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Further Engineering Evidence on a Submission on the Proposed Queenstown Lakes District Plan - Stage 3 – Extension of Settlement Zone in Luggate - Lake McKay Limited Partnership (#3196)

To:	Queenstown Lakes District Council
Submitter:	Lake McKay Limited Partnership
Address for Service:	Lake McKay Limited Partnership C/- IP Solutions Ltd Unit 2, Ground Floor, 15 Cliff Wilson Street Wanaka 9305 Attn: Dan Curley dan@ipsolutions.nz 027 601 5074

Background & Submission:

Lake Mckay Limited Partnership own the land identified as Lot 1, DP 534249, held within Certificate of Title 880021.

Lake Mckay Limited Partnership submitted that the Luggate Settlement Zone as proposed by Council should be extended onto the Submitter's land (zoned in previous stages of the District Plan Review Rural Residential). The submission is referenced as Submission **#3196**.

In addition to an extension of the Settlement Zone onto the Submitter's land, the Submitter also provided accurate survey information relating to the logical extent of zoning as it should relate to the Submitter's land, and also proposed options in regard

to how a Building Restriction Area (BRA) should be administrated by rules contained with the Settlement Zone chapter.

In response to the submission lodged, Council's 42a report, recommends '**accepting in part'**.

Ms. Bowbyes concludes at 13.21 and 13.22 of the Section 42a reporting:

> *"In my view rezoning the site SETZ is consistent with the objectives and policies of the PDP Strategic Directions chapters 3-6, notably because it promotes a compact, well designed and integrated urban form, builds on historical urban settlement patterns, minimises natural hazard risks and is integrated with existing and planned future infrastructure (strategic policy 3.2.2.1). The rezoning would also assist with achieving strategic policy 3.3.15, which seeks that the location of urban development of the settlements where no UGB is provided within land zoned for that purpose".*
>
> *However, at the present time insufficient information has been provided by the submitter regarding how the site would be serviced, and in the absence of this information the rezoning is unable to be supported from an infrastructure perspective.*

Ms. Bowbyes notes at 13.9 of the same report:

> *"I accept and rely on Mr Powell's conclusions, and note that this matter may be able to be resolved through evidence exchange in the event that the submitter provides further detailed information".*

In sum, the position of Council's experts is:

1. Mr Mathew Jones does not oppose zoning on landscape matters, subject to the inclusion of a Building Restriction Area on an escarpment slope within north western extent of the site.

The submitter agrees that the BRA suggested by Council is both logical and sensible and does not oppose the identification of a BRA in the position sought by Council.

2. Mr Robert Bond considers that the extent of BRA identified upon the land in earlier stages of the District Plan Review be retained. Council staff furthermore recommend retaining the current status to be applied to development within this extent of BRA.

The submitter agrees with points raised by Council and does not oppose a retention of the BRA as already identified, nor provisions relating to it.

3. Mr Michael Smith does not oppose a rezoning on any matter related to traffic.

The submitter does not wish to raise any matter related to Council's position related to traffic.

4. Mr Richard Powell considers that insufficient evidence has been provided by the Submitter relating to solutions available to service the proposed density private networks, Council infrastructure or a combination of both. Specifically, Mr Powell has requested greater detail in respect of Foul Sewer Disposal and Water Supply.

In response to matters related to how the proposed zoning is able to be serviced, please find evidence prepared by Mr Botting of Paterson Pitts Wanaka attached as Appendix 1 to this cover letter.

Mr Botting's evidence addresses considerations of Foul Sewer Disposal and Water Supply.

With consideration of the evidence provided by Mr Botting, Lake McKay Limited Partnership seeks the following decision from the Queenstown Lakes District Council:

1. Rezoning of the land identified at **Attachment 2** of Submission **#3196** from Rural Residential to Settlement Zone, including all consequential changes to proposed Chapters 20 and 27 of the Proposed District Plan;

2. Identification of this area as Settlement Zone on **Map 11** of the Proposed District Plan;

3. All and any necessary changes as a consequence of the changes sought.

……

Dan Curley (on behalf of Lake McKay Limited Partnership)

24 March 2020

BEFORE THE COMMISSIONERS
QUEENSTOWN LAKES DISTRICT COUNCIL PROPOSED DISTRICT PLAN

IN THE MATTER the Resource Management Act 1991 and Stage 3 of the Proposed District Plan (Settlement Zone)

SUBMISSION #3196

LAKE MCKAY LIMITED PARTNERSHIP

BRIEF OF EVIDENCE OF MICHAEL JAMES BOTTING (PATERSON PITTS, WANAKA)

INTRODUCTION

1. My name is Michael James Botting.

2. I am a Partner of Paterson Pitts Limited Partnership (Paterson Pitts). I hold the qualification of Bachelor of Surveying and am a Registered Professional Surveyor and Licensed Cadastral Surveyor. I am also a member of the New Zealand Institute of Surveyors.

3. I have over 20 years of experience in land development including 15 years of project managing the construction of large greenfield subdivisions. I started my career in Auckland working on a variety of land development projects across Auckland before moving to Wanaka in 2004.

4. I have experience in all aspects of the land development process from feasibility, budgeting, planning, detailed design, tendering, construction supervision and compliance with local authorities. My previous experience of particular relevance to the current proposal includes the Peninsula Bay, Riverside Residential and Kirimoko subdivisions in Wanaka and many smaller residential subdivision developments that require comprehensive reticulated service infrastructure.

5. Although this is a Council hearing I confirm that I have read the Code of Conduct for Expert Witnesses outlined in the Environment Court's Consolidated Practice Note 2014 and have complied with it in preparing this evidence.

6. I confirm that I have considered all material facts that I am aware of that might alter or detract from the opinions that I express and that this evidence is within the scope of my expertise, except where I state that I am relying on the evidence of another person.

SCOPE OF EVIDENCE

7. I will address the following matters in my evidence:

   (a) Matters raised by Council's expert in respect of infrastructure required to service a density anticipated by Settlement Zoning at the location of the

Submitter's land (as detailed within Submission #3196 Lake McKay Limited Partnership);

(b) Conclusion.

A MATTERS RAISED BY MR POWELL IN RESPECT OF INFRASTRUCTURE MATTERS RELATED TO AN EXTENSION OF SETTLEMENT ZONE AS REQUESTED BY LAKE MCKAY LIMIED PARTNERSHIP

1. WASTEWATER

14.2 Wastewater: *A wastewater rising main which connects Luggate to Project Pure is located along the northern boundary of the subject land.*

Investigation will need to be undertaken by the submitter to confirm capacity exists within this line to accommodate the expected additional flow and to determine a suitable connection point.

8. My evidence for assessing waste water is split into three parts. First a brief explanation of how the site is able to be serviced, secondly how the site is able to be connected to the network, and thirdly what existing capacity constraints and options exist to allow a connection to proceed.

9. Enclosed in **Appendix A** is an overview of the site and how the site is split into two catchments, referred to here on as the northern catchment and the southern catchment. The northern catchment falls in a north east direction towards Atkins Road which in turn falls gently to the east towards the State Highway. The southern catchment of the site falls towards Luggate Creek.

10. Servicing within the site would require the southern catchment to be pumped up into the northern catchment of the site. The northern catchment would then be gravity serviced down Atkins Road, out to the State Highway and directed to the recently completed West Luggate waste water pump station constructed near the intersection of the State Highway and Church Road.

