ANNEXURE 6 **Infrastructure Report**

DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

TAI TAPU – PRIVATE PLAN CHANGE PRELIMINARY SERVICE REPORT

32571 / HAUSCHILDS ROAD, TAI TAPU / S & Z CROFTS, J WILLIAMS

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Quality Assurance

Title:	Tai Tapu – Private Plan Change – Preliminary Services Report Hauschilds Road, Tai Tapu
Client:	S & Z Crofts J Williams
File Name:	T:\projects\32s\32571 - Tai Tapu\Plan Change Report\160909.32571.aod.Plan Change Report-rev6.docx
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Prepared By:	**Aiden O'Donoghue** Graduate Civil Engineer BE Civil (Hons), GIPENZ	**Signature:** 
Reviewed By:	**Jeremy Rees** Senior Civil Engineer BE Civil (Hons), CPEng, MIPENZ IntPE (NZ)	**Signature:** 

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Disclaimer

This engineering report has been prepared at the specific instruction of S & Z Crofts & J Williams. It outlines the design of the preliminary servicing for a private plan change application to rezone land for rural residential subdivision at Hauschilds Road, Tai Tapu.

Davis Ogilvie did not perform a complete assessment of all possible conditions or circumstances that may exist at the site or may be constructed. Conditions may exist which were undetectable given the extent of the investigation on site.

Davis Ogilvie's opinions are based upon information that existed at the time of the production of the document. Assessments made in this report are based on the conditions found onsite, where observed, and current engineering best practice. No warranty is included; either expressed or implied that all conditions will conform to the assessments contained in this report.

Davis Ogilvie has provided an opinion based on observations, site investigations, and analysis methodologies current at the time of reporting. The report cannot be used by any third party. The report cannot be used if there are changes in the referenced guidelines, analysis methodologies, laws or regulations.

Only S & Z Crofts and J Williams, and the Local and Regional Territorial Authority are entitled to rely upon this engineering report. Davis Ogilvie & Partners Ltd does not contemplate anyone else relying on this report or that it will be used for any other purpose.

Should anyone wish to discuss the content of this report with Davis Ogilvie & Partners Ltd, they are welcome to contact us on (03) 366 1653 or at 11 Deans Avenue, Addington, Christchurch.

1.0 Purpose of Report

The purpose of this report is to outline the preliminary engineering design concepts which are considered integral to the private plan change application for rezoning to facilitate rural residential development at Hauschilds Road in Tai Tapu. This report should be read in conjunction with the plan change application prepare by Aston Consultants.

This design report has been prepared to summarise:

- Proposed civil engineering design for the balance stages of the Tai Tapu development
- Existing infrastructure around the site
- Proposed conformance to national standards, Selwyn District Council's (SDC) policies and best practices relating to subdivision development, in particular:
    - Waterways, Wetlands and Drainage Guide (WWDG)
    - SDC's Engineering Code of Practice (ECOP)
    - NZS4404:2010 – Land Development and Subdivision Infrastructure

2.0 Proposal Description

The private plan change application for a rural residential development in Tai Tapu proposes to develop 16 rural residential lots. The lots are proposed to range in size from approximately 2,750 m² to 8,500 m². A copy of the indicative master plan is attached in Appendix 1 and shown below in Figure 1. The site is legally known as Lot 1 & 2 DP 436571, CT 537135 & CT 537136. The site is currently zoned Rural Inner Plains but is included in Selwyn District Council's Rural Residential Strategy as a preferred location for rural residential development.

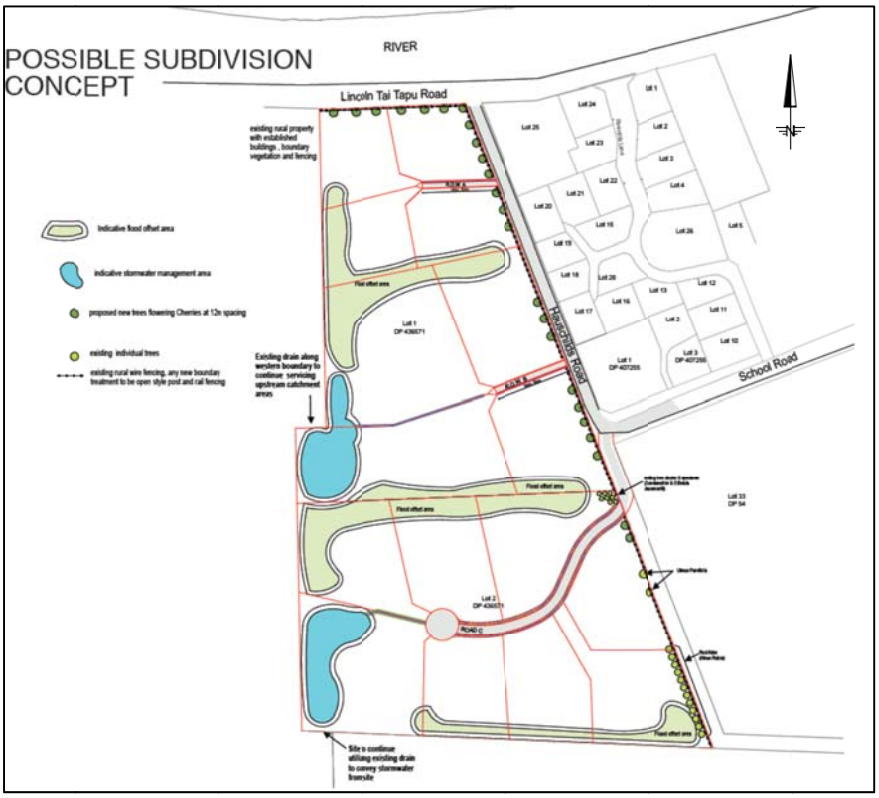

Figure 1: Possible Subdivision Concept (not to scale)

To the north of the site is Lincoln Tai Tapu Road. The western and southern boundary of the site is rural land. The site is also bounded by Hauschilds Road and the Tai Tapu township to the east of the site.

Historically, the site was has been used for agricultural and grazing purposes.

3.0 Existing Infrastructure

There is no existing SDC infrastructure within the site. However, there is existing gravity sewer and high pressure water reticulation adjacent to the site in Hauschilds Road. These are discussed further in Sections 5 and 7 respectively.

There is no existing stormwater infrastructure within the site, however, there are road side drains in Hauschilds Road.

4.0 Earthworks

All roads and ROWs in the development will be stripped of topsoil and the topsoil stockpiled in preparation for cutting to subgrade levels. Once stripped, the underlying material will be cut to the design subgrade levels.

Each lot will be provided with a nominated building platform. The finished level of this is discussed further in Section 6. Where sections required filling or cutting to achieve the design levels, the topsoil will be stripped and stockpiled. Where filling is to be undertaken, it will be done in accordance with NZS4431:1989.

The stormwater management areas, discussed in Section 6 below, will be excavated as part of the earthworks phase of the development. Finished surfaces will be grassed or planted as necessary.

In addition to the activities listed above, common services trenches, sewer, and stormwater infrastructure will require excavation for installation. The trenches will be backfilled with site material and pit run where necessary. Minor lot regrading will also be undertaken over the majority of the development.

Bulk earthworks for the development are expected to take approximately 3 months, excluding the winter period. Earthworks will be carried out in accordance with the requirements of NZS 4431:1989 (Code of Practice for Earthfill for Residential Development), SDC and Environment Canterbury.

Detailed design plans will be provided to Council during the engineering approval and Regional Authority consenting processes. A detailed erosion and sediment control plan and report will be submitted for each stage in accordance ECan's guidelines and to SDC for approval as part of these processes.

5.0 Sewer

Tai Tapu is not connected to SDC's Eastern Selwyn Sewerage Scheme (ESSS). The current agreement between SDC and the Christchurch City Council (CCC) allows for a maximum annual volume of 90,000 m³/year with a peak flow of 7.5 l/s. There are currently 279 lots allocated for connections within Tai Tapu[1].

Based on SDC's Engineering Code of Practice (ECOP) Section 6.4, the 279 allocated lots will have an average flow 1.92 l/s with a peak design flow of 9.6 l/s. This equates to approximately 60,500 m³/year of sewerage.

The applicant proposes to utilise a low pressure sewer system which will incorporate an enlarged onsite tank, e.g. an Ecoflow 2014iP tank. The pumps are proposed to pump only during off peak times and utilise the enlarged tank for storage during other times and therefore will not increase the peak flow from Tai Tapu. The optimal off peak time would be determined in consultation with SDC's asset management team. This would ensure the peak flow aspect of SDC's agreement with CCC is not breached.

With the proposed addition of 16 rural residential lots the total volume discharged per year is approximately 64,000 m³, which is still below the volume limit mentioned above. In combination with the off peak pumping the proposed 16 rural residential lots would have a less than minor effect on Tai Tapu's sewer reticulation.

Each of the onsite tanks will discharge into a common low pressure rising main which will be vested as a council asset. The rising main will discharge into an appropriate gravity reticulation sewer manhole determined during detailed design. The onsite tanks and associated pumps will remain under private ownership.

[1] Email correspondence with M. England, Strategic Asset Manager, Selwyn District Council on 04/02/14 & 12/02/14

6.0 Stormwater

Stormwater reticulation and management will be designed in accordance with the Selwyn District Council's Engineering Code of Practice (ECOP), the Christchurch City Council Waterways, Wetlands and Drainage Guide (WWDG) and engineering best practice.

A hydrological model will be developed based on the SCS TR-20 method, or similar, along with hand calculations using the Rational Method will be used to size the stormwater management system.

A discharge consent from Environment Canterbury will be gained as part of the subdivision process which will include construction phase stormwater along with operational phase stormwater. The stormwater management area is not expected to be vested with Council.

