Central Plains Water Limited

Groundwater and Surface Water Monitoring Plan
Part II

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- July 2015

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1. Background and Scope

1.1. Central Plains Water Limited

Central Plains Water Limited (CPWL) are currently in the process of developing an irrigation scheme which will encompass a command area of approximately 60,000 Ha extending between the Waimakariri and Rakaia Rivers, inland of SH1. **Figure 1** shows the approximate extent of the command area.

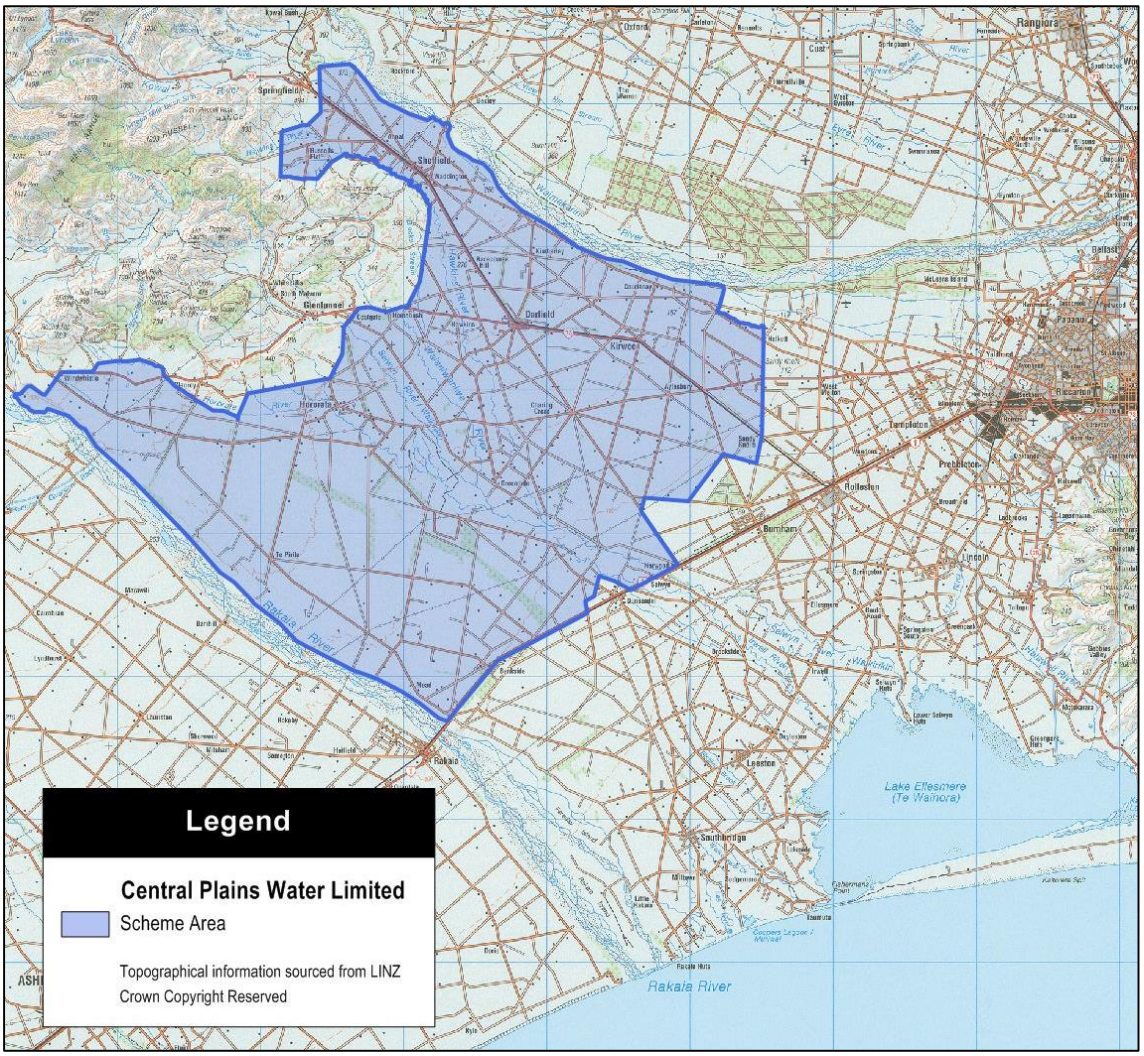


Figure 1. CPWL scheme area

Resource consents for the CPWL scheme were granted by a hearing panel appointed by Environment Canterbury and the Selwyn District Council in May 2010. The suite of consents granted includes a range of conditions which require extensive monitoring and assessment of environmental effects associated with the project.

1.2. Water management in the Selwyn/Waihora catchment

Lake Ellesmere/Te Waihora is a tribal taonga for Ngāi Tahu. It has long been an abundant source of mahinga kai and is also known by the name Te Kete Ika a Rākaihautū, the fish basket of Rākaihautū. The outstanding cultural significance of Lake Ellesmere/Te Waihora is recognised in the Ngāi Tahu Claims Settlement Act 1998 and the National Water Conservation (Te Waihora/Lake Ellesmere) Order 1990. Under the Ngāi Tahu Claims Settlement Act 1998, ownership of the lakebed of Lake Ellesmere/Te Waihora was returned to Te Rūnanga o Ngāi Tahu.

The culmination of a two year collaborative planning process with the Selwyn Waihora Zone Committee, which included 6 Rūnanga representatives was the Zone Implementation Programme addendum (ZIP). The vision of the ZIP is '*to restore the mauri of Te Waihora while maintaining the prosperous land-based economy and thriving communities*'.

The recommendations of a COMAR Report (*Cultural Opportunity Mapping, Assessment and Responses*) (Tipa and Nelson 2008), and the *Cultural Values, Flow & Water Management Issues for the Waimakariri/Selwyn-Te Waihora Catchments 2013* (Tipa & Associates) were key to informing the solution package established in the ZIP, to achieve the vision for the catchment.

Variation 1 to the proposed Land and Water Regional Plan (pLWRP) has been developed based on the recommendations in the ZIP and gives priority to the outstanding values of the lake and recognises the sensitivity of Lake Ellesmere/Te Waihora as a receiving environment, through the careful management of activities that can have a direct influence on lake health, and the relationship of Ngāi Tahu with the lake. This enables Ngāi Tahu to more effectively exercise kaitiakitanga with regard to Te Waihora.

Kaitiakitanga is the concept of stewardship, and is expressed through actions to protect natural resources. Water is central to the Ngai Tahu resource management philosophy of ki uta ki tai – from the mountains to the sea. Ngai Tahu and Te Waihora Te Taumutu are the acknowledged Kaitiaki Rūnanga for Lake Ellesmere/Te Waihora. The four Banks Peninsula Rūnanga: Ngati Wheke (based at Rapaki), Koukourārata (Port Levy), Onuku (Akaroa) and Wairewa (based at Little River) also have an interest in Te Waihora, and all have kaitiaki responsibilities.

A significant feature of Lake Ellesmere/Te Waihora is Kaituna Lagoon which is located at the eastern end at the mouth of the Kaituna River. The lagoon is particularly shallow and provides an important refuge for wildlife with its sheltered waters during storms. The lagoon is also significant because it is the area of Lake Ellesmere/Te Waihora that brings together all of the Rūnanga of mid Canterbury, namely Te Ngāi Tūāhuriri Rūnanga, Wairewa Rūnanga, Te Rūnanga o Koukourārata, Onuku Rūnanga, Te Taumutu Rūnanga and Te Hapū o Ngāti Wheke (Rāpaki).

Lake Ellesmere/Te Waihora is recognised in the Plan as a nationally significant wetland for wildlife. It supports a rich biological environment including native and introduced species. It is also regarded as an important recreational resource for both local community and visitors alike, being used for fishing, kayaking, boating, wind surfing, water and jet skiing, duck shooting, picnicking, bird watching and sightseeing.

The lake is one of New Zealand's most important wetlands, and is internationally significant for its abundance and diversity of wildlife. It is New Zealand's fifth largest lake covering approximately 20,000 ha with approximately 75 kilometres of shoreline. Lake Ellesmere/Te Waihora has a catchment of 276,000 ha, including hill and high country, downs and plains. It receives inflows from surface runoff, groundwater-fed tributaries, groundwater percolation, seawater inflows, and artesian springs. The groundwater hydrology of the area is complex and not completely understood, as is the connection between groundwater, spring flow and lake levels.

Lake Ellesmere/Te Waihora and the wider catchment face multiple cultural as well as environmental issues. Flows in lowland streams and the Selwyn River/Waikirikiri have decreased by 15 to 20% percent, there are elevated nitrate concentrations in shallow groundwater and lowland streams, and the health of Lake Ellesmere/Te Waihora has deteriorated. Phosphorus from historical land use has accumulated in the lake-bed sediments of Lake Ellesmere/Te Waihora and is released into the lake when wind-induced wave action disturbs the lake sediments. This can give rise to algal blooms that impact on cultural, recreational and amenity values associated with the lake.

There is also a recognised lag effect in the transport of nitrogen in the groundwater system of 10-30 years, so some environmental and cultural health outcomes will continue to decline even if immediate action were taken.

It has been acknowledged by the Zone Committee that achieving the vision for Lake Ellesmere/Te Waihora and its catchment will require a sustained effort over a long period of time, with all stakeholders working collaboratively to achieve the outcomes identified by the community. The catchment is not currently achieving all its 'freshwater objectives' and water quality is anticipated to get worse before it gets better as a result of lag effects.

1.3. Background to Document

Subsequent to granting of consents for the CPWL scheme the overall planning framework has changed substantially with the notification of Variation 1 to the proposed Land and Water Regional Plan (pLWRP) as part of the Canterbury Water Management Strategy (CWMS).

The CPWL consent decision recognised the trade-off between benefits associated with increased baseflows in lowland streams resulting from operation of the CPWL scheme and potential negative effects on land drainage and wastewater infrastructure in the lowland Central Plains area due to groundwater mounding. While Variation 1 to the pLWRP has provided explicit recognition of the positive benefits associated with increased baseflows in lowland streams, it does not provide equivalent guidance in terms of thresholds for adverse effects on land drainage and wastewater infrastructure. It remains the task of CPWL to operate in accordance with their consent conditions to ensure appropriate management of environmental effects resulting from operation of the scheme.

For this reason, CPWL met with representatives from Environment Canterbury during development of this document to discuss this matter and agree a practicable resolution. The outcome of the meeting was that, in developing Part II of the Groundwater and Surface Water Plan (GSWP) for the CPWL scheme, consideration should be given to the wider Variation 1 planning framework, with due consideration given to the mitigation measures identified and recorded by the Hearing

Commissioners in their Decision. This is reflected in the trigger levels and associated response processes prescribed in **Section 3**.

1.4. Groundwater and Surface Water Plan - Part II

This report forms Part II of the Groundwater and Surface Water Monitoring Plan required under Condition 21 of the CPWL consents[1]. The scope of this report includes:

- Evaluation of the cultural health and mahinga kai values of lowland Central Plains waterways (Condition 26(a)(i));
- Compilation of an inventory of land drainage, wastewater and stormwater infrastructure in the lowland Central Plains area (Condition 26(a) (ii-iv), (vi-vii));
- Summary of existing records of stream and drain flows and groundwater levels in the lowland Central Plains area (Condition 26(a)(v));
- Specification of trigger levels that may trigger implementation of mitigation measures to address potential adverse environmental effects (Condition 21(e)(ii), Condition 26(b));
- A description of mitigation measures that may be initiated in response to exceedance of specified trigger levels (Condition 21(e)(i) and Condition 21(e)(iii));
- An outline of the process initiated under Condition 32 in response to groundwater and surface water complaints.

Development of this document has taken into account policy development undertaken subsequent to granting of the CPWL consents. As detailed in Section 3, development of Variation 1 to the pLWRP has established an overall resource management framework for the Selwyn-Waihora catchment which takes into account development of the CPWL scheme. This framework includes specification of targets and/or limits for a range of water quality and water quantity variables. Wherever possible the environmental targets specified in Variation 1 to the pLWRP have been adopted as trigger levels for the CPWL environmental monitoring programme. However, due to spatial and temporal variations in baseline water quality and groundwater levels[2], the trigger level exceedance response process outlined in this document has been developed to account for the exceedance of the Variation 1 targets at a number of monitoring sites.

1.5. Monitoring and management of environmental effects associated with the CPWL scheme

In addition to the environmental monitoring specified in Part I of the GSWP and trigger levels, mitigation and complaint response processes outlined in this document (Part II), conditions of the CPWL consent also establish an expert review panel and an annual reporting process as two

[1] Part I was submitted to ECan for approval in February 2014

[2] Described in the *Baseline Water Quality* and *Baseline Groundwater Levels* reports submitted to Environment Canterbury as part of the GSMP Part I document

additional requirements for the monitoring and management of environmental effects associated with the CPWL scheme.

1.5.1. Ground and Surface Water Expert Review Panel

Condition 20 requires the establishment of a Ground and Surface Water Expert Review Panel (GSWERP) which includes representatives of various stakeholder groups including the Christchurch City Council (CCC), Selwyn District Council (SDC), Environment Canterbury (ECan), Te Rūnanga o Ngāi Tahu and drainage schemes in the lower plains including independent experts with knowledge and skills relating to groundwater, water quality and land drainage.

The function of the GSWERP is defined as including:

- Review of the Ground and Surface Water Plan (including this document)
- Consultation with Te Rūnanga o Ngāi Tahu regarding monitoring and mitigation measures related to effects on Lake Ellesmere/Te Waihora as well as cultural monitoring to be undertaken;
- Receiving and reviewing environmental monitoring reports prepared by CPWL and any other relevant monitoring results and reports prepared by ECan or other bodies;
- Reviewing the assessment and response to complaints initiated by CPWL in accordance with Condition 32;
- Determining the likely cause of reported problems with drainage, groundwater or localised surface water quality issues as well as appropriate response in terms of mitigation or remedial measures (including financial compensation in certain circumstances);
- Advising ECan if there are grounds to review conditions of consent in the event that an adverse effect arises which is not mitigated or remedied by the consent holder to the extent recommended by the GSWERP

1.6. Structure of the document

This document is divided into four sections as follows:

- **Section 2** outlines information required to satisfy requirements of Condition 26 including an evaluation of cultural health and mahinga kai values, an inventory of land drainage, wastewater and stormwater infrastructure in the lowland Central Plains area and records of relevant environmental monitoring information;
- **Section 3** specifies trigger levels for the CPWL monitoring programme along with the process initiated in response to trigger level exceedance or complains related to groundwater quality and groundwater levels.
- **Section 4** provides a summary of the trigger level response process including possible mitigation options as well as an outline of the Annual Reporting process.