11. Attached in **Appendix B** is an overview of the Luggate Township showing existing properties, which properties are currently serviced and connected to the new pump station near the corner of the State Highway and Church Road (blue area), which properties are currently un-serviced (pink area) and which properties are proposed from the applicant's site (yellow area) and the future Luggate Park development (yellow area). An assessment has also been made

based on recent aerial photography from 2019 and Google Maps of which properties have been built on and are now using the new pump station.

12. Within the blue area there are 152 properties of which 123 are built on and 29 are currently vacant. Within the pink area there are 126 properties of which 120 are built on and 6 are vacant. Within the Lake McKay yellow area 101 new lots are proposed and within the future Luggate Park yellow area a further 204 Lots are proposed. Overall a total of approximately 583 lots would be requiring service should all of Luggate Park be developed, the existing township connected and the proposed Lake Mckay subdivision developed.

13. We have liaised with Council's Property and Infrastructure engineers Richard Powell and Ulrich Glasner. Enclosed in **Appendix C** are copies of email correspondence.

14. Enclosed in **Appendix D** is a copy of Fluent Solutions report titled "Luggate to Project Pure Wastewater Options Concept Design Report".

15. This report has modelled the existing, the planned development of Luggate and possible future expansion of Luggate. On the basis of this report it is considered that sufficient modelling has already been carried out. The key points will be summarised as follows:

16. From reviewing the Fluent Solutions design report the Lake McKay site has already been factored into future capacity. On page 7 of the report Figure 4.1 identifies the site as area D1 (extract shown below)

The proposed scheme boundaries for the new Luggate wastewater system were provided by QLDC following consultation with the QLDC planning department. Figure 4.1 below presents the existing and potential zoning and the extent of the area to be serviced by the new wastewater system.

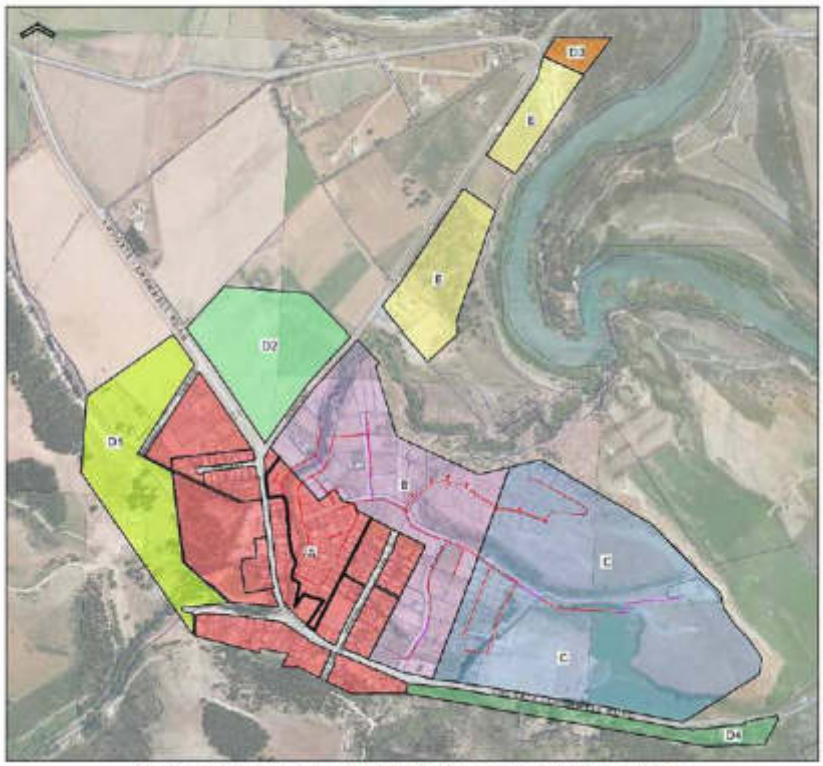


Figure 4.1: Luggate Wastewater Scheme Zones and Boundaries

17. On page 10 of the Fluent Solutions report section 6.2.1 identifies that the ultimate density for Area D1 was estimated based on Low Density Residential equivalent density rate of 7.5 lots/Ha. Area D has an approximate area of 15 Ha which would equate to 112 lots, this being slightly more than the 101 lots proposed by Lake McKay. Therefore capacity has already been allowed for in the recently installed West Luggate wastewater pump station.

18. In Appendix D of the Fluent Solutions report the following waste water flows and emergency storage estimates have been calculated;

- Existing Luggate WW Reticulation – total of 152 Lots currently reticulated.
- 2028 Luggate WW flows distribution – total of 287 lots serviced by the Main West Luggate WWPS.
- 2038 Luggate WW flows distribution – total of 537 lots serviced by the Main West Luggate WWPS.

• 2048 Luggate WW flows distribution – Total of 907 lots serviced by the Main West Luggate WWPS.

19. The overall ultimate Luggate + Future Areas WW reticulation distribution allowed for in the design report is approximately 900 lots.

20. Based on my assessment of the existing township lots being connected, all of Luggate Park being developed and Lake McKay being developed within say the next 10 – 15 years the total number of lots would be approximately 600. This is well within the design numbers allowed for in the Fluent design report.

21. From reviewing the risk assessment in Appendix E of the Fluent Solutions report the required upgrades to Project Pure are noted. This identifies that Project Pure will reach capacity at 2025 (even without the proposed connection of Luggate and Hawea). Upgrades to Project Pure are planned for 2020/21 to cater for the additional loads from Luggate and Hawea.

22. It is noted that I have not carried out an assessment of the final detailed design of the West Luggate wastewater pump station that has been recently constructed. Therefore I am unable to confirm what storage was initially allowed for. Note that pump stations often require a staged increase in emergency storage as demand increases. This reduces the initial cost and need for large storage until the demand requires it. Therefore further consultation with Council would be required at the time of subdivision to confirm what if any storage upgrades may or may not be necessary. The financial cost of required upgrades (if any) would be covered by development contributions.

23. It is considered that there are no system limitations that would prevent the proposed zoned land from being developed and connected to the Council waste water network in Luggate.

2. WATER SUPPLY

14.3 Water supply: *There is potential to connect services from a private bore and network. Modelling of the Luggate network would need to be undertaken by the submitter prior to any rezoning occurring, to confirm capacity if a connection was to be made to this network, a suitable connection point would also need to be determined.*

24. My evidence for assessing potable water is split into three parts. First a brief explanation of how the site would be serviced, secondly what options exist for how the water supply can be managed and or connected to the Luggate Township water supply and thirdly an option for supply of water from a private scheme.

25. Enclosed in **Appendix E** is an overview of the site and how the site would be supplied with water internally. Included are also possible connections to the wider Luggate Township supply and a possible location for a second water tank farm should this be necessary.

26. Our initial concept design details an internal pipe network showing possible connections via Atkins Road and also out via Kingan Road along with a possible water supply tank location above the proposed zone area which could be required if sufficient water pressure is unable to be supplied from the existing Luggate town supply. There is sufficient elevation above the proposed zone area to provide domestic water pressure (300KPa minimum) and firefighting pressure (100KPa minimum) as required by the Land Development and Subdivision Code of Practise (COP).

27. Sizing of the water supply tank (if required) has not been completed at this point however there exists ample room to accommodate a large tank or series of tanks partly setback from the terrace face. There is also the ability to dig the tanks into the ground partly located within the upper reaches of a gully feature and ensure that there is bunding to provide screening from a visual perspective.