The following parameters, amongst others, will be used to model the stormwater flows for the relevant design storms:

- Storm reticulation design storm – 10% AEP (1/10 year event)
- Secondary flow path design storm – 2% AEP (1/50 year event)
- Zone: Rural residential
- T_e = 10 minutes (NZBC 2.3.2 a))
- Storm profile as per Figure 21-7 of WWDG (December 2011 amendment)

The site is in the Halswell River catchment area, therefore all storm events up to and including the 60 hour 2% AEP storm events will be allowed for.

The pre-developed site has a Rational run-off coefficient of 0.3 due to being pastoral green field sites. The post-developed Rational run-off coefficient has been calculated to be 0.51. The table below shows the assumptions made when determining the post-developed run-off coefficient. Values for 'C' were taken from E1/VM1, Table 1: Run-off coefficients.

Table 1: Average run-off coefficient (C) for post-developed site		
Post-development run-off coefficient		
	Area (m²)	**C**
Roads	1,989	0.85
Driveways	2,103	0.85
Building Platforms	5,840	0.9
Landscaping	26,740	0.3
Ponds	3,828	1
Post-developed site run-off coefficient C		0.51

A stormwater management system, consisting of stormwater detention basins, amongst other devices, will be utilised to attenuate stormwater onsite back to pre-developed levels.

6.1 Primary Reticulation System - 10% AEP Event

Stormwater flows from events up to and including the 10% AEP event will be conveyed in road side swales, as shown in the typical cross section in Section 10. First flush treatment may also be required depending on Regional Consent requirements.

6.2 Secondary Reticulation System - 2% AEP Event

Stormwater up to and including the 60 hour 2% AEP flood events will be conveyed in secondary flow paths as shown in Sheet 101 B, Appendix 2. The road carriageway and roadside swales will serve as the main flow paths directing the stormwater into two proposed detention ponds with a combined storage volume of 2,700 m^3. The preliminary depth of these ponds will be 700 mm with sloping sides at a grade of 1:4.

This combined storage volume of 2,700 m^3 will be used to attenuate stormwater run-off created from the proposed development of the site. This was calculated using the Rational Method as per E1/VM1 and comparing the pre and post developed flows for the site. This volume is preliminary and will be confirmed during the consenting and detailed design phases.

First flush treatment ponds have also been shown indicatively on the plan. The exact size of these treatment areas will be confirmed during the detailed design phase should they be required.

All works will be designed in detail and constructed in accordance with SDC requirements. Final details and supporting calculations will be provided as part of the engineering approval process.

6.3 Flood Water Offset

A flood risk assessment of the site was undertaken by Environment Canterbury in 2012. A copy of this assessment is included in Appendix 3.

Historic photos from 1975, 1977, 1986, 1992, and 1994, in conjunction with ECan flood modelling based on 200 year and 500 year return periods for the site, indicate flood levels of approximately 6.4-6.9 m above mean sea level, depending on the return period.

To mitigate against the risk of flooding to future dwellings, it is proposed that building platforms be constructed to elevate the dwellings and achieve a minimum freeboard of 0.4 m from the 0.5% AEP event, as per Section 5.6.5 of the Selwyn District Council's Engineering Code of Practice (ECOP) Table 1 for "habitable building floors", and the Canterbury Regional Policy Statement (CRPS Dec. 2013).

The minimum finished floor level will need to be determined during the detailed design phase and then confirmed by SDC or ECAN as part of the subdivision consent or building consent.

These building platforms will be approximately 900 mm above existing ground levels on site and will have sloping sides at a grade of 1:5. This will result in approximately 4,350 m^3 of displaced flood water in the 200 year event. It is proposed that three off-set storage areas will be used to mitigate against the 4,350 m^3 of displaced flood water caused by these building platforms, thereby continuing to provide flood water storage on site.

6.4 On site soakage

Double ring infiltrometer soakage testing was carried out on site. Four tests were carried out; two tests on the topsoil in the proposed flood attenuation areas, and two tests approximately 240 mm below the surface in the proposed detention pond areas. An ultimate soakage value of 23 mm/hr was measured for the site silts. These soakage rates will be allowed for during the detailed design phase to provide nominal onsite volume attenuation. The tests results are included in Appendix 4 of this report.

7.0 High Pressure Water

The existing 100 mm uPVC main in Hauschilds Road will be utilised to provide high pressure water reticulation to each lot. During the detailed design phase, the layout of the mains and laterals will be confirmed.

Fire hydrant spacing will be in accordance with SNZ PAS 4509:2008 – New Zealand Fire Service – Fire Fighting Water Supplies Code of Practice.

Hydraulic gradients, when running at peak demand (excluding firefighting flows) will be kept below 0.01 m/m.

Submain layout will be designed in accordance with Section 7.8.5.

8.0 Common Services Trenching

Services including water, power and telecommunications will be installed within a common services trench to be located generally within the berm area of the road reserve immediately adjacent to the lot boundaries. Specific locations will be provided following consultation with the service authorities and plans are to be provided for approval by Council prior to installation.

Telecommunication reticulation design and supply for each stage will be undertaken by Chorus. Fibre optic reticulation will be installed in this subdivision.

Power reticulation design for each stage will be undertaken by an approved Orion networks designer and installed by an approved Orion contractor.

All works carried out will meet the requirements of Council and the network operators.

9.0 Lighting

Lighting will be designed to provide a minimum of P3 luminance on vested roads and pedestrian areas. The lighting will be designed in accordance with AS/NZS 1158.3.1 Road Lighting – Pedestrian Area (Category P) lighting. LED street lighting will be provided.

10.0 Roading

A transportation assessment has been prepared by Novo Group and is attached in the plan change application. It provides detail on the proposed legal and carriageway widths.

The carriageway pavements will be designed in accordance with the Christchurch City Council's Pavement Design Chart for the appropriate road hierarchy at the time of engineering approval. The ROW and roads will be designed in accordance with the Engineering Code of Practice during the detailed design phase.

11.0 Health and Safety

Health and safety are of paramount importance throughout the design and construction phase of any construction project. During the detailed design phase, the proposed methodologies for each aspect of construction and the alternatives considered, along with the health and safety considerations given toward future operations and maintenance, will be examined in detail.

In addition, a Site Specific Safety Plan (SSSP) will be prepared by the Contractor and provided to the Engineer and local authority for approval prior to any works commencing onsite. The SSSP will be treated as a live document and updated regularly by the main contractor when new hazards are identified.

The SSSP will assist in the recording of hazard identification and management; investigation into incidents, including near misses; training and inducting new personnel and visitors to site; explaining the procedures for what to do in an emergency; and clarification of the responsibilities of each party with regards to health and safety on the construction site.

12.0 Conclusion

Based on the above information we believe that there are suitable solutions to enable development of the applicant's land in Tai Tapu.

Stormwater will be managed and attenuated on site to pre-developed levels and flood water will also be managed on site to reduce the risk of affecting neighbouring properties.

The constraint identified in the draft Rural Residential strategy that no further connections are available to CCC's Bromley treatment plant can be managed by the use of a low pressure sewer system with extended duration storage tanks and off peak pumping.

It should be noted that the above assessment is based on the information available at the time of writing and that no detailed design has been undertaken for the proposed development. We expect that further investigation is required to confirm the economic viability of the development based on current market conditions

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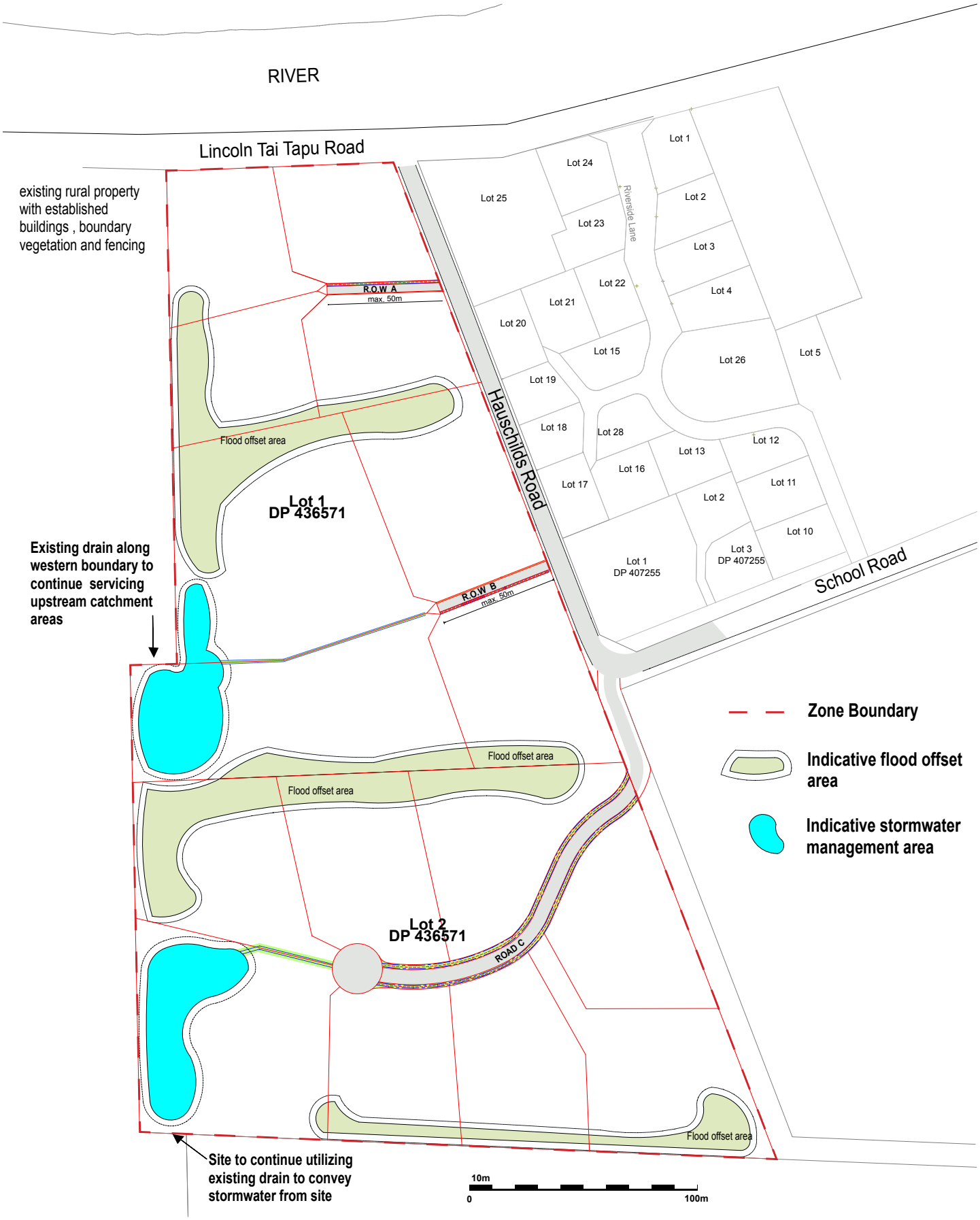
Appendix 1