1.7. Review of the Groundwater and Surface Water Monitoring Plan

It is recognised that the contents of this Plan and the development of the CPW Scheme represent a new approach to the management of the Central Plains area. Therefore it is considered appropriate that this document will be reviewed following receipt of the 2016 Annual Report (scheduled for 1 September 2016), and thereafter at intervals not exceeding 5 years during the life of the CPWL project. Reviews will consider the results of environmental monitoring (undertaken by CPWL, ECan and other agencies) as well as future changes in the overall resource management framework for the Selwyn-Waihora catchment. The trigger levels and associated complaint response process outlined in this document will also be reviewed by the GWSERP panel during the review process.

2. Inventory of Drainage, Wastewater and Stormwater Infrastructure

This section of the report addresses requirements of Condition 26(a) which specifies that:

Prior to the finalisation of the Ground and Surface Water Plan: Part 2, the consent holder shall:

(a) undertake a baseline survey of the lowland drainage systems of the Central Plains taking into consideration historical data. The survey shall build on existing data, and include:

(i) An evaluation of the current cultural health and identification of the mahinga kai values of these waterways;

(ii) An inventory of drains and streams, their location, size and capacity,

(iii) An inventory of sewerage systems (reticulated and individual septic tanks),

(iv) The conditions of these facilities, their capacities, maintenance activities, dates of installation, histories of water-level related issues,

(v) Records of stream and drain flows and groundwater levels,

(vi) Existing management and administration arrangements for the drainage schemes,

(vii) Current costs of maintenance and operation of the drainage schemes.

2.1. Cultural Health

Detailed information on cultural health assessment can be found in the COMAR[3] report prepared for Environment Canterbury as part of the Canterbury Water Management Strategy. This report can be accessed from:

http://files.ecan.govt.nz/public/lwrp/variation1/cultural-values-flow-water-management-issues-waikirikiri-selwyn-te-waihora-catchments.pdf

Cultural monitoring and assessments of progress against cultural values in the catchment will be carried out by Ngāi Tahu. It is considered that the Te Waihora Environmental Management Fund (TWEMF), provided for by CPWL and administered by Ngāi Tahu, may be utilised at least in part to fund this monitoring work.

CPWL anticipate that Ngāi Tahu representation on GSWERP, the Environmental Management Fund Committee (EMFC), the Zone Committee and amongst other groups and key stakeholder organisations will facilitate a high level of collaboration and information sharing, including details on use of, and outcomes achieved through, the TWEMF.

[3] *Cultural Values, Flow and Water Management Issues for the Waimakariri/Selwyn-Te Waihora Catchments*. Report prepared for Environment Canterbury by Tipa and Associates, February 2013

Sharing information and resources in this manner will best enable cultural as well as environmental aspirations to be addressed in an efficient and collaborative manner, incorporating input from all key stakeholders and interest groups. It will also minimise duplication of effort and expenditure.

2.2. Land Drainage

Land drainage to facilitate settlement and agricultural development in the lowland Central Plains area commenced in the mid-1800's. Early drainage development was largely undertaken by individual landowners with overall management of drainage activity managed under the Ellesmere and Forsyth Reclamation Act 1876. In the early 1940s the North Canterbury Catchment Board took over control of Lake Ellesmere/Te Waihora and undertook a range of works to improve drainage schemes across the area including construction of two new lower level ocean discharge culverts which increased the overall drainage capacity. Aside from two new outlet structures to drains in the Taumutu district, no significant new scheme drains have been installed in the area since the 1960s.

As listed in **Table 1**, there are currently 9 separate drainage schemes in the lowland Central Plains area, eight administered by the Selwyn District Council and one (the Halswell Drainage District) by ECan. These schemes include approximately 500 km of drains and streams and service around 36,900 ha of land on approximately 2,500 properties (plus residential properties in the Halswell District). In addition, there are significant natural streams outside the rated drainage districts, particularly in the area between Southbridge and Taumutu, which discharge directly to the sea. Numerous secondary private drains feed into the formal drainage network.

Figure 2 shows the spatial extent of the classified drainage network.

Table 1. Drainage schemes in the lowland Central Plains area

Scheme	Length of drain/river (km)	Area served (ha)	Properties served
Taumutu	8.2	500	14
Taumutu Culverts	4 Culverts	1,000	200
Leeston	207.9	12,847	393
Leeston Township	3.9	89.9	640
Ellesmere	25.7	1,329	74
LII	64.6	5,068	1,055
Greenpark	21.2	2,433	90
Osbornes	9.5	1,256	49
Halswell	156	11,700	-

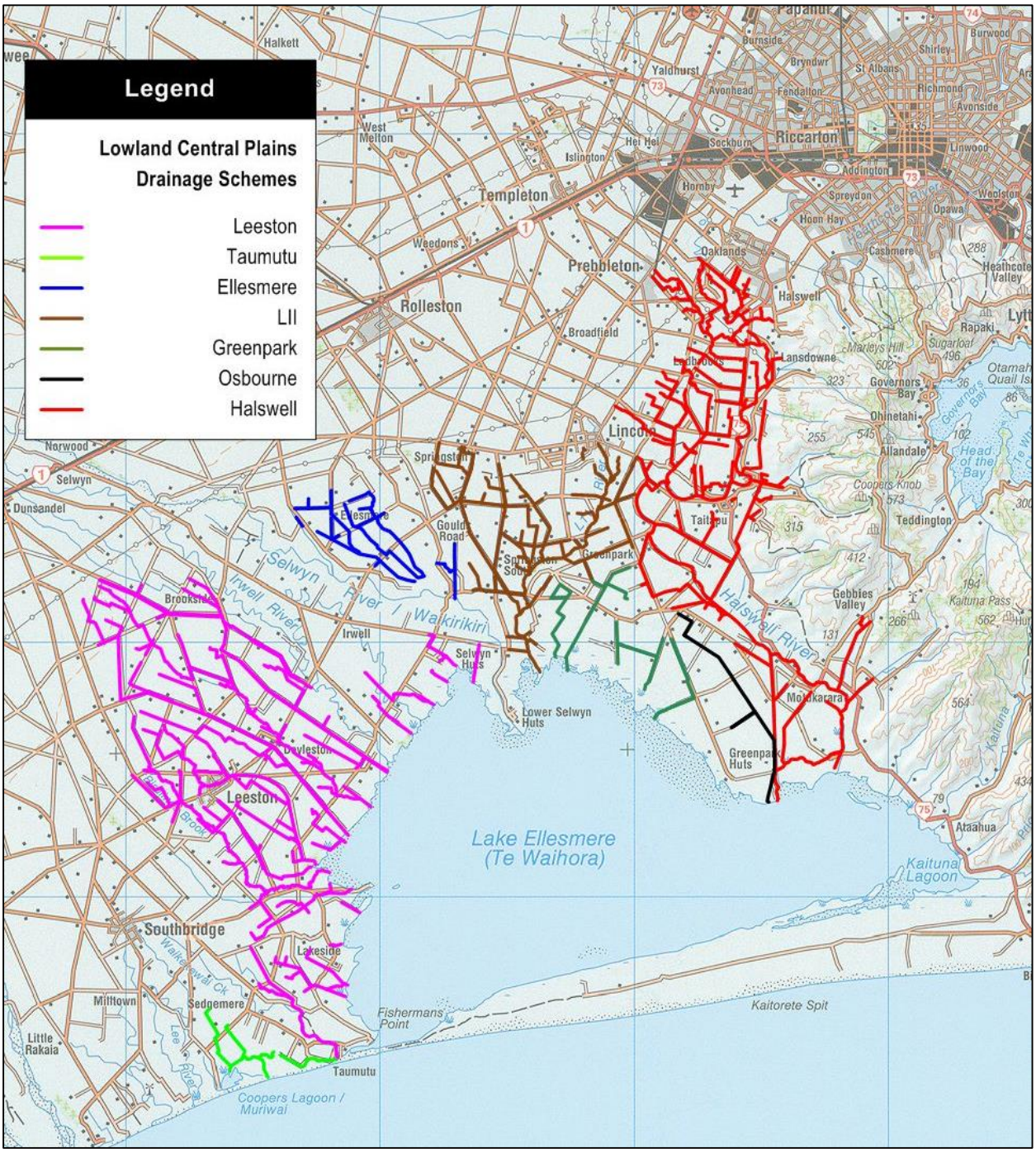


Figure 2. Land drainage schemes and classified drainage network in the Lowland Central Plains area

2.2.1. Ellesmere Drainage Scheme

As shown on **Figure 3** below, the Ellesmere drainage scheme services an area of approximately 2,820 ha between Curries Road and Bethels Road with drainage outlets for this scheme via the Selwyn River/Waikirikiri in the vicinity of Coes Ford to the ultimate receiving environment in Lake Ellesmere/Te Waihora. The scheme mainly comprises a network of excavated open channels that intercept, convey and discharge groundwater to enable agricultural land use.

The drainage network also discharges stormwater from individual properties via a network of open drains. However, the scheme is not designed to discharge peak stormwater flows, rather localised and brief flooding is a normal expectation following storm events (Lewthwaite, 2008).

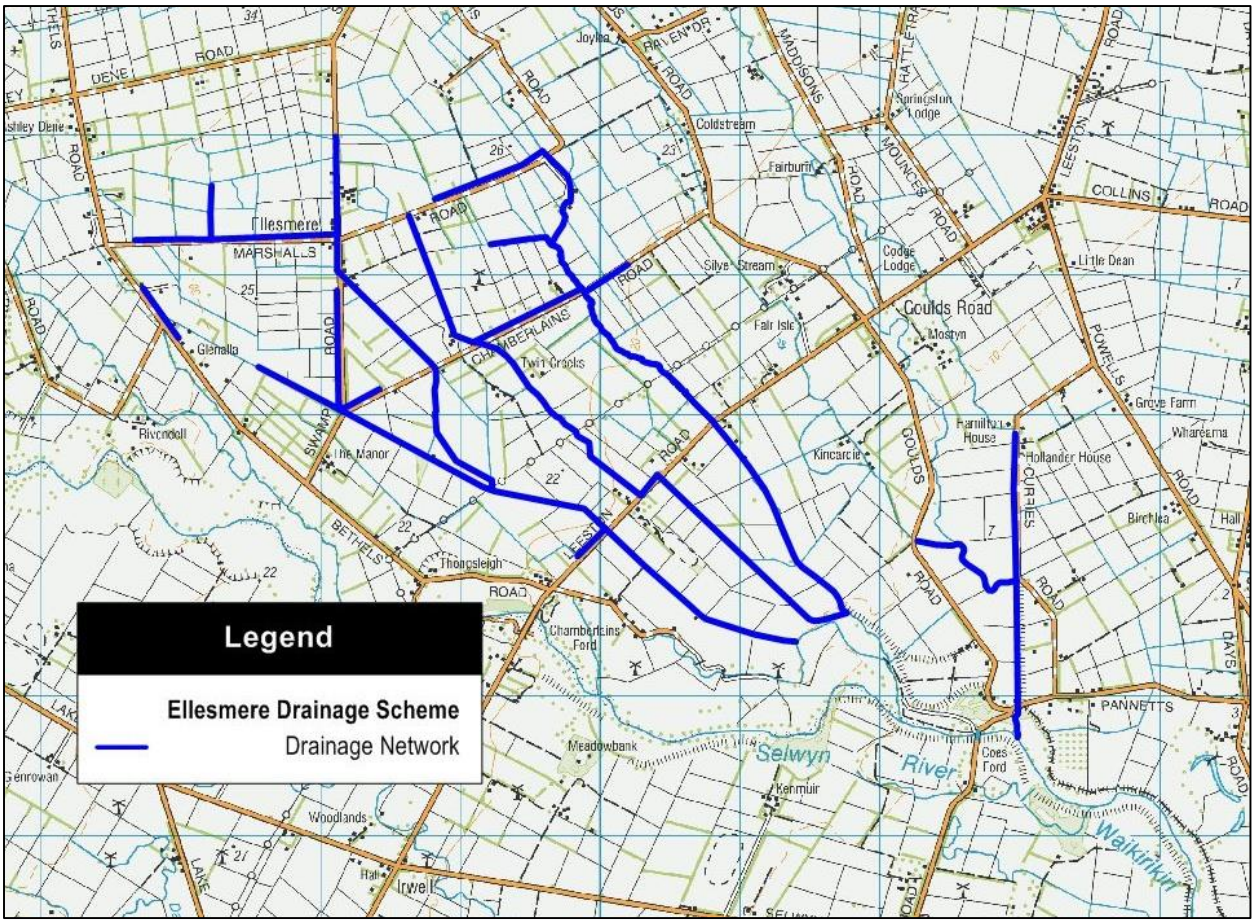


Figure 3. Ellesmere Land Drainage Scheme

Operational Management

Management of the Ellesmere drainage scheme is overseen by the Ellesmere Land Drainage Committee. SDC Operations staff work alongside the Committee to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the Ellesmere Drainage Scheme is $3.2 million, consisting entirely of excavated drainage channels.

The SDC Land Drainage Activity Management Plan (2015) provides a ranking of asset condition for the Ellesmere Drainage Scheme. This assessment identifies that approximately 75% of the drainage network is ranked as being in good condition, 15% in moderate condition, 8% in poor condition with approximately 2% assessed as failing.

