ANNEXURE 5

Feasibility of Stormwater Management

Feasibility of Stormwater Management for the Proposed Denwoods Trustees Development

Prepared for

Denwoods Trustees Limited

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Limitations:

The report has been prepared for Denwoods Trustees Ltd, according to their instructions, to support an application for a plan change for a site at 1486 Springs Road, Lincoln. The information contained in the report should not be used by anyone else or for any other purposes.

Executive Summary

It is proposed that 1486 Springs Road, Lincoln owned by Denwoods Trustees Ltd is developed into a rural residential subdivision. In order to develop the site, it is necessary to determine whether the quality and quantity of stormwater runoff from the site can be managed to ensure there are minimal impacts on the downstream receiving environment while maintaining the drainage capacity of the waterways receiving runoff.

Denwoods Trustees Ltd, has engaged Pattle Delamore Partners Limited to produce this report which assesses the ability of the site to be developed with respect to stormwater. The assessment demonstrates that the site is suitable for rural residential development subject to appropriate stormwater management.

This report has determined that the runoff from the site can be treated and detained within the site to minimise the rate of runoff and adverse effects on water quality. In addition, it is considered that a conveyance system can be put in place to maintain the existing drainage flow through the site.

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1.0 Introduction

Denwoods Trustees Ltd seeks a re-zoning of 57.7 ha of land at 1486 Springs Road, Lincoln, from Rural Outer Plains to Living 3 to enable rural residential development of the land. An application for a plan change for this site has been lodged previously and the site is now known as Plan Change 28 (PC28). This report is updated to take into account the change in land area now included in PC28 as a result of decisions in PC7 which included more of the Denwoods Trustees Ltd land in the urban limits.

Denwoods Trustees Ltd has commissioned Pattle Delamore Partners Ltd (PDP) to investigate whether stormwater treatment and detention can be carried out on site to mitigate the stormwater runoff resulting from the development.

Currently, stormwater runoff at the site is directed into a road side drain which runs along Springs Road on the eastern side of the site and a private drain which runs along the western side of the site. Both of these drains flow into local drainage networks which flow into the LII River and eventually into Lake Ellesmere. There is also another drain which enters the site from the north and passes through the property and flows into the drain on the western side of the site.

The site has been used for cropping purposes for the last 15 years and is currently covered in variety of crops. By developing the site, there will be an increase in the impervious areas and hence stormwater runoff. Management of this runoff will be necessary to minimise the effect on the downstream catchment.

This report includes sections describing:

- the site and the existing environment;
- the proposed stormwater management and options considered;
- relevant Selwyn District Council documents.

2.0 Site Description

The proposed development is located at 1486 Springs Road, Lincoln. The area of the PC28 land is approximately 57.7 hectares. It is located at approximately NZMS 260: M36 665 036 (see Figure 1, Appendix A). The legal description of the property is Lot 1 DP 12928 . It is currently owned by Denwoods Trustee Ltd. The proposed development site is bounded by Lincoln University land to the north and rural properties to the south and west with the PC7 Living Z and Business 2 Zones to the east between the site and Springs Road (see Figure 2, Appendix A). Appendix B is a contour map (provided by SURVUS Ltd) of the existing site levels. This Figure shows the existing contours of the PC28 site and neighbouring B2 and Living Z zoned land indicates that there is a ridge located approximately one third of the width of the property in from Springs Road. Therefore all the PC28 land falls from this ridge to the western boundary. The fall is approximately 2 to 2.5 metres across the site.

According to the ECan GIS database, the western two thirds of the PC28 land is underlain by Wakanui deep silt loam and the eastern third is underlain by Templeton deep and moderately deep silt loam on sandy loam. A site visit carried out on 9 December 2010 confirmed this variability of soil across the site with up to 1.4 metres of tightly packed silt with no gravel being observed at the western end of the property and gravel observed in the topsoil towards the eastern side of the site (east of the existing residential dwelling). There were also signs that the western end of the property did not infiltrate water particularly well, indicating significant runoff could be expected from this end of the site (shallow drainage ditches have been dug in western paddocks to enable water to drain off the paddocks, see Figure 2, Appendix A). Towards the eastern end of the property however there was very little evidence that runoff from the site occurs indicating much higher infiltration rates at this end of the site. The suspected poor soil infiltration rates across a large portion of the site indicate natural infiltration is unlikely to be a viable solution to manage stormwater at the site.

2.1 Description of the Existing Environment

The potential receiving environment of the stormwater discharge is a private drain which runs along the western boundary of the site. This drain is not part of the SDC drainage network but does flow into the network.

The groundwater table level beneath the site could influence the depth of stormwater management systems. Therefore, information about the groundwater has also been presented in this report.

The current land use surrounding the site is primarily rural, with the Lincoln University located 500 metres to the north and the Lincoln township located approximately 1,500 metres to the North-East of the site.

2.1.1 Surface Water

After a discussion with Vicki Rollinson (Water Race and Land Drainage Coordinator) at Selwyn District Council and observing aerial photographs of the site the drain located along the western boundary of the site is believed to be a historical intermittent natural drain that was formalised over 100 years ago. A stockwater race which is part of the Paparua Stockwater Race network flows into the northern end of this drain (this is formally the end of the stockwater race). The drain then flows into the SDC drainage network at Collins Road, which follows Sergeants Road until it enters the LII River approximately 3.4 km downstream from the site (see Figures 2 and 3, Appendix A). The LII River is a small spring fed river which begins at the confluence of the LI and Springs Creeks approximately 1 km south of the Lincoln township. The full length of the river (approximately 10 km) has been characterised and influenced by agricultural land use and farming practices as well as drainage (Integrated Stormwater Management Plan and Environmental Effects – Lincoln (ISMP), Selwyn District Council (2009)). The river flows into the northern end of Lake Ellesmere (see Figure 3, Appendix A).

There is also another drain which originates approximately 300 metres to the north of the site and travels approximately 200 metres south through the site before it turns 90 degrees and travels west until it reaches the drain on the western boundary of the site (see Figure 2, Appendix A). Vicki Rollinson also indicated that this is also a private drain and is not part of the SDC drainage network, however a stockwater race flows into the beginning of the drain. During a site visit on 9 December 2010 standing water was observed in this drain, and the build up of weed in the drain indicated there had not been significant flow down the drain for some time. During the site visit it was also observed that several shallow drainage ditches (approximately 200 mm deep) had been dug to drain water from the paddocks at the north west corner of the property into this drain.

