepared By	JH					
Approved By	RE					

1 Executive Summary

Smart Alliances have carried out an engineering appraisal of the geotechnical conditions, site excavation and filling, access tracks, the removal or retention of vegetation, the disposal of stormwater and sewage, and the supply and storage of potable water for the proposed accommodation facility of Ling Hai Group Ltd (the clients) at Lot 3 DP440416 and Lot 3 DP440416 Castles Road, Awatere Valley.

No signs of significant active or historic instability, colluvial debris, or soil creep were identified within the development area. The erosional events occurring within the gully escarpments are not considered to be caused by any global instability at the site, and are formed by water scour. The erosion is localised and considered controllable provided the recommendations in this report are adhered to.

It is proposed to vegetate the gully slopes in a restoration project. The plants will stabilise the slope and provide protection from scour, limiting any further recession of the escarpments. Significant interception and control of surface water runoff will also be provided within the development. This will reduce the stormwater flows that have activated the bank edge erosion. A 10m setback for any building platform from a gully edge is also recommended to provide a further factor of safety.

The subsoils within the proposed building area generally have a soil bearing resistance in excess of 300 kPa (ultimate bearing capacity) at relatively shallow depths. Good founding conditions were found below the topsoil layer at a depth of approximately 250mm.

Total approximate excavations required for the development are 2900m^3. It is recommended that any exposed surfaces are retained and planted as soon as possible after excavation. It is a relatively low risk area for the potential of sediment laden stormwater to enter waterways and no specific recommendations are made for sediment control on the site apart from standard best practice procedures outlined in this report.

The new access track is proposed from Renners Road so as to avoid the need to use Castle Road. The new track will link with the existing right of way and cross two ephemeral watercourses utilising the existing bridge and box culvert structures. The new track will be engineer designed and include a traffic management plan to minimise disturbance and control stormwater runoff. The existing bridge platform fording the Renners Road watercourse will be removed and replaced with an engineer designed structure better able to manage increased vehicle movements from the accommodation facility operation.

The wastewater management system should comprise a secondary treatment unit coupled with drip irrigation land application. The total area of drip line required for any new wastewater system is 7533m^2 (7620 lineal metres). Two areas have been identified as suitable for the drip line system. The irrigation lines will be placed 150mm below the ground surface in the topsoil profile. There is option also to utilise the landscaping areas to be developed around the building sites for the land application of treated wastewater through drip irrigation.

Installation is to be in accordance with the requirements and recommendations of AS/NZS 1547:2012.

It is recommended that all stormwater from roofed and paved areas be directed to discharge via sealed pipes at the base of the gully west of the proposed building sites into the ephemeral water course. Protection from scour shall be provided to the discharge outlet. Some bio-retention and treatment of stormwater run-off from parking areas may be required.

It is also recommended that an interception drain be constructed to collect and convey surface water run-off exiting the northern foothill area away from the facility buildings and the coastal gully escarpments. The stormwater management system for the facility should be designed by a chartered professional engineer.

There are two options to achieve the 19.2m³ a day to service the accommodation facility at full occupation. The first option is to take it from the 3542.4m³ a day available for vineyard irrigation. This is currently taken via an abstraction from the Awatere River under resource consent U130617 and would require a change in consent conditions for this to be achieved. The second option is to take an additional 19.2m³ water allocation from the Awatere Water Scheme (Birch). This may require an upgrade of the pipe network in the area should this option be chosen.

The water will have to be treated to a potable standard for both options. It is recommended that a minimum of 180,000 litres of storage capacity (approximately 10 days storage at full occupancy for the facility) be provided on site for both options.

The recommendations listed above should not be taken in isolation and must be read in conjunction with the balance of this report and the context of the proposed residential development at the site.

2 Introduction

The clients propose to construct an accommodation facility on their property at Castles Road, Awatere Valley. The facility will consist of a main lodge and separate accommodation units.

The property was originally a large farm that has been purchased by our clients who have begun to develop it as a working vineyard.

The purpose of this report is to present the results of site investigations carried out in relation to the geotechnical conditions, site excavation and filling, access tracks, the removal or retention of vegetation, the disposal of stormwater and sewage, and the supply and storage of potable water for the proposed accommodation facility. The site investigations were carried out on 08 January 2016.

3 Location & Site Description

The property adjoins the Clifford Bay coastline north of the Awatere River mouth. The clients own approximately 695 hectares made up of three separate titles. The accommodation facility will be adjacent to the current homestead on Lot 3 DP440416 (188.32ha) that is accessed directly off Castles Road. Another house and a number of farm support buildings are also located on this title.

A new access track is proposed off Renners Road. The majority of this track will cross Lot 2 DP440416 (73.33ha), which is directly south of the proposed development. A larger block, Lot 1 DP3473 (432.60ha), stretches to the north.

The majority of the property is made up of undulating coastal terrace and foothills elevated high above the beach below. It is predominantly covered in pasture grass with a series of vineyard blocks currently in development. A number of shelter belts are located randomly throughout. The proposed development site is on a relatively flat area of coastal terrace and enjoys good views out into Clifford Bay.

A deeply incised ephemeral water course runs to the west and south of the proposed development site. It is often dry through the summer months but can convey significant quantities of run-off to the sea in rainfall events. A series of shallow eroding gullies run from the upper terrace into the water course and to the beach platform on the northern boundaries.

The farm is currently being developed as a vineyard with approximately 60 hectares planted to date with another 80 hectares to be planted in the near future. Water for vineyard irrigation is currently sourced from the Awatere River under a resource consent (U130617). Water supply for the existing houses and the farm operation is currently sourced from the local Birch water scheme.

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

4 Geotechnical Investigations

We have conducted a visual assessment of the property, examining the exposed faces along the river and coastal terraces, completed five scala penetrometer tests within the proposed building areas and four hand dug test pits within the slopes proposed for the wastewater land application areas. The test locations are shown on the site plan attached in Appendix A with the test results presented in Appendix B and Appendix D.

The New Zealand Geological Map (Begg and Johnston 2000) indicates that the subsoils at the subject site consist of loess over weathered, poorly to moderately sorted gravel overlying sandstone and sandy siltstone of the Starborough formation.

The exposed faces and test pits examined confirmed variable depths of brown dry silty clay (loess) overlying poorly sorted gravels within a sandy silt matrix. The gravels are generally rounded and vary in size from 5mm pebbles to larger 250mm stones.

The gully incisions into the ephemeral waterway and down to the beach platform are areas of active surface erosion. They act as a conduit for the run-off of surface water from the terraces and the low foothills running to the north of the development area. The movement of stormwater erodes the loess deposits and has the potential to destabilise the soils on site.

An extension of the active Awatere fault runs on a south-west to north-east axis through the property at the approximate location of the boundary between Lot 3 DP440416 and Lot 1 DP3473. The site proposed for the building development will be approximately 1.5 kilometres from the faultline.

The greater Marlborough area is an active seismic zone, and it should be anticipated that a minimum ground shaking condition equivalent to a Modified Mercalli Intensity of VII to VIII would be experienced during the design life of any proposed building, and the proposed development should be appropriately designed to mitigate against the adverse affects of such potential ground shaking.

The slopes affected by the proposed development, including the slopes that will accommodate the dripline wastewater field and access track, have been assessed. No detailed assessment of the stability of the slopes away from the development area have been undertaken.

5 Geotechnical Assessment

The Development Risk with the proposed development is assessed as LOW as outlined in the geotechnical risk matrix provided in Appendix C. An opinion as to land stability in the format required by Council is also provided in Appendix C.

No signs of significant active or historic instability, colluvial debris, or soil creep were identified within the development area. The erosional events occurring within the gully escarpments are not considered to be caused by any global instability at the site, and are formed by water scour. The erosion is localised and considered controllable provided the recommendations in this report are adhered to.