Operation and Maintenance Costs

The 10 year budget for the Ellesmere Drainage Scheme outlined in the SDC Land Drainage Activity Management Plan (2015) shows budgeted maintenance costs rising from $9,300/annum between 2015/16 and 2017/18 to $11,300/annum between 2021/22 and 2024/25 (Figure 4Figure 4. Ellesmere Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

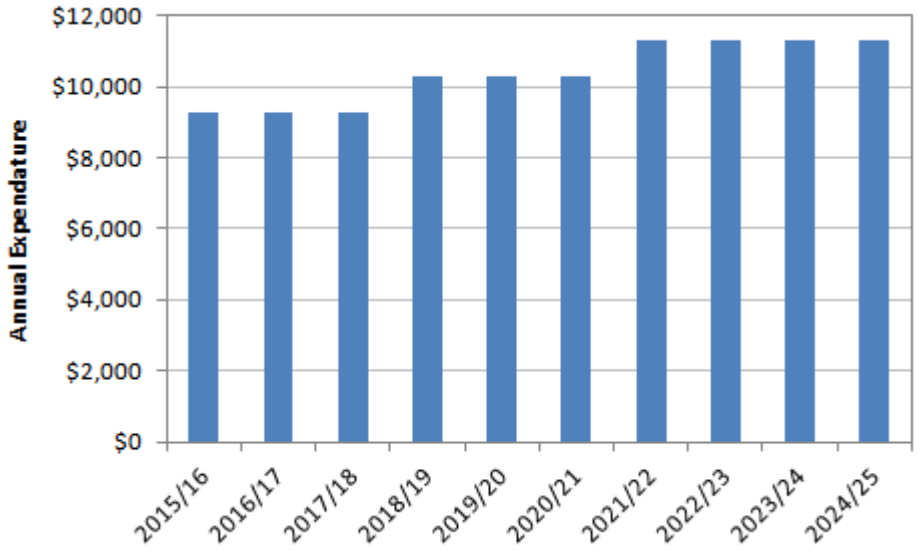


Figure 4. Ellesmere Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

No renewals or capital works are budgeted for this scheme which is assessed as having a maintained infinite life.

Groundwater Level and Flow Monitoring

Table 2 provides a summary of groundwater level and flow monitoring undertaken by Environment Canterbury in the vicinity of the Ellesmere Drainage scheme. Location of the respective sites is shown on **Figure 5** below. **Appendix 3** provides a summary of groundwater level and flow data for the sites shown as well as the observed correlation between groundwater level and stream discharge at these sites.

Table 2. Groundwater Level and Flow Monitoring in the Ellesmere Drainage Scheme area

Parameter	Site	Depth (m)	Monitoring Type
Groundwater Level	M36/0465		Manual Monthly
	M36/0599		Manual Monthly
Flow	Snake Stream at Lincoln-Leeston Rd		Manual gauging
	McGraths Stream at Lincoln-Leeston Rd		Manual gauging
	Miles Drain at Pannetts Road		Manual gauging

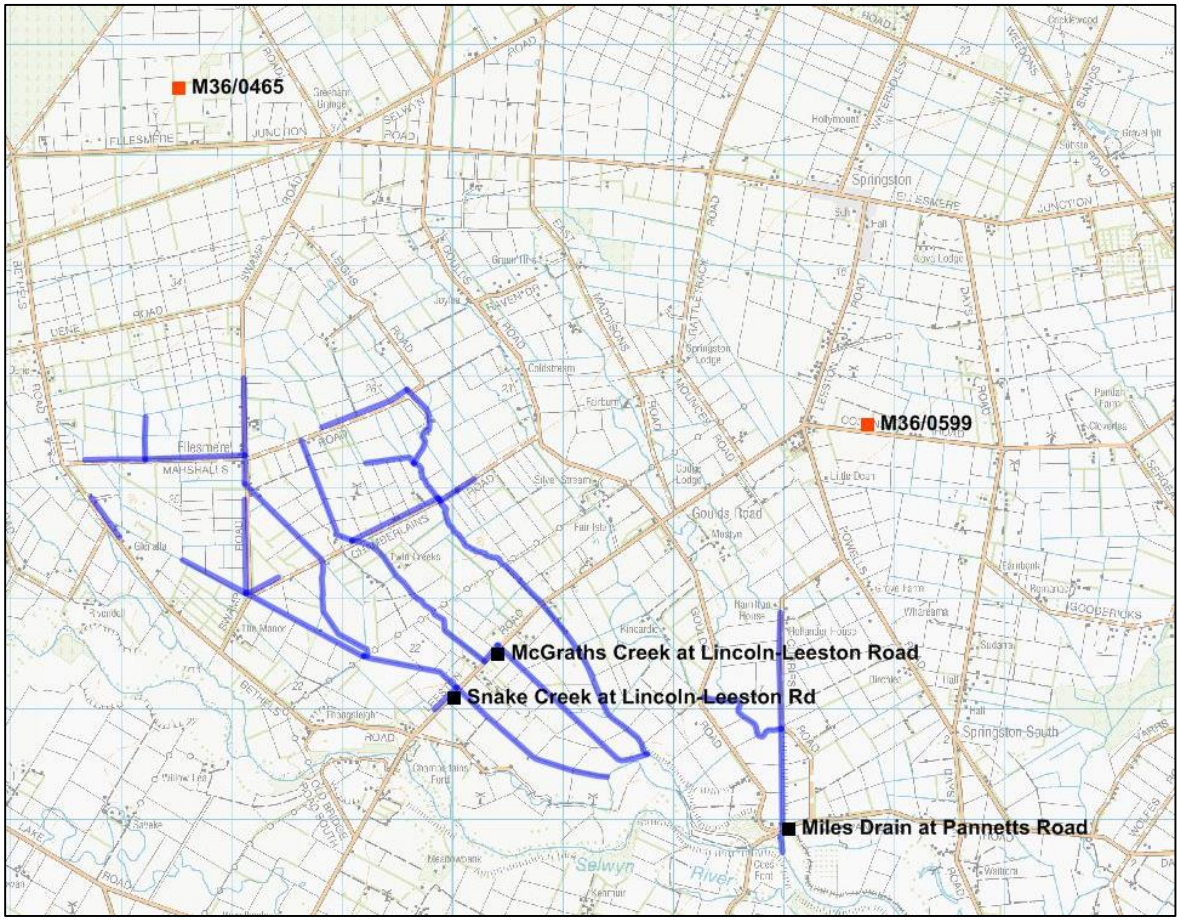


Figure 5. Groundwater level and flow monitoring sites in the Ellesmere Drainage Scheme area

Operational Constraints / Potential Pressures on Drainage Infrastructure

No major issues or constraints on discharge are currently identified in the Ellesmere Drainage scheme.

2.2.2. Greenpark Drainage Scheme

As shown on **Figure 6** below, the Greenpark drainage scheme services an area of approximately 2,244 ha between Hudsons Road, Carters Road and Lake Ellesmere/Te Waihora. The scheme comprises a total of 21.2 kilometres of classified drains which discharge via 5 separate outlets along the northern margin of Lake Ellesmere/Te Waihora to the east of the Selwyn River/Waikirikiri.

The drainage network also discharges stormwater from individual properties via a network of open drains. However, the scheme is not designed to discharge peak stormwater flows, rather localised and brief flooding is a normal expectation following storm events (Lewthwaite, 2008).

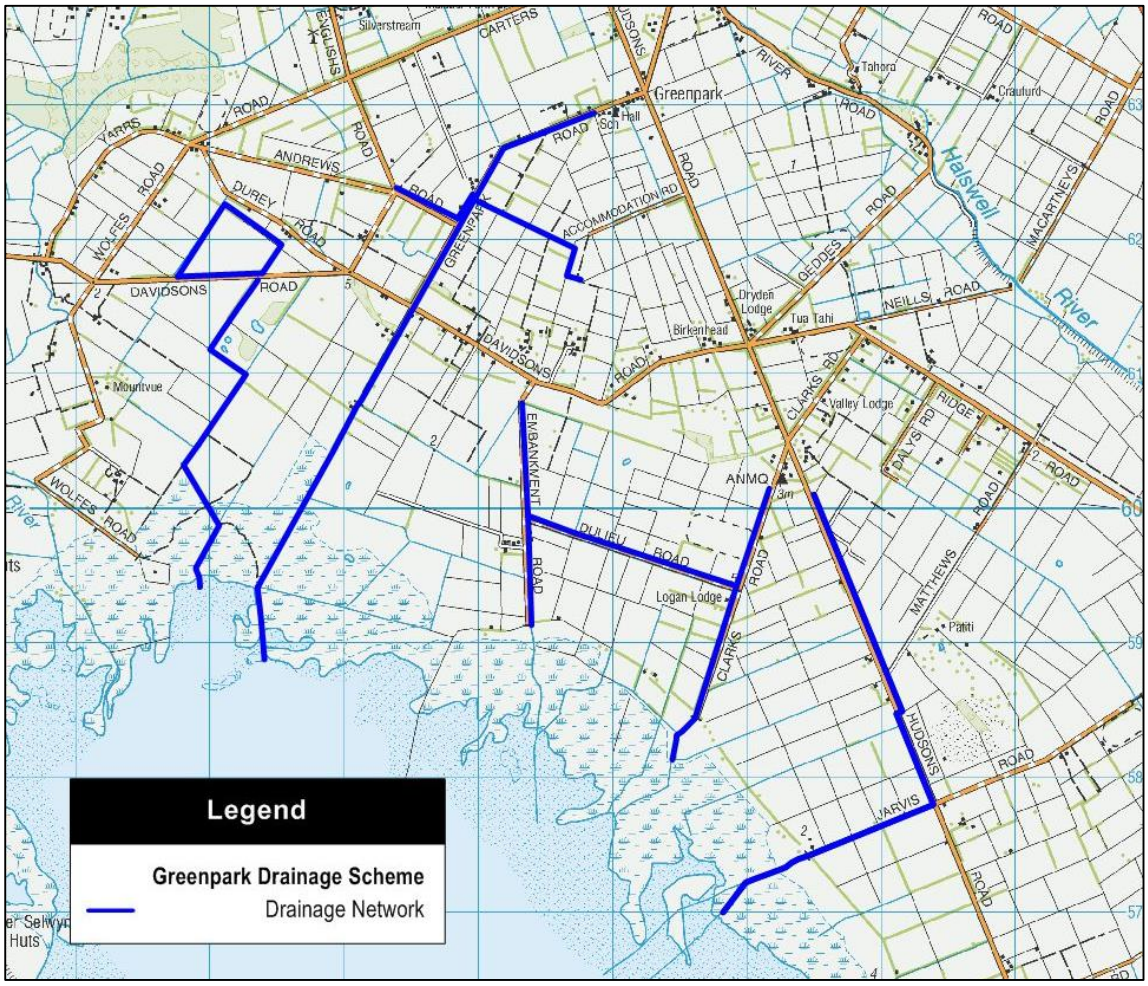


Figure 6. Greenpark Drainage Scheme

Operational Management

Management of the Greenpark drainage scheme is overseen by the Greenpark Land Drainage Committee. SDC Operations staff work alongside the Committee to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the Ellesmere Drainage Scheme is $1.85 million, consisting entirely of excavated drainage channels.

The SDC Land Drainage Activity Management Plan (2015) does not provide an assessment of asset condition in the Greenpark Drainage Scheme as no survey of asset condition has been undertaken.

Operation and Maintenance Costs

The 10 year budget for the Greenpark Drainage Scheme outlined in the SDC Land Drainage Activity Management Plan (2015) shows budgeted maintenance costs vary on a 3-yearly cycle between $6,300/annum in the first year and $2,300/annum during the second and third years.

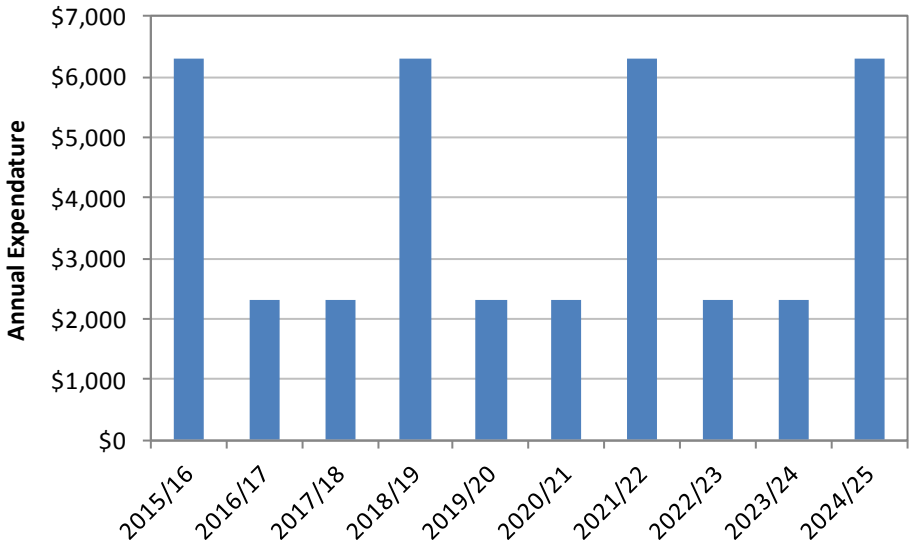


Figure 7. Greenpark Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

No renewals or capital works are budgeted for this scheme which is assessed as having a maintained infinite life

