Before an Independent Commissioner
Appointed by Selwyn District Council

Under	the Resource Management Act 1991
In the matter of	Proposed Plan Change 62 to the Selwyn District Plan

Statement of evidence of James Matthew Phelps Hopkins

31 August 2020

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Qualifications and experience

1 My name is James Hopkins. I completed a Bachelor of Technology (Environmental Engineering) degree in 1999 and I am current a Chartered Professional Engineer (CPEng) and a Chartered Member of Engineering NZ.

2 My work experience includes 20 years of civil engineering, asset management, resource management and land development.

3 I co-authored the engineering servicing report that was prepared for the plan change application.

4 In preparing this statement of evidence I have considered the following documents:

(a) Environment Canterbury (ECan) Land and Water Resources Plan (LWRP);

(b) ECan 0.5% AEP (200 year) and 0.2% AEP (500 year) flood maps;

(c) Selwyn District Council (SDC) Leeston North Bypass Report and 1% AEP (100 year) flood maps;

(d) SDC Rapid Flood Map - 2% AEP (50 year);

(e) ECan Flood assessment for plan change area;

(f) New Zealand Building Code;

(g) SDC Engineering Code of Practice (ECOP);

(h) Christchurch City Council (CCC) Waterways Wetlands and Drainage Guide (WWDG);

(i) Te Waihora/Lake Ellesmere Catchment Flow Review – Ecological values and flow requirements (produced on behalf of ECan);

(j) Relevant submissions and further submissions on proposed Plan Change 62; and

(k) The section 42A officers report prepared by Ms Jocelyn Lewes, and infrastructure report prepared by Mr Murray England.

5 My evidence primarily addresses stormwater and flooding related elements of the Application. I will also provide brief comment on water supply and wastewater disposal.

Code of Conduct for Expert Witnesses

6 While this is not a hearing before the Environment Court, I confirm that I have read the Code of Conduct for expert witnesses contained in the Environment Court of New Zealand Practice Note 2014 and that I have complied with it when preparing my evidence. Other than when I state I am relying on the advice of another person, this evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

Scope of evidence

7 I have prepared evidence in relation to:

(a) Stormwater quality;

(b) Stormwater quantity;

(c) Flooding;

(d) Water supply; and

(e) Wastewater management.

My evidence provides high level analysis of the runoff flow rates that can be expected to originate from the fully developed plan change area and highlight the nature and scale of flow attenuation that is necessary to mitigate this.

I also provide a high level analysis of the typical contaminants found in residential development stormwater and discuss the suite of treatment options that are available to ensure that the stormwater discharged from the plan change area will not result in adverse effects in the receiving environment.

Plan change area summary

8 The proposed plan change area is comprised of land that is currently utilised for agricultural purposes. The total plan change area is approximately 60 ha. Under current zoning this is comprised of:

(a) 5.3 ha living 1 (deferred);

(b) 24.4 ha of living 2 (deferred);

(c) 13.9 ha of Outer Plains Living 1; and

(d) 17.3 ha of Outer Plains Living 2.

9 If the deferrals on the Living 1 and Living 2 zones were to be lifted the potential yield of the plan change area is approximately 129 lots.

10 The proposed plan change will yield approximately 410 lots.

Zone Deferral

11 The zone deferral has been placed on the existing Living 1 and Living 2 zones within the plan change area in recognition of an existing flooding issue within the township of Leeston. This existing flooding also affects the Living 1 and Living 2 zoned land within the plan change area. SDC have commenced works on a project known as the Leeston north stormwater bypass project (LNSB), which will divert excess water from the Leeston Creek and surrounding land to the north, around the township, via a network of purpose built drains and thus minimising the flooding risk to the township. Land at the northern extent of the plan change area is to be vested to SDC that will enable them to complete this section of the bypass project.

12 Once complete the LNSB project will reduce the flows through the township in events up to 1% AEP (100 year) and therefore reduce flooding. In essence, once this LNSB is completed, the deferral on the zoning could be lifted. It is understood that this deferral is not necessarily in place due to potential adverse effects generated by the development of this land, it is in place due to the need to address an existing problem caused by runoff from land upstream (to the north) of the plan change area which results in flooding of the plan change area and the township of Leeston. In the following sections I will discuss how any potential effects generated by the development of the plan change area will be managed.

Summary of stormwater management options

13 I will provide high level analysis of stormwater management for the plan change area to demonstrate that it is practicable to service the plan change area with a stormwater system that does not result in adverse effects on the environment.

Pre-development catchments

14 By inspection it can be determined that the proposed plan change area is comprised of 4 key catchments. These are tabulated in table 1 below and depicted in figure 1 below.

Catchment	Area	Description
1	5.3 ha	North of Leeston Dunsandel Road
2	4.2 ha	North east of Leeston Creek
3	40 ha	Drains via High St to Chapman St
4	10.5 ha	Drains to Birdlings Brook via High St open drain

Table 1 – Plan change area sub-catchment summary

Pre-Development stormwater runoff vs post-development stormwater runoff.