The current owner of the site has observed intermittent ponding occurring in a low spot on the western side of the site which he believes to be due to a high groundwater levels (see Figure 2, Appendix A).

A search on ECan’s GIS showed no relevant surface water quality data from the drainage network in the area however monthly water quality data has been collected from the LII River at the Pannetts Road Bridge (see Figure 3, Appendix A) since September 1994. A summary of these results are shown in Table 1 below.

Table 1. Summary of Surface Water Data from Pannetts Road Bridge (SQ30878) September 1994 – November 2010

Parameter	Average	Median	Range	Units
Ammonia Nitrogen	0.03	0.02	0.01-0.16	mg/L
Dissolved Oxygen	9.37	9.20	3.8-14.7	mg/L
Dissolved Reactive Phosphorus	0.03	0.02	0.0-0.22	mg/L
E coli`	319	235	28-2400	MPN/100mL
Nitrate + Nitrite Nitrogen	3.28	3.20	0.97-4.60	mg/L
Total Nitrogen	3.54	3.50	1.8-6.0	mg/L
Total Phosphorus	0.05	0.04	0.01-0.26	mg/L
Total Suspended Solids	5.84	2.50	0.50-166.0	mg/L
Turbidity	1.25	0.80	0.20-9.60	NTU

These water quality results are representative of stormwater runoff from land being used for agricultural purposes which could be expected given the catchment area of the LII River. There was also a one off testing of heavy metals carried out at Pannetts Road Bridge on 10 May 2001. These results are shown in Table 2 below.

Table 2. Results of Heavy Metal Sampling at Pannetts Road Bridge (SQ34440) on 10 May 2001

Parameter	Concentration	Units
Arsenic	1.9	mg/kg
Cadmium	0.25	mg/kg
Chromium	21	mg/L
Copper	52	mg/kg
Lead	27	mg/kg
Mercury	0.1	mg/L
Nickel	13	mg/L
Zinc	140	mg/kg

It is unclear from the records of this sampling whether these results are concentrations within the water or if they are concentrations measured in the sediment within the samples, however due to the high concentrations recorded it is expected these are concentrations within the sediment of the sample collected, and hence should all be expressed in mg/kg.

Note that the drain on the western boundary of the site is not identified in Environment Canterbury's (ECan) Natural Resources Regional Plan (NRRP) however the LII River which the drain ultimately flows into is identified as a "spring-fed-plains" river.

Under Rule WQL 7 of the NRRP, discharge of residential stormwater into the drain may be classified as permitted or a discretionary activity depending on whether compliance of all conditions can be demonstrated. It is noted that ECan will notify the new Land and Water Plan in July or August 2012. This may change the planning classification associated with the proposed discharge.

Groundwater

The Environment Canterbury (ECan) GIS database shows 41 wells within 1000 m of the centre of the proposed development site. The location of these can be seen in Figure 4, Appendix A. The wells are used for domestic supply (8), Irrigation and/or stockwater (10), groundwater quality and water level observations (15), fire fighting (1) and no specified use (7). The productive water supply wells range in depth from 16 m to 93 m. The shallower wells (16 m-40 m deep) draw water from the semi or unconfined aquifer within the Riccarton and Linwood gravels while the deeper wells (70 m-93 m deep) draw water from the confined aquifers within the Burwood gravels. The highest measured depth to groundwater in shallow wells near the site varies between 0.2 and 0.42 m below ground level.

The current landowner has identified a wet area as shown on Figure 2, Appendix 1 where groundwater is at, or close, to ground level over the winter. This is consistent with the drain on the western boundary which probably intercepts seasonally high groundwater in this area and drains it out into the SDC drain starting on Collins Road to the south. This groundwater level probably represents the highest groundwater in the vicinity of the site. As the eastern side of the site is 2 to 2.5 m higher than this wet area it is probable therefore that the depth to groundwater will be 2 to 2.5 m at the eastern side of the site and decreasing as land falls away to the west. Pattle Delamore Partners recommends the installation of a number of shallow monitoring bores to assess groundwater levels over winter to confirm this assessment.

According to the ECan GIS data base there is no groundwater quality data within 1000 m of the site.

3.0 Stormwater Management

The stormwater discharging from the proposed development needs to be managed for both quality and quantity. Observations indicate that for most of the site conditions (poorly drained soils and high groundwater levels) mean stormwater generated within each individual lot will not be able to be infiltrated on site and therefore will need to be managed with surface structures. For the remainder of the site disposal to ground may be feasible. However for the purpose of this assessment it is assumed that all additional stormwater resulting from the development will be managed using detention systems. The additional runoff will be associated with roof runoff, runoff from driveways and road derived runoff. These will need containment and treatment before being discharged to the drain.

The following general criteria have been used to determine the feasibility of options with respect to the stormwater management in the proposed development.

- Stormwater quality management options

  Criteria used: Stormwater quality is to be managed so that the first flush volume is treated to a particular standard.

  Options: Stormwater treatment is likely to comprise a combination of swales and detention basins and/or constructed wetlands. The area required for these systems will depend on the storage available above the groundwater level.

- Stormwater quantity management options.

  Criteria used: Stormwater is to be managed such that in the 5-year event, there is no more than a 1 percent increase (Condition 5: Rule WQL7 of the NRRP) in peak discharge into the two drains which run along the eastern and western boundary of the site as a result of the proposed new development. This means that there must be storage on-site.

  Options: Storage can be in the form of a single basin, or multiple smaller basins.

  Feasibility is dependent on available storage areas and proximity to the runoff source and discharge points, or use of technology or landscaping to get stormwater to the storage area. Feasibility is also governed by restricted side-slopes (no steeper than 1 in 4 for mowing) and a maximum depth of 1 m (safety issues).

3.1 Stormwater Quality Management

In a rural residential environment, it is expected that there will be pollutants on the impervious surfaces that will be washed off during the rain event. This analysis will assume that the stormwater will contain contaminants commonly found in typical roof, road and hardstanding areas. After characterising the stormwater, the following section will present an analysis of the treatment volume and options.