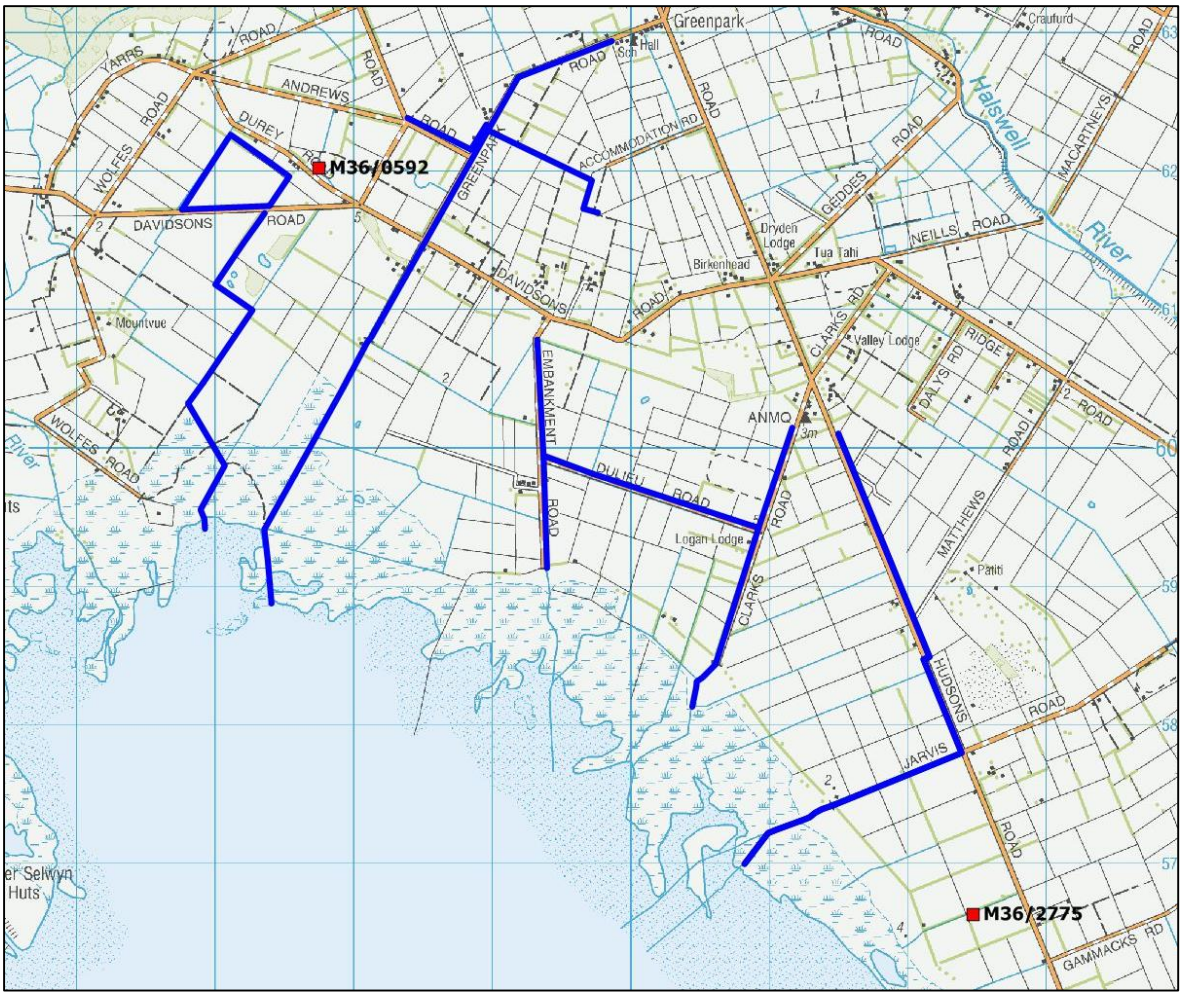
Groundwater Level and Flow Monitoring

Environment Canterbury currently operates two groundwater level monitoring sites in the vicinity of the Greenpark Drainage scheme:

- M36/0592 - a 43 metre deep well located near the northern extent of the scheme monitored monthly; and,
- M36/2775 - a 31.5 metre deep automatic recorder site located approximately 1 kilometre from Jarvis Drain which marks the eastern extent of the scheme

No regular flow monitoring is undertaken in the Greenpark drainage scheme. Stream stage is monitored on an irregular basis by SDC staff. The location of the groundwater monitoring sites is shown on **Figure 8** below. **Appendix 2** provides an outline of summary groundwater level monitoring for the sites shown.

Figure 8. Groundwater level monitoring in the Greenpark Drainage Scheme area



Operational Constraints / Potential Pressures on Drainage Infrastructure

The SDC Land Drainage Activity Management Plan identifies the limited understanding of the influence of lake levels on the drainage system as a potential constraint on efficiency of the Greenpark Drainage Scheme. Council staff monitor currently visually stream stage and lake levels to better characterise this relationship.

2.2.3. Leeston Drainage Scheme (Urban and Rural)

The Leeston drainage district is subdivided into two management areas; 'Leeston Rural' and Leeston Township'. The rural drainage district services a relatively large catchment extending across a triangular area of approximately 10,400 ha on the south-side of the Selwyn River between Sandersons Road in the west and Taumutu. The urban drainage district encompasses a number of drains which flow around the Leeston township. The combined scheme comprises at total of 211.1 kilometres of classified drains which discharge via numerous outlets along the western margin of Lake Ellesmere/Te Waihora. **Figure 9** shows the layout of the Leeston Drainage Scheme.

Figure 9. Leeston Drainage Scheme

The Leeston Drainage Scheme includes Hanmer's Drain which is unique in the Lowland Central Plains area in that it was constructed for both land drainage and flood relief purposes. This channel includes 14 drop structures designed to reduce flow velocities.

Operational Management

Management of the Leeston drainage scheme is overseen by the separate committees for the rural and urban components of the scheme.

SDC Operations staff work alongside the Committee to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the Leeston Drainage scheme (Urban and Rural) is $20.89 million, consisting of excavated drainage channels ($20.69 million), pipes, weirs and headwalls ($0.2 million).

The SDC Land Drainage Activity Management Plan (2015) provides an assessment of asset condition in the Leeston Drainage Scheme. This assessment indicates approximately 70% of the channel network is assessed as being in moderate or better condition, 15% in poor condition with approximately 5% meeting the fail criteria. The approximately 650 metres of piped drainage is assessed as being in excellent condition.

Operation and Maintenance Costs

The 10 year budget for the Leeston Drainage Scheme outlined in the SDC Land Drainage Activity Management Plan (2015) indicates fixed expenditure of $46,150/annum for the Leeston Rural scheme and $14,300/annum for the Leeston urban scheme. Project expenditure of $5,000 is programmed for the Leeston urban scheme during 2015/16 to undertake site measurements to inform the stormwater upgrade strategy. Expenditure of $5,000/annum is programmed on a three yearly basis from 2017/18 for the rural scheme, covering costs associated with engineering inspection and assessment of the Hanmer Drain drop structures.

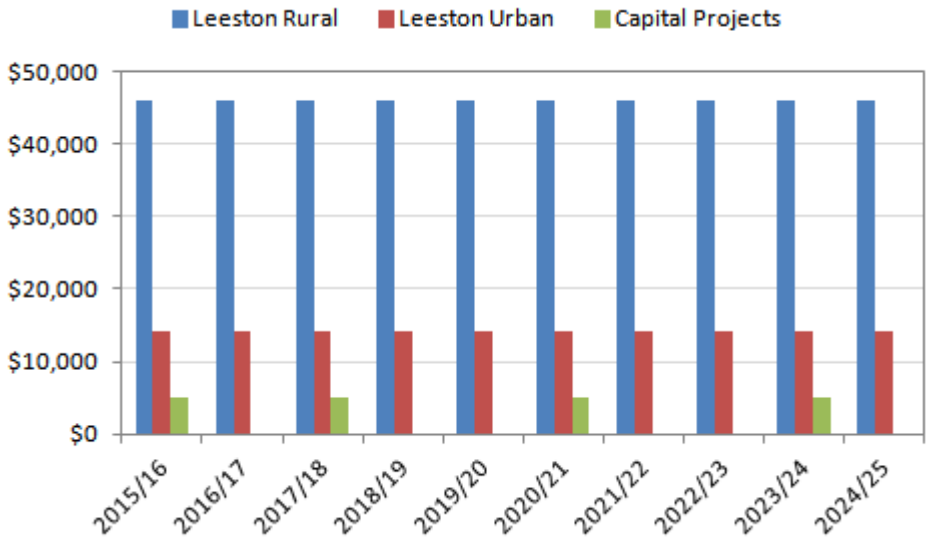


Figure 10. Leeston Drainage Scheme operation, maintenance and capital expenditure (Source: SDC, 2015)

Groundwater Level and Flow Monitoring

Table 3 provides a summary of groundwater level and flow monitoring undertaken by Environment Canterbury in the vicinity of the Leeston Drainage scheme. Location of the respective sites is shown on **Figure 11** below. **Appendix 2** provides a summary groundwater level and flow statistics for the sites shown and **Appendix 3** outlines the observed correlations between groundwater level and stream discharge at a number of these sites.

Table 3. Groundwater level and flow monitoring sites in the Leeston Drainage Scheme area

Parameter	Site	Depth (m)	Monitoring Type
Groundwater Level	M36/7880	8	Monthly manual
	M36/4674	9	Automatic
	M36/7694	6	Monthly manual
	M36/0424	12.8	Automatic
	M36/1918	11.6	Monthly manual
	M36/0664	18	Monthly manual
Flow	Irwell River at The Lake Road		Gauging
	Harts Creek at Timberyard Point Road		Automatic
	Hanmer Road Drain at Lake Road		Automatic
	Doyleston Drain at Lake Road		Automatic
	Boggy Creek at Lower Lake Road		Gauging
	Birdlings Brook at Locheads Road		Gauging

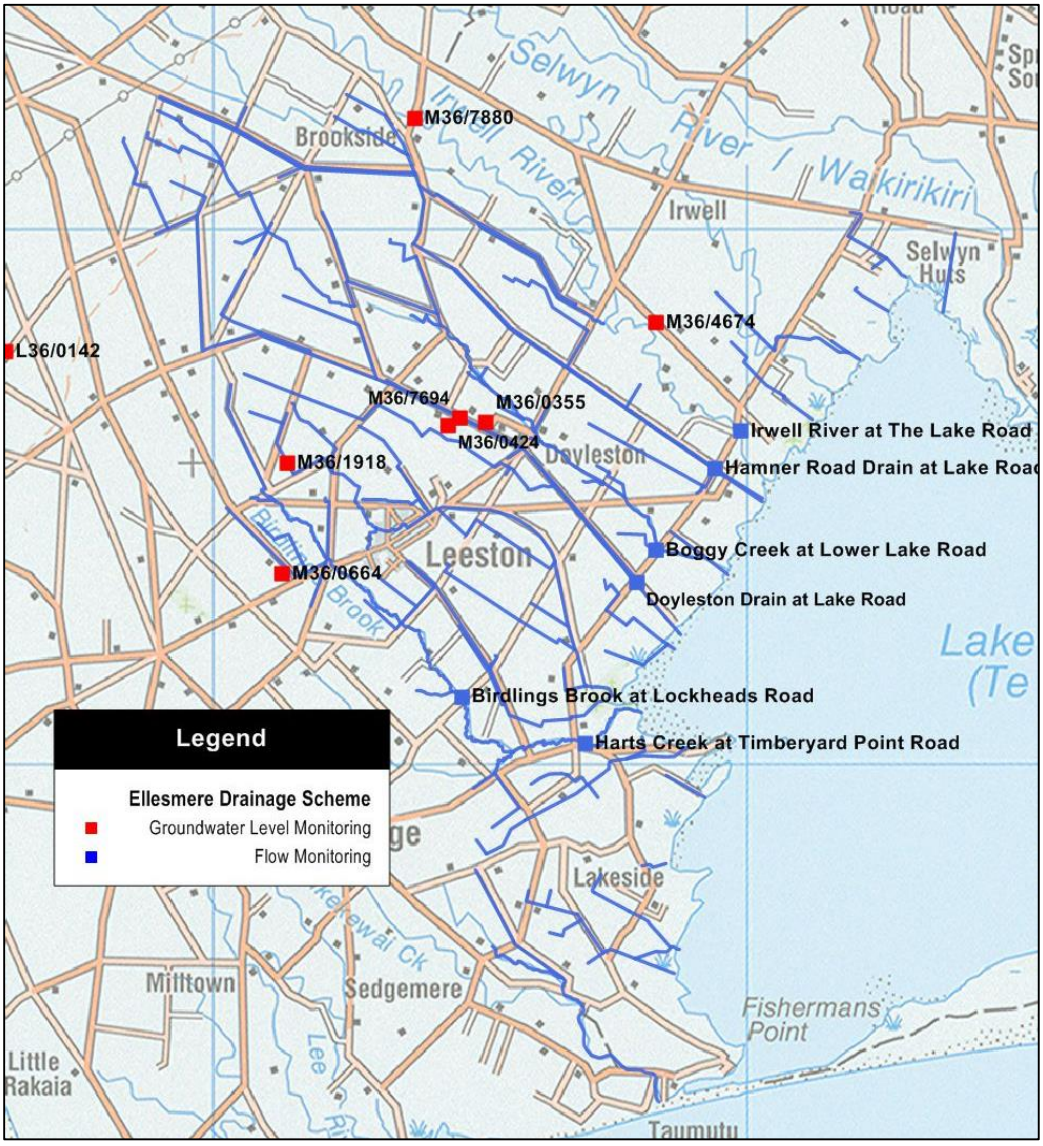


Figure 11. Groundwater level and flow monitoring sites in the Leeston Drainage Scheme area

SDC also operate a telemetered flood gauge used to provide flood warning for the Leeston township.

Operational Constraints / Potential Pressures on Drainage Infrastructure

Table 4 provides a summary of operational issues identified with the Leeston Drainage Scheme in the SDC Land Drainage Activity Management Plan. These issues primarily relate to the capacity of the drainage system to discharge peak flows in the vicinity of the Leeston township, the use of Volckman Road drain to discharge treated effluent from the Ellesmere Wastewater Plant during periods of high groundwater levels as well as the condition of the Hanmer Road Drain drop structures. In conjunction with stormwater management, works are currently planned to reduce flooding risks to Leeston township following flood events following heavy rainfall in 2013 and 2014.

Table 4. Operational issues associated with the Leeston Drainage Scheme (SDC, 2015)

Scheme Area	Issue
Leeston Rural	▪ Potential failure of Hanmer Road Drain drop structures ▪ Sewer discharges from Ellesmere Treatment Plant to Volckman Road Drain at times of high groundwater and wastewater inflow ▪ Proposed changes to drainage patterns around Leeston township as part of Leeston stormwater mitigation
Leeston Urban	▪ Drain capacities in the Leeston township are poorly characterised ▪ Flooding in the township from classified drains including Leeston Creek and the upper catchment. Leeston Creek and others undersized for flows from township and upper catchment ▪ Access to clean Leeston Creek. Not all parts of the Creek are accessible by machine

2.2.4. LII Drainage Scheme

The LII Drainage Scheme services an area of approximately 4,755 ha south of Ellesmere Junction Road between Hudsons Road in the east and Powells Road in the west. Drainage from this scheme occurs via the LII River into Lake Ellesmere/Te Waihora. The scheme comprises at total of 76.0 kilometres of classified drains. The drainage network also discharges stormwater from individual properties via a network of open drains.