As noted in the previous chapter, the gully incisions surrounding the development terrace are potential areas of instability. However, the erosion is slow and controllable in the long term. Vegetation root systems aid in the prevention of localised erosion. It is proposed to vegetate the gully slopes in a restoration project. The plants will stabilise the slope and provide protection from scour, limiting any further recession of the escarpments. Significant interception and control of surface water runoff will also be provided within the development. This will reduce the stormwater flows that have activated the bank edge erosion. A 10m setback for any building platform from a gully edge is also recommended to provide a further factor of safety.

Suitable areas for the land application of secondary treated wastewater have been identified on the slopes to the north and the south of the proposed development area. The method of land application is to be via dripper-lines at a low application rate over a large area. To maximise evapotranspiration the dripper-lines will be placed at a depth of 150mm within the topsoil layer. For these reasons the land application of wastewater is not considered to pose a hazard to the stability of the slopes on site.

The test results for the five penetrometer tests, numbered P1 to P5, are provided in Appendix B and the test locations are shown on 5249-G11.

The attached test results of P1 to P5 indicate that the subsoils within the proposed building area generally have a soil bearing resistance in excess of 300 kPa (ultimate bearing capacity) at relatively shallow depths. Good founding conditions were found below the topsoil layer at a depth of approximately 250mm.

On the basis of the foregoing it is considered that the site is suitable for the proposed accommodation facility and for construction on conventional foundations at a depth of 250mm below ground level designed and constructed in accordance with NZS 3604:2011. Specific foundation requirements will be confirmed at building consent phase.

In summary, the proposed accommodation facility and wastewater field are unlikely to be adversely affected by slope instability provided the recommendations in this report are followed. Of particular importance is insuring that the revegetation programme on the gully escarpments is initiated to prevent uncovered soils from being subject to slope erosion and surface water scour. Stormwater control is very important to ensure stability of the surrounding area. The management of stormwater is discussed in section 8.

6 Site Excavation and Filling

The earthworks to be undertaken on the property include (approximate cubic metres of excavation required in brackets):

- Trenching of water, power and telecom services to the building sites (280m³)
- Trenching of the stormwater and wastewater disposal (420m³)
- Construction of the building platform and parking areas (1500m³)
- Construction of the access track (700m³)

Total approximate excavation required for the development- 2900m³.

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 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 practicable.

Level building platforms will be formed with excavation of the relatively flat development site. It is expected that the cut will be made to good ground through removal of the topsoil layer and no filling will be required aside from that specified by the foundation design. The cut material will be distributed on site and be used for landscaping purposes. The cut material is not considered suitable for use in areas proposed for the siting of foundations.

The new access track will follow an existing farm track and only minor earthworks will be required to upgrade it to an all weather standard. These earthworks will include the re-formation of drainage channels on the track edge and battering of existing cuts to mitigate against any erosion potential. Some additional excavation will be required to achieve an acceptable 1:5.5 grade on the north side of the existing culvert to provide direct access to the development area. Revegetation of cut faces and some retaining may be required however this will be identified in specific engineering design.

7 Sediment Control

It is a relatively low risk area for the potential of sediment laden stormwater to enter waterways. The watercourse is ephemeral and mostly dry, is vegetated and has a large surface area to assimilate sediment deposits. The development is setback from the ocean and a good land buffer is in place between proposed excavations and the high tide mark. No specific recommendations are made for sediment control on the site apart from standard best practice procedure. Such best practice procedures entail:

- Vegetation clearance is to be generally limited to the forming of building platforms, access and conveying of services.
- Contractors to take all practicable measures to ensure that the sedimentation of waterways does not occur within site works.
- Where required drainage should be installed to prevent water flowing into any exposed subsoils.
- Exposed surfaces are to be topsoiled and planted or seeded as soon as possible after excavation to limit erosion and reduce the movement of soil laden stormwater from the site.
- The stockpiling of excavated material should not occur in areas where stormwater flows may occur.

8 Access Tracks

The property is currently accessed from Castles Road and a right of way exists to an adjoining property east of the development area via a gravel track. The track was installed as part of condition of a previous resource consent that subdivided the farm and has been inspected and certified by Davidson Partners Ltd engineers. This includes a large box culvert that fords the ephemeral watercourse adjacent to the development area.

The new access track is proposed from Renners Road so as to avoid the need to use Castle Road. The track will follow an existing farm track and only minor earthworks will be required to upgrade it to an all weather standard.

The new track will link with the existing right of way. It will be engineer designed and certified and include a traffic management plan to minimise disturbance. Acceptable grades are achievable (less than 1 in 5.5) and, with an engineer designed stormwater management system, no problems are envisaged in long term access to the property.

The track will cross two ephemeral watercourses. The first, being approximately 250m off Renners Road which has an existing bridge structure to ford it. The second is the watercourse adjacent to the development area with its box culvert structure. Both watercourses are generally dry aside from during high rainfall events.

An examination of the Renners Road bridge has found the concrete wing walls to be adequate but the bridge platform structure is insufficient for the ongoing transit of accommodation facility related vehicles. An engineer designed bridge platform is

recommended to replace the existing structure. The design will conform to dimension requirements suitable for the proposed activity.

An inspection of the existing box culvert confirms that the structure is of suitable length and width for the passage of vehicles related to the ongoing operation of the accommodation facility. A visual appraisal of the structure found the existing gabion basket wing walls and the box culvert structure itself to be in good condition. Some improvement will need to be made in the kerbing lead in guides either side of the culvert to improve entry and exit safety. Engineering input into the design of the guides will be required.
Some small culverts may be necessary once the full track has been formed to aid in the drainage of stormwater from the road infrastructure. Their exact location will be confirmed in the engineered road design. No new culverts will be required in the waterways on the property.

9 The Removal or Retention of Vegetation

The subject site is predominantly vegetated in grass with a number of shelter belts around it and random tree specimens within the stream area. Minimal vegetation cover aside from pasture grasses will be removed in construction of the proposed accommodation facility, 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. Significant restoration planting is proposed to occur within the exposed gully areas which will assist in the long term stability of the site.

10 Wastewater Assessment

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

Three areas are considered acceptable for the application of secondary treated effluent. 'Area 1' is a long north facing slope to the south of the development area. The slope is extremely exposed and possesses very high evapotranspiration rates. 'Area 2' is significantly closer to the development on the foothills to the north. While the slopes here still achieve high evapotranspiration rates they are generally south-east and south-west facing, are slightly steeper and more stormwater runoff controls would be required to ensure adequate land application.

A third area will be available within the landscaping areas to be developed around the building sites. Drip irrigation can be placed within the plantings and covered with mulch to provide additional sustenance to the plant establishment. It is unlikely that these areas will be of sufficient size to cater for the full area of dripline needed so land application within 'Area 1' or 'Area 2' will also be required in combination. The gully areas which are proposed for landscaping are not considered suitable for the land application of wastewater due to their instability and proximity to surface water sources.

Two hand dug test pits, numbered TP1 and TP2, were put down within Area 1 and an examination of an exposed cut face in close proximity occurred. Two hand dug test pits,

numbered TP3 and TP4 were put down in Area 2. Their locations are shown on the site plan provided in Appendix A. Logs of the representative soil properties are provided in Appendix D.

Based on the soil assessment carried out, an average drainage category of 5 has been adopted. Due to the extremely high evapotranspiration rates and low rainfall experienced in the area we believe there is no need for a reduction in the design irrigation rate to account for the slopes within which the land application areas are located.

Groundwater was not encountered within the subsurface investigation and is anticipated to be at a depth greater than 5m below ground level.

The unnamed ephemeral watercourse runs approximately 120m from the northern edge of 'Area 1' and 130m from the southern edge of 'Area 2'. Both potential areas are also elevated high above the waterline when there is flow in it.

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/m^3
Suspended solids (average) < 30 g/m^3

Any system that has been tested and meets the above standard is satisfactory. Secondary treatment units utilise a number of methods to treat the effluent, each with differing treatment capacities. The chosen unit will need to be shown to have the ability to treat a maximum design load of 22,600 Litres per day (as detailed below).