Possible Subdivision Concept



aston CONSULTANTS
resource management & planning

a+urban
architecture masterplanning urban design

POSSIBLE SUBDIVISION CONCEPT
Living 3 Zone Tai Tapu

Appendix 2

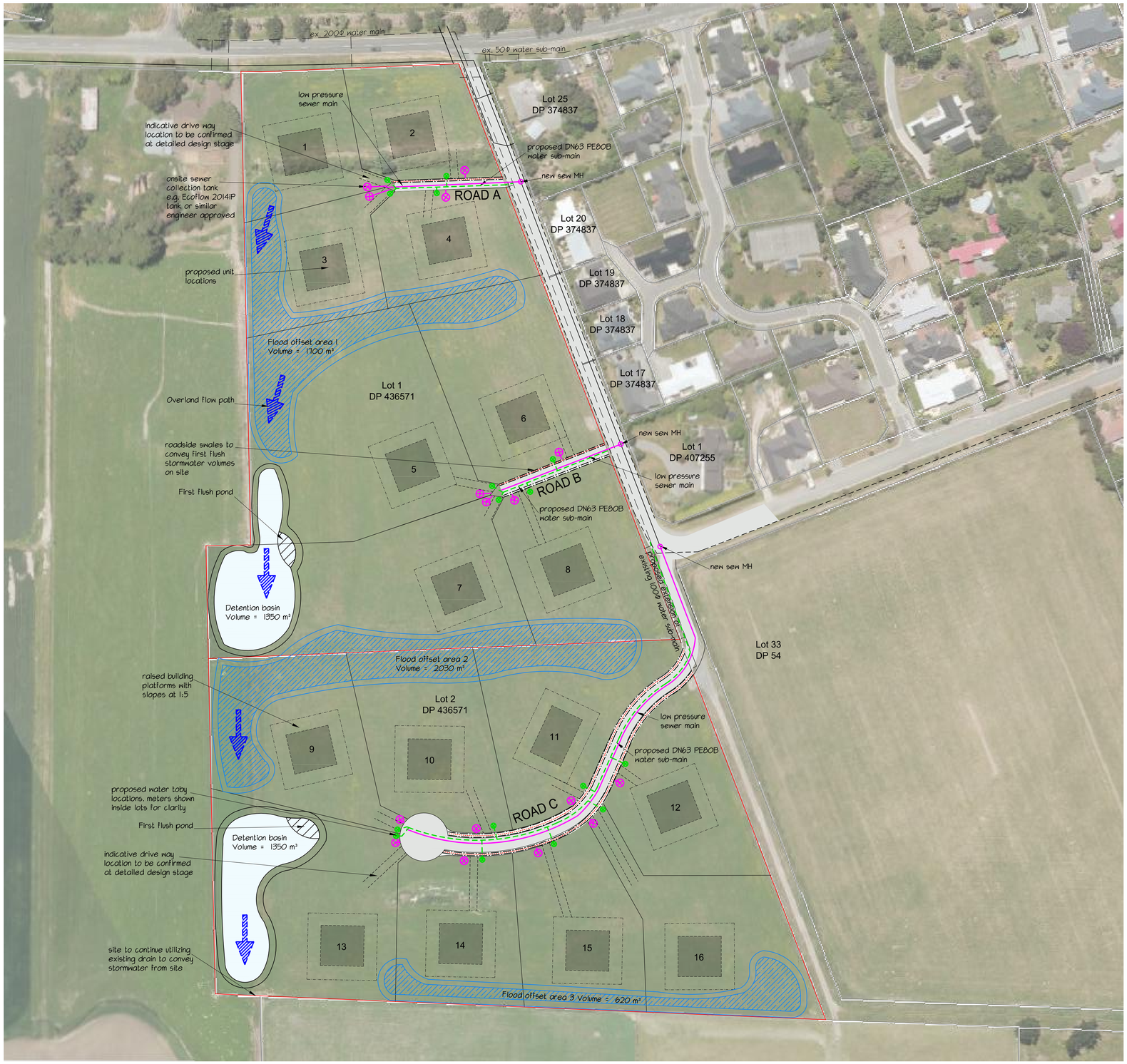
Sewer, Stormwater, Water, & Roading Plan

contractor to locate all existing services & verify all dimensions before commencing work

issue	date	reason	approved
A	24/02/16	Preliminary engineering design for plan change	JR
B	05/04/16	Revision based on client's feedback	JR
C	09/09/16	Removal of road cross-sections	JR

KEY

- SWALE
- SWALE INVERT
- NEW WATER
- EXISTING WATER
- NEW STORMWATER
- EXISTING STORMWATER
- NEW SEWER
- EXISTING SEWER
- BUILDING PLATFORMS
- INDICATIVE DRIVEWAY LOCATIONS
- STORMWATER MANAGEMENT BASIN
- FLOOD OFFSET AREA
- FIRST FLUSH TREATMENT PONDS
- HATCH - ROADS
- HATCH - BERM
- OVERLAND FLOW PATH
- 25mm OD SECTION CONNECTION (unless noted otherwise)
- ONSITE SEWER COLLECTION TANK E.G. ECOFLOW 2014IP TANK OR SIMILAR ENGINEER APPROVED



THESE PLANS ARE PRELIMINARY DESIGN ONLY. THEY ARE INTENDED TO BE READ WITH DAVIS OGILVIE & PARTNERS' TAI TAPU - PRIVATE PLAN CHANGE PRELIMINARY SERVICES REPORT.

CAD ref: 32571.Tai Tapu.Plan change.dwg

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Also - Nelson, Timaru, Greymouth

PROPOSED PLAN CHANGE
LOT 1 DP 436571, & LOT 2 DP 436571, TAI TAPU

POSSIBLE ENGINEERING CONCEPT
SEWER, STORMWATER, WATER, & ROADING PLAN

design	drawn	QA check	dwg	issue
AO'D	AO'D	JR	101	C
scale @ A1	date	file		
1:1000	02/16	32571		

Environment Canterbury
Your regional council

58 Kilmore Street, PO Box 345, Christchurch
General enquiries: (03) 365-3828
Fax: (03) 365-3194
Email: ecinfo@ecan.govt.nz
Customer services: (03) 353-9007
or: 0800 EC INFO (0800 324-636)
Website: www.ecan.govt.nz

8 August 2004

Fiona Aston Consultancy Ltd
P O Box 1435
Christchurch

Attention: Fiona Cooper

Dear Fiona

FLOOD RISK – CUNNINGHAM HOLLAND ENTERPRISES, LOT 1 DP 37450, HAUSCHILDS RD, TAI TAPU

Reference your inquiry seeking any information that Environment Canterbury holds on flood risk in relation to the proposed subdivision of Lot 1 DP 37450 located at Hauschilds Road, Tai Tapu as shown on the attached plan.

Environment Canterbury has photographs of the property taken following rainfall events in 1975, 1977, 1986, 1992 and 1994. Attached for your information are Photograph No.15833(16 June 1975), No.16482(6 July 1977), No.603(24 August 1986), No.617(30 August 1992) and No.216(28 July 1994). Rainfall over 72 hours recorded at Lincoln for the 1986 and 1992 events and approximate return periods were 1986, 81mm, 2yr; 1992, 94mm, 4yr. With regard to the 1986 event, because of rainfall earlier in the month, it is considered that the return period of the flooding associated with this rainfall was slightly higher than the return period of the rainfall. Rainfall figures for the general area indicate that the 1994 event had a return period of approximately 1 year.

The 1975 & 1977 events were considerably larger than those in 1986 and 1992 with 150mm of rainfall being recorded at Tai Tapu for the 72 hours to 9am on 16 June 1975. The return period of this rainfall is considered to be in the order of 20 years. River levels in the Halswell River for the 1977 event, which are the highest on record, are estimated to have a 20 year return period following a rainfall event of similar magnitude to that in 1975. However wetter antecedent conditions contributed to higher flood levels than in 1975.

It should also be noted that the photographs may not necessarily show flooding at its peak as there is usually a delay between the cessation of rainfall and taking the photographs. Rainfall and river level information for the above storm events is attached.