Figure 12 shows the layout of the LII Drainage Scheme.

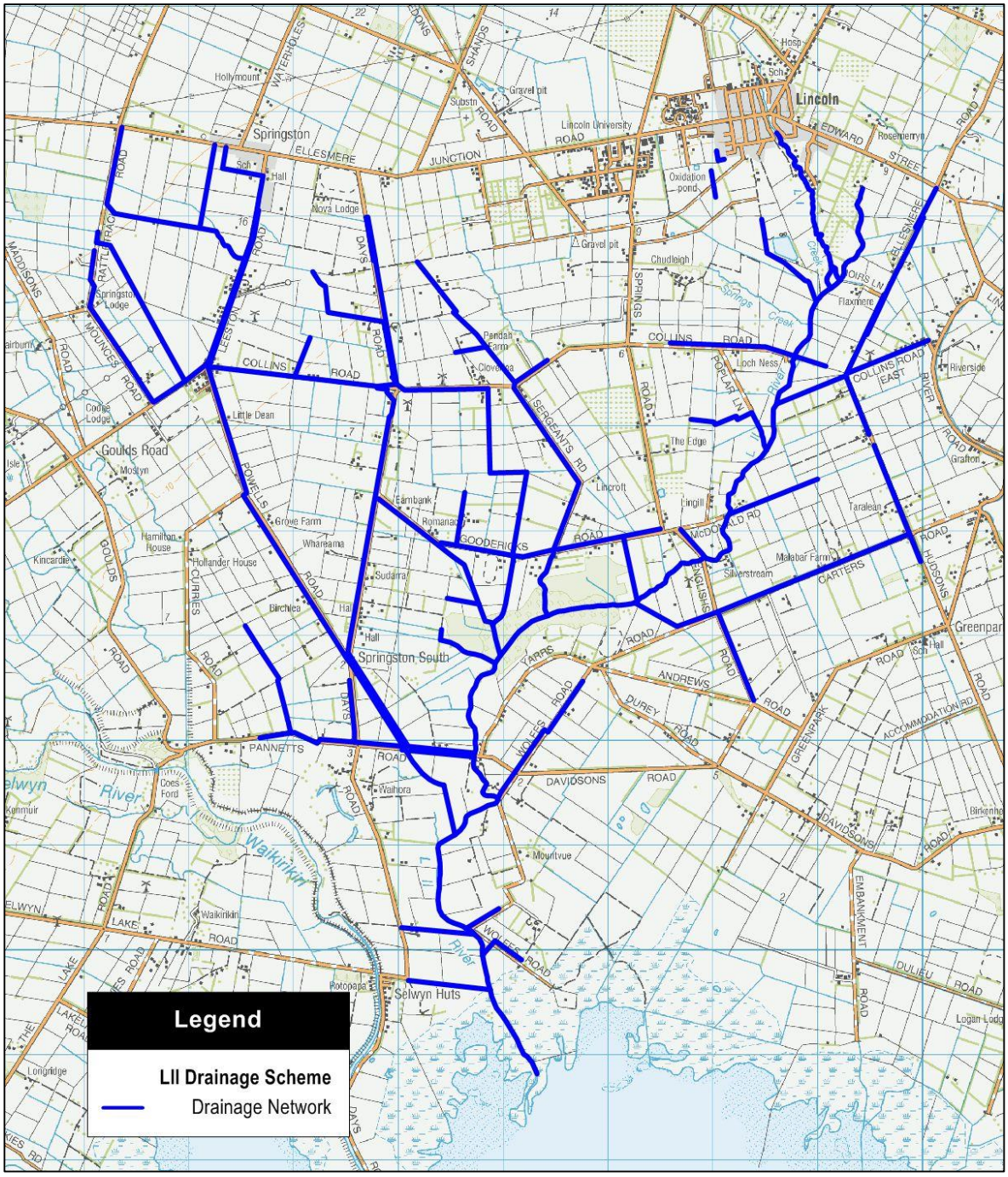


Figure 12. LII Drainage Scheme

Operational Management

Management of the LII Drainage Scheme is overseen by the LII Land Drainage Committee. SDC Operations staff work alongside the Committee to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the LII Drainage Scheme is $7.895 million, primarily consisting excavated drainage channels.

The SDC Land Drainage Activity Management Plan (SDC, 2015) provides an assessment of asset condition in the LII Drainage Scheme. This assessment indicates approximately 55% of the channel network is assessed as being in good to excellent condition, 30% in moderate condition with around 15% classified as poor to fail.

Operation and Maintenance Costs

The 10 year budget for the LII Drainage Scheme outlined in the SDC Land Drainage Activity Management Plan (2015) shows budgeted maintenance costs fixed at $43,200. The budget includes provision of $5,000 for engineering inspection of the scheme in the 2015/16 year and $70,000 for renewals (pipes and headwalls) in the 2017/18 year.

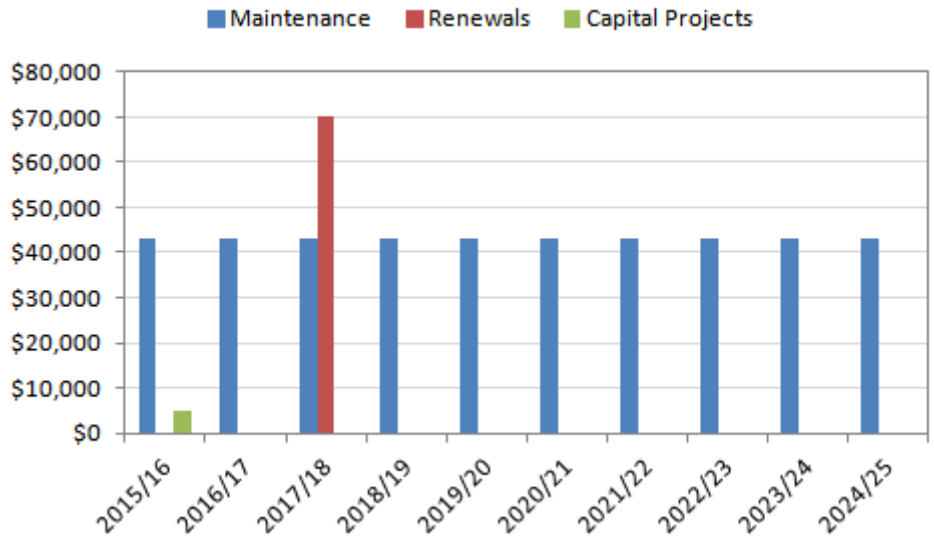


Figure 13. LII Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

Groundwater Level and Flow Monitoring

Table 5 provides a summary of groundwater level and flow monitoring undertaken by Environment Canterbury in the vicinity of the LII Drainage Scheme. Location of the respective sites is shown on **Figure 14** below. **Appendix 2** provides a summary of groundwater level and flow statistics for the sites shown and **Appendix 3** outlines the observed correlations between groundwater level and stream discharge at a number of these sites.

Table 5. Groundwater level and flow monitoring in the LII Drainage Scheme area

Parameter	Site	Depth (m)	Monitoring Type
Groundwater Level	M36/0183	29.6	Monthly manual
	M36/0250	18	Monthly manual
	M36/0255	24.4	Monthly manual
	M36/0592	43	Monthly manual
	M36/0599	9.1	Monthly manual
Flow	LII River at Moirs Bridge		Gauging
	LII River at Pannetts Road		Automatic
	LII River at Wolfs Road		Gauging

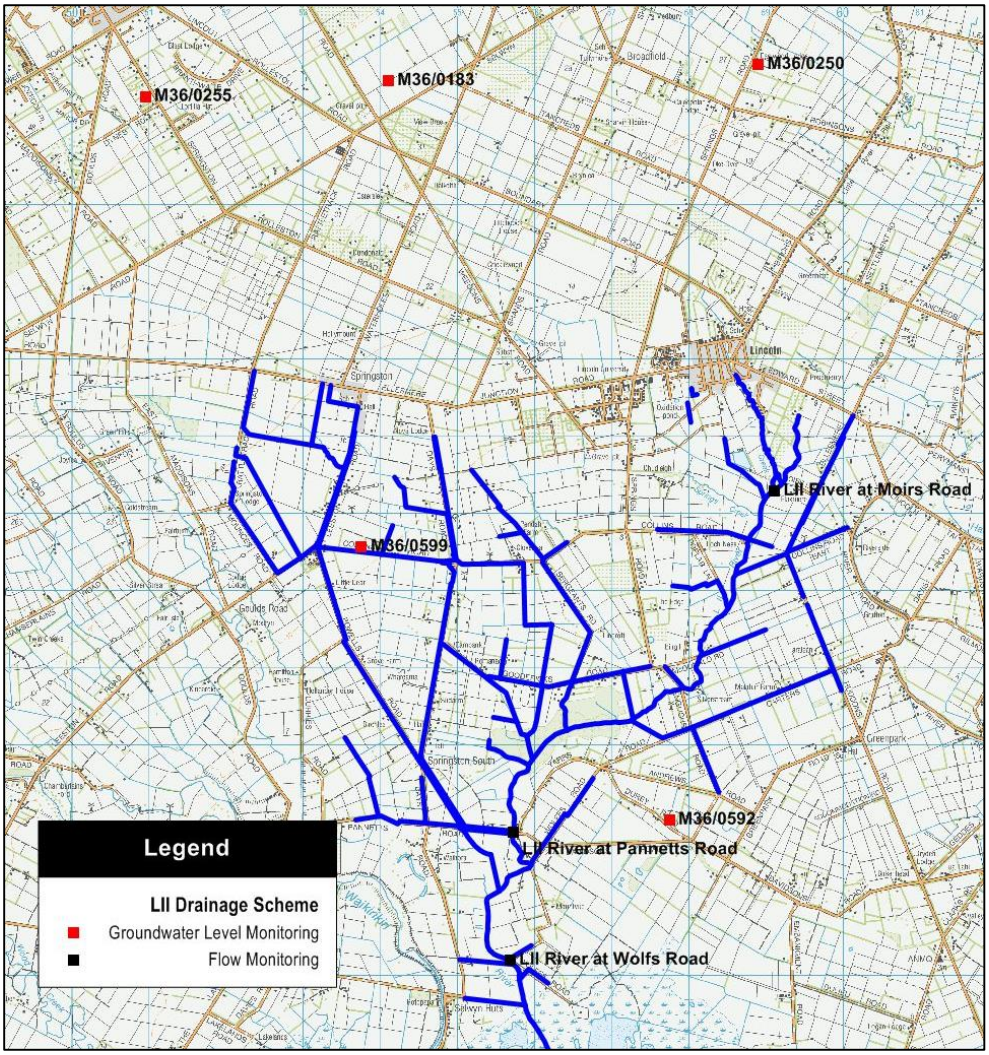


Figure 14. Groundwater Level and flow monitoring in the LII Drainage Scheme area

Operational Constraints / Potential Pressures on Drainage Infrastructure

The SDC Land Drainage Activity Management Plan identifies a number of issues/ pressures in the LII Drainage Scheme. These include:

- The ongoing requirement for mechanical weed control to maintain channel capacity in the lower catchment;
- Flooding in lower catchment areas (and associated requirements for weed control, drain cleaning and dredging);
- Increased sediment loading and peak flows associated with subdivision development in the catchment;
- Changing community expectations regarding levels of channel maintenance required in urban areas which were formerly rural

2.2.5. Osborne Drainage Scheme

The Osborne Drainage Scheme services an area of approximately 1,790 ha between the Halswell Canal, Hudson Road and Lake Ellesmere/Te Waihora. The scheme comprises at total of 10.2 kilometres of classified drains which discharge via a pump station which discharges to Lake Ellesmere/Te Waihora in the Motukarara area.

Osbornes Drain originally discharged to the lower reaches of the Halswell Canal but was reconfigured as a pumped drainage scheme following improvements to the lower reaches of the Halswell catchment in the 1950s which maintained higher water levels. The scheme has an installed pumping capacity of 1,700 L/s which is sufficient to cope with a range floodwaters except under extreme rainfall, with ponding capacity provided in the main canal. Operation of the pump station varies significantly through the year. During the late spring to autumn the pump station typically operates for less than 25 hours/month. However, during the winter months or during extended periods of wet weather pump operation may increase to over 500 hours/month

Figure 15 shows the layout of the Osborne Drainage Scheme.

Figure 15. Osborne Drainage Scheme

Operational Management

Management of the Osborne drainage scheme is overseen by the Osborne Land Drainage Committee. Committee members also actively manage operation of the pump station.

SDC Operations staff work alongside the Committee to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the Osborne Drainage Scheme is $2.33 million, comprising $2.18 million for excavated drainage channels and $0.15 million for plant and equipment.

The SDC Land Drainage Activity Management Plan (2015) does not provide an assessment of asset condition in the Osborne Drainage Scheme as no survey of asset condition has been undertaken.

Operation and Maintenance Costs

The 10 year budget for the Osborne Drainage Scheme outlined in the SDC Land Drainage Activity Management Plan (2015) shows budgeted maintenance costs of $11,080 over the forecast period with a total of $50,186 budgeted for renewals (mainly culverts) over this period.