28. The first option available for Council to allow the rezoning to proceed is to connect the future subdivision to the existing Luggate scheme. We have liaised with Council's Property and Infrastructure engineers Richard Powell and Ulrich Glasner about the existing Luggate water scheme. Enclosed in **Appendix G** are copies of email correspondence.

29. The existing Luggate bore field can sustainably yield 37 l/s for 16 hours per day. This equates to 2,131 m^3 per day. Based on supplying 2100 L/household/day there is sufficient capacity to supply upwards of 1014 lots.

30. Based on my previous assessment under waste water above the existing Luggate township and the planned Luggate Park and Lake McKay developments would yield approximately 600 lots within say the next 10 – 15 years. This number is well under the calculated capacity of the bore therefore there is no limitation with the source of Council water.

31. Note that no detailed assessment has been carried out to determine how best to deliver water to the Lake McKay site should a connection from the existing Council network be utilised however upsizing of pipes is possible along both Atkins Road and also Kingan Road to provide a linked ring main supply into the site should detailed modelling require such upgrades. Therefore further consultation with Council would be required at the time of subdivision to confirm what if any upgrades may or may not be necessary. The financial cost of undertaking any such upgrades (if any) would be covered by development contributions.

32. The second option available for Council to allow the rezoning to proceed is simply a private water supply.

33. Enclosed in **Appendix F** is Otago Regional Council Water Permit RM18.345.01 This water permit authorises a communal domestic water extraction of 8 litres per second with a maximum annual volume of 182,500m^3 for supplying water to site proposed for Settlement zoning and wider farm block.

34. Water Permit RM18.345.01 specifies a maximum annual water take of 182,500m^3 for the Communal Domestic supply. This equates to 500m^3 per day The required supply of water to a household requires a minimum of 2,100 litres per day. Clause 6.3.5.5 of Councils Land Development and Subdivision Code of Practise (COP) specifies daily consumption of 700 L/person/day (occupancy per residence = 3 people). Based on 2100 L/household/day this volume has the ability to supply 238 households.

35. The existing water take is able to supply up to 238 households. Therefore there is currently no impediment for supply of water to the site and at this stage no need to undertake modelling to confirm this.

36. It is considered that there are no system limitations that would prevent the proposed zoned land from being developed and connected to Council potable water network in Luggate or from being developed with a private water scheme.

B CONCLUSION

37. Overall, it is my opinion that future land use and subdivision development to densities anticipated by the Settlement Zone can be appropriately serviced by the means detailed within this evidence.

38. Specifically in respect of Waste Water Disposal, I consider that the site can be included within the new Luggate pumping scheme and that planned upgrades can be undertaken to accommodate the zoned land. Any planned upgrades can be staged and also funded by the additional development of residential lots.

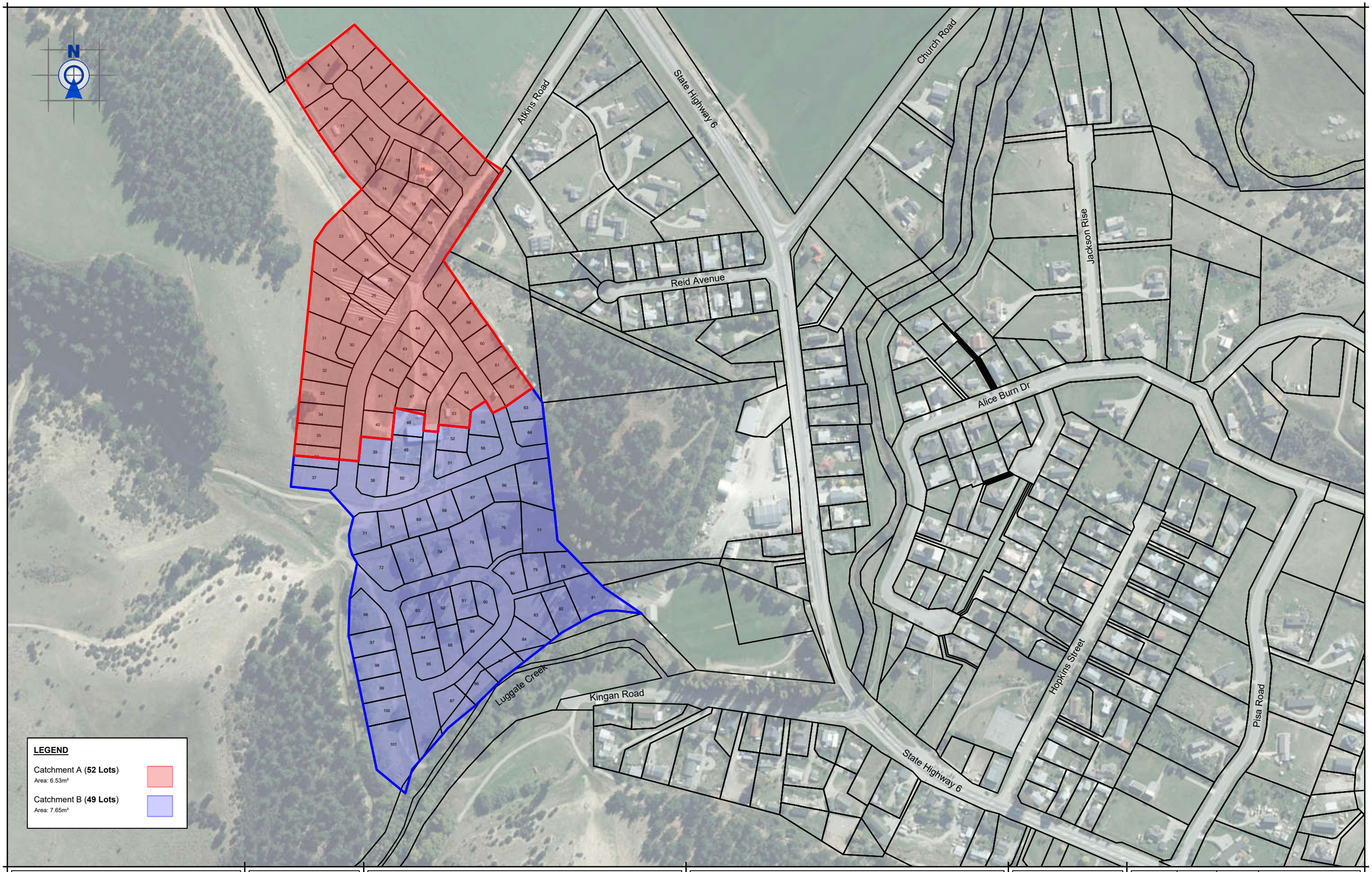
39. Specifically in respect of Water Supply, I consider that there exists an immediate solution by way of private water scheme to supply water to the zoned site. This water scheme can be managed separately from Council's existing water network by a private management company. Alternatively the zoned site could be connected to the existing Luggate water supply.