As previously mentioned, the highest recorded flood levels that Environment Canterbury has for the Halswell River were recorded in the storm event of July 1977. The 1977 North Canterbury Catchment Board flood report(R Dineen) comments that it is believed that the flood level recorded at the Tai Tapu Depot for this event was the

Our Ref: AD5C-0018
Your Ref:
Contact: R Holmes

highest recorded flood in the Halswell River in the history of the Board(since 1947). Environment Canterbury does not have a 1977 Halswell River flood level recorded at the township. Interpolating from levels recorded at the Environment Canterbury Depot and Branthwaites Bridge(Golf Links Road) gives an estimated water level at the SH75 Bridge of 6.69metres above mean sea level(m.a.m.s.l.).

During the 1977 event a flood level of 6.426m.a.m.s.l. was recorded at Mr Schouten's property at 11 Main Road, Tai Tapu and is considered to be representative of levels in the School Road / Forbes Road ponding area. This is the highest he had known in the 39years he had lived at the property prior to 1996. Flood modelling for the School Road/Forbes Road area has recently been completed and the flood level for a 200 year and 500 year return period 48 hour duration rainfall event without the pumps working are 6.88 and 6.93m.a.m.s.l. respectively.

The area that you have inquired about is to the west of SH75 and historical information shows that it is not at risk from ponded floodwaters to the same degree as the School Road/Forbes Road area. As you are aware, levels have been taken across the property. Further levels to the southeast of the property are required to fully assess the extent of any flood risk to the property as any ponding on the property will be largely determined by the topography of the land to the southeast.

The disposal of stormwater from the proposed development needs to be carefully assessed. Stormwater outlets to the Halswell River have the potential to be severely restricted at times of high river levels and stormwater retention systems may be required to mitigate adverse effects associated with stormwater disposal. The need for discharge consents should be discussed with staff of Environment Canterbury's Customer Services Section.

Tai Tapu has also been mapped as being on the Waimakariri River floodplain because of the possibility of Waimakariri River overflows reaching the Halswell River catchment. The risk is such that Environment Canterbury has not previously recommended the need for minimum floor levels to mitigate against flooding from that source.

Yours sincerely

R Holmes

Richard Holmes
SENIOR RESOURCE MANAGEMENT PLANNER
Encl

Cunningham Holland Enterprises

Grid Reference: M35:7334-2701

The information in this plot has been taken from Environment Canterbury's records. It is supplied in good faith but its accuracy or completeness is not guaranteed. If the information is relied on in support of a resource consent application it should be verified independently.

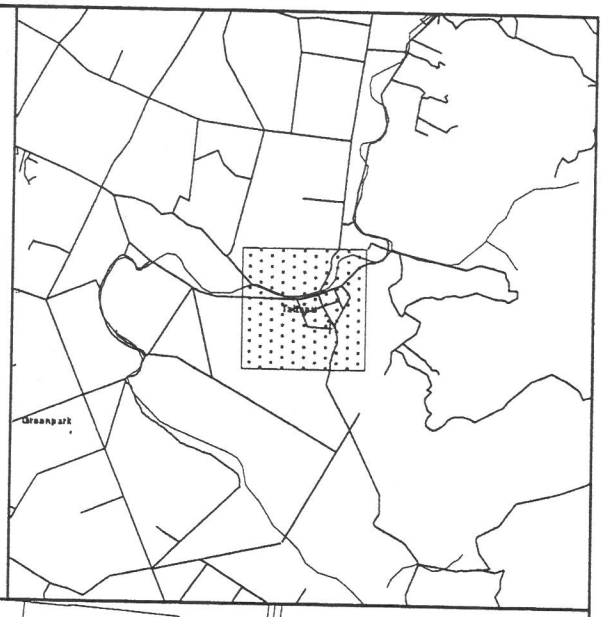
Digital Terrain information obtained from the NZTopo Database. (CROWN COPYRIGHT RESERVED).

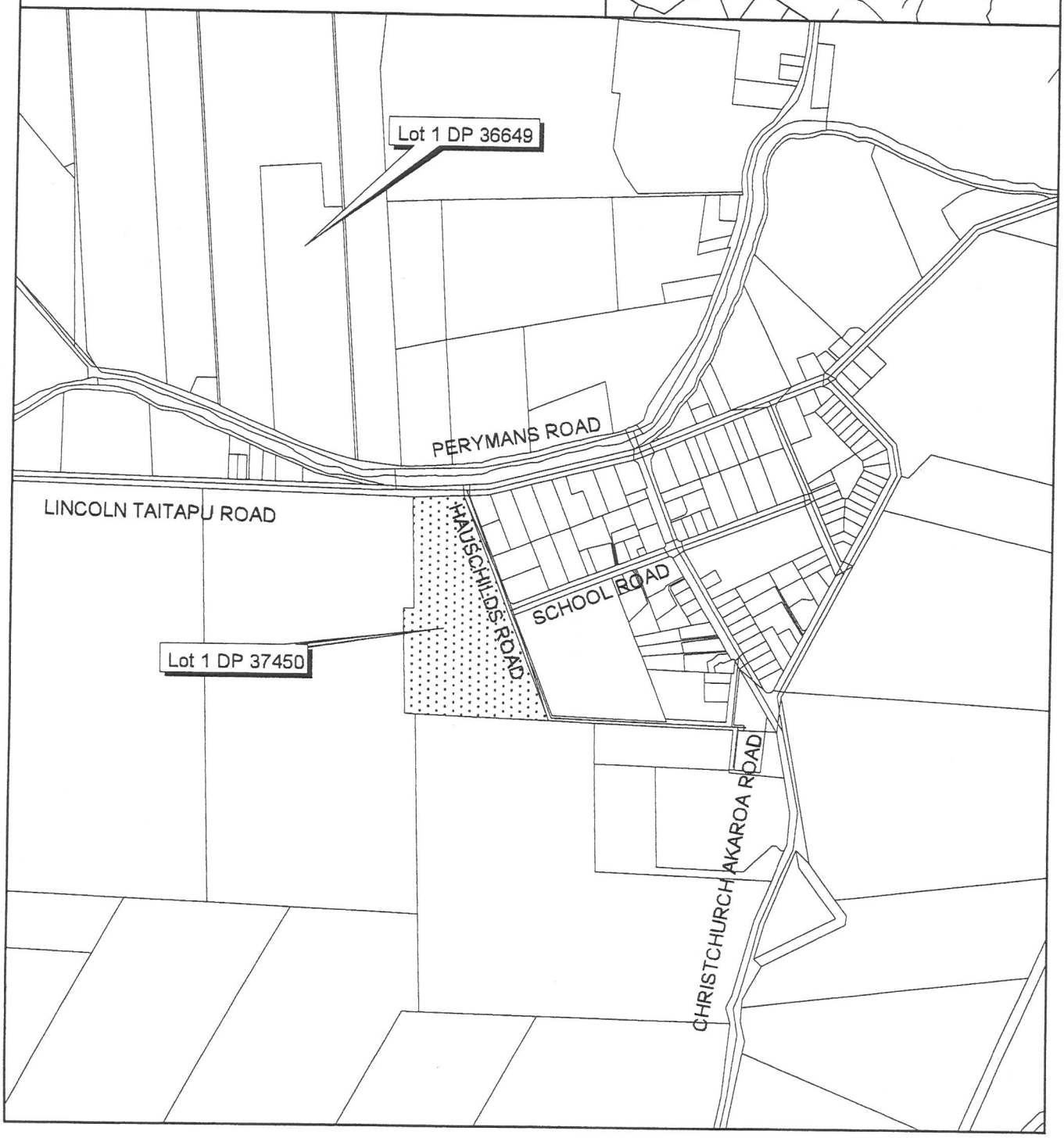
Created by the Environment Canterbury's GIS PLOTS system (2001).

Created by: RichardH
Date: June 13, 2004
Scale: 1:11485

Land Parcels
District Boundaries
Roads

0 100 200 300 400 Meters





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Grid Reference: M36:7334-2701