3.1.1 Contaminants in Runoff from Roof, Road and Hardstanding Areas

Contaminated stormwater runoff generated from the proposed subdivision is expected to mainly result from runoff of roof, road and hardstanding areas. Roads located in rural residential subdivisions typically have among the lowest vehicle movements. In this case they are expected to be particularly low as it is unlikely that any of the roads will be used for through traffic. Contaminant concentrations will be towards the lower end of any data generally reported in literature. The most likely contaminants that may be found in runoff derived from roads and other hardstanding areas such as driveways include;

- Heavy metals such as zinc, copper (from brake linings), lead (from vehicle weights) and chromium (from vehicle trim);
- Hydrocarbons from leaks in the engines, vehicle transmission and exhaust fumes;
- Sediments from atmospheric deposition and vehicles;
- Nutrients from exhaust fumes.

Stormwater runoff from roofs is likely to contain concentrations of metals, typically zinc with much lower concentrations of other metals, windblown sediments and possible faecal bacteria from bird droppings.

Brough et. al. (2012) analysed water quality data for stormwater runoff from new residential sites in the Halswell and Rolleston area. While this represents higher density sites, given that the impervious materials are likely to be very similar, it is considered that the water quality is likely to be similar.

Table 3 shows the water quality data recommended for the stormwater, the expected concentrations in the discharge after treatment, and for comparison, existing water quality or recommended concentrations in the LII River.

For total phosphorous and polynuclear aromatic hydrocarbons (PAH), data from PDP (2006), which reviewed a range of water quality data at that time has been adopted in the absence of data available in Brough et. al. (2012).

The only contaminants of potential concern are the heavy metals (copper and zinc). These are not expected to be of concern after dilution by the existing flow in the LII River.

Table 3: Concentrations of Contaminants in Stormwater from Residential Subdivisions and Removal Efficiency Through First Flush Basins

Stormwater Parameter	Concentration[3]	Removal Efficiency (%)[3]	Range of Expected Discharge Concentrations	Range of Concentrations Measured at Pannetts Road Bridge (LII River)	ANZECC Guidelines (2000)[2]
Suspended Solids (g/m^3)	70[1]	60-80	14-28	0.50-166	-
Nitrate-Nitrogen (g/m^3)	1.0[1]	20-60	0.4-0.8	0.97-4.60	-
E-Coli (cfu/100mL)	-	60-100	-	28-2400	-
Total Phosphorus (g/m^3)	0.5[4]	40-80	0.1-0.3	0.01-0.26	0.033[a)]
Metals					
Copper (g/m^3)	0.007[1]	40-80	0.0014-0.0042	-	0.0014[b]
Lead (g/m^3)	0.004[1]	40-80	0.0008-0.0024	-	0.0034[b]
Zinc (g/m^3)	0.08[1]	40-80	0.016-0.048	-	0.008[b]
Polynuclear Aromatic Hydrocarbons (PAH) (g/m^3)	0.007[4]	40-80	0.0014-0.0042	-	-

Note:
1. Brough et. al. (2012).
2. From *Australian and New Zealand Guidelines for Fresh and Marine Water Quality, 2000.*
   a. Default trigger value for lowland river (Table 3.3.10).
   b. Trigger values for freshwater species, 95% (Table 3.4.1.).
3. From *Integrated Stormwater Management Plan and Assessment of Environmental Effects – Lincoln,* Selwyn District Council (2009).
4. PDP (2006).

3.1.2 Accidental Discharges

Any stormwater disposal system is vulnerable to contamination arising from accidental discharges. Traffic accidents may result in oil, petrol or other substances being transported by overland flow entering the stormwater system.

It is expected that the majority of traffic in the subdivision will consist of private vehicles with medium-sized commercial vehicles occasionally entering the subdivision. It is expected that private vehicles will have a fuel tank capacity of approximately 60 L while the medium-sized commercial vehicles could have a fuel tank capacity of up to 400 L.

In the unlikely event of a ruptured fuel tank a quantity of diesel or petrol may be released depending on how full the fuel tank is and the location of the rupture. In the worst case scenario, the puncture of a full fuel tank and the loss of all its contents will release up to 400 L into the catchment. This fuel would spread across the road area, and if it is not contained it will go into the stormwater collection system. Fuel spill capacity of the stormwater system is discussed in Section 3.1.5 below.

3.1.3 Stormwater Treatment Options

The ISMP recommends the use of infiltration treatment systems such as rain gardens and Biofiltration areas to treat stormwater at a street level and swale, pond and wetland systems for larger catchments. However due to the suspected high groundwater levels in the area it is suspected that the infiltration treatment systems will not be a viable option at this site. Due to this it is proposed that stormwater from the site will be collected either via a kerb and channel system or grassed swales and conveyed to designated treatment areas at the site. It is proposed the stormwater will be treated via a first flush dry detention basin and surface or subsurface flow wetland system before it is discharge into the drains which run along the eastern and western boundaries of the site. A conceptual configuration of an urban stormwater treatment wetland is shown in Figure 5, Appendix A. Figure 5 shows a sediment forebay. In this situation, the first flush dry detention basin replaces the sediment forebay. However, should the groundwater monitoring identify very high groundwater levels, it is feasible to use a wetland design as shown in Figure 5 without the first flush detention pond.

The mechanisms of treatment for the first flush basin and wetland for retaining chemicals include settling and trapping of suspended solids, the uptake of some dissolved contaminants by macrophytes, benthic algae and phytoplankton and the adsorption of dissolved metals into oxidised bed sediments.

Due to the suspected high groundwater level and poor infiltration capacity of the natural soils in parts of the soil it has been assumed that all stormwater runoff from the individual lots will be collected and treated in this manner. It is however expected that in some parts of the site the groundwater levels and soil infiltration rates will allow for treatment of stormwater within the individual lots. This however can only be determined after further site investigations have been carried out.