15 A comparison of the pre-development and post-development flows is one of the methods used to determine whether any development has an effect on the surrounding or receiving environment. In general, at the time of subdivision it will be a requirement of both SDC and ECan to demonstrate that the post-development flows leaving the subdivision do not exceed the pre-development flows.

16 The peak net runoff from the plan change area can be estimated utilising the rational method. For simplicity this has been completed as an exercise for the plan change area as one, rather than breaking down to sub catchments. Assumptions used in this analysis are included in Appendix 1. To ensure potential effects of all duration events are identified the following event durations have been analysed:

30 minute, 1 hour, 2 hour, 6 hour, 12 hour and 24 hour

An excel spreadsheet was used to analyse the inflow and outflow of the plan change area stormwater management system and facilitated comparison between pre-development and post-development runoff from the plan change area. This analysis identified the maximum volume of water storage in the attenuation portion of the stormwater management system. For the purposes of this analysis attenuation was designed to ensure that the 24 hour event peak flow rate was not increased as a result of the development. This ensures that all shorted duration events are also well managed. The results are tabulated in table 2 below.

Event	Avg Pre-dev flow rate L/s	Avg Post-dev flow rate L/s	Estimated Storage Volume Required m^3	Over attenuation of peak flow
30 min	3,109	5,052	7,973	88%
60 min	2,024	3,289	9,599	83%
2 hr	1,517	2,464	19,357	77%
6 hr	870	1,414	23,985	60%
12 hr	580	942	27,109	40%
24 hr	346	563	20,332	0%

Table 2 – Pre-development and post-development runoff (2% AEP event)

17 Longer duration rain events have lower rainfall intensity than a short duration event of the same AEP. Thus in these calculation results it can be seen that as duration increases, runoff flow rate reduces. However, the total volume of runoff over the duration increases.

18 The outlet control device in the attenuation portion of the stormwater management system is typically designed to manage the longer duration (lower flow rate) events. This is because if it was designed solely for the short duration events it will not be effective at reducing the flow rates in longer duration (lower intensity) events.

19 From table 2 it can be seen that, while the wider-area critical duration identified in the stormwater bypass project design is 6 hours, the duration that results in the largest storage facility volume within the plan change area is the 12 hour event. In designing a system for all events up to and including the 24 hour event, the peak flows in the 6 hour and 12 hour events is reduced by 60% and 40% respectively from the pre-developed flow rates.

Stormwater management area required

20 In the 12 hour event it can be seen that approximately 27,000 m^3 of storage will be required to buffer the post-development flows back to pre-development flows.

21 In order to achieve a storage volume of 27,000 m^3, assuming a system depth of 1.0m, allowing for margin of error in the simplistic analysis, pond batter slopes, access, riparian margins and other ancillary area requirements it is estimated that a total stormwater management area will be in the order of 38,000 m^2. (An allowance of 40% of the gross area is made for these features). This area represents approximately 6% of the total plan change area which is in line with the area required in most residential developments in the Canterbury plains where the stormwater discharge is to a waterbody that is sensitive to flow increases.

22 While the stormwater management area on the ODP closely aligns with this, it should be noted that the purpose of the features shown on the ODP is to show the general scale and general location of the key stormwater management areas to demonstrate that it is practicable to provide those features. The precise area required and the precise location can only be determined at the time of detailed engineering design and at the time the stormwater system is consented by ECan. This will be dependent on the layout and staging of development, the individual ownership of the land and the specific requirements of SDC and ECan identified at the time of consent. Additional areas may be required that are not shown on the ODP. For example it may be determined that the development of the block north of the Leeston Dunsandel Road is best managed with a stormwater management area within that block (or equally it could be determined that it is better to direct those flows to a central stormwater management area elsewhere within the plan change area – such as the one shown). Similarly land to the north-east of the Leeston Creek may be better managed via its own stormwater management area rather than directing those flows (across the creek) to the centralised stormwater management area. These details will be worked through at the time of subdivision and stormwater discharge consent.

Primary Flow and Secondary Flow

23 In smaller events, typically less than 10% AEP (10 year) event, runoff is contained entirely within pipe networks. This is referred to as the primary flow, and the pipes are referred to as the primary network. Flows in events that exceed the capacity of the primary network are referred to as secondary flow. Provision of secondary flow paths is essential as it is not

practicable to contain all flows within a primary network. Secondary flow paths are usually above ground and contained within road corridors or other areas identified for that purposes (where dwellings will not be constructed).

24 Subject to detailed engineering design and consent processes it is envisaged that attenuated primary flows from the stormwater management area(s) will be directed via the existing pipe network in Chapman Street, which discharges into Birdlings Brook in the southwest corner of Leeston. Smaller portions of the plan change area may discharge (after attenuation) to other existing pipe networks. This will all be subject to SDC approval. As all primary flows will be attenuated by the stormwater management area(s) there will not be any adverse effects on the downstream network and/or the adjacent properties.