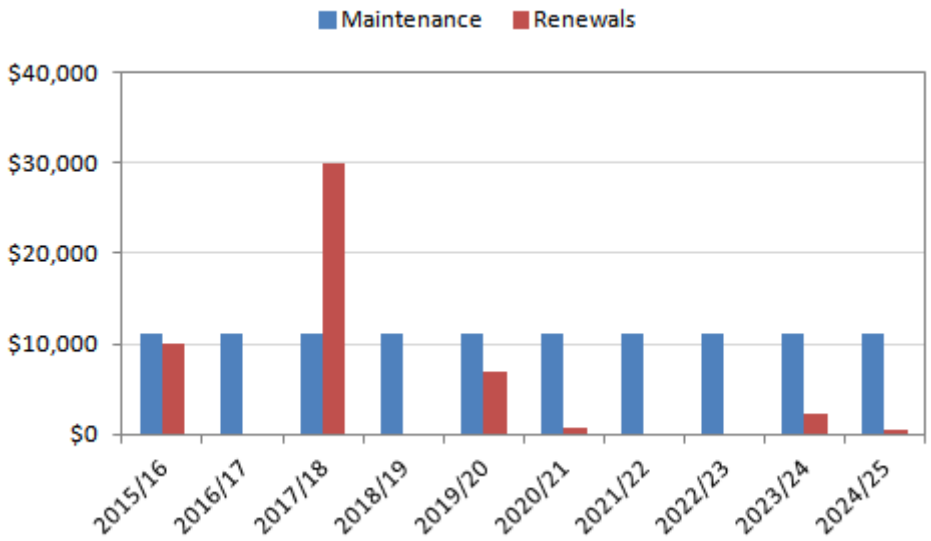


Figure 16. Osborne Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

Groundwater Level and Flow Monitoring

Environment Canterbury currently operates one groundwater level monitoring site in the vicinity of the Osbourne Drainage scheme:

- M36/0592 - a 43 metre deep well located approximately 4 kilometres west of the main drainage channel (monthly monitoring); and,
- M36/2775 - a 31.5 metre deep automatic recorder site located adjacent to Hudsons Road

No regular flow monitoring is undertaken in the Osbourne drainage scheme. However, SDC maintain a log of pump operation which can be converted to cumulative discharge based on rated pump capacity. The location of the groundwater monitoring sites is shown on **Figure 17** below. **Appendix 2** provides a summary of groundwater level monitoring data available for the sites shown.

Figure 17. Groundwater level monitoring in the Osborne Drainage Scheme area

Operational Constraints / Potential Pressures on Drainage Infrastructure

Although the SDC Land Drainage Activity Management Plan identifies quality of water discharged to Lake Ellesmere/Te Waihora as a significant issue for the scheme, no specific issues related to water quantity are identified.

2.2.6. Taumutu Drainage Scheme

For the purposes of this report the Taumutu Drain and the Taumutu Culvert schemes are reported together.

The Taumutu Drain scheme services an area of approximately 650 ha between Leeston-Taumutu and Smiths roads. This scheme diverts groundwater and stormwater via a culvert to the coast and an open channel to Lake Ellesmere/Te Waihora near Taumutu. The scheme also holds resource consent (CRC916349) to divert water from Coopers Lagoon via the scheme outlet. The Taumutu Culverts scheme consists of four culverts which provide drainage to the coast between Coopers

Lagoon and the Rakaia River. These culverts provide a direct drainage outlet for the western section of the Taumutu Drain scheme as well as a number of natural streams including the Lee River, Jollies Brook and Youngs Creek. The combined Taumutu scheme comprises 10.4 km of drainage channels and the four culvert structures.

Figure 18 shows the layout of the Taumutu Drainage Scheme.

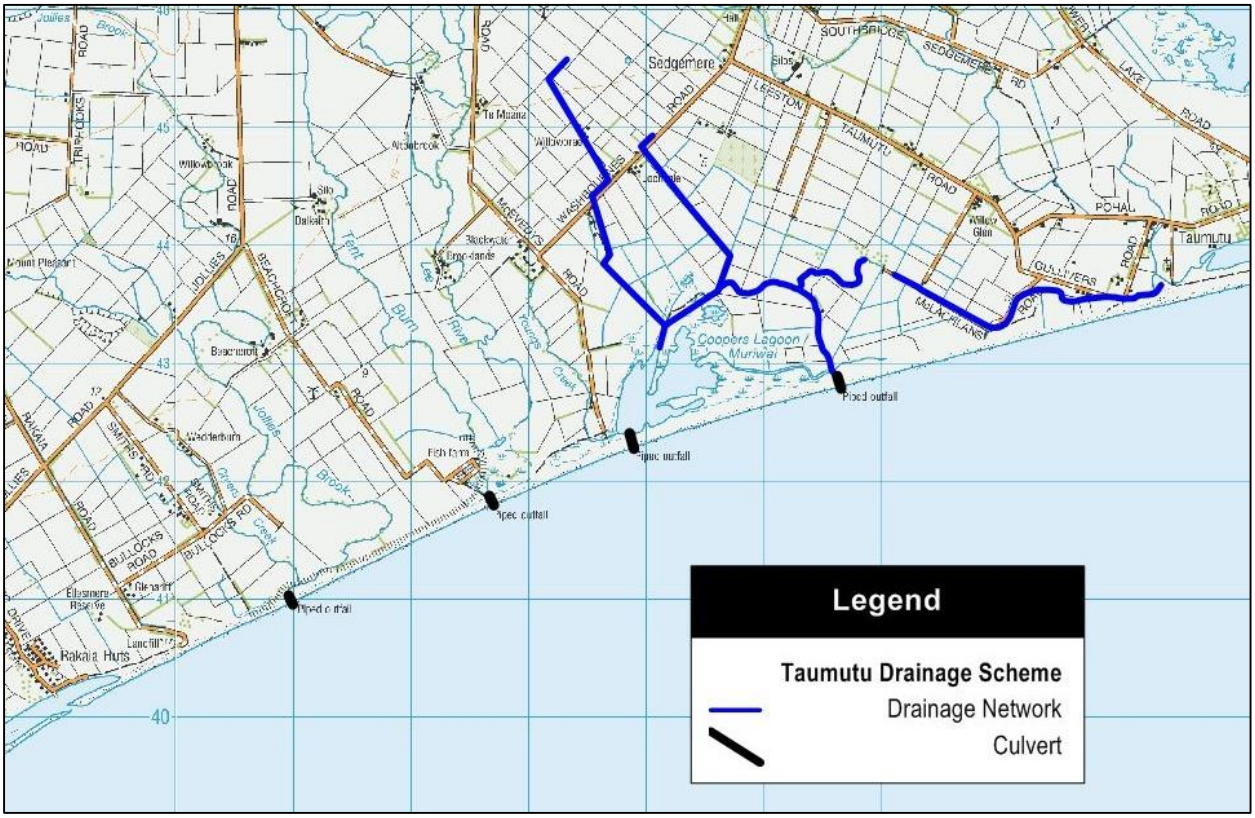


Figure 18. Layout of the Taumutu Drainage Schemes

Operational Management

Management of the Taumutu Drains and Taumutu Culverts schemes are overseen by separate management committees formed by the SDC. SDC Operations staff work alongside the Committees to prioritise and facilitate maintenance activities which are undertaken by contractors in autumn (April/May) each year.

Asset Valuation and Condition

The total replacement value of assets within the Taumutu Drainage Scheme is $2.20 million, comprising $1.53 million for the Taumutu Drains network and $0.67 million for the four culverts.

The SDC Land Drainage Activity Management Plan (2015) indicates that all assets in the Taumutu scheme are assessed as being in moderate or better condition.

Operation and Maintenance Costs

The 10 year budget for the Taumutu Drains and Taumutu Culverts schemes outlined in the SDC Land Drainage Activity Management Plan (2015) shows budgeted maintenance costs of $2,800/annum for the drains and $1,300/annum for the culverts over the forecast period. The budget also includes provision of $30,000 for culvert upgrade works in 2018/19 and $50,000 for culvert replacement in 2019/20.

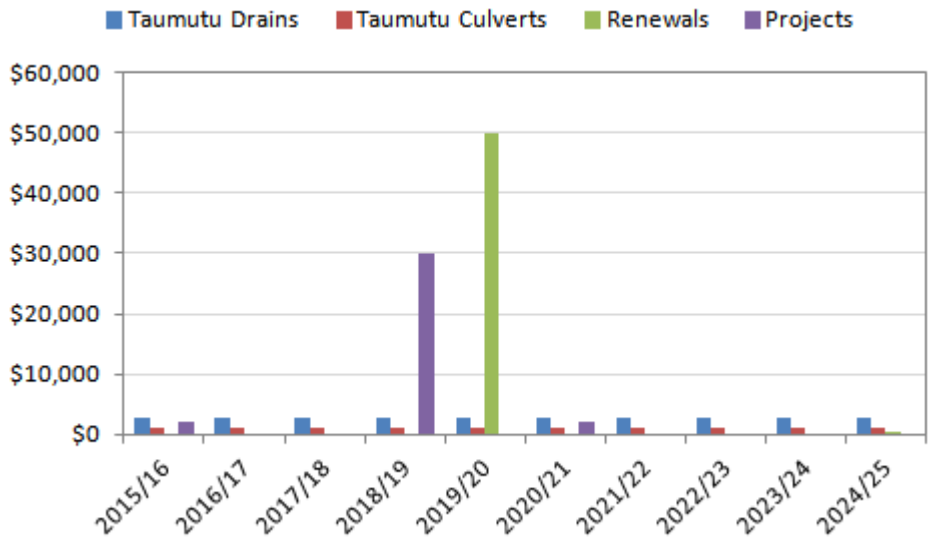


Figure 19. Greenpark Drainage Scheme operation and maintenance expenditure (Source: SDC, 2015)

Groundwater Level and Flow Monitoring

Environment Canterbury currently operates two groundwater level monitoring sites in the vicinity of the Taumutu Drainage scheme:

- M37/0462 - a 40 metre deep well located at the northern end of McLachlans Road (monthly manual); and,
- M36/0010 - a 7.6 metre deep well adjacent to Leeston-Taumutu Road

The location of the groundwater monitoring sites is shown on **Figure 20** below. **Appendix 2** provides a summary of groundwater level monitoring for the sites shown.

Figure 20. Groundwater level monitoring in the Taumutu Drainage Scheme area

Operational Constraints / Potential Pressures on Drainage Infrastructure

The primary issue for the Taumutu drainage scheme identified in the SDC Land Drainage Activity Management Plan is the continued erosion of the outfall structures and associated maintenance due to blockage of the culverts with gravel.

2.2.7. Halswell Drainage District

The Halswell Drainage scheme services an area of approximately 18,000 ha generally to the south of Halswell Junction Road and between the foot of the hills to Motukarara and a line approximately along Springs Road to Lincoln then Greenpark and Lake Ellesmere. As shown on **Figure 21** the drainage system consists of a series of main drains discharging to the Halswell River which runs from Halswell Junction Road, generally around the foot of the hills to Tai Tapu, discharging to Lake Ellesmere/Te Waihora via both the Old Course and the Halswell Canal. The drainage system comprises 113.4 km of excavated drains, and 25 floodgate structures in addition to 42 km of the natural channel of the Halswell River/Waikirikiri.

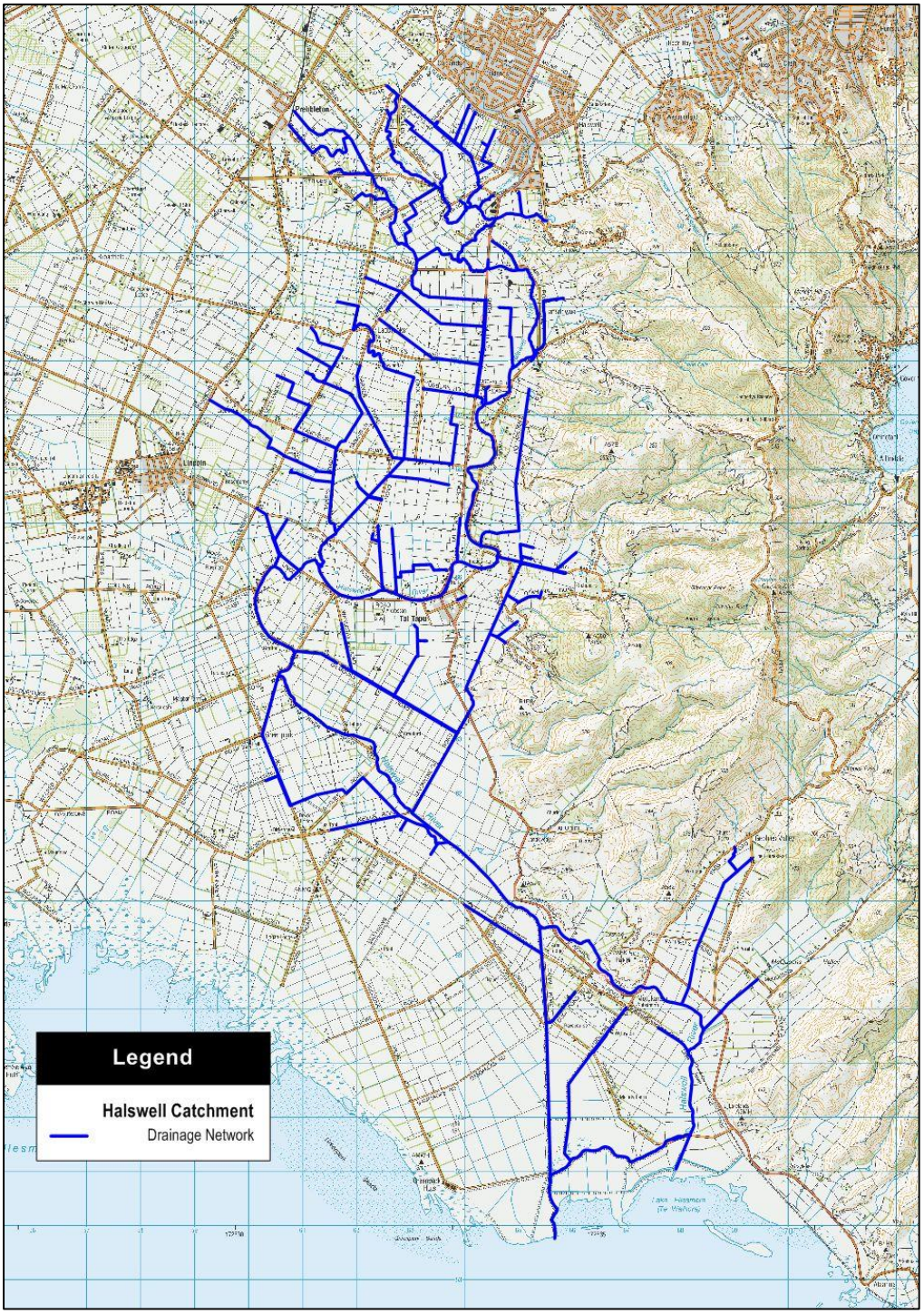


Figure 21. Halswell Drainage District

Extensive damage was caused to the river and drainage system in the September 2010 Greenpark earthquake, including:

- Liquefaction of underlying soils causing substantial quantities of sediment to infill parts of the Halswell River/Waikirikiri and some drains, (notably Hubbards Drain, Minchins Creek, Woods

Drain, Sharps Drain, Greens Drain and Birdlings No1 and 2 drains). The normal water level in the river rose by about 0.5m over long lengths of the river.