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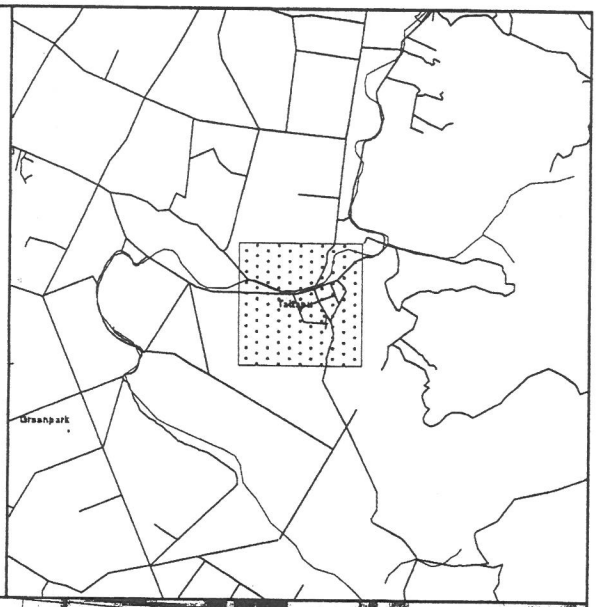
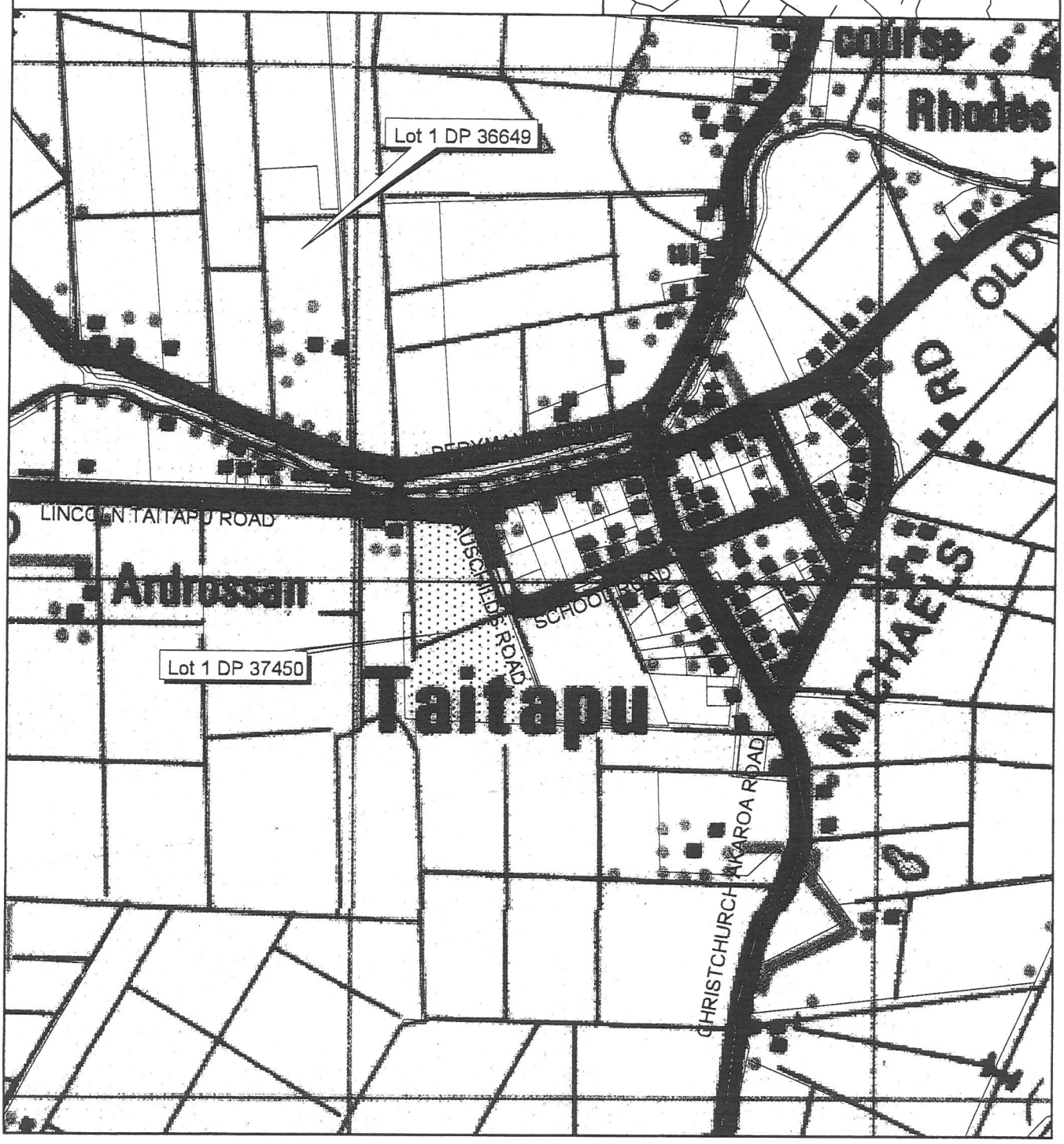
Created by: RichardH
Date: June 13, 2004
Scale: 1:11486

Land Parcels
District Boundaries
Roads

0 100 200 300 400 Meters





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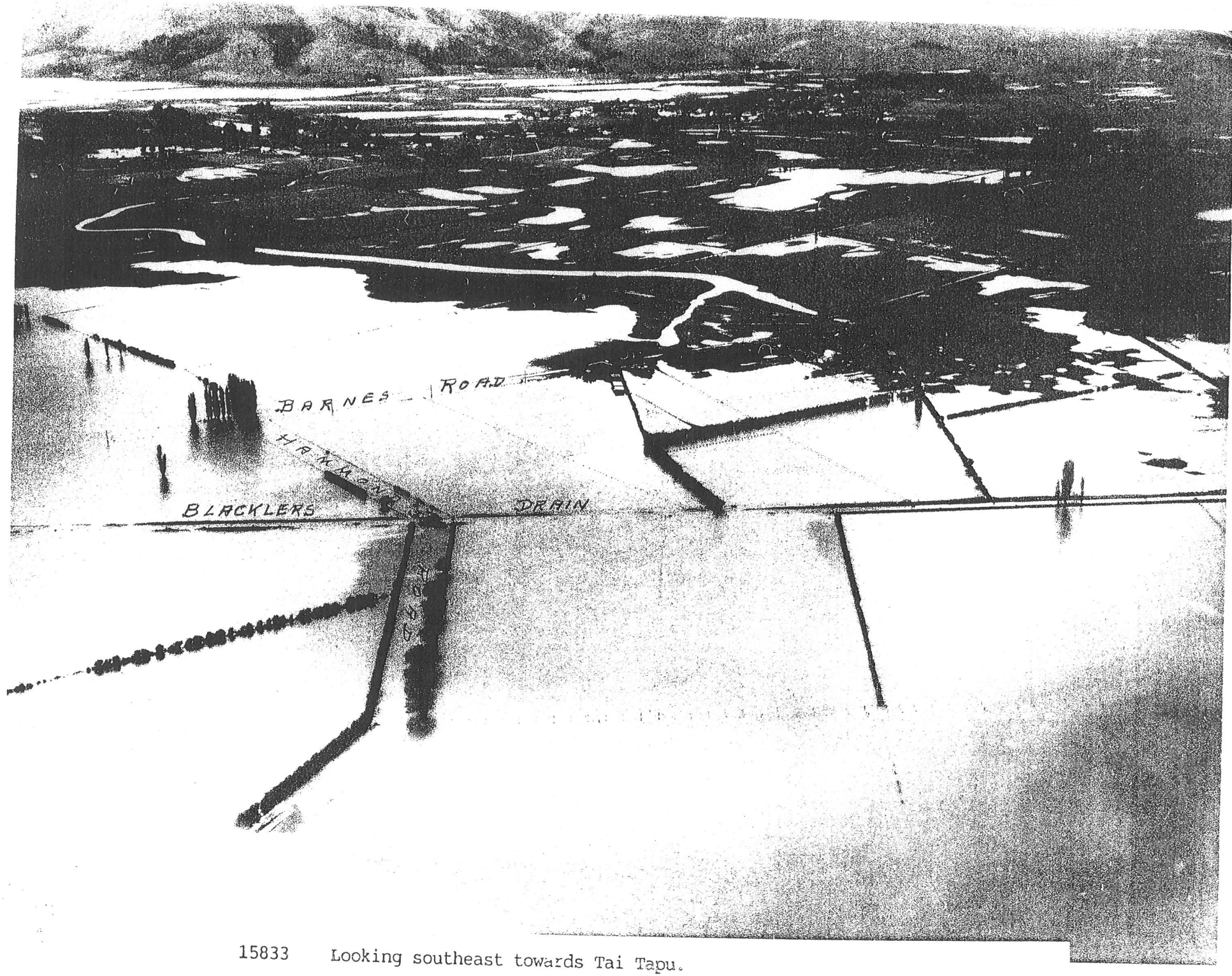
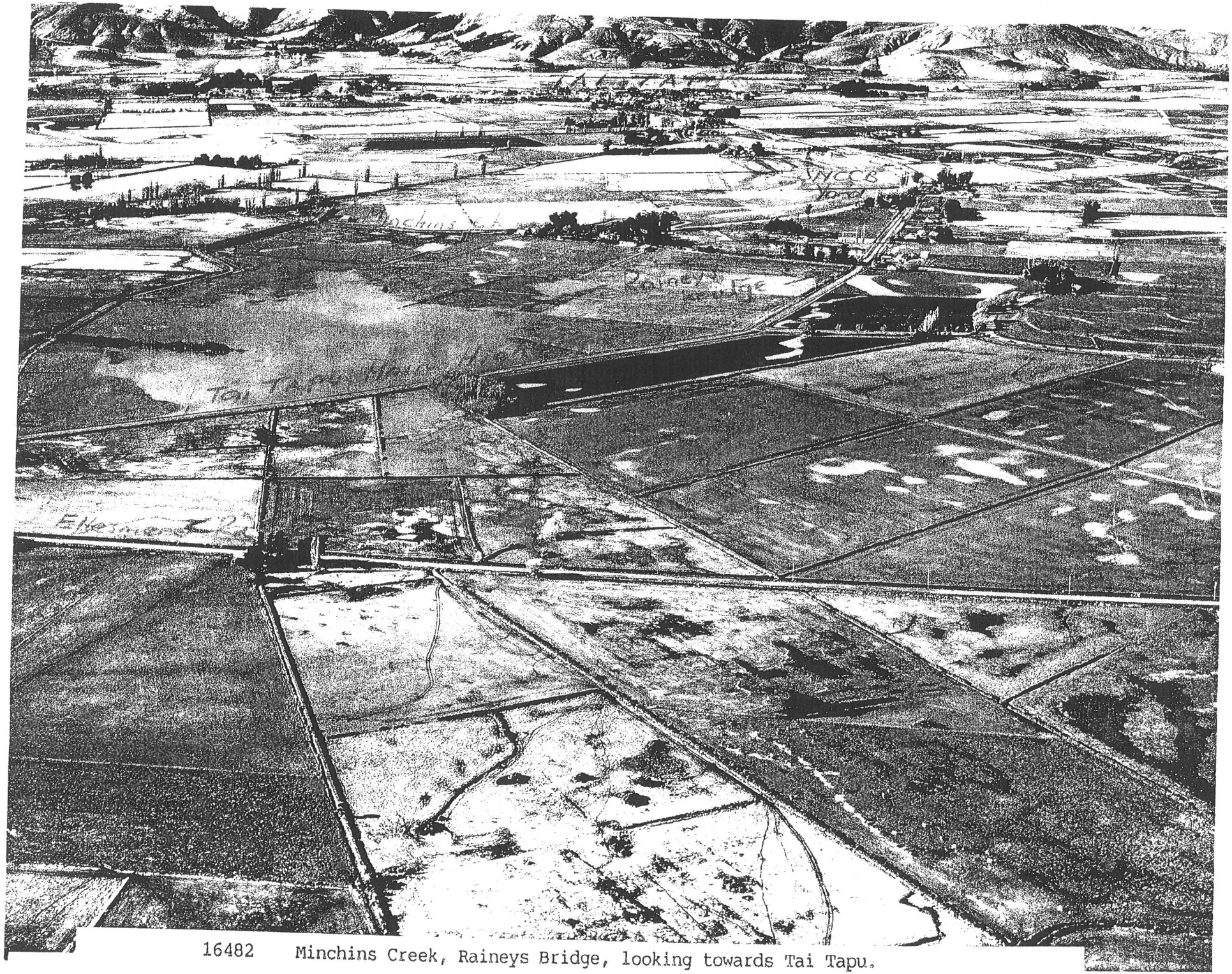