25 It is proposed that secondary flows will generally be directed via purpose built secondary flow paths along the northern berm of the High Street frontage to enter the Birdlings Brook at the corner of High St and Faradays Rd.

Flooding

26 In order to assess the potential effects of flooding on the development land analysis of a variety of flood maps has been completed.

2% AEP (50 year) flood.

27 2% AEP (50 year) flood events are addressed by the New Zealand Building Code (NZBC), which requires that no flood waters from a 50 year flood event enters buildings. The SDC 2% AEP (50 year) flood maps, attached as Appendix 2 shows flooding focused around existing open drains, the Leeston creek, and obvious low points within the plan change area. Good engineering design at the time of subdivision, combined with standard procedures at the time of dwelling design and construction will ensure that the plan change area is not subject to any flooding contrary to the NZBC requirements in a 50 year event.

1% AEP (100 year) event.

28 The 1% AEP (100 year) flood levels as modelled by Aurecon for the SDC, attached as Appendix 3, for the stormwater bypass project identifies small areas of flooding, up to 100mm depth in the “existing scenario”. It should be noted that the type of model utilised to generate this flood map is quite different to the type of model used to generate the aforementioned 2% AEP maps, so they will not necessarily appear to correlate.

29 The design scenario maps for the bypass project show that there will not be any flooding within the plan change area once the bypass project has been completed.

30 Further to the above, this flood map clearly shows the extensive flooding that occurs in Leeston during significant rainfall events (including the adjacent properties in Spring Place and Mountain View Place). The provision of land in the plan change area to facilitate the stormwater bypass project will enable the amelioration of this existing flooding risk.

0.5% and 0.2% AEP (200 and 500 year) events

31 ECan flood maps (attached in Appendix 3) for the 200 and 500 year events identify the potential surface flooding in the respective events. Table 3 below summarises the extent of flooding in the 0.5% AEP (200 year) event for the plan change area.

Flood Depth	% of developable area	Solution
0 to 50mm	64%	Minor shaping to ensure any flows are contained in road carriageway
50 to 100mm	15%	Minor shaping and filling to avoid low points that may pond water and shed flows to stormwater network
100 to 200mm	16%	Minor filling and/or specific floor level specification(if needed), Shape land to direct all runoff to stormwater network
200 to 500mm	5%	Only identified within existing farm drains and Leeston Creek. Fill drains as part of development, designate creek areas as waterway reserve.

Table 3 – Summary of 0.2% and 0.5% AEP event flooding in plan change area.

This table shows that the majority of the proposed plan change area (64%) does not suffer from widespread flooding of significant depth (greater than 50mm) in the 0.5% AEP event. Approximately 15% of the plan change area shows as being subject to flooding up to 100mm depth, however analysis of the flood map indicates that this is mostly localised ponding in

depressions, rather than widespread or run-on flooding. This shallow flooding does not present an obstacle to development as standard best practice engineering design will eliminate this type of flooding. A further 16% is identified as having flooding in the order of 100-200mm. The majority of this is focused around the Leeston creek and can be resolved by a combination of the Leeston North Bypass Project and good engineering design of the plan change area. The remaining 5% of the plan change area where flooding is shown to be in the range of 200 to 500mm is limited entirely to the Leeston Creek alignment and the existing farm drains. This flooding shows up because the invert of those drains are approximately 200-500mm deep. The existing farm drains will no longer be needed and will be filled and the Leeston Creek will be designed to contain any such flows without risk of flooding dwellings.

Stormwater Volumes

32 Increasing the quantity of hardstand will always result in an increase in runoff as more water is directed off roofs, driveways and roads to the stormwater network. The provision of stormwater management areas buffers this increase. Where soil and groundwater conditions suit the increases can be disposed of by discharging stormwater to ground. Given the known high groundwater levels and low permeability of soils in the Leeston area, discharge to ground may not be viable.

33 Stormwater management areas are proposed to be designed to attenuate the 24 hour duration storms, which invariably results in over attenuation of other (shorter) duration storms. Thus while the net volume discharged from the site post-development will be larger than pre-development (unless there is an option to discharge to ground), the peak flow rate post-development will be no greater than pre-development in the 24 hour event and substantially lower in shorter duration rain events. This was identified in table 2 above. With the provision of well-designed attenuation, flows in events up to 24 hour duration reduce to an extent that offsets volumetric increases.

Stormwater Quality

34 Stormwater quality is also a critical factor when it comes to stormwater management. The receiving environment for the plan change area includes natural waterways which ultimately discharge to Te Waihora (Lake Ellesmere). The ECan Land and Water Resources Plan (LWRP) provides rules pertaining to stormwater quality. While this is a matter that is best determined by ECan when discharge consent is sought, I respond to concerns raised by submitters by providing some clarification as to how the

ultimate development of the plan change area will not result in degradation of stormwater quality.