A wastewater design sheet is provided in Appendix D with the design calculation based on the following criteria:

- Proposed accommodation facility catering for 100 overnight guests and resident staff and 20 day staff
- Total design flow of 22,600 litres/day (100 guests and resident staff at 220 litres/person/day and 20 day staff at 30 litres/person/day).
- Soil category 5 and a design irrigation rate of 3mm.
- Community Water Supply

A loading certificate outlining the design criteria for the proposed system is provided in Appendix E.

A locality and site plan outlining both 'Area 1' and 'Area 2' is contained in drawings 5249-G10 and 5249-G11 in Appendix A.

The total area of drip line required for any new wastewater system is 7533m^2 (7620 lineal metres) – refer wastewater design sheet in Appendix B. The irrigation system design requires 1.6 litre/hr emitters at 0.6m spacing with lines laid at 1.0m intervals. The irrigation lines will be placed 150mm below the ground surface in the topsoil profile.

It is recommended that the field be split into a number of sectors with each sector being alternatively dosed via a sequencing valve. Specific design of the dripper system will be required at building consent phase.

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.

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 Environmental Assessment

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

- Secondary treated effluent
- Low application rate of effluent evenly distributed
- Split field, alternatively dosed and rested
- Large property size
- Further uptake of effluent through very high evapotranspiration rates
- Thick topsoil layer
- The environmental buffering capacity of land

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

Both the possible land application areas are sited on elevated ground and not within any ground depressions that are prone to flooding.

The effect of a failed system will primarily affect the applicant's property. In the event of a failed system wastewater is likely to accumulate within the vineyard area below

'Area 1' and the flat grassed area below 'Area 2'. Infiltration into the topsoil layers and the environmental buffering capacity of the land will ensure all water sources and neighbours are 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 property is large and a reserve area is available to relocate the field should the field fail.

Regular maintenance and inspection by the owner will ensure the onsite wastewater system is operating to a suitable standard.

12 Stormwater Management

It is recommended that all stormwater from roofed and paved areas be directed to discharge via sealed pipes into the base of the gully west of the proposed building sites into the ephemeral water course. Protection from scour shall be provided to the discharge outlet with the concrete and rock pad detail provided in drawing 5249-G12, to minimise erosion potential.

An assessment of site soils has found them to have limited ability to cater for the disposal of stormwater by way of ground soakage, such as that utilised in soak pits.

Some bio-retention and treatment of stormwater run-off from parking areas may be required. Design details can be confirmed at building consent phase of the development.

It is also recommended that an interception drain be constructed to collect and convey surface water run-off exiting the northern foothill area away from the accomodation buildings and the coastal gully escarpments. Details of stormwater movement and the preferred location of the interception drain is shown on drawing 5249-G11.

There is option available to collect and store stormwater for non-potable uses within the development. This may include landscape plant watering and other outdoor water use.

13 Water Supply

Vineyard irrigation is currently supplied from an abstraction from the Awatere River under Resource Consent U130617. A maximum of 3542.4 cubic metres of Class A surface water can currently be taken.

The supply of water to the areas of the property not planted in grapevines is currently by way of the Awatere Water Supply (Birch). Under the Birch water scheme rules a minimum of $5m^3$ per day is required per household unit and $0.05m^3$ per hectare per day for farm stock watering purposes. Using these allowances under the currently regime of the property $37.7m^3$ of water is required. A summary is provided below:

1. For occupants of the existing 2 dwellings;

   10m3 per day for the 2 dwellings for domestic use and irrigation of gardens in the immediate vicinity of the dwellings.

2. For farm use;

   The existing farm supply of 31m3 per day results from an existing allocation of 50 litres or 0.05m3 per day per hectare of the 621 hectares within the farm that has been calculated by the Council to be below the 100m contour up to which water is able to be supplied and therefore considered able to be supplied by the Black Birch scheme.

   Currently 60 hectares is planted in grapes with a further 7 hectares to be taken up with the development including the wastewater land application area. This reduces the area available for stock farming to 554 hectares with a required allocation of 27.7m³ per day.

The accommodation facility will require an additional 19.2m³ of water per day for its operation. This is summarised below:

1. For the guest accommodation;

   18.8m³ for the guest accommodation, resulting from a requirement of 188 litres or 0.188m³ per person per day for 100 guests adopted by the Council.

2. For staff;

   0.4m³ per day based on a present expectation of between 6 and 10 staff on the site during the day at a rate of 40 litres or 0.04m³ per person per day adopted by the Council.

There are two main options available to supply the 19.2m³ per day to support the accommodation facility at full occupancy.

Option 1

Take the water from the vineyard Awatere River abstraction and store for use within the facility.

As so much water is available from the abstraction (3542.4m³ per day), the relatively small amount required for the facility operation (19.2m³) will have no effect on the vineyard operation. The abstracted water is currently filtered but will require additional filtering and treatment to a potable standard to ensure compliance with the Drinking Water Standard for New Zealand 2005 (revised 2008). An ultraviolet light (UV) filter would achieve these standards. This is a standard procedure and many accommodation facilities filter and treat their water sources in a similar manner.

A change in consent conditions will be required for water to be taken from the vineyard Awatere River abstraction for use within the accommodation facility.

Option 2

Take the water from the Awatere Water Supply (Birch) and store for use within the facility.

To take the 19.2m³ a day from the Awatere Water Supply may involve an upgrade of the water distribution network to ensure continuity of supply.

The water from the Awatere Water Supply is only partially treated and will require treatment to a potable standard to ensure compliance with the Drinking Water Standard for New Zealand 2005 (revised 2008) for use within the accommodation facility. An ultraviolet light (UV) filter would achieve these standards.

It is recommended that a minimum of 180,000 litres of water storage (approximately 10 days supply for the accommodation at full occupancy) be provided for both options.

Supplementing of the water supply with harvested rainwater is also an option. However, the low rainfall experienced in the area means this would have limited effect on the water available for use. It would however provide a valuable complimentary supply in dry periods so is encouraged if chosen.

14 Conclusion

No signs of significant active or historic instability, colluvial debris, or soil creep were identified within the property. The proposed building areas are currently stable.

It is considered that the proposed development site and wastewater land application areas are unlikely to be adversely affected by slope instability provided the recommendations in this report are followed.

Stormwater and wastewater management is achievable to a sufficient level so as to satisfy resource management plan requirements.

15 Limitations

This report is valid for five years from the date of issue and covers the geotechnical conditions, site excavation and filling, access tracks, the removal or retention of vegetation, the disposal of stormwater and sewage, and the supply and storage of potable water for the proposed accommodation facility at Lot 3 DP440416 and Lot 3 DP440416, Castles Road, Awatere Valley for Ling Hai Group Ltd. 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.

16 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. Guideline for the Field Classification and Description of Soils and Rock for Engineering Purposes NZ Geotechnical Society Inc December. 2005.