15833 Looking southeast towards Tai Tapu.

16 JUNE 1975



16482 Minchins Creek, Raineys Bridge, looking towards Tai Tapu.

603. Leatham Swamp centre left. Tai Tapu centre right. (North)
(24/8/1986)

617 Looking along Lincoln Tai Tapu Road and Halswell River. Davis/Wards Roads lower right (East) (30/8/1992)

Cunningham Holland Enterprises

Grid Reference: M36:7334-2701

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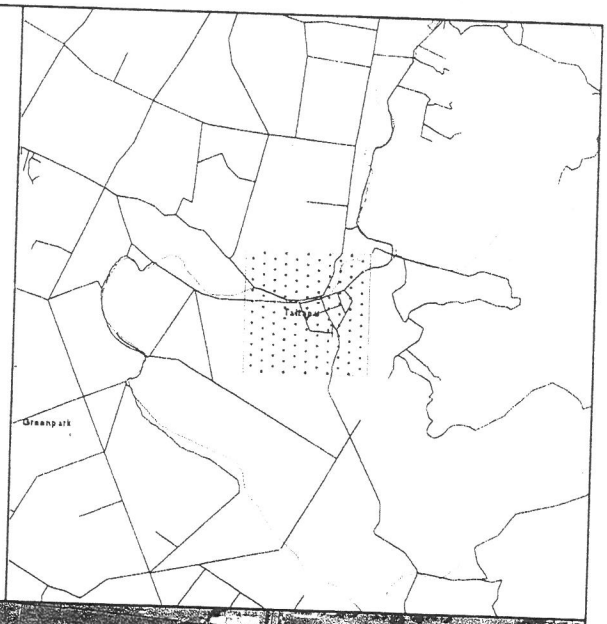
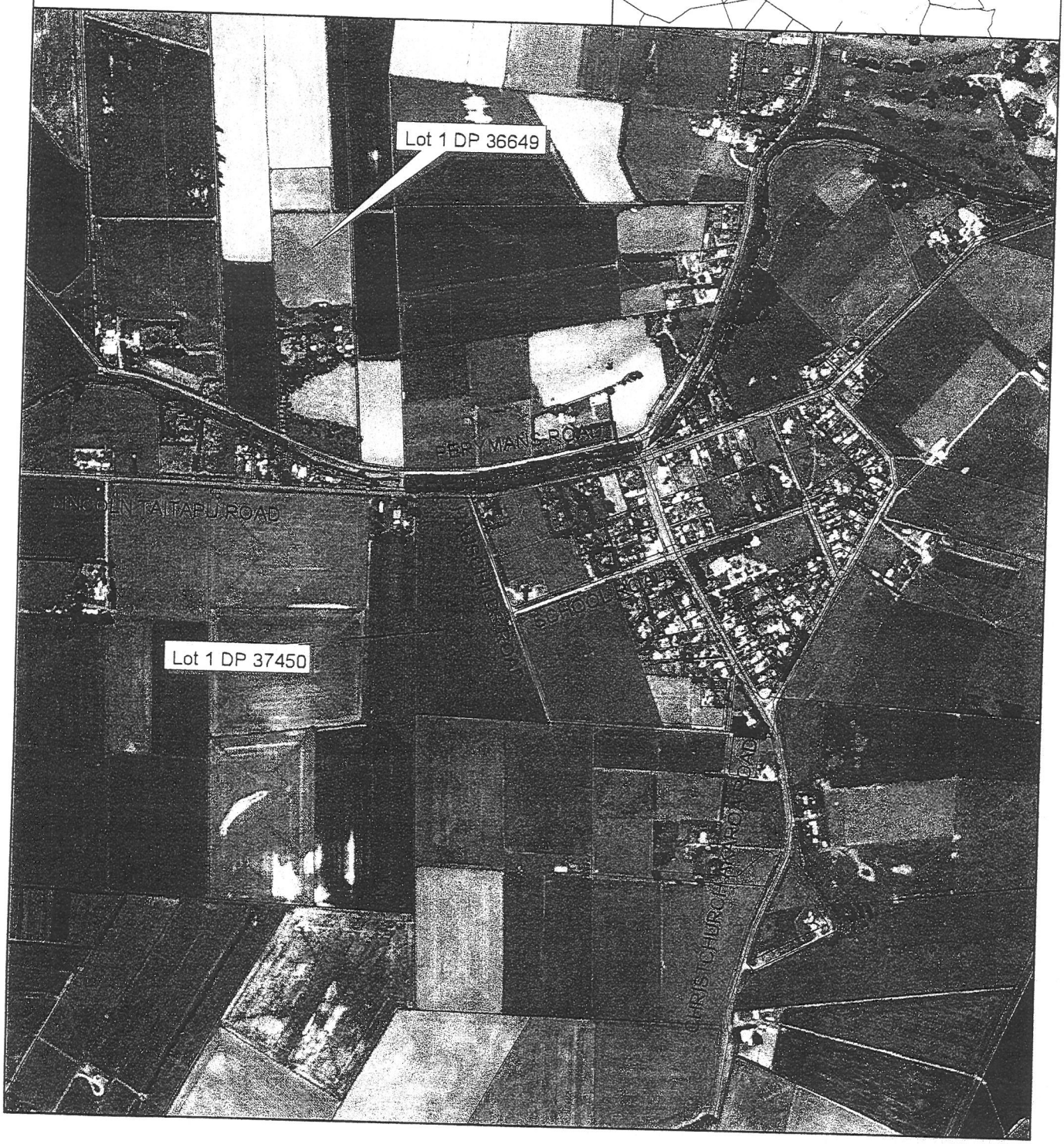
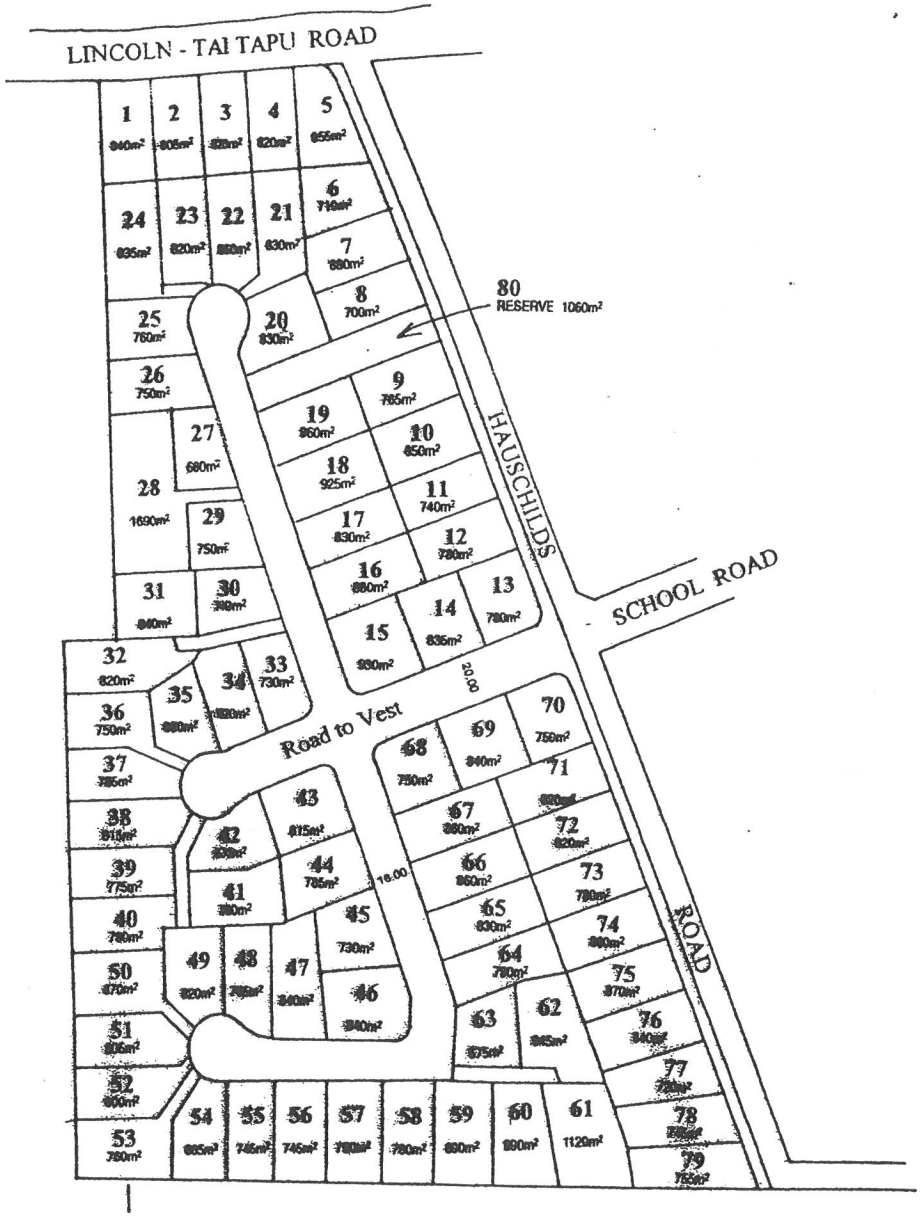




Contour Levels for

Lot 1

DP 37450



2
D. P. 37450

SHERWOOD GRANGE

Residential Development, Tai Tapu

FRIZZELL & ASSOCIATES SURVEYORS
452 Papanui Road, Papanui, Christchurch, New Zealand
Ph: 03 357 5199 Fax 03 352 5527 P O Box 5554

Proposed Subdivision of Lot 1 D.P. 37450 - C.T. 16F/1243

Note: Areas & dimensions are approx only & subject to final survey & approval.