Michael James

Botting

22 May 2020

Appendix A – Subdivision Waste Water Catchments



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E wanaka@ppgroup.co.nz

Client & Location:

Lake McKay Ltd
Atkins Road
Luggate

Purpose & Drawing Title:

Wastewater Catchment
Lake McKay

Surveyed by:	QLDC	Original Size:	Scale:
Designed by:	-	A3	1:2500 @ A3
Drawn by:	EGH		DO NOT SCALE
Checked by:	MJB		
Approved by:	MJB		
Job No:	DWG No:	Sheet No:	Revision No: / Date Created:
W6068	009	101	1 / 28/04/20

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Appendix B – Overview of Luggate Township Subdivision Waste Water Catchments

PATERSONPITTSGROUP
Your Land Professionals
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0800 PPGROUP

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Wanaka 9343
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E wanaka@ppgroup.co.nz

Client & Location:

Lake McKay Ltd
Atkins Road
Luggate

Purpose & Drawing Title:

Overview Plan
Luggate Township Waste Water

Surveyed by:	QLDC	Original Size:	Scale:
Designed by:	-	A3	1:6000 @ A3
Drawn by:	EGH		
Checked by:	MJB		DO NOT SCALE
Approved by:	MJB		
Job No:	DWG No:	Sheet No:	Revision No: / Date Created:
W6068	009	100	1 / 4/5/2020

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Appendix C – Wastewater Council Correspondence

Mike Botting

From: Richard Powell <richard.powell@qldc.govt.nz>
Sent: Tuesday, 12 May 2020 2:35 PM
To: Mike Botting
Subject: Luggate Infrastructure
Attachments: RP-18-04-26 HMW Q000427 Rev1 - FINAL.pdf

Hi Mike,

See attached for the requested report on the Luggate – Project Pure wastewater.

It looks like the area you interested in is D1 on page 7, and to be included in the scheme for 2033 if so this area has been considered in the design attached and is therefore feasible, upgrades if necessary will need to be determined around timing with other developments.

The water side of things has been a bit of a moving target, I have a meeting with the Project Manager tomorrow morning to see if decisions have been made around upgrades and new bore fields. I will be able to let you know more about the water after this meeting.

Cheers

Rich

Appendix D – Fluent Solutions – Luggate to Project Pure Waster Options Concept Design Report April 2018

Queenstown Lakes District Council

Luggate to Project Pure Wastewater Options Concept Design Report

April 2018

Fluent SOLUTIONS

www.fluentsolutions.co.nz

Queenstown Lakes District Council

Luggate to Project Pure Wastewater Options Concept Design Report
Revision 1

Task	Responsibility	Signature
Project Manager:	A Steel	
Prepared By:	H Wightman, D Railton, A Steel	
Reviewed By:	D Railton	
Approved For Issue By:	A Steel	

Issue Date	Revision No.	Author	Checked	Approved
4 May 2018	1	HW	AS	AS

Prepared By:
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Job No.: Q000427
Date: April 2018
Reference: RP-18-04-26 HMW Q000427 Rev1

Queenstown Lakes District Council

Luggate to Project Pure Wastewater Options Design Report
Revision 1

EXECUTIVE SUMMARY

Introduction

Fluent Solutions have been engaged by Queenstown Lakes District Council to investigate the options to collect and transfer wastewater from the Luggate township to the Project Pure wastewater treatment plant. Once the new scheme is commissioned it will allow the existing small Luggate wastewater treatment plant, that is currently not able to meet its discharge consent requirements, to be decommissioned and the homes currently serviced by septic tanks to be connected to the new scheme. The investigations have also taken into consideration future growth in the area to help determine the most appropriate wastewater system to service the community for the next 40 years.

This report presents options for the future wastewater scheme to service Luggate along with descriptions as to how the options were determined. Preliminary cost estimates for each of the options have been prepared to help determine and recommend the most cost effective and suitable wastewater scheme.

Investigations

A large number of documents relating to this project were read to enable a better understanding of all the issues that needed to be considered. These included a report assessing the growth of the Wanaka airport area and the Heads of Agreement with Willowridge Ltd who are developing Luggate Park.

Investigations were made in to the quality, extent and capacity of existing wastewater systems in the community to assess the ability or otherwise of utilising the assets in the new scheme going forward. It has been determined that there are currently approximately 125 properties currently draining their wastewater to septic tanks and disposal fields on their properties in Luggate.

The intended extent of Luggate to be serviced by the new wastewater scheme was determined in consultation with QLDC's planning department and an assessment of population growth rates was performed to establish possible future demands on the wastewater system.

Figures ES1 – ES2 below presents peak wet weather wastewater flows for 3 – 6% per annum growth rates taking into consideration either future conventional gravity reticulations feeding into the new Luggate wastewater scheme scheme or future pressure sewer systems feeding into the scheme. Figure ES2 and ES3 also show the impact of where growth occurs in Luggate going forward and the influence of gravity sewer peak flows on the new system.

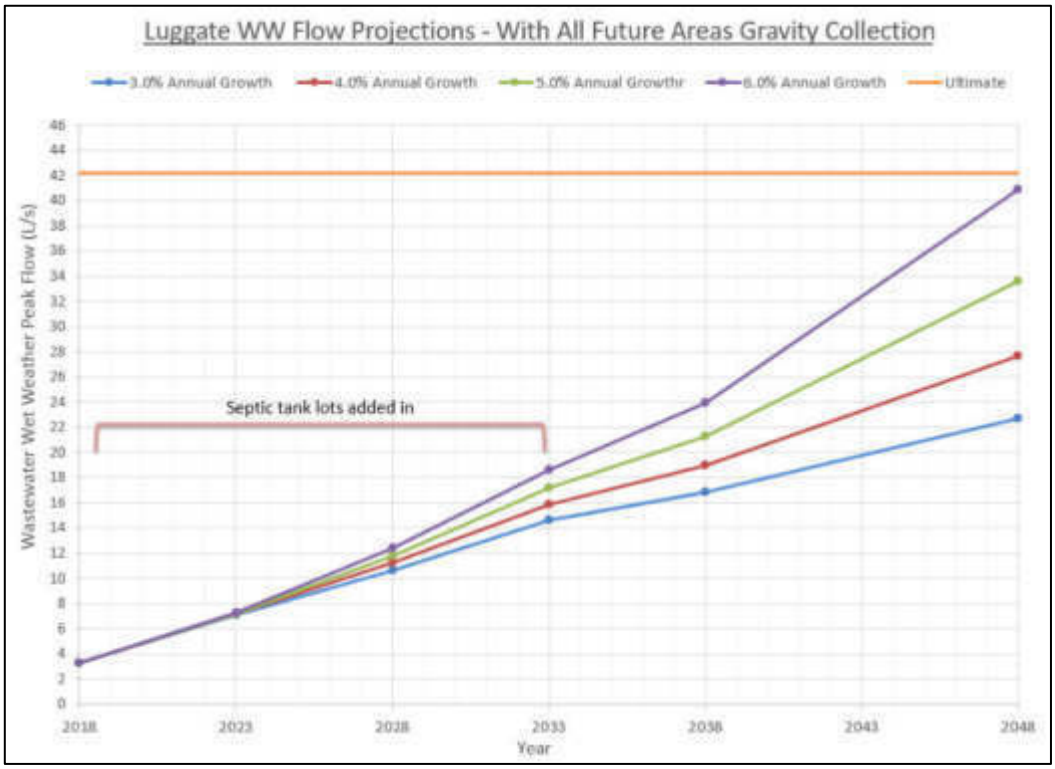

Figure ES1: Peak Wet Weather Wastewater Flow Projections for Luggate – Conventional Gravity Reticulation Option