35 The following rules in the LWRP currently apply to all applications to discharge stormwater at the time of subdivision:

> ***5.93***
>
> ***The discharge of stormwater or construction-phase stormwater from a reticulated stormwater system onto or into land or into or onto land in circumstances where a contaminant may enter water, or into groundwater or a surface waterbody is a restricted discretionary activity, provided the following conditions are met:***
>
> > *1. For a discharge that existed at 11 August 2012, an application for a discharge permit is lodged prior to 30 June 2018, or at a later date as agreed between the reticulated stormwater system operator and the CRC; and*
> >
> > *2. A stormwater management plan has been prepared to address the management of stormwater in the catchment and is lodged with the application; and*
> >
> > *3. The discharge will not cause a limit in Schedule 8 to be exceeded.*
>
> ***The exercise of discretion is restricted to the following matters:***
>
> > *1. The quality of, compliance with and monitoring of the stormwater management plan prepared to address the management of stormwater in the catchment and matters set out in guidance documents prepared by the CRC; and*
> >
> > *2. The rate and volume of discharge and the changes to the flow regime of a river or artificial watercourse, flood frequency, including flooding of land or dwellings, erosion of river bank and channels; and*
> >
> > *3. The concentration of contaminants and resulting actual and potential adverse environmental effects, including cumulative effects on the receiving water quality of surface and groundwater, aquatic ecosystems, Ngāi Tahu cultural values and other existing uses and users of the water, including takes and discharges; and*
> >
> > *4. Measures to:*
> >
> > > *a. reduce the volume and concentration of contaminants in the discharge; and*

b. ensure the volume and rate of discharge do not exceed:

i. the capability of the soil and subsoil layers at the site to reduce contaminant concentrations in the discharge; and

ii. the infiltration capacity of the soil and subsoil layers at the site; and

c. avoid the accumulation of toxic or persistent contaminants in the soil or subsoil layers; and

d. minimise suspended sediment in stormwater from activities involving earthworks; and

5. The potential benefits of the activity to the applicant, the community and the environment; and

6. The need for measures to protect any human or animal drinking-water sources.

and

Rule 11.5.30

Within the Selwyn Te Waihora sub-region Regional Rule 5.93 includes the following additional matter of discretion:

1. Any adverse effects on mahinga kai, wāhi tapu or wāhi taonga within the Cultural Landscape/Values Management Area.

36 Conditions 2 and 3 of ECan rule 5.93 are quite broadly worded, thus the analysis of flow management and contaminant management will need to be quite broad at the time discharge consent is sought. A suite of best practice stormwater design solutions will be required to demonstrate to ECan that the effects on the environment, including the downstream waterbodies, will be less than minor.

Contaminant loadings from rural and residential runoff.

37 The CCC Waterways Wetlands and Drainage Guide 2003 (WWDG), Part B (updated 2012), as well as a number of other NZ and international publications, identifies concentrations of typical contaminants in residential subdivision runoff. Many of these contaminants are also present in runoff from agricultural (rural) land and often in similar concentrations, so the change of land use from rural to residential is not indicative of these contaminants suddenly being introduced to the receiving environment. Furthermore. some contaminants found in rural runoff are often not present in modern residential subdivision stormwater runoff. Notwithstanding that, given the sensitivity of the receiving environment, the permitted level of

contaminants in the ultimate (treated) discharge will be compared to limits that are aligned with freshwater ecology protection of the Birdlings Brook, Harts Creek and Te Waihora, rather than just benchmarked against the quality of water that may be originating from the land under its current land use.

38 A summary of common contaminants is identified in table 4 below. Note that a treatment train will typically include two or three treatment steps. For example this could include road sumps with trapped inverts and siphoned outlets, followed by a raingarden, followed by a wetland. Thus the cumulative contaminant removal over the treatment train can often be in excess of 99%.

Contaminant	Rural Source	Residential Source
Sediment (TSS)	Rreshly cultivated land and from land where crops do not cover 100% of the soil.	Soil disturbance during construction. Ongoing road sediment.
Hydrocarbons	Agricultural burnoffs (PAH) Agricultural fuels (storage and farm vehicle leakage/spillage)	Vehicle fuel and oil
Organochlorines (e.g. DDT)	Agricultural herbicides	Typically not present
Heavy Metals	Agricultural herbicides and pesticides	Roofing materials (zinc and copper), vehicle brakes (copper), Lead (historically from fuel). Typically low concentrations in new residential subdivisions.
Nitrogen (Nitrates and Nitrites)	Agricultural fertilisers Poor wastewater management (residential or dairy)	Not significant in modern residential developments with reticulated wastewater. Over-fertilised residential lawns
Phosphorous	Agricultural fertilisers	Deposition (via wind) from adjacent agricultural land. Over-fertilised residential lawns
Pathogens	Effluent runoff Failed septic tanks	Not present in significant quantities in residential subdivisions with reticulated wastewater

Table 4 – Summary common contaminants in rural and residential stormwater.