4. Marlborough District Council Guidelines for New On-site Wastewater Management Systems, July 2005.

5. Crites, R.W. and Tchobanoglous. Small and Decentralised Wastewater Management Systems. WCB/McGraw-Hill, 02/04/1998

6. 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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25 January 2016

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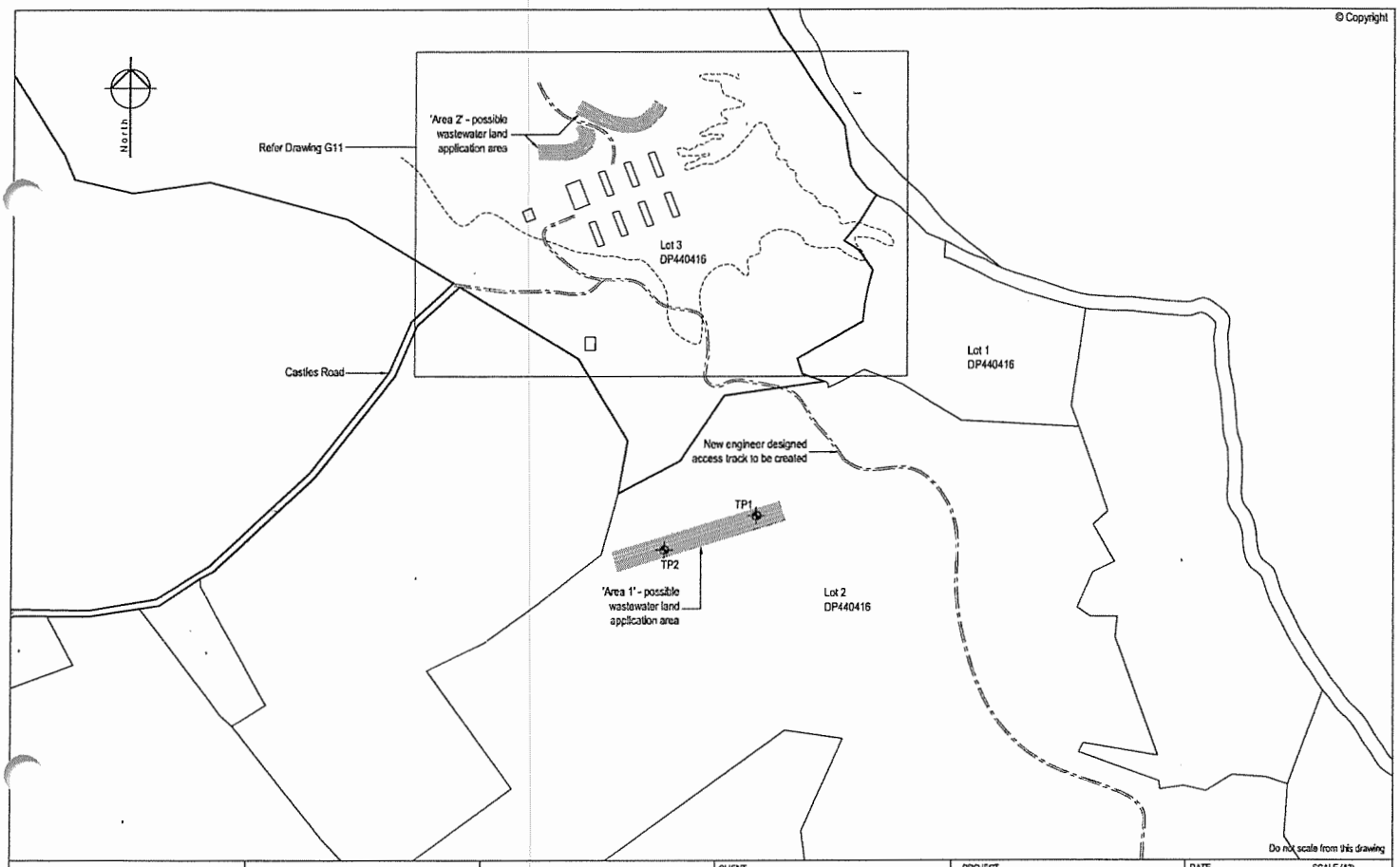
Appendix A - Drawings

- **Site Plan Drawing**
- **Stormwater Discharge Outlet Detail**



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REV	DATE	DETAILS	REV	DATE	DETAILS

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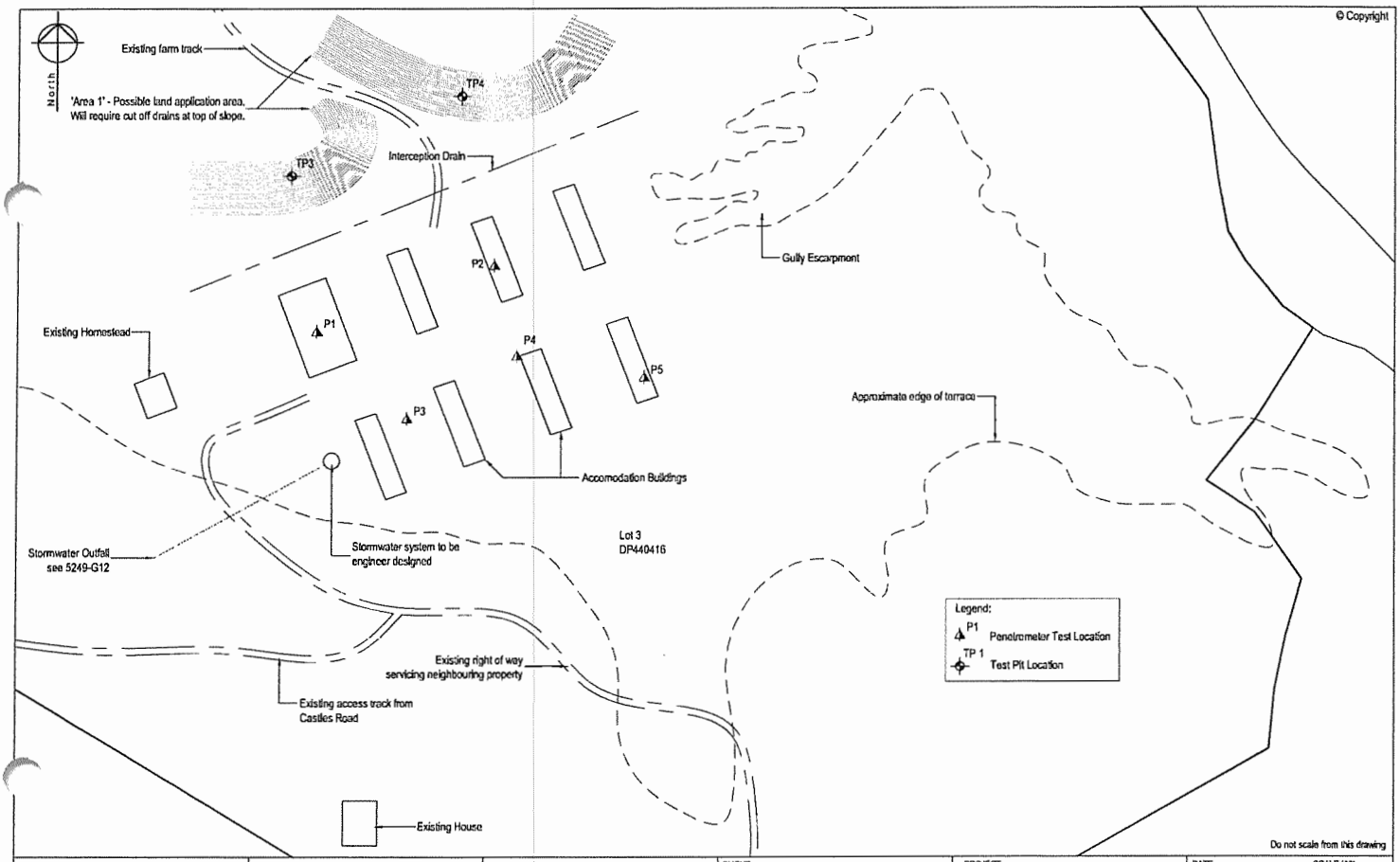
CLIENT: LING HAI GROUP LTD	PROJECT: CASTLES ROAD DEVELOPMENT CASTLE ROAD	DATE: 25-01-16	SCALE (A3): 1:5000
ISSUE: REPORT	DRAWING: LOCALITY PLAN	DRAWN: JH	REVISION: 01
		APPROVED: RE	DWG NO.: 5249-G10