3.1.4 Stormwater Treatment Volume

It is generally accepted that the highest concentration of contaminants present in stormwater runoff occurs at the beginning of the storm, described as the “first flush” of stormwater. The depth of rainfall that can be considered to be first flush can vary. For instance CCC (2003) give an acceptable range of 15 mm to 25 mm. ARC (2003) recommends the treatment volume be one third of the 2-year return period for the 24-

hour duration storm. On the Canterbury Plains this rainfall depth is in the order of 15 mm to 20 mm.

The rainfall depth used to calculate the treatment volume should be selected taking into consideration the existing water quality of the receiving environment, the potentially achievable improvement to the receiving environment, the quality of the downstream environment, and the scale of the development relative to the catchment and other existing discharges into the receiving environment.

In this circumstance it is considered that a treatment volume equivalent to 25 mm of rainfall is appropriate. Based on an average lot size of approximately 0.5 ha the impervious area of the developed site is estimated to be approximately 28 %. This gives a first flush volume for the entire site of approximately 4,000 m^3.

While the layout of the systems may vary, these systems are all designed to treat the volume of runoff generated from the first 25mm of rainfall. The site is large enough that the treatment of stormwater can be readily achieved within the site boundaries.

Using an operating depth of 0.5 m for the dry detention basins and a release time period of two days (ISMP) and a buffer around the first flush pond of 5 m, the required area for the dry detention basin is approximately 10,500 m^2. Based on a wetland operating depth of 0.5 m (as per Kadlec and Wallace (2009) and TP10), a hydraulic retention time of one day and a 5 m buffer around the wetland the required area is approximately 9,200 m^2. These give a total area required of approximately 19,700 m^2. It should be noted that the depth of the detention ponds and wetlands will depend on the local groundwater levels which will need to be more accurately assessed during the design process.

3.1.5 Hydrocarbons After Treatment

With respect to the ability of the first flush treatment systems to contain a spill of hydrocarbons all sumps (catchpits) in the road areas shall be designed with submerged outlets so that there is a containment volume of 60 litres above the submerged outlet.

This will ensure hydrocarbon spills from vehicles with a fuel storage capacity of up to 60 L will be intercepted before it reaches the first flush treatment system. In the unlikely event that a 400 L spill occurs due to a ruptured fuel tank of a medium sized commercial vehicle the hydrocarbons that are not intercepted by the sumps will be discharged into the first flush dry detention ponds. It is anticipated that the spill will remain in the dry detention pond long enough for it to be removed and disposed of appropriately.

3.1.6 Options

There are several dry detention and wetland systems to manage the treatment of the stormwater quality described above. The treatment efficiencies for all systems are similar and the size and location of the system will determine its suitability. This is considered acceptable provided that the required volume can be achieved.

It is considered alternative options using proprietary treatment systems incorporating filtration (such as the Stormfilter (Stormwater 360) or the Upflow Filter (Hynds)) can achieve a suitable water quality. Such systems, in conjunction with first flush dry basins, have been consented elsewhere (e.g. Silverstream in the Waimakariri District). A preliminary conversation with Murray England (SDC) (pers. comm. 15 June 2012) indicated a reluctance to accept such an option for Selwyn District.

3.2 Stormwater Quantity

The proposed development is to be a low density residential development with average lot sizes of approximately 0.5 ha. It is likely that a large portion of the lots will remain as pervious surfaces with the exception of the building foot prints and driveways and patios/decks and tennis courts. It is normal to assume that the patios and decks do not contribute runoff to a reticulated stormwater system.

From an initial site visit it appears that the natural soil in some parts of the site (the western end of the site in particular) does not drain particularly well and therefore it is expected that there will be stormwater runoff from these lots, however in other areas where there is better drainage it could be expected that stormwater from each lot including roof runoff could be managed onsite.

It is proposed that the stormwater runoff from the developed site will be managed to ensure that in a 50 year 7.5 hour duration storm event the stormwater runoff from the developed site will not exceed the stormwater runoff which currently occurs at the site. Murray England (pers. comm.) indicated the 50 year 7.5 hour duration storm was is the estimated time of concentration of the LII River.

To predict the current and future stormwater runoff from the site a simple HEC-HMS model was used. It was assumed that approximately 25 % (based on an average lot size of approximately 0.5 ha) of the development will be impervious. Using the rainfall depths given on the Selwyn District Council website for urban developments and allowing for climate change (an increase of 16 %) a rainfall depth of 80.5 mm for a 50 year 7.5 hour duration storm event was estimated for the site. The CCC (Christchurch City Council) (CCC, 2003) standard rainfall profile was used to develop a rainfall hyetograph for the site.

The pre-development and post-development runoff volumes were determined. To maintain hydraulic neutrality, it is necessary to store the difference between the pre-development and post-development runoff volumes. For the 50-year, 7.5 hour duration storm event, the pre-development runoff volume was estimated to be 22,000 m^3 and the post-development runoff volume was estimated to be 29,500 m^3. This is a difference of 7,500 m^3. If it is assumed that no onsite infiltration will occur, (note this is a conservative assumption as some infiltration is expected) the amount of storage required in addition to the first flush dry detention pond (a volume of 4,000 m^3) to maintain hydraulic neutrality during a 50-year, 7.5 hour duration storm event is 3,500 m^3.

3.2.1 Provision of Flood Storage

The first flush dry detention basin and wetland to treat the first flush volumes can be designed to provide an additional storage depth of 300 mm above their treatment volume. Based on this the first flush systems can be designed to provide up to 4,665 m^3 of flood storage catchment. As this is more than the 3,500 m^3 of additional flood storage required to maintain hydraulic neutrality during a 50 year, 7.5 hour duration storm event, no additional flood storage is required.

3.2.2 Location of Stormwater Treatment System

The location of the stormwater treatment system is a critical factor in its suitability. The natural grades of the site indicate that the system should be located approximately in the south western corner of the site as shown in the outline development plan included as part of the Plan Change application. To allow the runoff to be directed either through a piped reticulation system or swale system via gravity, the location of the treatment systems must be down-gradient of the proposed development. An alternative to this is to place the treatment systems in a higher location, and use a system of pumps to direct the water to the treatment systems.