- General subsidence of land in some areas – many paddocks dropped around 0.2m, with a few areas dropping by as much as 0.5m. There was much cracking of the ground adjacent to the river, as a result of a combination of subsidence and lateral spread of the banks, raising concern about bank stability in many areas.

Operational Management

Management of the Halswell Drainage Scheme is undertaken by Environment Canterbury. A liaison committee is elected 3-yearly at a public meeting. The purpose of the liaison committee is to liaise with Councillors/Commissioners and staff on matters relating to drainage works, rating and floodplain management.

Asset Valuation and Condition

The total value of assets within the Halswell Drainage District is calculated at $3.37 million, comprising $3.11 million for drainage channels and $0.25 million for floodgate structures.

No information is available to quantify the current condition of the drainage network. However it is noted substantial works have been completed post the 2010 earthquake to restore drainage capacity in the system. The Halswell Drainage District Asset Management Plan (ECan, 2014) also identifies that management of the system is required to ensure drains are maintained in a condition that enables performance standards established for the scheme to be met.

Operation and Maintenance Costs

The Halswell Drainage District Asset Management Plan (ECan, 2014) identifies a 5-year average maintenance cost of $549,500 for the scheme (excluding costs for earthquake repairs). The maintenance works programme is funded by a combination of targeted rates, Works and Services rates and General rates following the formula established in the Environment Canterbury Annual Plan.

Groundwater Level and Flow Monitoring

Table 6 provides a summary of groundwater level and flow monitoring undertaken by Environment Canterbury in the vicinity of the Halswell catchment. Location of the monitoring sites identified is shown on **Figure 22** below. **Appendix 3** provides a summary of groundwater level and flow statistics for the sites shown.

Table 6. Groundwater level and flow monitoring in the Halswell Drainage Scheme area

Parameter	Site	Depth (m)	Monitoring Type
Groundwater Level	M36/5714	5.1	Monthly manual
	M36/4886	9.0	Automatic
	M36/1273	41.9	Monthly manual
	M36/1328	19.6	Monthly manual
Flow	Halswell River/Waikirikiri at Leadleys Road		Gauging
	Halswell River/Waikirkiri at Braithwaites		Gauging
	Halswell River/Waikirikiri at Ryans Bridge		Automatic
	Halswell River/Waikirikiri at Tobecks Bridge		Gauging
	Halswell River/Waikirikiri at Niels Road		Gauging
	Halswell River/Waikirikiri at Hogdens Bridge		Automatic

Operational Constraints / Potential Pressures on Drainage Infrastructure

The two most significant issues for management of land drainage in the Halswell catchment are:

- Ongoing urban development and consequent changes in retention times for stormwater flows in the catchment. This issue is largely addressed through requirements for floodwater retention as part of any new residential development.
- Effects of the September 2010 and February 2011 earthquakes on channel capacity and stream stage. A majority of issues resulting from liquefaction and other earthquake-related effects have now been remediated. However, changes in ground surface elevation have potentially changed the extent of flood inundation within the Halswell catchment.

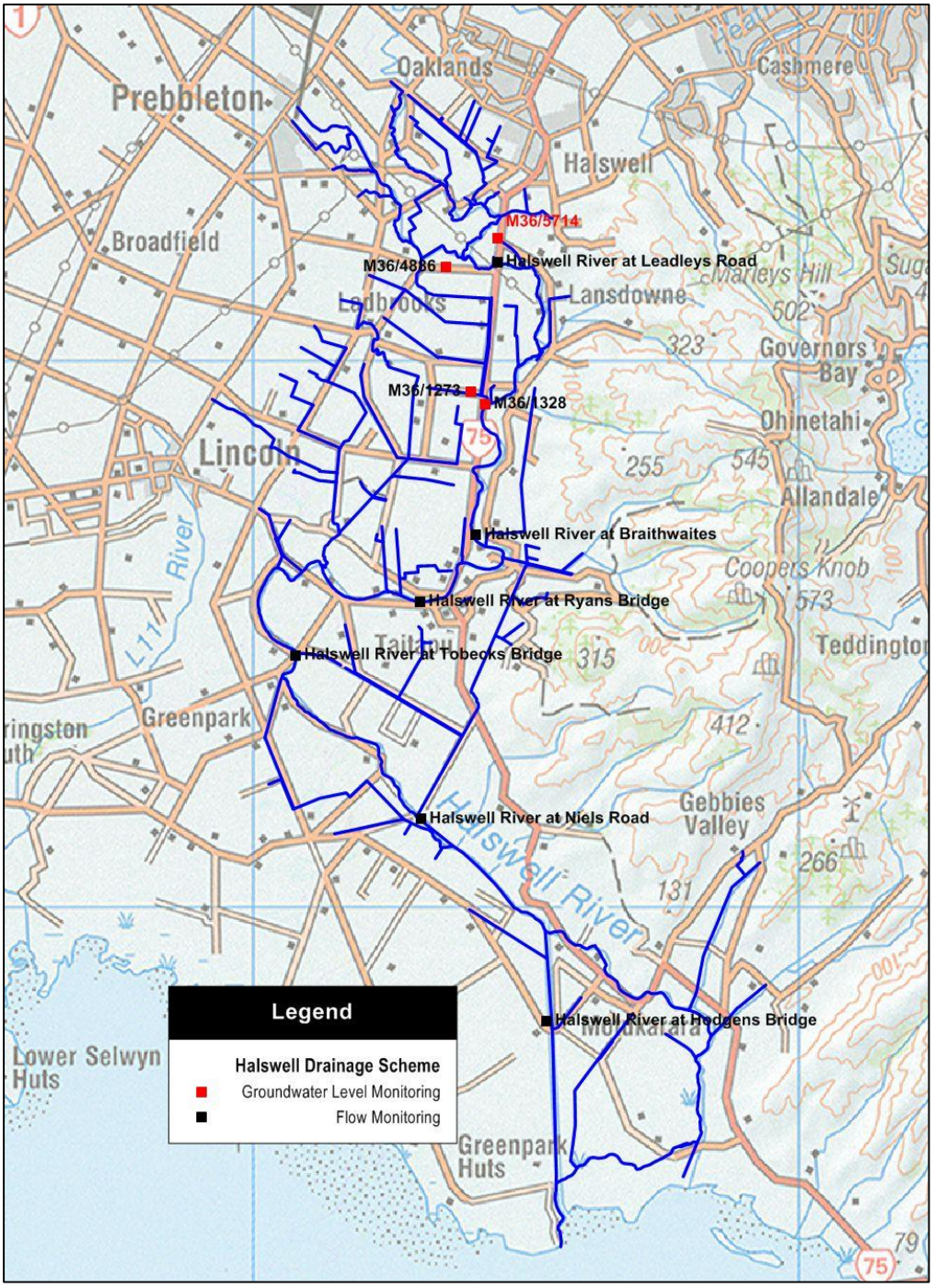


Figure 22. Groundwater level and flow monitoring in the Halswell catchment

2.2.8. Summary

Table 7 provides a summary of the potential sensitivity of drainage schemes in the lowland Central Plains area to changes in groundwater levels resulting from operation of the CPWL scheme.

Table 7. Potential sensitivity of drainage schemes to effects of groundwater mounding associated with CPWL scheme

Scheme	Sensitivity	Comment
Ellesmere	Low	Increased groundwater levels will increase baseflow (positive outcome) but are unlikely to adversely affect scheme function
Greenpark	Low	Potential effects limited by distance from CPWL command area and intervening LII Drainage scheme
Osbornes	Low	Potential effects limited by distance from CPWL command area and intervening LII Drainage scheme
LII	Moderate	Increased baseflow will provide positive benefit during low flows but may contribute to existing flooding issues in lower catchment during heavy rainfall events
Leeston	High	Increased baseflow will provide positive benefit during low flows but may exacerbate existing flooding/capacity issues in the vicinity of the Leeston township
Halswell	Moderate	Increased baseflow will provide positive benefit during low flows but may contribute to flood risk in lower catchment
Taumutu	Low	Likely to be relatively insensitive to CPWL effects due to existing recharge flux from Northbank irrigation scheme and Rakaia River

2.3. Reticulated Wastewater Schemes

Figure 23 shows the location and spatial extent of reticulated wastewater schemes in the lowland Central Plains area. Summary details of the individual schemes are outlined in **Table 8**.

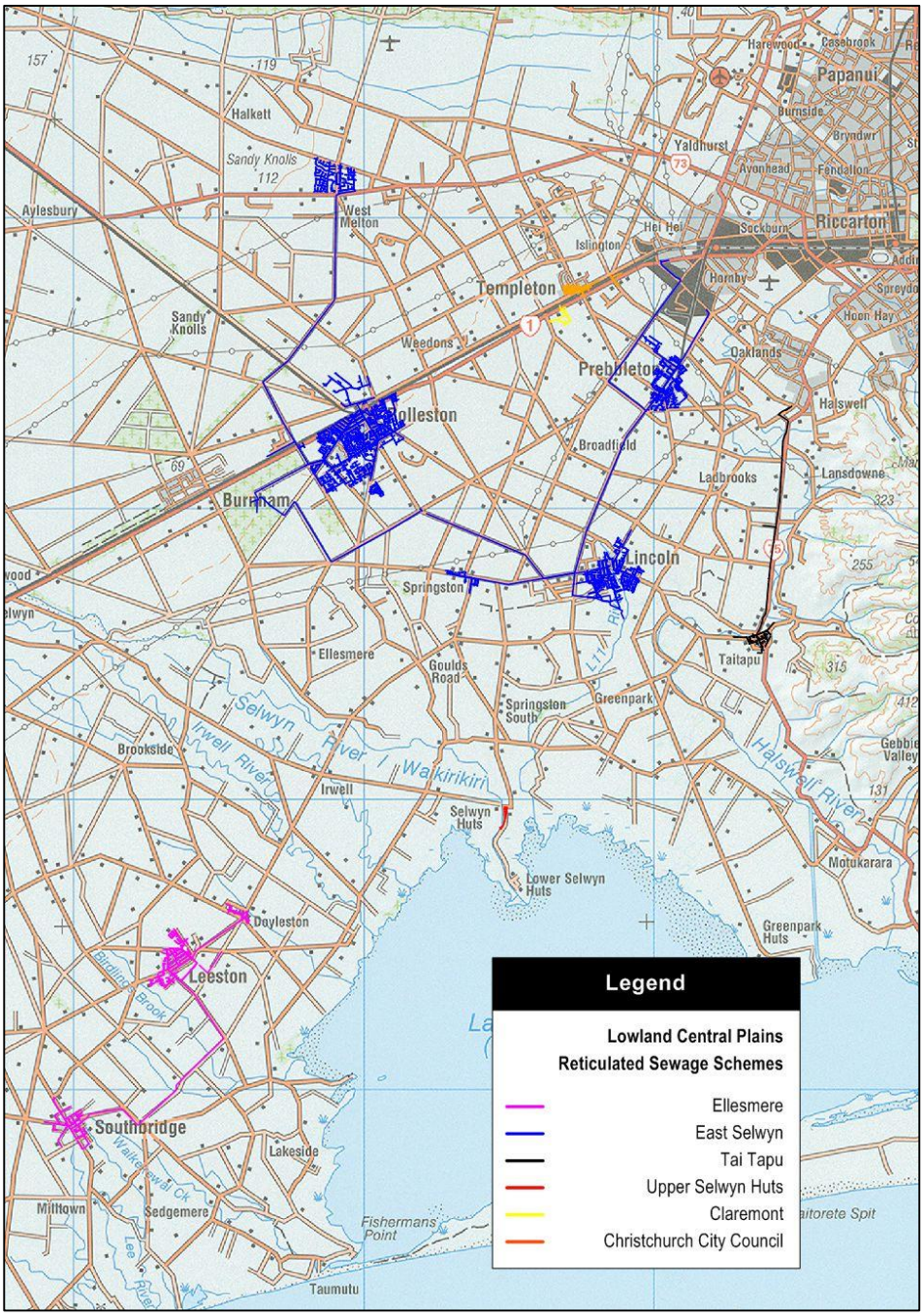


Figure 23. Reticulated wastewater schemes in the lowland Central Plains area

Table 8. Summary details of reticulated wastewater schemes in the Lowland Central Plains area

Wastewater Scheme	Location	Approximate Population Served	Reticulation (km)	Treatment
Claremont	Templeton	143	2.9	Secondary aerated package plant
Ellesmere	Doyleston Leeston Southbridge Ellesmere WWTP	308 2,140 899	5.9 24.8 22.5	Ellesmere WWTP Ellesmere WWTP Ellesmere WWTP Oxidation ponds, wetlands, UV disinfection, land disposal (RIB, border dyke, spray)
East Selwyn	Lincoln Prebbleton Rolleston Springston West Melton The Pines WWTP	3,962 3,041 10,080 476 1,440	69.0 39.2 144.7 9.1 18.3	The Pines WWTP The Pines WWTP The Pines WWTP The Pines WWTP The Pines WWTP Activated sludge bioreactor, UV disinfection, land irrigation (centre pivot)
Upper Selwyn Huts		16 permanent residences	1.6	Septic tank and oxidation pond
Tai Tapu		488	16.1	CCC Wastewater system

2.3.1. Claremont Wastewater Scheme

The Claremont Wastewater Scheme services a subdivision adjacent to Templeton. Wastewater is treated by a small package plant and effluent is disposed of land. The system is designed to accommodate wastewater flows for the current number of connected properties with limited scope for expansion. The system was constructed by the developer with ownership passed to SDC. The system is currently operated and maintained under Council maintenance contracts.