39 The ANZECC guidelines provided a complete suite of guideline values for contaminants, for various levels of protection for freshwater. At the time that stormwater discharge consents are sought, analysis of relevant contaminants will need to be made and the design of the stormwater system will need to be demonstrated to achieve contaminant levels less than the identified relevant guidelines required to protect the ecology of the receiving waterbody. This analysis will likely identify that many contaminants that originate from the existing agricultural land use will be reduced in the treated residential stormwater discharge.

Best practice stormwater design

40 Contaminants in stormwater runoff from different types of land use has been widely studied internationally. There are numerous published figures (including within NZ and Canterbury) suitable for calculating the likely concentrations of a variety of contaminants from a variety of development types. This research makes it possible to prepare a design for a "treatment train" to ensure that the water quality of the runoff exceeds guideline requirements. at the time of development, resource consents for stormwater discharge (under the two rules identified above) will need to be obtained. At that time the developer(s) will need to demonstrate that the proposed stormwater treatment and attenuation system will result in a discharge that will have acceptable effects on the receiving environment, including Birdlings Brook, Harts Creek and Te Waihora.

41 Some examples of the options available to achieve stormwater quality objectives are:

(a) Sumps with trapped and drowned outlets to trap solids, metals that are entrained in those solids, and hydrocarbons;

(b) Proprietary devices that remove contaminants;

(c) Treatment swales, where contaminants are adsorbed into selected plant species within the swale, preventing them from entering the downstream waterways;

(d) Restrictions on the use of roof materials, such as no copper and no unpainted galvanised iron;

(e) First flush ponds, that allow bulk settlement of contaminants, particularly suspended solids and other contaminants entrained in the suspended solids;

(f) Rain gardens, where contaminants are adsorbed onto the selected plant species in the garden; and

(g) Wetlands, where contaminants are adsorbed onto the selected plant species in the wetland.

42 Some examples of the options available to achieve stormwater quantity (flow) objectives are:

(a) Limitations on maximum roof and hardstand areas;

(b) Provision of on-site rainwater storage tanks;

(c) Disposal of stormwater to ground where possible; and

(d) Detention of stormwater in attenuation basins, ponds or wetlands (these also serve to enhance stormwater quality whilst buffering flow rates).

It is noted that the use of individual on-site rainwater storage tanks is usually less effective than a centralised attenuation pond, and in this case disposal of stormwater to ground is unlikely to be feasible. The stormwater management area allowed for in the ODP recognises this.

43 It has historically been demonstrated that runoff from modern residential developments, with well-designed and operated stormwater treatment facilities, often has better water quality than the runoff from original agricultural land that has no stormwater quality management.

Submissions

44 Several submissions have been received relating to concerns about stormwater management and flooding risks.

45 Responses to the submissions that pertain to stormwater are:

(a) Alan and Janet Manning – 9 Spring Place.

This submission presents concern that increased development will make flooding worse. In item 5 of the Manning's submission reference is made to water backing up in the gutter and flooding the street.

The plan change area is not proposed to discharge any stormwater to Spring Place, and further to this any discharges that enter the Leeston Creek (that passes through Spring place and creates a tailwater effect on the drainage network within Spring Place) will be required to be no greater than pre-development flows. Furthermore,

and likely more importantly the plan change will facilitate the vesting of land necessary to complete the Leeston North stormwater bypass project, which will divert flood flows around the township, thus reducing flooding issues such as this in Spring Place.

(b) Rachael Prestige – 178 High Street

The proposed plan change area does not currently drain via 178 High Street, nor the street frontage of that property. The proposed stormwater management area and associated pipes and secondary flow paths will direct flows to appropriate outfalls. There is no perceived benefit to additional drainage in the frontage of this property to manage stormwater from the plan change area as the stormwater management system on the development side of the road will be designed to cater for primary and secondary flows from the plan change area.

(c) Rachael Marriott – 11 Spring Place.

This submission refers to flooding in 2013, which is being addressed by the Leeston North Bypass project. The proposed plan change provides land necessary to complete this project which is documented as being designed to alleviate these existing flooding issues.

(d) Nikki Warren – 24 Spring Place

This submission refers to the land being susceptible to flooding and inundation. Concern that issues could be displaced onto the contiguous established township and high school. Further reference is made to climate change.

The flood maps within the Leeston north stormwater bypass design report identify the flooding concern identified in this submission. The stormwater quantity section of this evidence identifies the nature and scale of this flooding and how it will be managed. Further to this, mitigation of existing flooding of the township has been initiated by SDC and the proposed plan change will facilitate the vesting of land necessary to achieve the design outcomes of the Leeston North Bypass project. At the time of subdivision stormwater discharge consents (from ECan) will be required and those consents will ensure that all effects of the proposed discharge on the surrounding environment will be less than minor. All stormwater design is required to include allowance for climate change.

(e) Toby and Lisa Pullen – 26 Mountain View Place.