It is expected that the wetlands will use a pipe with an outfall structure to discharge the water to the drain. The wetlands shall also release water at a rate to the drain such that it will not cause more than a one percent increase in the peak discharge or flows in these drains under the 5 year scenario (NRRP). While this release rate may not increase the peak flows, there may be concern about the possibility of increased erosion to the drains. Any potential for erosion can be mitigated for with an appropriately designed outfall structure. This will need to be considered further during more detailed design.

In summary, we are satisfied that stormwater treatment and detention storage can be readily achieved on site.

3.3 On-Site Drain

In addition to managing stormwater created at the site any development of the site will need to ensure that water passing through the site via the onsite drain (see Figure 2, Appendix A) can continue to pass through the site. During the site visit carried out on 9 December 2010 there was evidence that the on-site drain had not had any significant flow in recent times. However, it is expected that this drain and the upstream stockwater race network will collect significant amounts of stormwater during high rainfall events. Due to this any proposed development of the site will need to allow for this water to continue to pass through the site and discharge into the drain which runs along the western boundary of the property.

As the drain is not part of any stockwater race or formal drainage system it is classified as a private drain meaning it can be altered in any way. Due to this there are several options to convey the water currently carried by this drain across the site including piping it or using an engineered channel. The chosen method is likely to depend on the final layout of the proposed subdivision. The expected peak flow through the current drain will need to be calculated in order to appropriately design the chosen conveyance method to ensure that flooding onsite or of the upstream properties does not occur.

4.0 Relevant Selwyn District Planning Council Documents

Selwyn District Council has carried out three key projects with respect to development in and around Lincoln which discuss stormwater. These are:

- Lincoln Structure Plan (May 2008)
- Integrated Stormwater Management Plan and Assessment of Environmental Effects – Lincoln (ISMP) (June 2009)
- Proposed Plan Change 7 – growth of Townships, Urban developments and Implementation of the Lincoln and Rolleston Structure Plans (PC7) (notified 27 February 2010)

As can be seen from the date of the documents, each subsequent document incorporates ideas and strategies formulated in the earlier documents.

This section discusses the relevance of these documents to stormwater management and is not a comprehensive analysis of the relevance of the planning documents to this Proposed Private Plan Change as a whole.

This proposed plan change site was included in the study area of the Lincoln Structure Plan however has been excluded from the stormwater management proposed in the Lincoln Structure Plan and the ISMP as it is outside the urban limits in Proposed Change 1 (PC1) to Environment Canterbury's regional Policy Statement. Note also that this proposed plan change site was not included in the Urban Limits as recommended by the Commissioners after hearing the submissions and further submissions to PC 1 hence the area is not included in the stormwater management areas identified as part of PC7.

The question then is can the stormwater management for the site be included into those already proposed or can it be managed separately.

It is noted that part of the Denwoods Trustees Land has been included in the urban limits under PC7 and has deferred Business 2 and Living Zones. These are both deferred subject to preparation and acceptance by SDC of a suitable ODP.

As identified previously this site falls to the west. This could not be incorporated into stormwater management systems proposed in the ISMP and PC7.

The nature of the stormwater management system that has been identified for this site is similar to that identified in the SDC planning documents i.e. treatment via detention and wetlands with storage for flood control.

Therefore it is considered that stormwater management for this site can proceed with the proposed system which discharges into local drain on the western boundary of the site. The timing of the development would not be constrained by other landowners and would achieve similar environmental outcomes as identified in the ISMP.

5.0 Conclusions

The review of the site and surrounding environment indicates that:

- The existing water quality of the LII is not high due to rural runoff in the catchment above the proposed development
- Provision of a first flush treatment system to treat the runoff from the first 25mm of rainfall will be sufficient to prevent adverse effects to the water quality in the river
- Detention storage will be required to ensure the development does not increase peak flows in the drain along the western boundary of the property. This can readily be achieved on the site.
- A conveyance system will also be required to maintain the drainage provided by the current drain that runs through the site.

We are satisfied that systems can be put in place at the site to meet the stormwater quality and quantity issues associated with the proposed development, along with maintaining the conveyance of the existing on-site drain.

6.0 References

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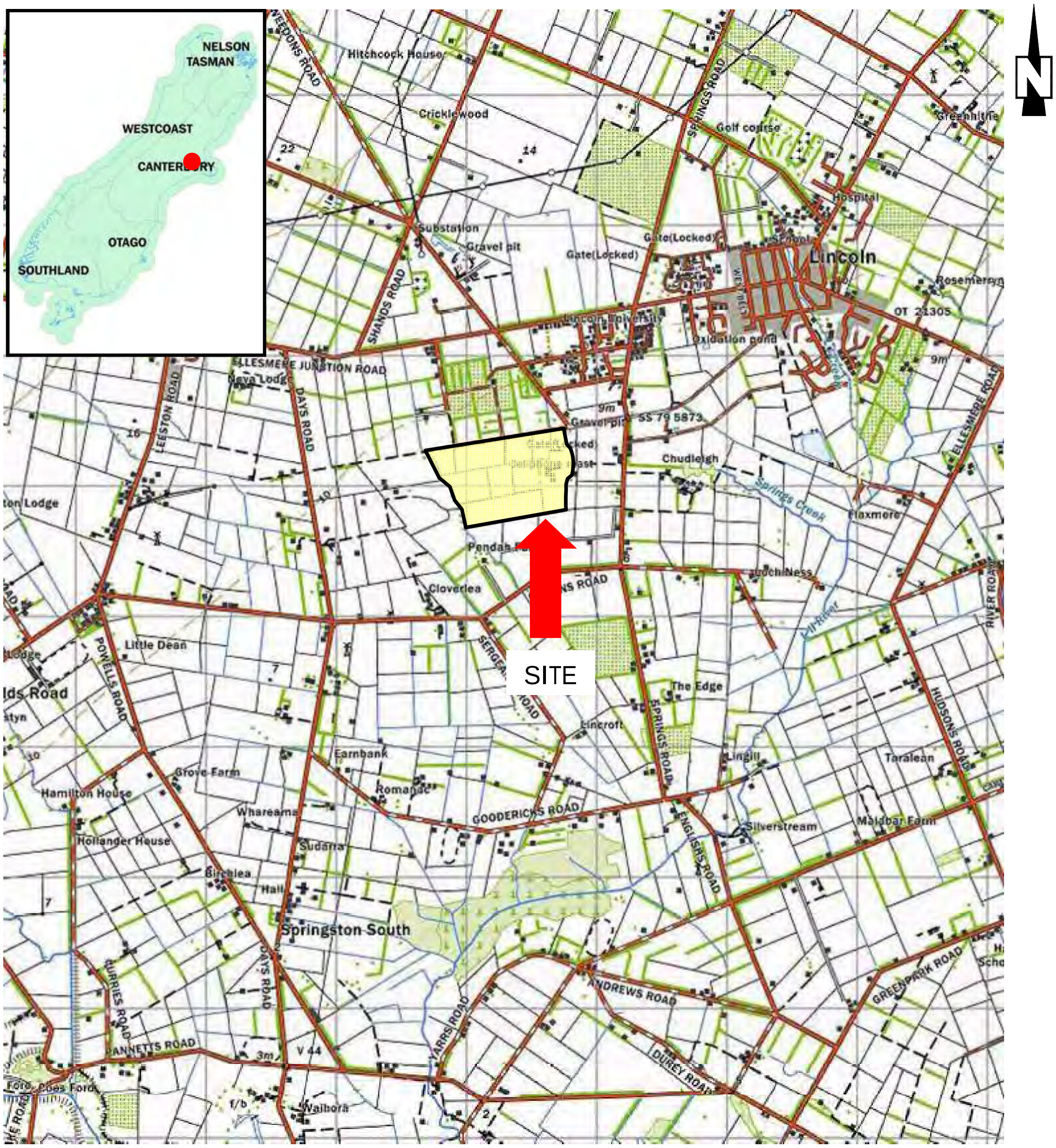
Appendix A