SHEET 02

28 JULY 1994

216 Tai Tapu (Northwest) (28/7/1994)

30 AUG 1992

617 Looking along Lincoln Tai Tapu Road and Halswell River. Davis/Wards Roads lower right (East) (30/8/1992)

603. Leatham Swamp centre left. Tai Tapu centre right. (North)
(24/8/1986)

Cunningham Holland Enterprises

Grid Reference: M36:7334-2701

The information in this plot has been taken from Environment Canterbury's records. It is supplied in good faith but its accuracy or completeness is not guaranteed. If the information is relied on in support of a resource consent application it should be verified independently.

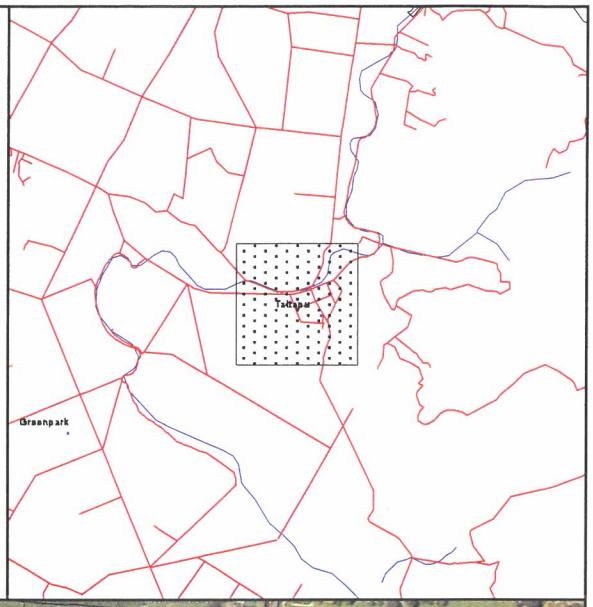
Digital Terrain Information obtained from the NZTopo Database. (CROWN COPYRIGHT RESERVED).

Created by the Environment Canterbury's GIS PLOTS system (2001).

Created by: RichardH
Date: June 13, 2004
Scale: 1:11486

Land Parcels
District Boundaries
Roads

0 100 200 300 400 Meters



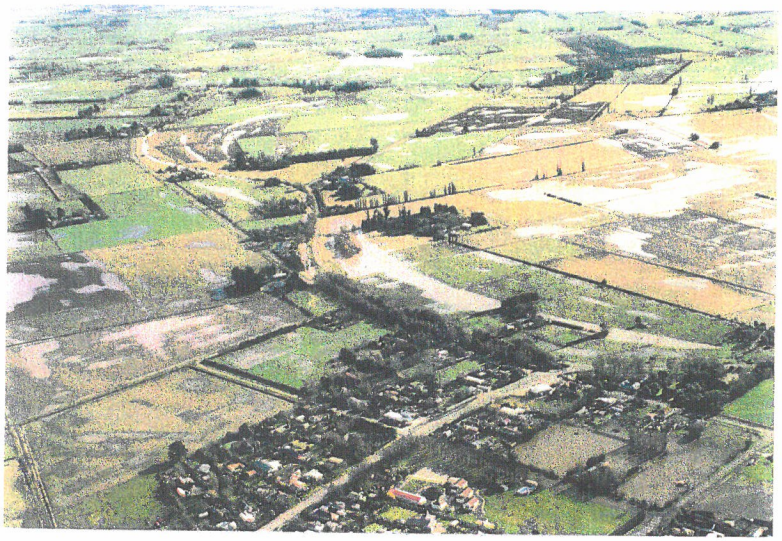
28 JULY 1994

st) (28/7/1994)

28 JULY 1994

st) (28/7/1994)

28 JULY 1994



216 Tai Tapu (Northwest) (28/7/1994)

Appendix 4

Soakage Test Results

DAVIS OGILVIE AND PARTNERS LIMITED
T. 0800 999 333 / T. (03) 366 1653
E. hello@do.co.nz / **www.do.co.nz**
11 Deans Ave, Addington / P O Box 589, Christchurch
OFFICES IN CHRISTCHURCH, TIMARU, NELSON AND GREYMOUTH

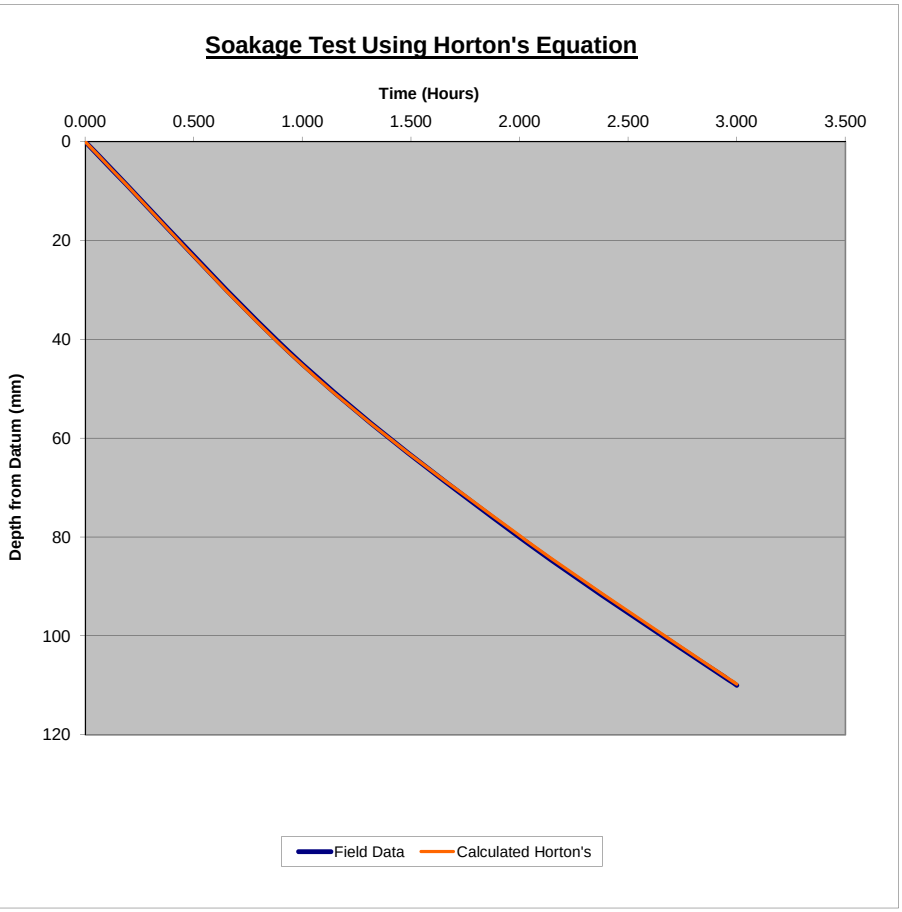
DAVIS OGILVIE
ENGINEERS / SURVEYORS / PLANNERS

FALLING HEAD INFILTRATION TEST RESULTS

TEST 1

Issued to:	**File**		
Date:	**26 July 2016**	Job name:	**Tai Tapu - Lots 1 & 2 DP 436571**
Time:		Job no:	**32571**
People/equipment/materials on site:		**Mark s and Andy B**	
Weather/ground conditions:		**Sunny**	
Test/photographs taken:		**Double Ring infiltration test (below Topsoil - 0.24m)**	
Health and safety:		✓	

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	60.00	45
2	120.00	80
3	180.00	110



Initial Infiltration Rate:	**54.50**	**mm per hour**
Ultimate Infiltration Rate:	**27.00**	**mm per hour**
Horton's Decay Coefficient:	**0.89**	**per hour**