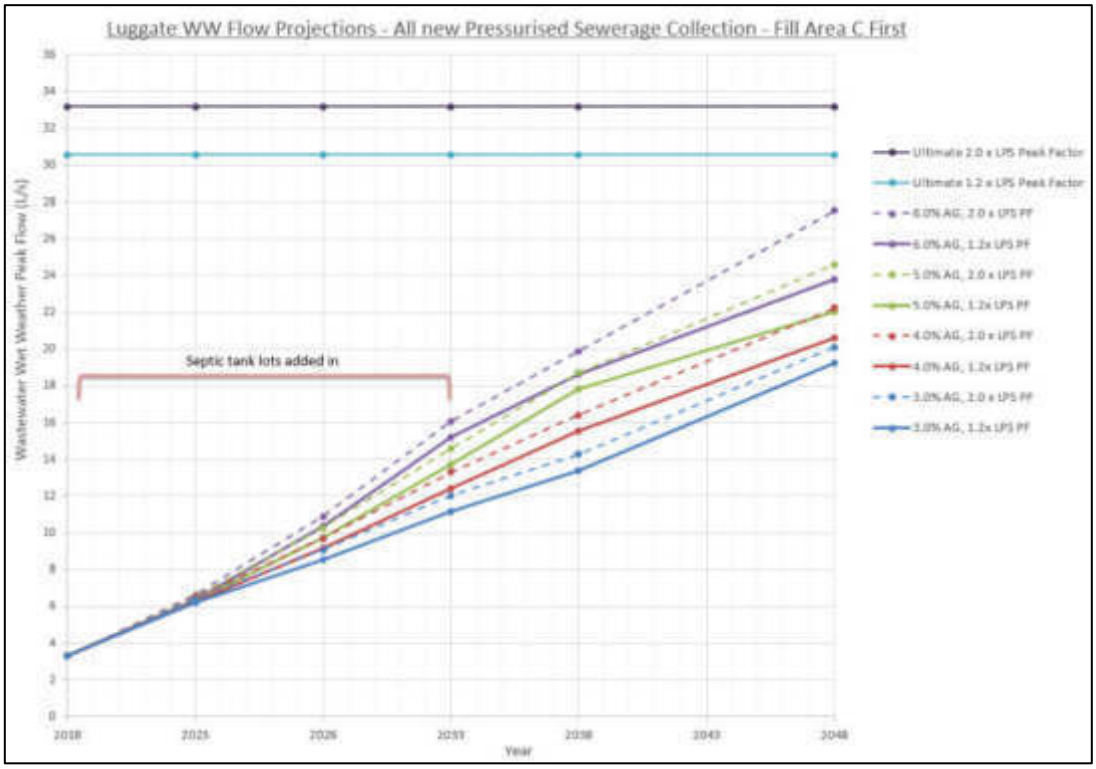

Figure ES2: Peak Wet Weather Wastewater Flow Projections Pressurised Sewer Option – Area C Developed First

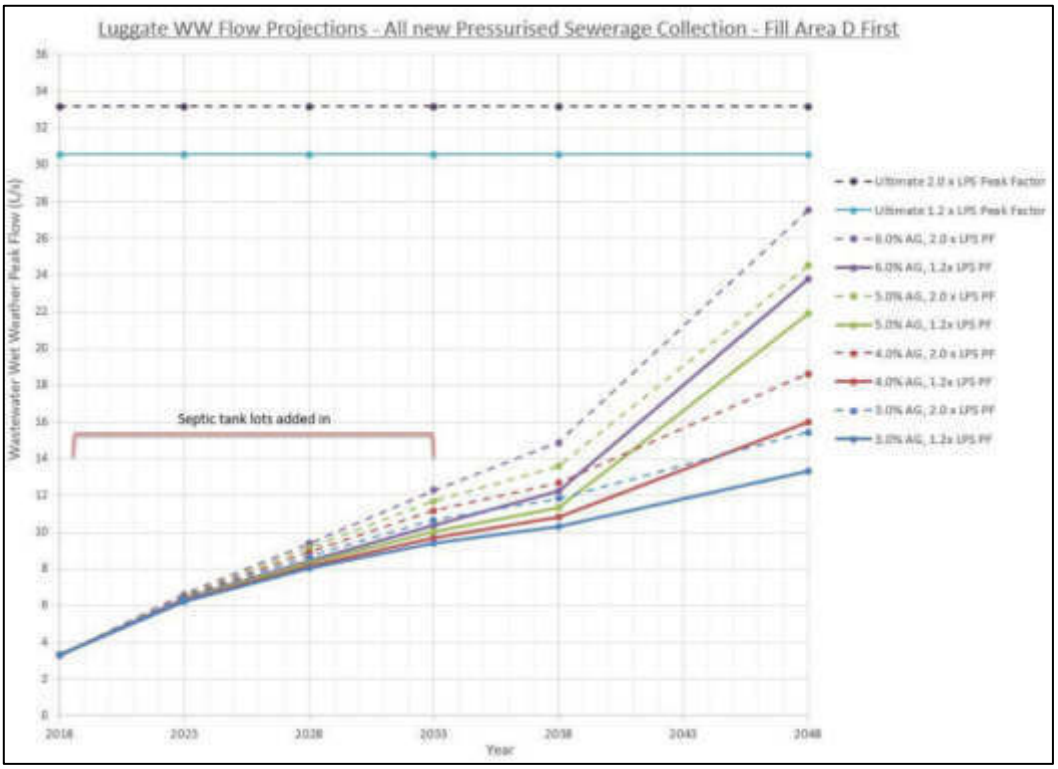

Figure ES3: Peak Wet Weather Wastewater Flow Projections Pressurised Sewer Option – Area D Developed First

Options Assessments

The report discusses the basis of design, the intended design components and other works that are required to be completed alongside the project. Preliminary construction cost estimates are presented for three main options for a trunk wastewater system consisting of pumping stations and rising mains as well as preliminary cost estimates for the collection and transfer of wastewater from the existing houses to the trunk wastewater system.

The most cost-effective schemes for the trunk wastewater system are Option 3 and 3a as shown in Figure ES4 below.