Figures



NZMS 260 Map 36.

Sourced from Land Information New Zealand data.
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SCALE 1 : 50,000 (A4)

Figure 1 : Site Location

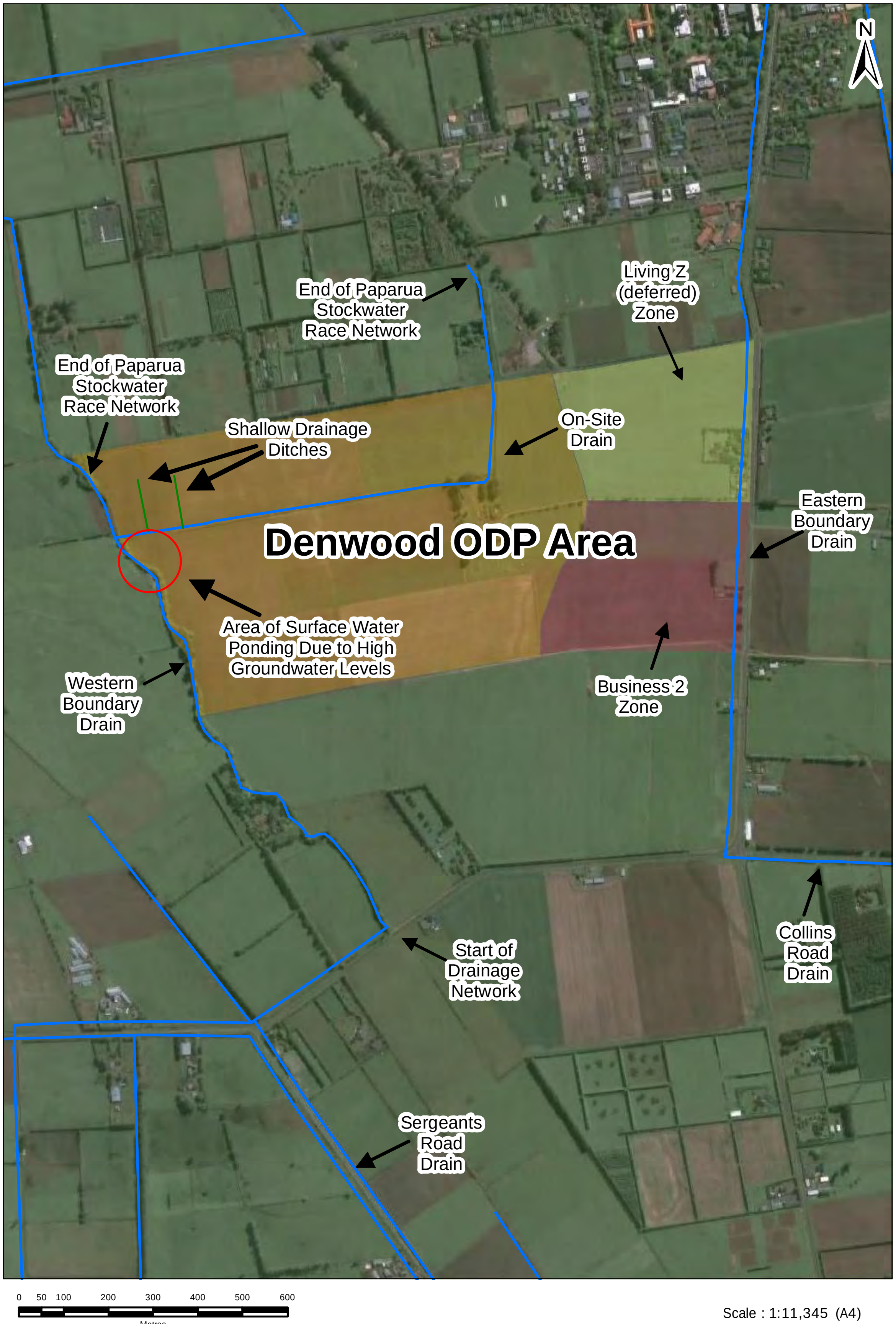

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Figure 2 : Surface Water Drains in Vicinity of the Site
Source - Corax Topo 2005

Scale : 1:23,000

Figure 3 : Downstream Surface Water Network and Water Quality Monitoring Site
Source - Corax Topo 2005