This submission refers to flooding, with the assertion that "*water drain-off from most of the new properties would run off down into our property*."

Portions of the undeveloped land almost certainly does currently drain that way as the Leeston creek passes just a few metres south of number 26. The development of land within the plan change area would be required to be shaped so that each lot drains to the new roads and the new roads drain to the new stormwater management areas. No runoff from the developed land would be directed into properties in Mountain View Place.

Further to this, the Leeston North Bypass project design report shows that the completion of the bypass will address existing flooding in Mountain View Place.

(f) Ministry of Education Ellesmere College – Leeston Dunsandel Road.

The Ministry is concerned about the potential adverse effects arising from the proposed plan change, particularly as the college currently experiences flooding from time to time.

On behalf of the applicant I have met with MoE representatives where we discussed this issue. I summarise the points presented to the MoE's representatives below.

The proposed plan change facilitates the vesting of land necessary to complete the Leeston North Bypass Project, which will eliminate the existing flooding issues on the school site (in events up to 1% AEP/100 year). The vast majority of the plan change area is lower than the School land and is proposed to be drained to the south to a stormwater management area which will discharge to appropriate discharge points, which are all downgradient of the school.

It was identified by the MoE's representatives that portions of the school playground/sportsfields do drain naturally via the proposed plan change area. Provision will need to be made to ensure that natural land drainage of the school site is not obstructed by the development. This would be required at subdivision and stormwater consent stage.

The portion of the plan change area above Leeston Dunsandel Road, which is upgradient of the school, will be required to manage

stormwater flows so that the post development discharge flow rates are no greater than pre-development flow rates, thus no new flooding issues will be generated.

(g) Stuart and Jane McLachlan – 44 Bluetts Rd

The McLachlans submission refers to several properties: 84 High Street, farm land on Leeston Southbridge Rd, Harts Creek (which runs through the submitters' property), and 21A Spring Place.

The submission identifies potential flooding on High street, the potential for drainage serving their farm land to be compromised, existing flooding in Spring Place (which has resulted in insurance being declined) and deterioration of water quantity in Birdlings Brook (and thus Harts Creek).

Little information was included about the near flooding experienced at 184 High Street.. The proposed plan change area is separated from this property by the road carriageway of High Street. Thus the proposed stormwater management area, stormwater conveyance network and secondary flow paths are isolated form the property. It will be a requirement at subdivision and/or stormwater consent stage to demonstrate that there will be no adverse effects on this (and other) properties.

Improvements to the flooding issues in Spring Place have been identified in my commentary on submissions above. Spring Place will benefit from a substantial reduction in flooding once the bypass is complete and any new development in the plan change area will be required to not create any new adverse effects on properties in Spring Place.

The proposed stormwater disposal from some of the plan change area will discharge into the Birdlings Brook after being attenuated by a stormwater management areas. The attenuation system has been demonstrated as resulting in significant reductions in flow in stormwater events less than 2% AEP (50 year) 24 hour event, thus the drainage network serving this farm land will not be compromised.

Stormwater quality has been addressed in the main body of my evidence. There is a comprehensive suite of suitable solutions to manage stormwater quality from residential developments that will ensure that the water quality of the downstream water bodies is not adversely affected. This is managed at the time stormwater consents

are obtained (which is required prior to any subdivision construction occurring).

(h) Harts Creek Streamcare group

The streamcare group have indicated that they would like the plan change to be declined entirely, or only approve part only of the re-zoning to ensure all adverse effects on Birdlings Brook and Harts Creek are completely avoided.

I have met with streamcare group representatives. One of the key points presented at this site meeting is that stormwater quality is managed by ECan at the time of subdivision when stormwater discharge consents are obtained. While it is acknowledged that it is very difficult to provide sufficient detail at this juncture to demonstrate exactly how this would occur, the information set out in the stormwater quality portion of my evidence provides some clarity regarding anticipated stormwater quality. To summarise: There is a comprehensive suite of suitable solutions to manage stormwater quality from residential developments that will ensure that the water quality of the downstream water courses is not adversely affected. In fact the appropriate collection and treatment of contaminants (some of which are unmitigated in rural runoff) generally results in a higher water quality in treated residential runoff. As the land will no longer be utilised for agricultural purposes, the contaminants that originate from that land use will be eliminated.

The adoption of an appropriate suite of treatment devices will ensure that the water quality meets or exceeds prescribed guidelines for freshwater quality protection which take into account the nature of the receiving environment. This is managed at the time stormwater consents are obtained (which is required prior to any subdivision construction occurring).

Response to section 42A report

46 I have reviewed the section 42A report and comment as follows.

47 Mr Murray England has identified in his officer's report (items 7 to 33) that the existing water supply and network has capacity for a further 80 lots. The planned new water bore within to the plan change area has undergone drawdown tests that have indicated there will ability to service the entire plan change area, as on demand supply for residential lots in the Living 1 zone, while the larger lots in the Living 2 zone will be restricted supplies as is common in the Selwyn District. This indicates to me that standard water

supply network design will be able to be applied to meet both the potable and fire fighting demands of the plan change area and I do not see any limitations to being able to service the development with potable and fire-fighting water.