CAD FILE REF: P:/ 5249-G10



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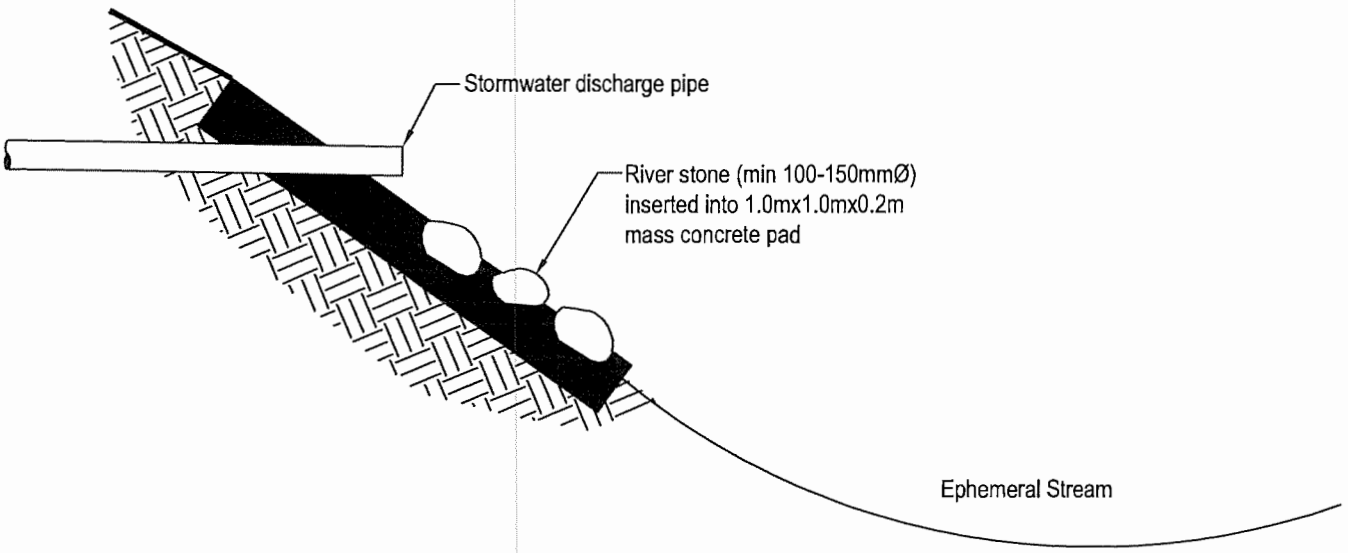
CLIENT	LING HAI GROUP LTD
ISSUE	REPORT
PROJECT	CASTLES ROAD DEVELOPMENT CASTLES ROAD
DRAWING	SITE PLAN
DATE	25-01-16
SCALE (A3)	1:1500
DRAWN	JH
REVISION	01
APPROVED	RE
DWG NO.	5249-G11

CAD FILE REF: P:/ 5249-G10



01
-

STORMWATER OUTFALL DETAIL

SCALE 1:25

Do not scale from this drawing

REV	DATE	DETAILS

smartalliances LTD
1st Floor · River View House · 10 High Street · Blenheim · New Zealand
T: 03 579 0211 F: 03 579 0233 PO Box 546 · Blenheim · 7240
E: info@smartalliances.co.nz Website: www.smartalliances.co.nz

CLIENT
LING HAI GROUP

PROJECT
CASTLES RD DEVELOP.
CASTLES ROAD, AWATERE

DRAWING
STORMWATER OUTFALL DETAIL

ISSUE
REPORT

DATE	SCALE (A4)
25-01-16	1:25
DRAWN	REVISION
JH	**01**
APPROVED	DWG NO.
RE	**5249-G12**

CAD FILE REF: P:/ 5249-G12

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Appendix B – Penetrometer Test Results

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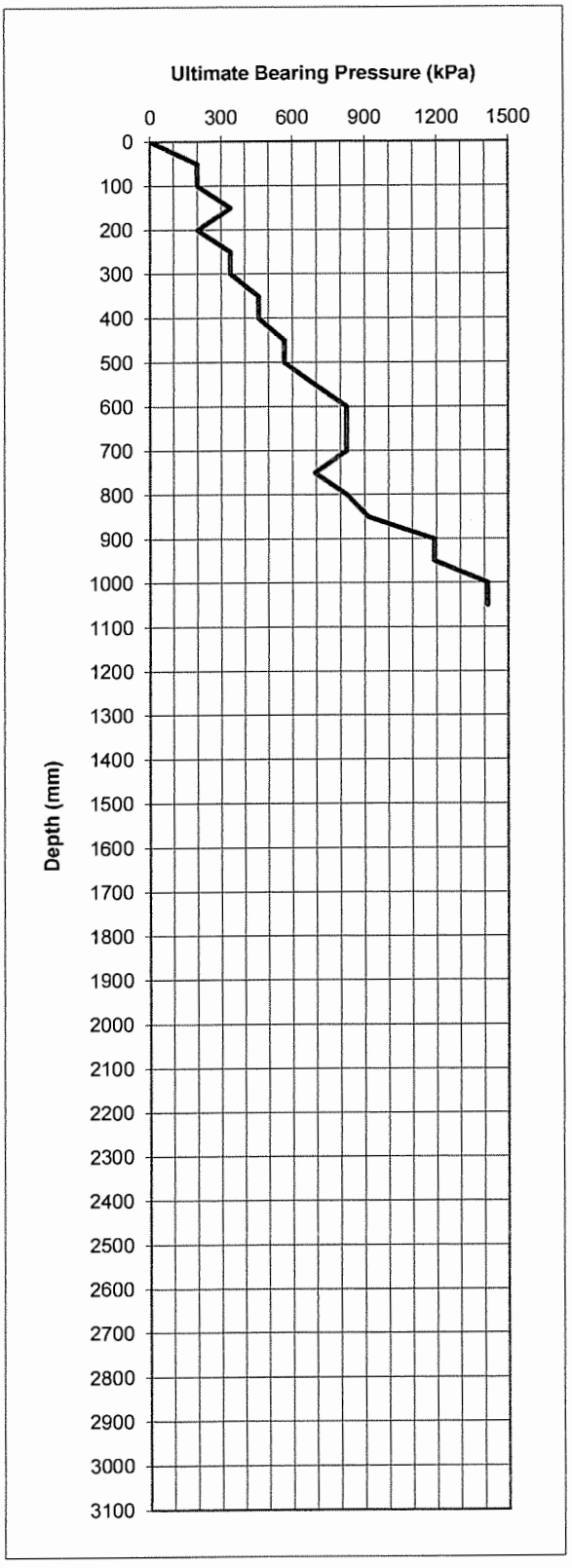
Project:	Castles Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	08/01/2016	Sheet:	1 of 5

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
1	50	**198**	100
2	25	**339**	150
1	50	**198**	200
2	25	**339**	250
2	25	**339**	300
3	17	**458**	350
3	17	**458**	400
4	13	**565**	450
4	13	**565**	500
5	10	**693**	550
6	8	**824**	600
6	8	**824**	650
6	8	**824**	700
5	10	**693**	750
6	8	**824**	800
7	7	**915**	850
10	5	**1189**	900
11	5	**1189**	950
13	4	**1414**	1000
13	4	**1414**	1050