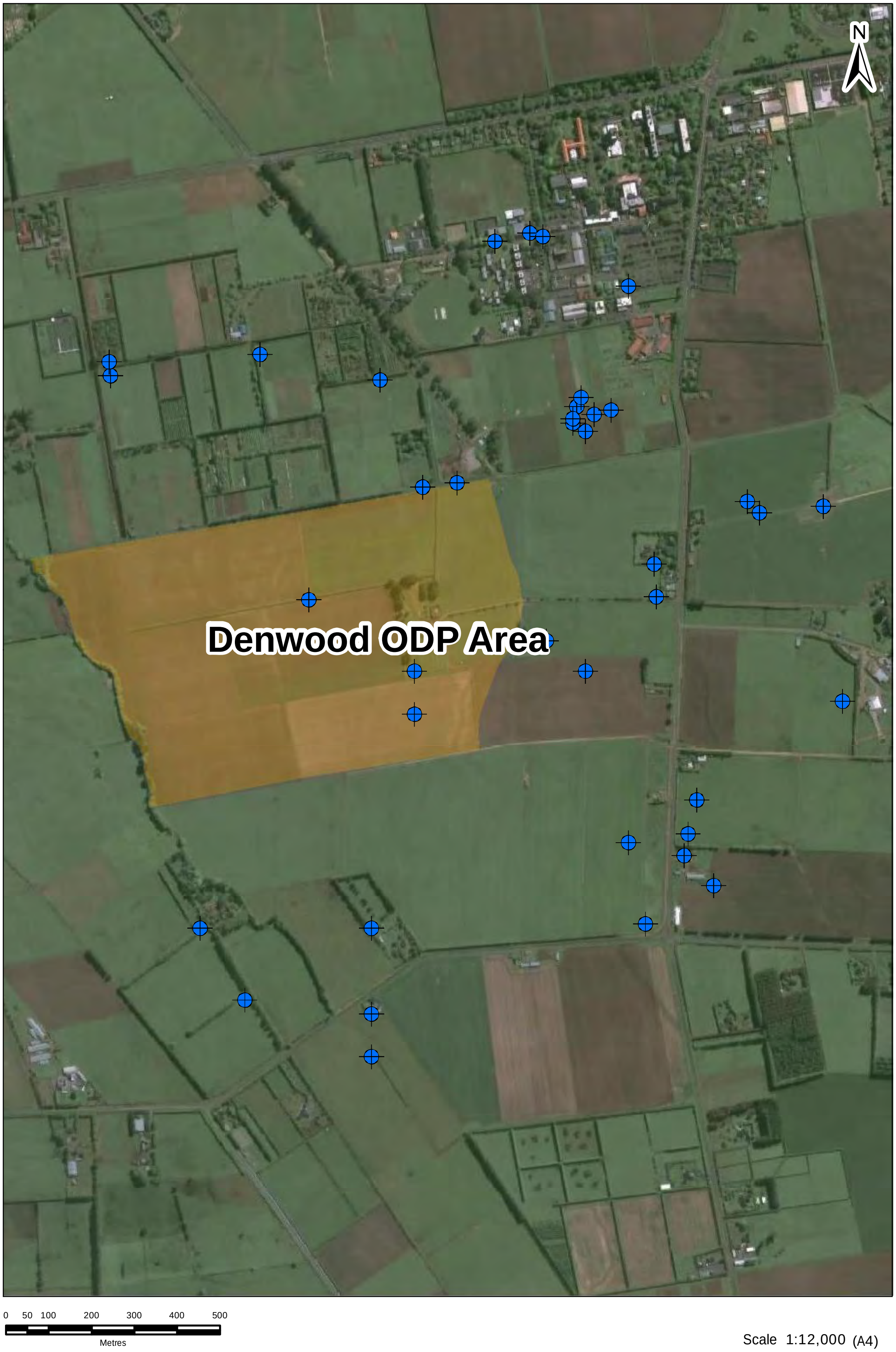

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Figure 4: Wells located within 1000 metres of the site centre