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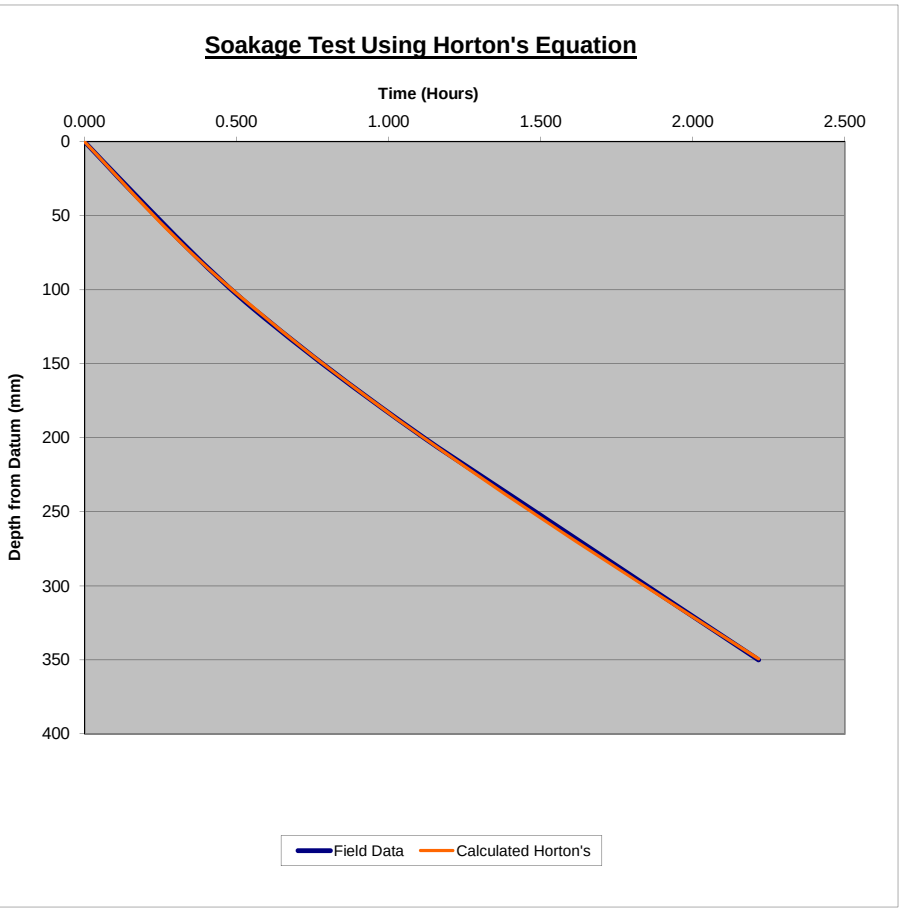
FALLING HEAD INFILTRATION TEST RESULTS

TEST 2

Issued to:	**File**		
Date:	**26 July 2016**	Job name:	**Tai Tapu - Lots 1 & 2 DP 436571**
Time:		Job no:	**32571**
People/equipment/materials on site:		**Mark s and Andy B**	
Weather/ground conditions:		**Sunny**	
Test/photographs taken:		**Double Ring infiltration test (On Topsoil)**	
Health and safety:		✓	

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	14.00	50
2	29.00	100
3	47.00	150
4	67.00	200
5	89.00	250
6	111.00	300
7	133.00	350



Initial Infiltration Rate:	**241.00**	**mm per hour**
Ultimate Infiltration Rate:	**127.00**	**mm per hour**
Horton's Decay Coefficient:	**1.64**	**per hour**

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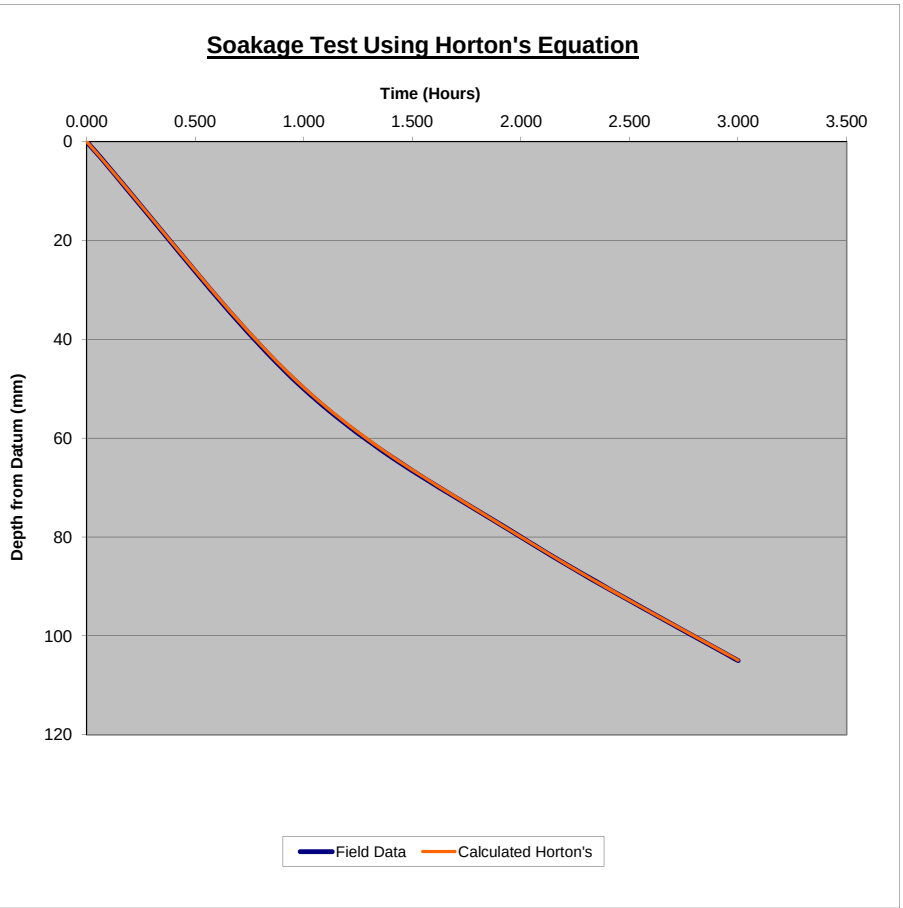
FALLING HEAD INFILTRATION TEST RESULTS

TEST 3

Issued to:	**File**		
Date:	**26 July 2016**	Job name:	**Tai Tapu - Lots 1 & 2 DP 436571**
Time:		Job no:	**32571**
People/equipment/materials on site:		**Mark s and Andy B**	
Weather/ground conditions:		**Sunny**	
Test/photographs taken:		**Double Ring infiltration test (below Topsoil - 0.24m)**	
Health and safety:		✓	

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	60.00	50
2	120.00	80
3	180.00	105



Initial Infiltration Rate:	**71.00**	**mm per hour**
Ultimate Infiltration Rate:	**23.00**	**mm per hour**
Horton's Decay Coefficient:	**1.31**	**per hour**

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DAVIS OGILVIE
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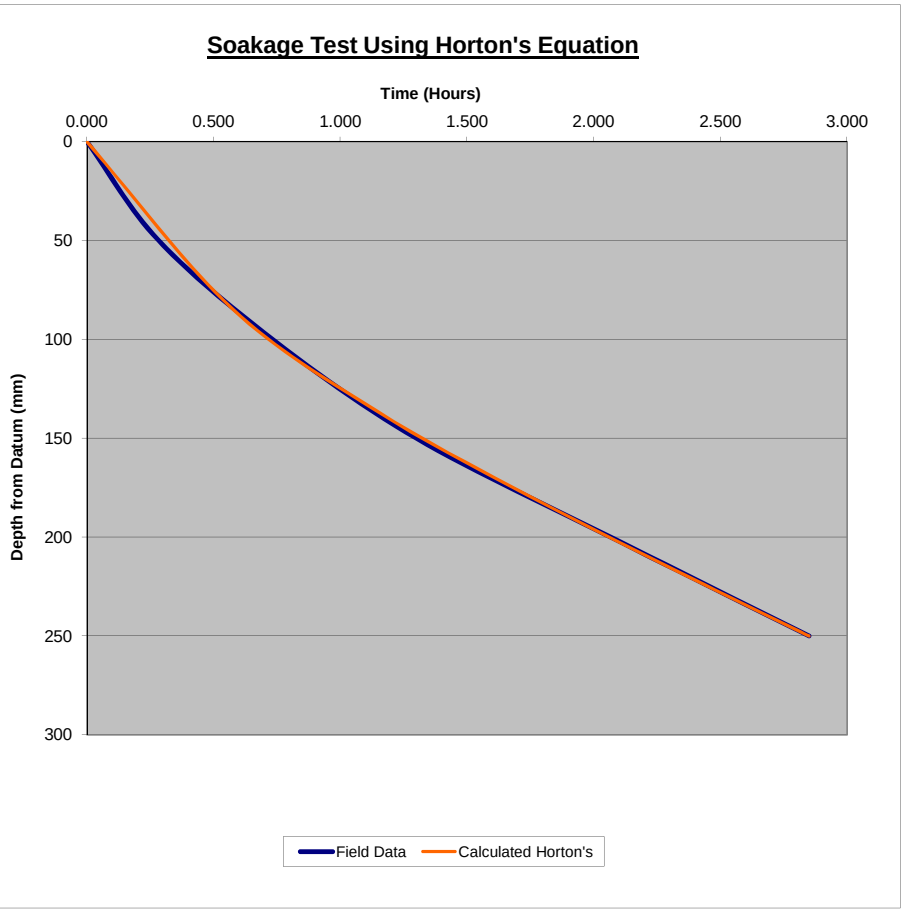
FALLING HEAD INFILTRATION TEST RESULTS

TEST 4

Issued to:	**File**		
Date:	**26 July 2016**	Job name:	**Tai Tapu - Lots 1 & 2 DP 436571**
Time:		Job no:	**32571**
People/equipment/materials on site:		**Mark s and Andy B**	
Weather/ground conditions:		**Sunny**	
Test/photographs taken:		**Double Ring infiltration test (On topsoil)**	
Health and safety:		✓	

Timestep	Time (mins)	Depth from Datum (mm)
0	0.00	0
1	17.00	50
2	44.00	100
3	78.00	150
4	124.00	200
5	171.00	250



Initial Infiltration Rate:	**202.00**	**mm per hour**
Ultimate Infiltration Rate:	**62.00**	**mm per hour**
Horton's Decay Coefficient:	**1.90**	**per hour**