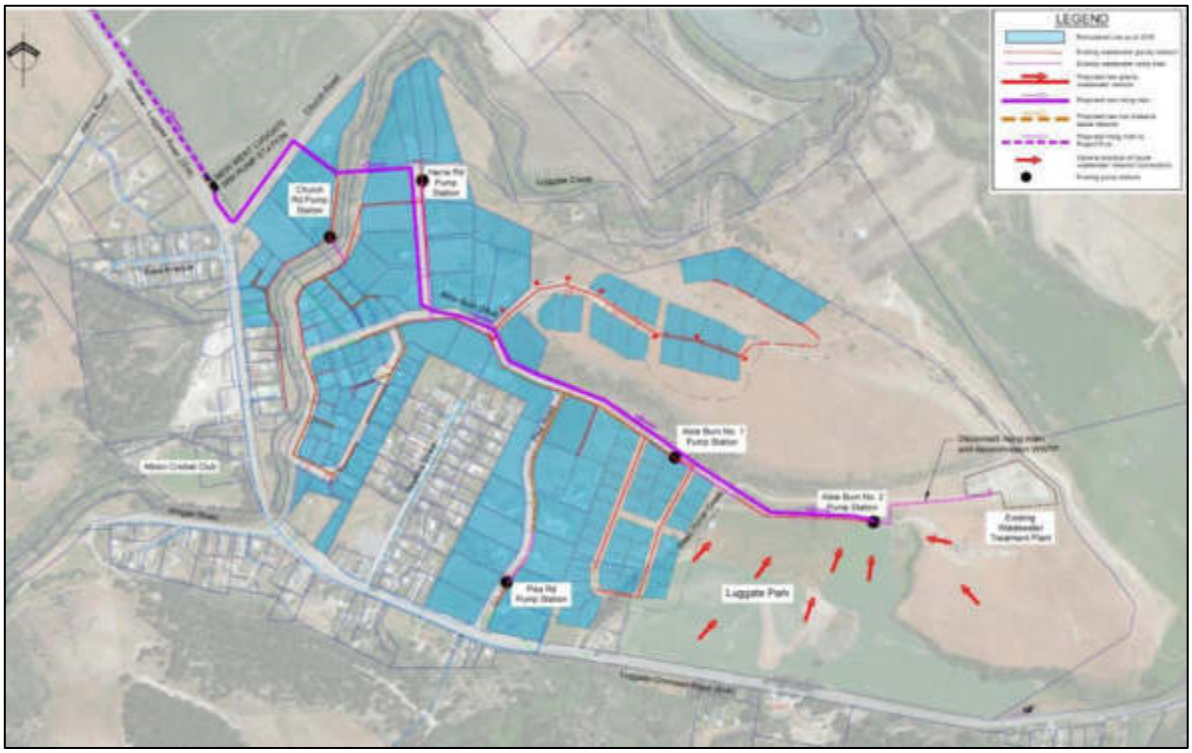

Figure ES4: Preferred Trunk Main Option

These options make use of the existing Alice Burn 2 WWPS to collect flows from the Luggate Park development area (as is currently intended by Willowridge Ltd) and a small section of land south of the State Highway. The wastewater is then pumped along Alice Burn Drive and Harris Road, through Council reserve, under Luggate Creek and to a new main West Luggate WWPS located near the corner of Church Road and State Highway 6.

The West Luggate WWPS then pumps flows all the way up to the existing gravity main on Stevenson Road feeding into the Project Pure WWTP. Future wastewater flows from the Wanaka airport will also be able to connect into the rising main as it passes the airport.

The preliminary capital cost estimates including a 20% contingency allowance for these options are:

Option 3 – Rising Main (for conventional gravity sewerage system feeds) along Alice Burn Drive, using Alice Burn 2 WWPS and building new West Luggate WWPS = **$2,713,000 + GST.**

Option 3a – Dual Rising Main (for Pressurised Sewerage System feeds) Along Alice Burn Drive, using Alice Burn 2 WWPS and building new West Luggate WWPS = **$2,736,000 + GST.**

Albeit that Option 3a is slightly more expensive it includes a dual rising main with two different sized pipes. This option allows for better initial operation of the main pump station in terms of meeting scouring velocities and minimising septicity formation. The dual pipeline also allows for flexibility in the operation of the scheme as growth occurs.

Given the advantages that the dual rising main option offers in relation to reducing wastewater septicity and the potential for the addition of further lots to be connected in the future it is recommended that this option be considered further even though it is slightly more expensive. QLDC do however need to consider whether they wish to impose on future developers that their lots be fitted with pressure sewer pumping stations (with the exception of Luggate Park).

In determining the most effective wastewater trunk main options, careful consideration was also made to the ways and means of connecting existing properties, currently serviced by septic tanks, to the new system. This report also presents options and preliminary cost estimates to connect these existing properties to the new system.

This report has presented two possible options:

- A mixture of gravity collection and pressure sewer pumping stations for each of the properties currently serviced by septic tanks
- The supply and installation of pressure sewer pumping stations for all the septic tank properties.

The preliminary cost estimates for both options are very similar at approximately **$2.1M + GST**. The difference between the two is how much is allocated directly to the property owner versus the cost shared by the community. At this stage the entire pressure sewer pumping stations option has less impact on QLDC's costs, and, with smart management, has the ability to further reduce the total peak flows to the Luggate West Main Pump Station.

It is recommended that this concept design report be read and the options considered. If QLDC are happy with the proposed solutions then the detailed design of the preferred option should be started as soon as Willowridge Ltd have agreed the way forward with QLDC.

Works should start with documentation being issued to the community describing the proposed scheme, the intention to survey their properties to locate their current wastewater pipelines and septic tanks for future designs and the ways and means of recovering the capital cost expenditure from the ratepayers.

The timing of requiring connection to the new scheme is something that needs to be discussed at a political level and is not covered in this report.

1.0 Introduction

Fluent Solutions have been engaged by Queenstown Lakes District Council to investigate the options to collect and transfer wastewater from the Luggate township to the Project Pure wastewater treatment plant. One of the drivers of this investigation is that the existing Luggate Wastewater Treatment Plant is not able to meet its discharge consent requirements. Once the new scheme is commissioned it will allow the existing small Luggate wastewater treatment plant to be decommissioned and the homes currently serviced by septic tanks to be connected to the new scheme. The investigations have also taken into consideration future growth in the area to help determine the most appropriate wastewater system to service the community for the next 40 years.

This report presents options for the future wastewater scheme to service Luggate along with descriptions as to how the options were determined. Preliminary cost estimates for each of the options have been prepared to help determine and recommend the most cost effective and suitable wastewater scheme. These works can then be used to help complete detailed design of the new scheme and facilitate its construction.

1.1 Abbreviations used in this Report

A number of abbreviations have been used in the body of this report. An explanation of these abbreviations is shown below:

WW	Wastewater
WWTP	Wastewater Treatment Plant
WWPS	Wastewater Pump Station
PS	Pump Station
QLDC	Queenstown Lakes District Council

2.0 Literature Review & Data Collection

Various reports and documentation relating to the Luggate wastewater system, and the possibility of conveying the wastewater to Project Pure have been completed in the past. Fluent Solutions have reviewed the following relevant reports:

- "*Luggate to Project Pure Wastewater Concept Design*" Fluent Solutions for Willowridge Developments Ltd, October 2016
  - A high level look at the basic design of pumping to Project Pure.
- "*Luggate Wastewater Pump Stations & Network Operation as & Maintenance Manual*" United Water for QLDC, 2011
  - Operations and Maintenance manual for the existing Luggate wastewater infrastructure. This was light on detail in some places.

- "*Development Agreement*" (also called Heads of Agreement) between QLDC and Willowridge Developments Ltd, by Meredith Connell, dated 9 November 2017
    - Agreement by which QLDC have arranged to own and operate the existing Luggate WWTP, and to develop the infrastructure to replace the Luggate WWTP by delivering wastewater to the Project Pure WWTP, subject to certain conditions.
- "*3-Waters Infrastructure Review of Wanaka Airport*" Beca Ltd for Queenstown Airport Corporation Ltd, August 2017
    - An assessment of the existing 3-waters infrastructure at the Wanaka Airport site, and options and recommendations on improvement for future development plans.
- "*Luggate Wastewater Scoping Report*" GHD Ltd for QLDC, September 2008
    - A scoping report of possible wastewater options for Luggate township.
- "*QLDC Growth Projections to 2058* " Rationale Ltd, May 2017
    - A report showing population and dwelling growth projections for the Queenstown Lakes District.