Potential issues associated with increased groundwater levels

The potential for adverse effects on current operation of the wastewater treatment system due to increased groundwater levels is limited due to the water table depth in the area.

2.3.2. Ellesmere Wastewater System

The Ellesmere WWTP was designed to accommodate wastewater from Leeston, Doyleston and Southbridge, with a long-term population equivalent to 3,600 people.

Wastewater from the reticulation area is conveyed to the treatment plant near Leeston. Treatment consists of a screening plant, oxidation and maturation ponds, and UV disinfection. Treated wastewater is disposed to land via various options including border dyke and spray irrigation. However, during periods of elevated groundwater levels, consent conditions preclude the use of land disposal options so wastewater is discharged via rapid infiltration basins (RIB) and groundwater pumped from beneath the basins and discharged to the nearby Tramway Reserve Drain.

Operational Constraints / Potential Pressures on Wastewater Infrastructure

The SDC Wastewater Activity Management Plan (SDC, 2015) identifies the following issues associated with the Ellesmere Wastewater scheme:

- Doyleston - infiltration of groundwater into the reticulation system is a potential issue as the scheme ages. SDC currently monitor groundwater levels and scheme flows.
- Leeston - significant infiltration and inflow into the reticulation system occurs during periods of wet weather and/or high groundwater levels.
- Southbridge - infiltration of groundwater into the reticulation system is a potential issue as the scheme ages. SDC currently monitor groundwater levels and scheme flows.
- Ellesmere WWTP
  - infiltration to the reticulation system overloads treatment capacity during periods of wet weather and/or high groundwater levels.
  - Periods of high groundwater levels require discharge of treated wastewater to the surface water drainage network with potential effects on drainage capacity and water quality.

Potential issues associated with increased groundwater levels

Changes in the magnitude and/or duration of high groundwater levels has the potential to adversely affect the current operation of the Ellesmere Wastewater Scheme due to:

- Increased infiltration and inflows to the reticulation system which overload treatment system capacity; and,
- An increase in the period over which treated wastewater must be discharged to surface water.

In addition to groundwater level monitoring information collected by SDC, ECan groundwater level monitoring sites that could potentially be utilised to characterise any changes in groundwater levels associated with CPWL development in the Ellesmere Wastewater Scheme include:

- Doyleston (M36/7425, M36/7694 and M36/0424)
- Leeston (M36/7425, M36/7694, M36/0424 and M36/1918)
- Southbridge (M36/20108, M36/0693 and L36/0664)

A summary of monitoring data from these sites is provided in **Appendix 3**.

2.3.3. Eastern Selwyn Sewerage Scheme

The Eastern Selwyn Sewerage Scheme serves the Rolleston, Lincoln, Prebbleton, Springston and West Melton townships with and has current capacity to service a population of 22,000 people. Wastewater from these communities is reticulated to The Pines WWTP near Rolleston. Treatment consists of an activated sludge bioreactor plant, clarifier and tertiary UV treatment. Wastewater is disposed to land via centre pivot irrigators.

Operational Constraints / Potential Pressures on Wastewater Infrastructure

Aside from treatment and reticulation capacity to service a rapidly growing population, the SDC Wastewater Activity Management Plan (SDC, 2015) identifies the following issues for the Eastern Selwyn Sewerage Scheme:

- Lincoln - significant inflow and infiltration to the reticulation network during periods of wet weather and/or high groundwater levels;
- Prebbleton - significant inflow and infiltration to the reticulation network during periods of wet weather and/or high groundwater levels.

Potential issues associated with increased groundwater levels

Changes in the magnitude and/or duration of high groundwater levels has the potential to adversely affect the current operation of the Ellesmere Wastewater Scheme due to:

- Increased infiltration and inflows to the reticulation system in Prebbleton and Lincoln

Environment Canterbury groundwater level monitoring sites that could potentially be utilised to characterise any changes in groundwater levels associated with CPWL development in the Eastern Selwyn Sewerage Scheme include:

- Prebbleton (M36/4886, M36/1273, M36/4783 and M36/0250)
- Lincoln (M36/4804, M36/0183, M36/0599 and M36/0250)

It is also noted that evidence to the CPWL resource consent hearing identified the potential for significant groundwater mounding to impact on the operation of land disposal at The Pines WWTP during periods of peak groundwater level. Groundwater level monitoring sites that could potentially be utilised to characterise any changes in groundwater levels associated with this site include M36/0183 and M36/0255. A summary of monitoring data from these sites is provided in **Appendix 3**.

2.3.4. Upper Selwyn Huts Wastewater Scheme

The Upper Selwyn Huts Wastewater Scheme services a small settlement on SDC owned land adjacent to the lower Selwyn River/Waikirikiri. The settlement comprises 92 dwellings of which up to 19 may be permanently occupied. Wastewater from the reticulation network passes through a septic tank to an oxidation pond before final disposal to land via border dyke irrigation.

Operational Constraints / Potential Pressures on Wastewater Infrastructure

The SDC Wastewater Activity Management Plan (SDC, 2015) identifies a strong correlation between winter groundwater levels/rainfall and increased inflows to the oxidation ponds, with a sustained period of winter sewage flows attributed to groundwater infiltration to the reticulation system. Such high winter flows result in the exceedance of consent conditions for the scheme (in terms of cumulative discharge volume).

Potential issues associated with increased groundwater levels

Changes in the magnitude and/or duration of high groundwater levels has the potential to adversely affect the current operation of the Upper Selwyn Huts Wastewater Scheme due to increased infiltration to the reticulation system and associated exceedances of resource consent conditions for the discharge.

Environment Canterbury groundwater level monitoring sites that could potentially be utilised to characterise any changes in groundwater levels associated with CPWL development in the Upper Selwyn Huts Wastewater Scheme include M36/0768 and M36/3194. A summary of monitoring data from these sites is provided in **Appendix 3**.

2.3.5. Tai Tapu Wastewater Scheme

The Tai Tapu Wastewater scheme comprises a reticulation network which conveys wastewater from the Tai Tapu township into the Christchurch City Council (CCC) sewage reticulation network under an agreement which allows the pumping of raw sewage at a rate of up to 7.5 L/s up to a maximum volume of 90,000 m^3/year. The system has capacity for 279 domestic connections, with approximately 30 percent of this capacity currently not utilised.

Operational Constraints / Potential Pressures on Wastewater Infrastructure

The SDC Wastewater Activity Management Plan (SDC, 2015) identifies significant infiltration and inflow into the reticulation system during periods of wet weather/high groundwater levels. Issues related to infiltration may have been exacerbated by damage associated with the September 2010 and February 2011 earthquakes.

Potential issues associated with increased groundwater levels

Changes in the magnitude and/or duration of high groundwater levels have the potential to adversely affect the current operation of the Tai Tapu Wastewater Scheme due to increased infiltration to the reticulation system and associated reductions in system capacity.

Environment Canterbury groundwater level monitoring sites that could potentially be utilised to characterise any changes in groundwater levels associated with CPWL development in the Tai Tapu Wastewater Scheme include M36/1328 and M36/1273. A summary of monitoring data from these sites is provided in **Appendix 3**.

2.3.6. Summary

Table 9 provides a summary of the potential sensitivity of reticulated wastewater schemes in the lowland Central Plains area to changes in groundwater levels resulting from operation of the CPWL scheme.

Table 9. Potential sensitivity of wastewater schemes in the lowland Central Plains area to effects of groundwater mounding associated with CPWL scheme

Scheme	Sensitivity	Comment
Claremont	Low	Unlikely to be significantly impacted by changes in groundwater levels
Eastern Selwyn	Low/Moderate	Main effects of increased groundwater levels likely to be associated with increased infiltration and inflows to reticulation system in Lincoln and Rolleston
Ellesmere	High	Increased groundwater levels will potentially increase inflows to the reticulation system in Doyleston, Leeston and Southbridge Increased groundwater levels may result in an increased frequency of treated wastewater discharge to the surface drainage network (with resulting water quality and drainage capacity issues)
Upper Selwyn Huts	High	Increased groundwater levels may result in increased inflows to the reticulation system and more frequent exceedance of consent conditions
Tai Tapu	Low	Increased groundwater levels may result in increased infiltration and inflows to reticulation system

2.4. On-Site Wastewater Disposal

On-site wastewater discharge is utilised extensively throughout the Central Plains outside areas serviced by reticulated sewage systems. Such systems typically comprise a primary treatment device (septic tank or similar) which discharges to a land infiltration system (e.g drip line or sand trench). **Figure 24** shows the location of current resource consents for on-site wastewater discharge in the lowland Central Plains area. The data show a total of 822 on-site wastewater systems in the area east of SH1, with a significant concentration of systems around the margins of the Lincoln, Tai Tapu and Prebbleton townships

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Figure 24. Location of resource consents for on-site wastewater discharge in the lowland Central Plains area

However, there are a large number of on-site wastewater systems which were installed prior to requirements for resource consent or which were installed as a permitted activity under historical planning rules. In order to estimate the total number and approximate location of on-site wastewater systems in the lowland Central Plains area, 2013 census meshblock data was utilised to calculate the total number of occupied dwellings outside existing reticulated sewage schemes, assuming each dwelling would be serviced by an individual on-site wastewater system. Results of this assessment are illustrated on **Figure 25** which shows the total number and relative density of occupied dwellings per meshblock. These data show a total of 3,144 dwellings, with the highest density in areas surrounding Prebbleton, Templeton Springston and Rolleston.

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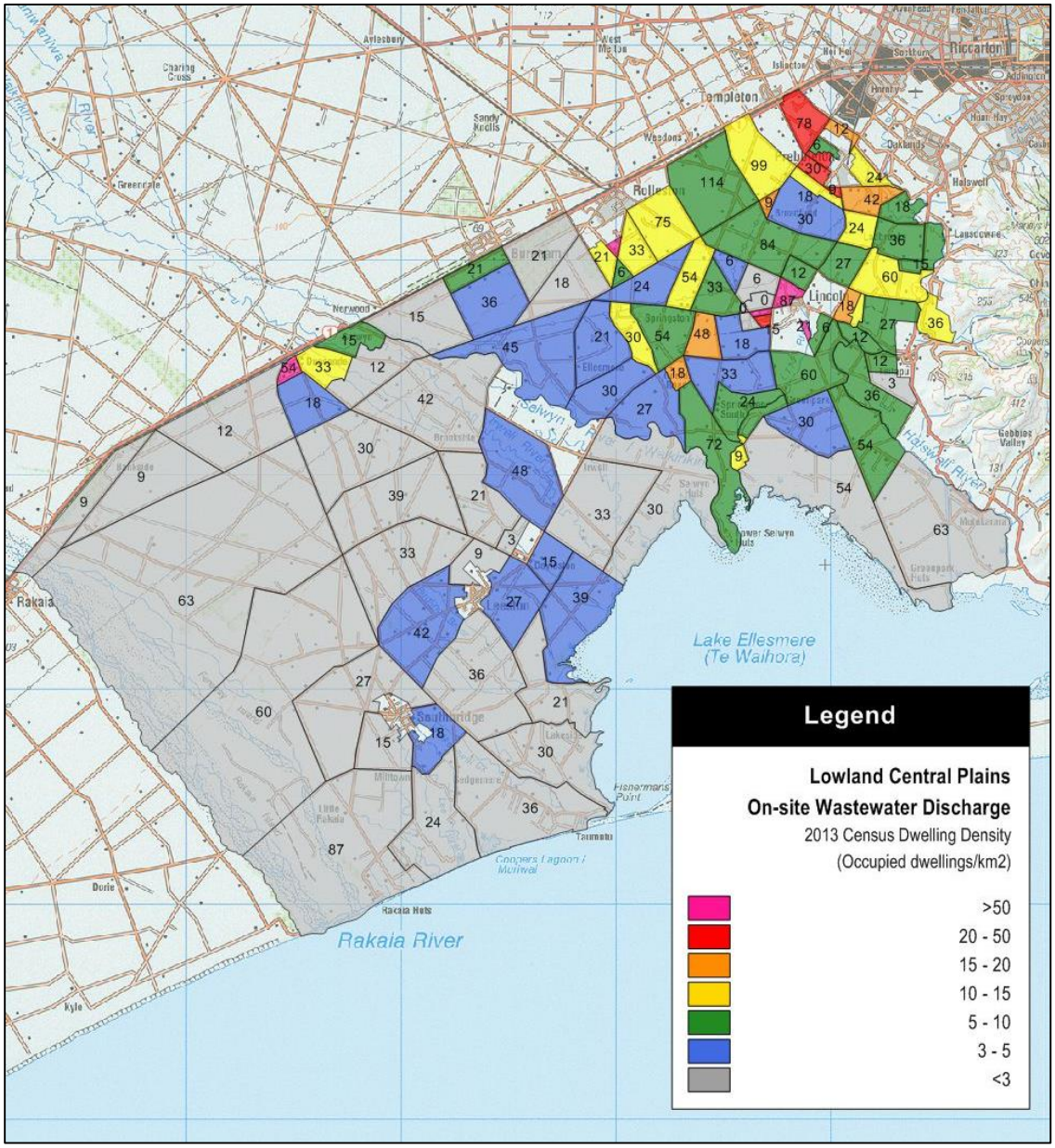

Figure 25. Number of occupied dwellings and dwelling density for 2013 Census meshblocks in the lowland Central Plains area (Note: figures on the map denote the total number of occupied dwellings per meshblock, shading illustrates dwelling density)

Potential issues associated with increased groundwater levels

Changes in the magnitude and/or duration of high groundwater levels have the potential to adversely affect the current operation of on-site wastewater systems in the lowland Central Plains area due to reduced infiltration, ponding or breakout around infiltration systems. Rules 5.7 and 5.8 of the Canterbury Land and Water Regional Plan (CLWRP) require resource consent (as a discretionary activity) to be obtained for systems where there is less than 1 metre vertical separation between the discharge point and underlying water table at any time.