48 Mr England identifies in his report (items 34 to 40) that the existing wastewater network, treatment and disposal system has capacity for a further 80 lots. Planned upgrades (likely to occur around 2023/24) will expand the overall capacity of the system, allowing full development of the plan change area (as well as any other growth that is projected in the Leeston township). Mr England has also identified the point of connection for the plan change area. Therefore I do not see any limitations to being able to service the development with reticulated wastewater disposal.

49 Mr England identifies in his report (items 41 to 45) that existing flooding in the Leeston township is a well known problem and SDC has undertaken significant works to facilitate a stormwater bypass to alleviate the existing township and the plan change area, of this existing problem. The provision of land within the plan change area to facilitate the bypass is critical to this. Mr England also identifies (items 46 to 51) that stormwater quantity and quality management are important and that there are processes that developers must go through (consents with SDC, SDC Engineering Approval and consents with ECan) prior to subdivision. Mr England has identified (most clearly stated in conclusion, item 53) that the stormwater management areas shown on the ODP appear to be of adequate size, but notes that additional areas may be required to ensure all discharges are managed adequately, and that such additional stormwater areas could be shown on the ODP. I concur with this sentiment but suggest their absence does not in any way reduce the obligation of individual developers to provide any and all stormwater management necessary. Showing additional (smaller) areas could introduce a level of detail in the ODP that could then complicate or even hinder a developer in providing appropriate stormwater management if a solution was identified that does not closely align with one of the (smaller) areas shown on the ODP. I believe that there are robust processes in place at subdivision and stormwater discharge resource consent stages to ensure that appropriate management is adopted regardless of the configuration shown on the plan change ODP. I agree that significant design work will be needed prior to development, however it will be feasible to provide appropriate stormwater management.

Conclusion

50 Stormwater quantity and quality have generated a significant number of submissions. This presents as an indicator that stormwater management will likely provide the most significant constraint on the civil design of the subdivisions within the plan change area.

51 The scale of these constraints have been adequately identified as detailed in my evidence and adequate provision has been made in the plan change ODP and recommended provisions to ensure that stormwater quantity can be appropriately managed at the time of development and stormwater discharge consenting. The area required for stormwater management is of the same scale as other developments in the Canterbury plains where stormwater discharge to ground is not an option.

52 Similarly, stormwater quality can be managed by a wide variety of treatment options, which can be combined into a “treatment train” to ensure that any stormwater discharges do not have an adverse effect on stormwater quality in the receiving environment.

53 The provision of land to facilitate the SDC stormwater bypass project is key to SDC being able to address existing flooding issues which have presented themselves in all stormwater related submissions. The bypass project will address the flooding concerns presented in all of the stormwater related submissions.

54 I conclude that it will be practicable to develop the plan change area in accordance with the new zoning rules without stormwater discharges having adverse effects on the receiving environment.

Dated 31 August 2020

James Hopkins

Appendix 1 – Stormwater calculation assumptions.

Stormwater analysis assumptions and parameters

Runoff Co-efficients

For the purposes of this analysis it has been assumed that the predeveloped runoff coefficient is 0.4 (NZBC E1/VM1 Table 1 – Heavy clay soil types – pasture and grass cover).

For the purposes of this analysis it has been assumed that the post-developed runoff co-efficient is 0.65. This value is set out in the SDC ECOP as being an appropriate residential land runoff coefficient in larger, 2% AEP (50 year) events. Note this is significantly higher than the standard runoff coefficient for residential land of C = 0.55.

Return Period

The New Zealand Building code requires that stormwater runoff in a 2% AEP (50 year event) is not allowed to enter buildings. It is noted that flood events in recent history (1986 and 2013) were in the order of 5 to 10 year return period as indicated in an ECan Flood Hazard Assessment to BLG dated 15 August 2017.

SDC has completed a design for the stormwater bypass project that assesses and manages the 1% AEP (100 year) flood event.

ECan have provided 0.5% AEP (200 year) and 0.2% AEP (500 year) flood maps that identify the general extent and scale of flooding within the plan change area.

Time of Concentration

Time of concentration is important for stormwater design. The Ministry of Works formula generally accurately estimates Time of Concentration (Tc) for rural pastoral land, which in this case estimates the Tc to be 45 minutes for the plan change area. This Tc will be used for the design of the internal reticulation.