In addition to the above reports, other key sources of information used to help prepare this report have been:

- QLDC Land Development and Subdivision Code of Practice, 2015
- Veolia and QLDC records, flow data derived from SCADA and as-builts for existing Luggate and Project Pure wastewater systems
- Luggate Park consenting and as-built information
- Census NZ data on populations and dwelling numbers
- Willowridge Developments Ltd for information on proposed development plans for the Luggate Park area

3.0 Existing Infrastructure

3.1 Existing Luggate Sewerage Scheme

An existing reticulated sewerage scheme at Luggate collects wastewater from recent subdivisional developments constructed within the last 12 years and delivers it to a package sewage treatment plant. The layout and location of the existing sewer infrastructure and treatment plant is shown in Figure 3.1. The lots that are serviced by the existing infrastructure are shaded blue in Figure 3.1 below. These serviced lots total 152, although not every lot has a dwelling on it, and at the time of issue of this report, 62 of these lots are still awaiting title and hence cannot yet be built upon.

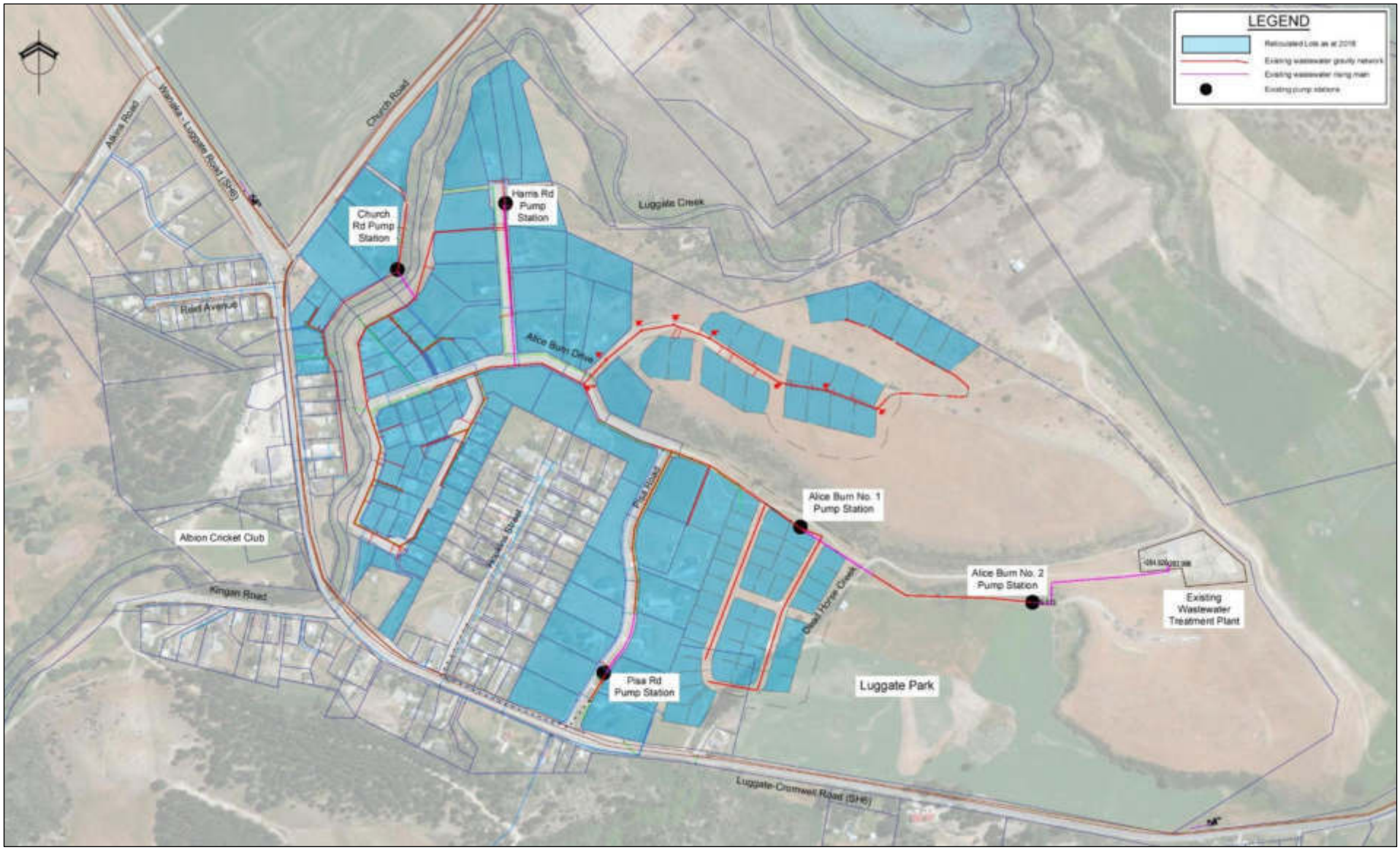

Figure 3.1: Plan of Existing Sewerage System at Luggate

The existing sewerage scheme comprises conventional gravity sewer reticulation and five sewer pumping stations, the last of which (Alice Burn No. 2) delivers the wastewater to the WWTP. It is understood that the current discharge consent for the Luggate WWTP is due to expire in 2021.

Veolia currently maintain this sewerage scheme. The nominal rated capacities of the five pump stations as identified in their Operations and Maintenance Manual are:

WWPS Name	Pump Type	Nominal Rate	Wet Well	
Alice Burn No. 1	ABS AFP 1049.4	35 L/s @ 10m	3.0m dia.	3.63m depth
Alice Burn No. 2	ABS AFP 1049.4	35 L/s @ 10m	3.0m dia.	2.55m depth
Pisa Road	Flygt 3057.091/181	10 L/s @ 12m	TBC	TBC
Church Road	Flygt 3057.091/181	10 L/s @ 12m	1.8m dia.	2.1m depth
Harris Road	Flygt 3057.091/181	10 L/s @ 12m	2.3m dia.	TBC

The latter three pump stations are 'collector' pump stations that deliver to the Alice Burn No. 1 PS. Alice Burn No. 1 PS then pumps flows to the Alice Burn No. 2 PS where it is then pumped to the WWTP.

There is no flow or pump operating data for the existing pump stations. Each pump station has a duty and standby submersible centrifugal pumps installed. Each of the pumping stations is locally controlled with their status reported to the operators via SCADA. Upstream pumping stations are inhibited via SCADA from pumping by the pumping station immediately downstream should there be a problem with the downstream pumping station. This is important to reduce the risk of overflows, as there is minimal emergency storage at any of the pumping stations. Furthermore, there is no permanent standby generation at any of the existing WW pump stations. These issues are discussed later in this report.

Wastewater inflows into the Luggate WWTP are recorded manually in a log book taken from a flow meter on the inlet pipeline. These inlet flow data records for the last three months show an average of around 40 to 45m^3/day, with a peak of around 51m^3/day, occurring at the Christmas/New Year 2017/18 period.

3.2 Existing Old Luggate Township Wastewater

The existing "Old Luggate" areas (housed areas not shaded in blue in Figure 3.1) have no reticulated sewerage system and all sewage treatment is by septic tanks located on individual properties, with disposal to ground. These septic tanks are maintained by the individual property owners and it is not known what state they are in.

It is intended that the approximately 125 lots with septic tanks will be required to connect into the new wastewater infrastructure at some point. Discussions are needed around when the connections should be made and who will cover the cost. QLDC will no doubt implement strategies for connection time-frames and may consider possible subsidising or connection incentives.