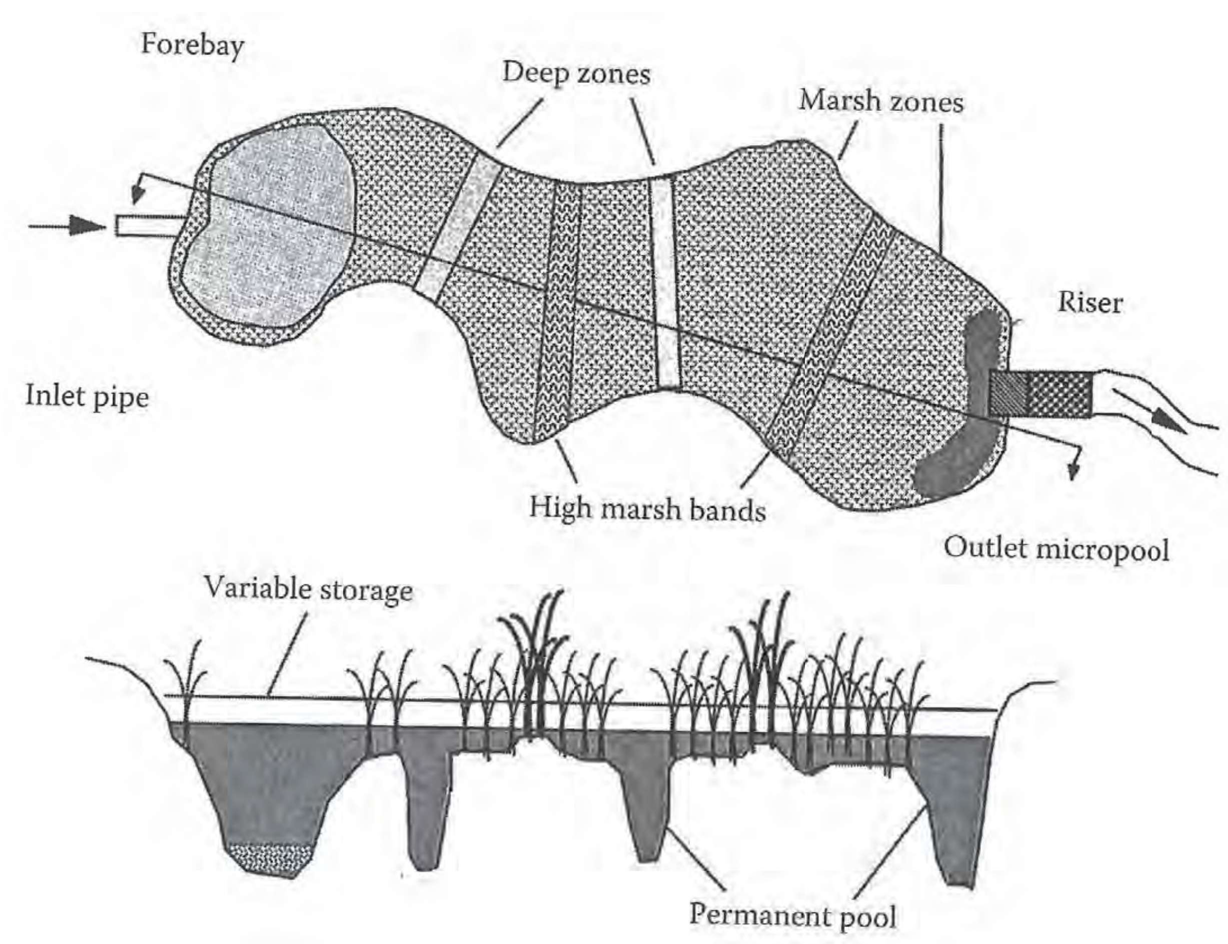
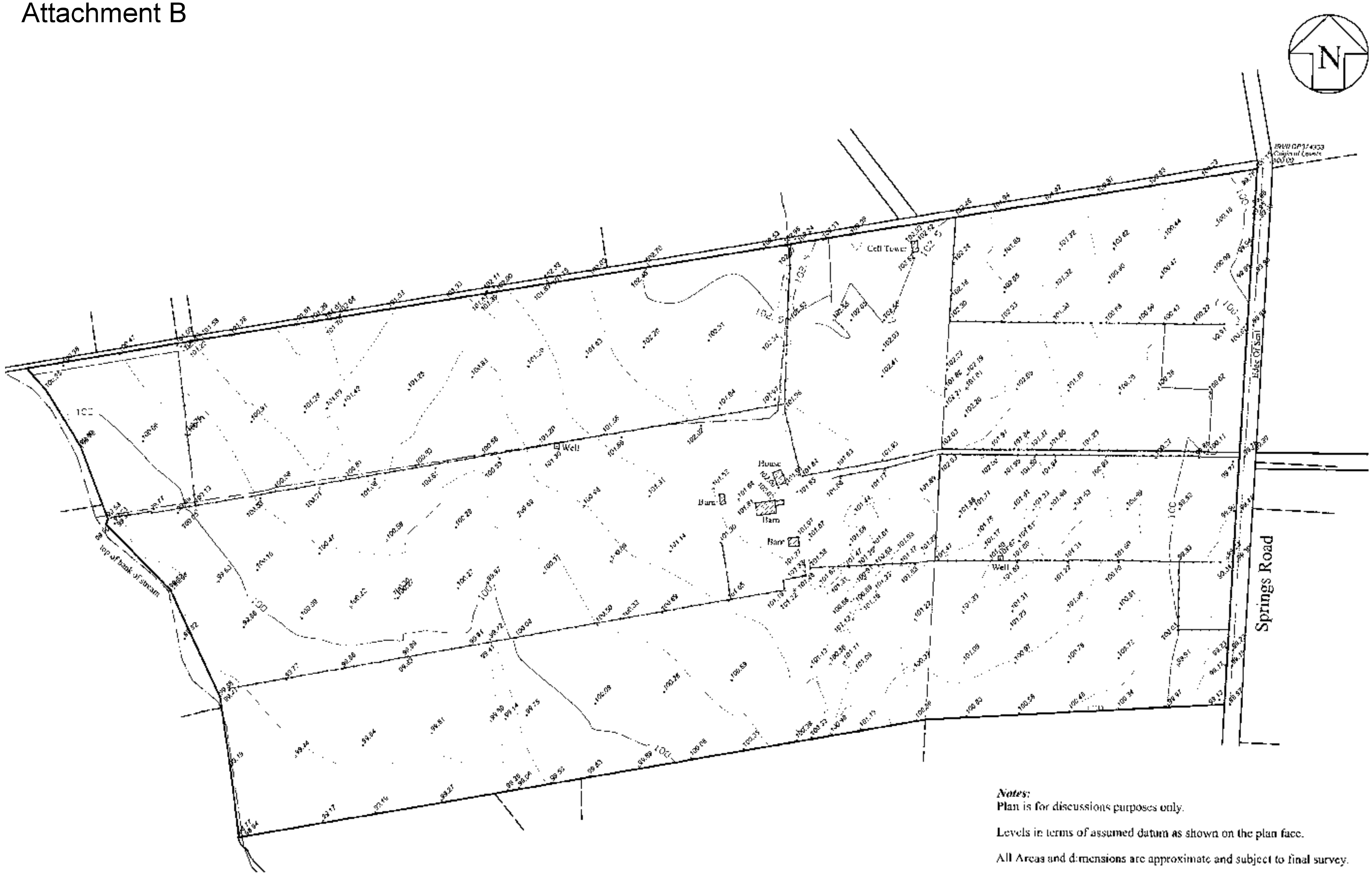


Figure 5: Conceptual Configuration of an Urban Stormwater Treatment Wetland (from Kadlec and Wallace (2009))

Appendix B

Existing Site Plan (from SURVUS Ltd)

Attachment B



Notes:
Plan is for discussions purposes only.

Levels in terms of assumed datum as shown on the plan face.

All Areas and dimensions are approximate and subject to final survey.

Rev.	Date	By	Amendments
A		ADL	Proposed Roading Alignment

Outline Development Plan - Springs Road Lincoln
Lots 1 & 4 DP 12928, Lots 1 & 2 DP 54824 & Lots 1 & 2 DP 26815
Springs Road Lincoln, Total Area 83.4912 0ha

Survus CONSULTANTS SURVEYORS • ENGINEERS
452 Papanui Road, Papanui, Christchurch
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Scale	Job Ref		
1 : 3000	9132/01		
Date	Sheet	Revision	
Oct 2009	1 of 1	A	A2

Figure 3