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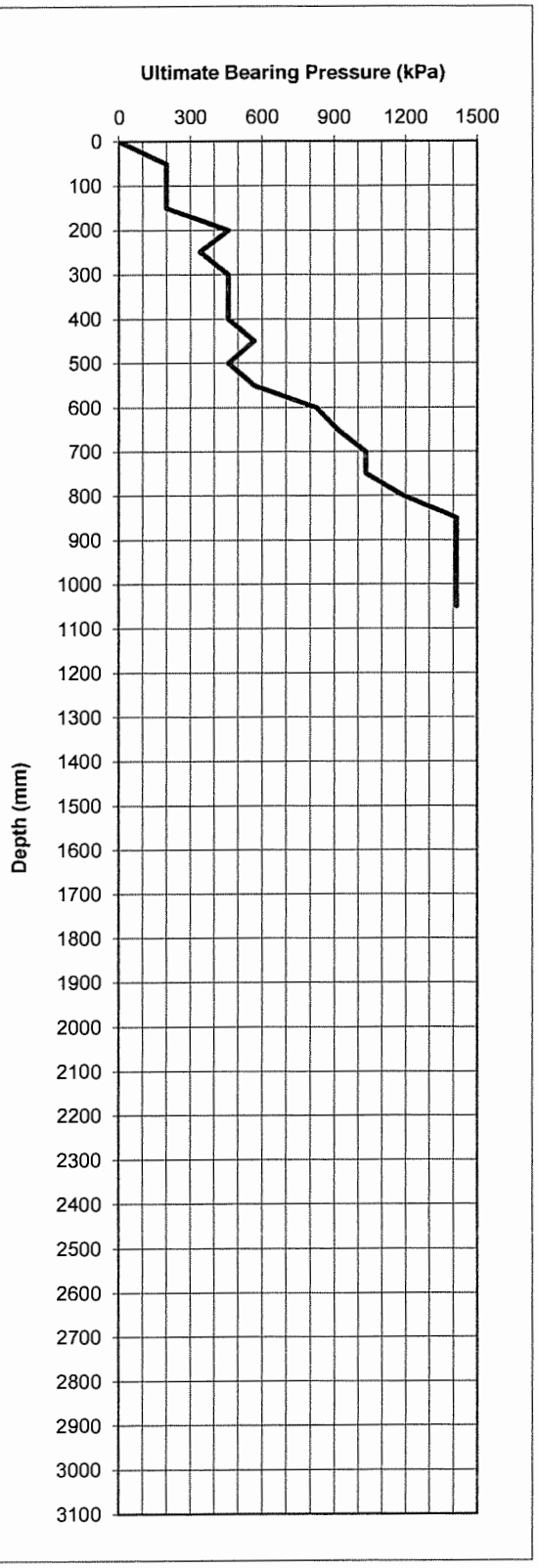
Project:	Castles Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	08/01/2016	Sheet:	2 of 5

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
1	50	198	100
1	50	198	150
3	17	458	200
2	25	339	250
3	17	458	300
3	17	458	350
3	17	458	400
4	13	565	450
3	17	458	500
4	13	565	550
6	8	824	600
7	7	915	650
8	6	1031	700
8	6	1031	750
10	5	1189	800
13	4	1414	850
14	4	1414	900
13	4	1414	950
13	4	1414	1000
13	4	1414	1050



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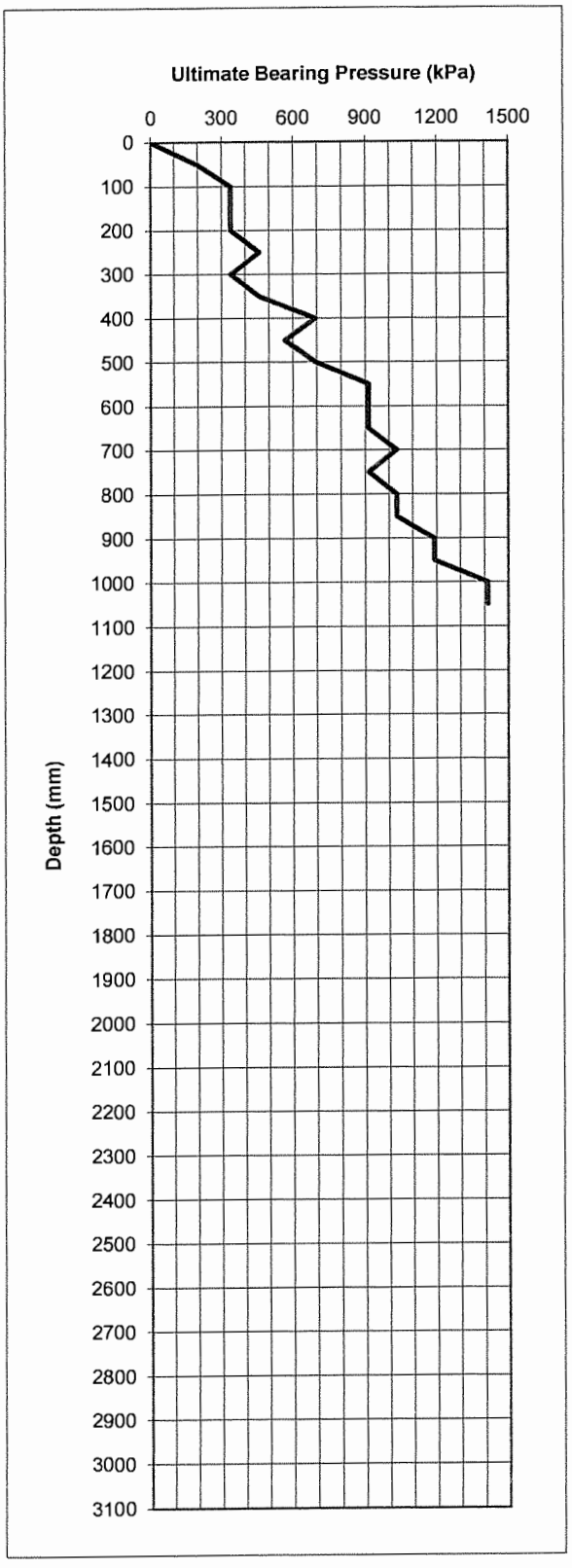
Project:	Castles Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	08/01/2016	Sheet:	3 of 5

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
2	25	339	100
2	25	339	150
2	25	339	200
3	17	458	250
2	25	339	300
3	17	458	350
5	10	693	400
4	13	565	450
5	10	693	500
7	7	915	550
7	7	915	600
7	7	915	650
8	6	1031	700
7	7	915	750
8	6	1031	800
9	6	1031	850
10	5	1189	900
11	5	1189	950
14	4	1414	1000
12	4	1414	1050



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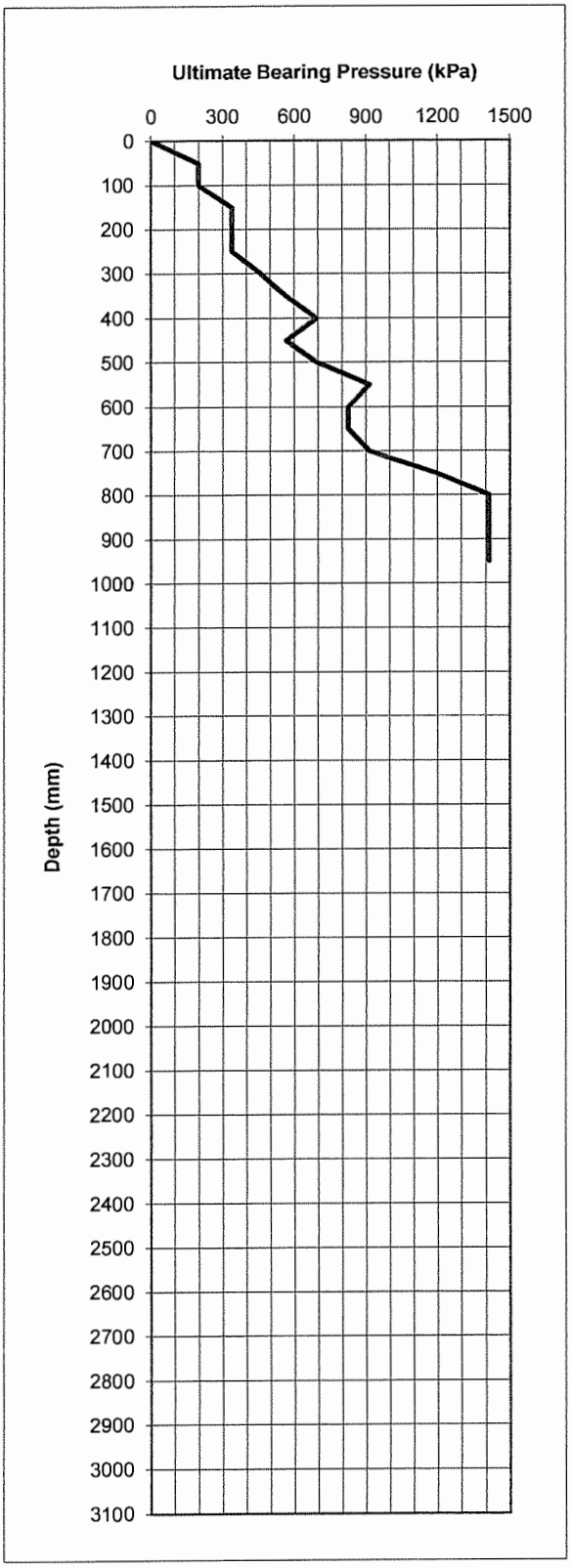
Project:	Castles Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	08/01/2016	Sheet:	4 of 5