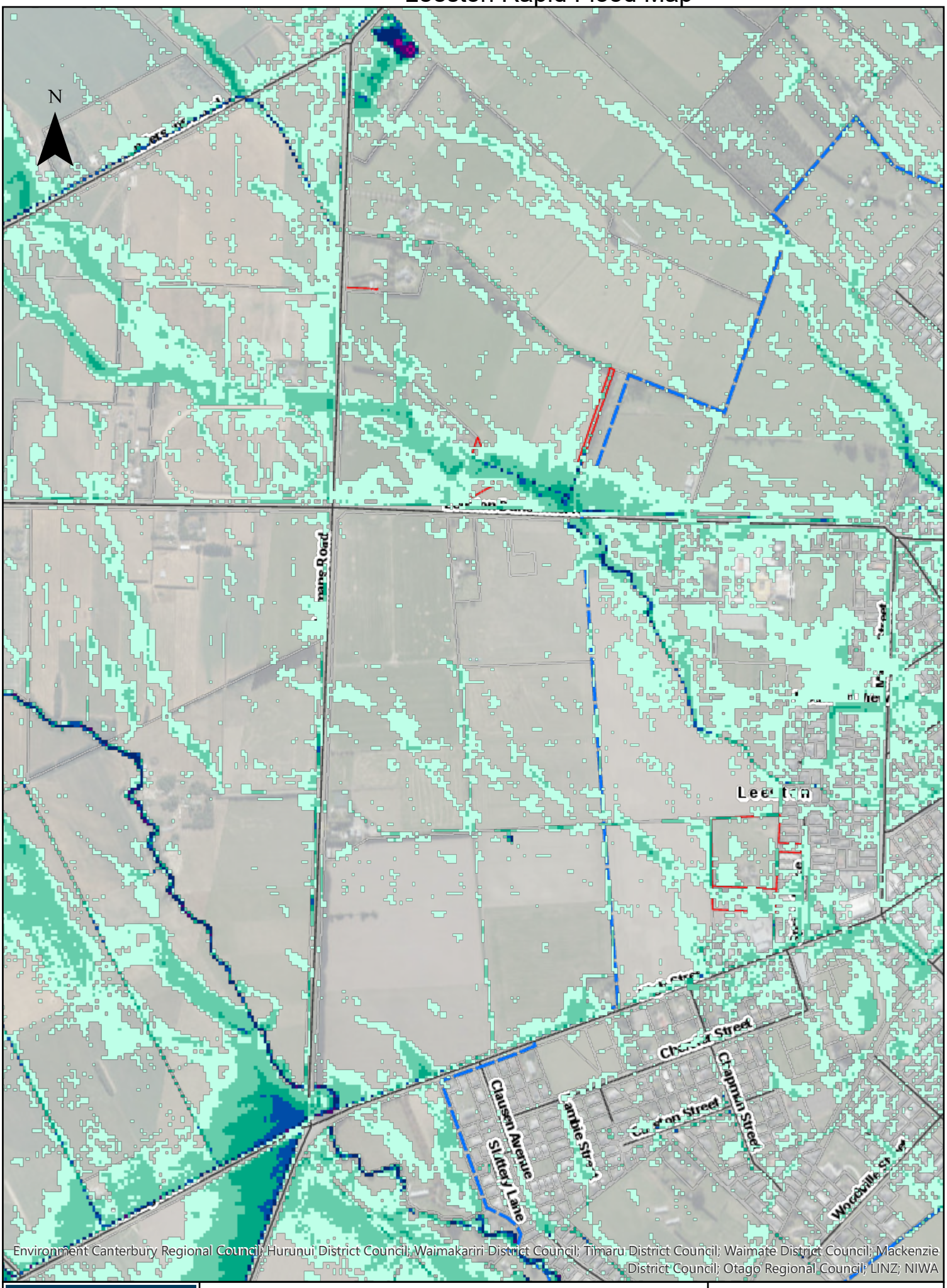
For larger scale flooding (that is affecting an area much larger than the development site) the critical duration for the greater catchment plays a more important role in stormwater management design. In Canterbury these events are typically in the order of several hours duration. The stormwater bypass project design has identified a critical duration for this catchment of 6 hours.

For the purposes of this analysis storm events up to and including the 24 hour duration event have been analysed.

Rainfall intensity

SDC prescribes a methodology for estimating rainfall depths for a variety of duration events and for a variety of return periods. For Leeston the rainfall figures for “Christchurch Aero” within the SDC ECOP are to be adjusted by a factor of 1.01.. The rainfall figures have then also been adjusted for climate change by adding an additional 16%.

Leeston Rapid Flood Map



Selwyn DISTRICT COUNCIL

0 125 250 375 500

Metres

Date: 19/08/2020
Cadastral Information dervided from Land Information New Zealand's Digital Cadastral Database (DCDB)

NW Leeston - 200 year flood model results

Legend

Land Parcels

0 125 250 500 Metres

N

Legend

SDC_10m_200yr_RCP8pt5_maxWD

Depth (m)

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- > 1.0

NW Leeston - 500 year flood model results

Legend

Land Parcels

0 125 250 500 Metres

N

Legend

SDC_10m_500yr_RCP8pt5_maxWD

Depth (m)

- < 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- 0.2 - 0.5
- 0.5 - 1.0
- > 1.0