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
1	50	**198**	100
2	25	**339**	150
2	25	**339**	200
2	25	**339**	250
3	17	**458**	300
4	13	**565**	350
5	10	**693**	400
4	13	**565**	450
5	10	**693**	500
7	7	**915**	550
6	8	**824**	600
6	8	**824**	650
7	7	**915**	700
11	5	**1189**	750
12	4	**1414**	800
13	4	**1414**	850
14	4	**1414**	900
14	4	**1414**	950



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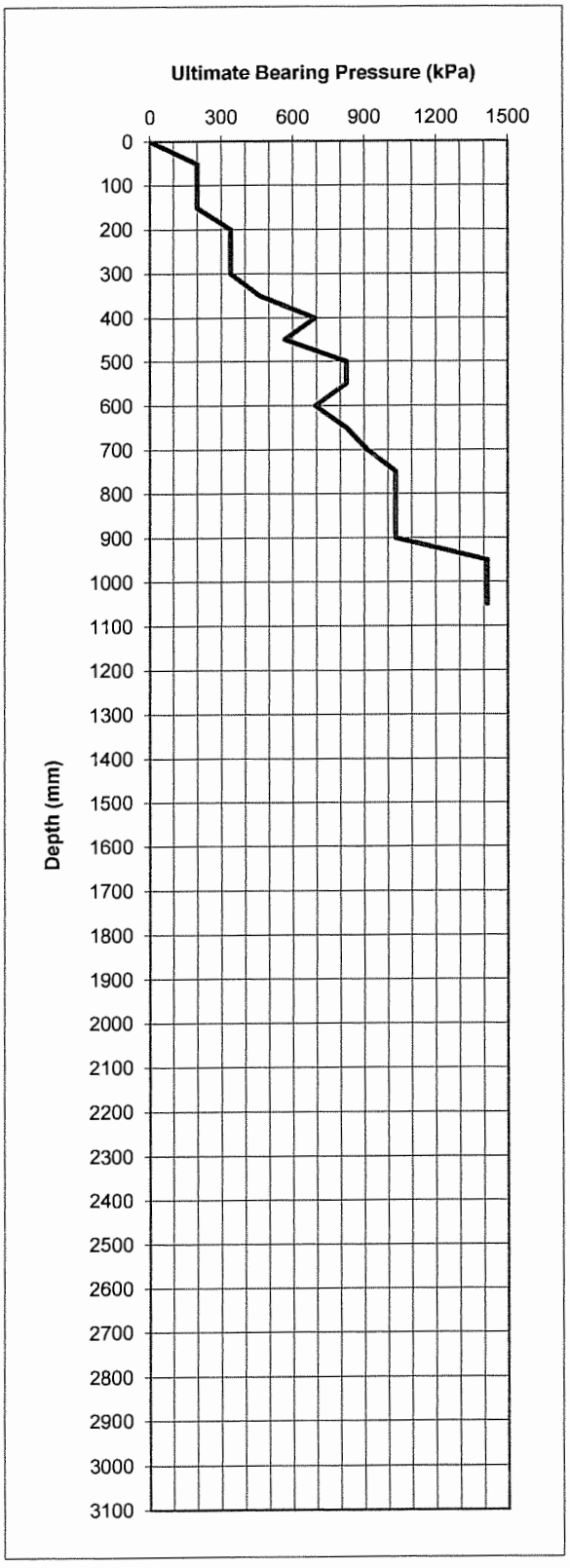
Project:	Castles Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	08/01/2016	Sheet:	5 of 5

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
1	50	198	100
1	50	198	150
2	25	339	200
2	25	339	250
2	25	339	300
3	17	458	350
5	10	693	400
4	13	565	450
6	8	824	500
6	8	824	550
5	10	693	600
6	8	824	650
7	7	915	700
8	6	1031	750
9	6	1031	800
9	6	1031	850
9	6	1031	900
12	4	1414	950
13	4	1414	1000
12	4	1414	1050



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Appendix C – Opinion as To Land Stability
Geotechnical Risk Matrix

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25.01.2016

Opinion as a Practitioner in the Field of Geotechnical Engineering

Description: Ling Hai Group Ltd

For: Lot 3 DP440416 and Lot 2 DP440416, Castles Road, Awatere Valley

I, Richard Evans, hereby confirm that:

1. I am an experienced practitioner in the fields of soils engineering including land stability and providing of foundation design parameters.

2. I am a Chartered Professional Engineer and am recognised by the Institution of Professional Engineers New Zealand as a Civil Engineer having relevant experience in the practice field of geotechnical engineering.

3. I am familiar with and understand the purpose of the Marlborough District Councils geotechnical reporting standards. This professional opinion is furnished to the Marborough District Council for the proposed accommodation facility at Lot 3 DP440416 and Lot 2 DP440416, Castles Road, Awatere Valley.

4. I understand that the Marlborough District Council will rely on this opinion and the accompanying site report for any subsequent statutory process including, but not limited to, the considerations for consent pursuant to the Building Act.

5. A site investigation report is attached.

6. Site investigations have been carried out under my direction and these are described in our site investigation report dated 25 January 2016.

7. In my professional opinion and having regard to the specifics of the site which I have investigated to the extent that acceptable engineering practices require, giving due regard to acceptable engineering principles and practices for land slope and foundation stability, then the assessed building area is suitable for the development, providing that the following recommendations described in our accompanying report are adhered to:

   (a) A 10m setback be applied for any structure from the edge of the terrace or gully escarpments.

   (b) A revegetation programme of the gully slopes surrounding the development be initiated.

   (c) A stormwater management system is designed by a chartered professional engineer.

   (d) The access road be designed by a chartered professional engineer.

This professional opinion shall remain current for a maximum of five years.

Richard Evans, Smart Alliances
Chartered Professional Engineer
BSc Eng Civ, CPEng, MIPENZ

PROJECT:	Castles Road Development		
CLIENT :	Ling Hai Group Ltd		
REF:	5249	Eng:	JH
DATE:	25-01-16	Page:	1 of 1

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Geo-technical Risk Matrix

Lot 3 DP440416 & Lot 2 DP440416, Castles Road, Awatere Valley

Gentle Slopes 0 - 10°
Moderate Slopes 10 - 25°
Steep Slopes 25 - 35°
Very Steep Slopes > 35°

Likelihood \ Consequence		No risk to life, minor financial loss (<$5k). Potential for small scale instability only	No risk to life, minor financial loss (<$50k). Potential for small scale instability only	Very low risk to life, moderate damage and financial loss (<$150k). Potential for moderate scale instability	Low risk to life, significant damage and financial loss (<$500k). Potential for large scale instability	High risk to life, extensive and significant damage and financial loss (>$500k). Potential for large scale instability
Almost Certain	Extensive evidence of active creep and active instability Steep slope	**M**	**H**	**H**	**E**	**E**
Likely	Evidence of active creep and/or historic instability Steep to Moderate slopes	**M**	**M**	**H**	**E**	**E**
Moderate	Evidence of historic soil creep and/or historic instability Steep to Moderate slopes	**L**	**M**	**M**	**H**	**H**
Unlikely	No evidence of historic soil creep and/or historic instability Steep to Moderate slopes	**L**	**L**	**L**	**M**	**H**

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Appendix D – Wastewater Details, Calculations and Logs

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Wastewater Logs - 5249

Two hand dug test pits, numbered TP1 and TP2, were put down in proposed land application 'Area 1' and two hand dug test pits, numbered TP3 and TP4, were put down in proposed land application 'Area 2'. Their locations are shown on the site plan in Appendix A. The representative soil properties are:

Area 1

TP1

Lower Depth (m)	USCS Soil Class	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.3	OL	Topsoil	Brown	Loam	None	Loose	Soft	Strong	Dry	3
0.45	ML-CL	Alluvial	Light Brown	Silty Clay	None	Medium	Firm	Moderate	Dry	4
0.8	ML-CL	Alluvial	Light Brown	Silty Clay	2%	Stiff	Firm	Moderate	Dry	5

TP2

Lower Depth (m)	USCS Soil Class	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.25	OL	Topsoil	Brown	Loam	None	Loose	Soft	Strong	Dry	3
0.4	ML-CL	Alluvial	Light Brown	Silty Clay	None	Medium	Firm	Moderate	Dry	4
0.8	ML-CL	Alluvial	Light Brown	Silty Clay	2%	Stiff	Firm	Moderate	Dry	5

Area 2

TP3

Lower Depth (m)	USCS Soil Class	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.25	OL	Topsoil	Brown	Loam	5%	Loose	Soft	Strong	Dry	3
0.8	GC	Alluvial	Light Brown	Silty Clayey Gravels	35%	Medium	Firm	Moderate	Dry	4-5

TP4

Lower Depth (m)	USCS Soil Class	Genesis	Description							Drainage Category
			Colour	Field Texture	% + 2mm Fragments	Compactness	Consistency	Structure	Moisture Condition	
0.25	OL	Topsoil	Brown	Loam	None	Loose	Soft	Strong	Dry	3
0.35	ML-CL	Alluvial	Light Brown	Silty Clay	None	Medium	Firm	Moderate	Dry	4
0.7	ML-CL	Alluvial	Light Brown	Silty Clay	5%	Stiff	Firm	Moderate	Dry	5

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Project:	Castle Road Tourist Development		
Client:	Ling Hai Group Ltd		
Ref:	5249	Eng:	JH
Date:	25/01/2016	Sheet:	1 of 1

WASTEWATER SYSTEM DESIGN SHEET

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

Intended water Supply: Community Scheme

Soil Category Determined on Site: Category 5

DRAINAGE CONTROLS:
Need for surface water collector / cut-off drains? *Within Area 2 only*

AVAILABILITY OR RESERVE / SETBACK AREAS
Reserve area available for extensions, % of design area: *100%*

DESIGN
Daily Loading Rate: ***3.0*** mm/day

Occupancy:	**100** *Guests and resident staff*		
	20 *Staff*		
L/person/day:	***220*** L/p/d	**22000**	L/day from Table M1 in AS/NZS1547:2012
	30 L/p/d	**600**	L/day from Table M1 in AS/NZS1547:2012

DESIGN DAILY FLOW: **22600** L/day

AREA REQUIRED: **7533** m²

LENGTH REQUIRED: **7620** m

RESERVE AREA REQUIRED: *100%* of specified

Irrigation Design

Acceptable daily loading rate (mm/day)	**3.0**
Daily influent (l/day)	**22600**
Emitter type	**Raam 17**
Emitter flow rate (l/h)	**1.6**
Emitter Spacing (m)	**0.6**
Dripline Spacing (m)	**1**
Field Size (m^2)	**7533**
Field length assuming square area	**87**
Number of lines	**88**
Total Dripline Length (m)	**7620**

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Appendix E – Loading Certificate

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WASTEWATER SYSTEM LOADING CERTIFICATE

ISSUED BY:	Smart Alliances Ltd – Jeremy Harnett
TO:	Ling Hai Group Ltd
TO BE SUPPLIED TO:	Marlborough District Council
IN RESPECT OF:	On-site Wastewater Management System
AT:	Lot 3 DP440416 and Lot 3 DP440416, Castles Road, Awatere Valley

SYSTEM CAPACITY:	System designed for a maximum of 100 overnight guests and resident staff and 20 day staff. Design load based on 220 litres/person/day for overnight users and 30 litres/person/day for day staff with a maximum daily allowance of 22,600L/day.
SPECIFIED SYSTEM:	Secondary treatment unit with land application through subsurface dripline.
RESERVE AREA:	Two potential areas identified. One can be used as a reserve once the preferred option selected at building consent phase.
WASTEWATER INPUTS:	Design based on standard accommodation facility plumbing fixtures.
CONSEQUENCES OF OVERLOADING THE SYSTEM:	Overloading the system beyond the design load specified could result in the treatment plant failing to meet the performance standards specified and/or the dripline land application area failing to adequately distribute the effluent due to blockages. The odour will be unpleasant and inhibit the owners use of the property.
CONSEQUENCES OF UNDERLOADING THE SYSTEM:	The treatment plants are living systems and require regular 'feeding' to maintain essential biological activity. In periods of inactivity the system may become dormant and may take a period of time before full functionality is restored. Property owners should be aware of this if the property is to be vacated for any length of time.
CONSEQUENCES OF INADEQUATE MAINTENANCE	The system should be annually maintained by a recognised maintenance contractor with a copy of maintenance records being provided to the council. Failure to do this may result in the same consequences that are outlined for overloading the system, as well as mechanical failures with system hardware. Regular monitoring should also be carried out by the owner to ensure the system is working adequately.

Date 25-01- 2016

Prepared by: Jeremy Harnett

Environmental Scientist, Accredited Wastewater System Designer

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Appendix F – Setback Distance Matrix from AS/NZS 1547 Appendix R

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Project: CASTLES ROAD
Client: LING HAI GROUP LTD
Ref: 5249
Date: 25/01/2016

Setback Distance Matrix AS/NZ 1547 Appendix R

Note - Refer to Table R1 and R2 and relevant NOTES

Site Feature	Constraint Scale			Notes:
	Low	Medium	High	
Property Boundary				
Distance Range	1.5m ----------		----------50m	
A - Microbial Quality	•			Secondary Treated
D - Slope	•			10-15°, downgradient and subsurface
J - Application Method	•			Drip and subsurface application
Weighted Setback Selected	*2m*			
Actual Setback Provided	**10m min**			
Buildings/ houses				
Distance Range	2m ----------		---------- > 6m	
A - Microbial Quality	•			Secondary Treated
D - Slope	•			10-15°, downgradient and subsurface
J - Application Method	•			Drip and subsurface application
Weighted Setback Selected	*3m*			
Actual Setback Provided	**20m min**			
Surface Water				
Distance Range	15m ----------		----------100m	
A - Microbial Quality	•			Secondary Treated
B - Surface Water (Soil effect)		•		Cat 5 soil-
B - Surface Water (Water)	•			No permanent water
B - Surface Water (Rainfall)	•			Low Rainfall
D - Slope	•			10-15° and subsurface application
E - Position of LAA		•		Up gradient of water
F - Drainage		•		Elevated, vegetated, generally draining
G - Flood Potential	•			Elevated Site
J - Application Method	•			Drip and subsurface application
Weighted Setback Selected	*30m*			
Actual Setback Provided	**120m**			

Low risk site. Secondary treated effluent. Low application rate over a large area at shallow depths to utilise the evapotranspiration benefits of the ground cover. Very high rates of evapotranspiration. Favourable setback distances from boundaries, buildings and surface water. Elevated site with no groundwater in vicinity of the land application area.