Five sites have been identified in “Old Luggate” with non-residential flows. These include the following:

- Albion Cricket Club and campground – larger than residential flows, with toilet/bathroom facilities servicing the campground, and toilet facilities servicing the cricket ground. The existing septic tank is located at the SW end of the property, so would require a pumped system to get the wastewater to the front boundary.
- Luggate pub – with a large pub building, café and general store.
- Town Hall – currently unusable as the building has been deemed unsafe. Need to provide WW service for future building/lot use.
- Public toilet facility adjacent to the Town Hall.
- Upper Clutha Transport yard.

These commercial sites have been considered in the sizing of wastewater infrastructure to service them.

3.3 Existing Project Pure Scheme

The existing Project Pure sewerage scheme collects wastewater from the Wanaka and Albert Town areas and delivers it to the Project Pure WWTP located north of the Wanaka Airport. The final collection point for the Project Pure scheme is at the main pump station named “L.Hawea Rd 2 WWPS,” located on the Lake Hawea Road. SCADA data of the flows from the pump station have been reviewed.

Figure 3.2 below presents a screenshot taken from the HMI (Human Machine Interface) for the Wanaka Wastewater Network showing the extent and inter-relationships of the WW pumping stations in the network.

Wanaka and Albert Town’s wastewater is pumped from the final L.Hawea Rd 2 WWPS to the Project Pure WWTP via a 560 OD PE100 rising main. The final 1500m of the wastewater pipeline on Stevenson Road leading to the Project Pure WWTP is a 560 OD PE100 PN8 gravity main.

It is intended to deliver wastewater flows from the Luggate Wastewater scheme into the Project Pure gravity main on Stevenson Road. The available capacity of this pipeline has been reviewed. It was calculated that the maximum flow capacity of the pipe itself (not taking into account any surcharging of manholes) is 294 L/s. The highest recorded pumped flow from the L.Hawea Rd 2 WWPS is 168 L/s (occurred as the peak flow during a major storm event on 1st February 2018). This identifies that there is capacity for an additional 126 L/s flow through the pipe. It is understood that the ultimate design capacity of the L.Hawea Rd 2 WWPS is approximately 232 L/s.

The Project Pure pipeline is designed to be duplicated, and a second duty pump installed in the L.Hawea Rd 2 WWPS, sometime in the future when growth in Wanaka dictates.

If, in the future, flow capacity of this gravity main section of pipe becomes critical, there is an option of not having L.Hawea Rd 2 WWPS and the Luggate WWPS pumping at the same time by using emergency storage at each of the sites. Alternatively the gravity pipeline section could be duplicated to add more capacity.

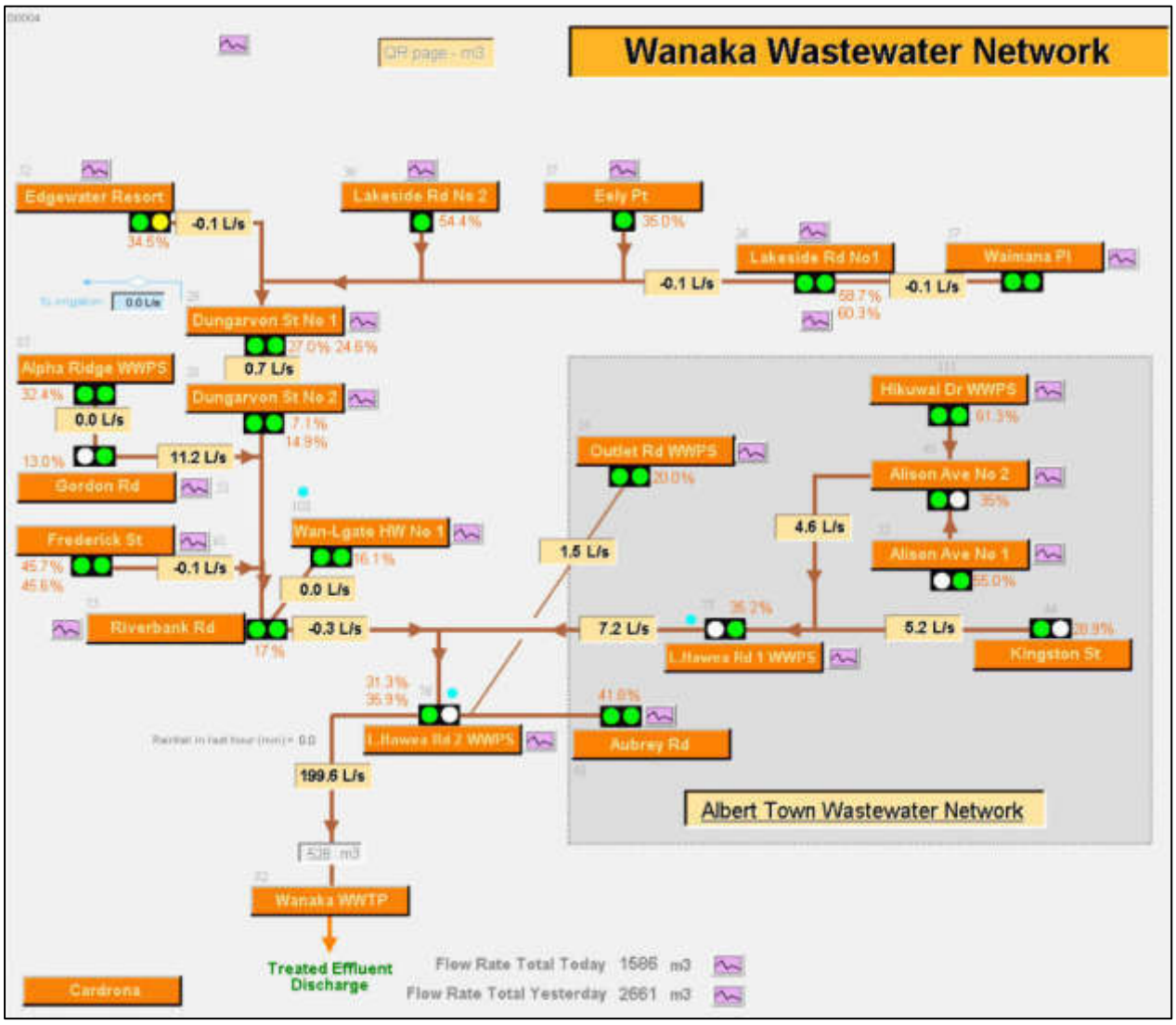

Figure 3.2: Schematic of Wanaka Wastewater Network Pumping Stations

The capacity of the Project Pure WWTP to receive and/or treat any additional inflows is not a part of the scope of this report and has not been investigated. However, upon discussion with operators and QLDC personnel, it is understood that the WWTP has capacity to take the extra Luggate flows. It is understood however that the inlet screens need to be replaced and upgraded and that this was currently being rectified. It is also understood that there is the potential that alkalinity of the inflow at the WWTP inlet works may need to be dose adjusted with an increase in raw sewage to the works.

4.0 Luggate Wastewater Scheme Boundaries

The proposed scheme boundaries for the new Luggate wastewater system were provided by QLDC following consultation with the QLDC planning department. Figure 4.1 below presents the existing and potential zoning and the extent of the area to be serviced by the new wastewater system.

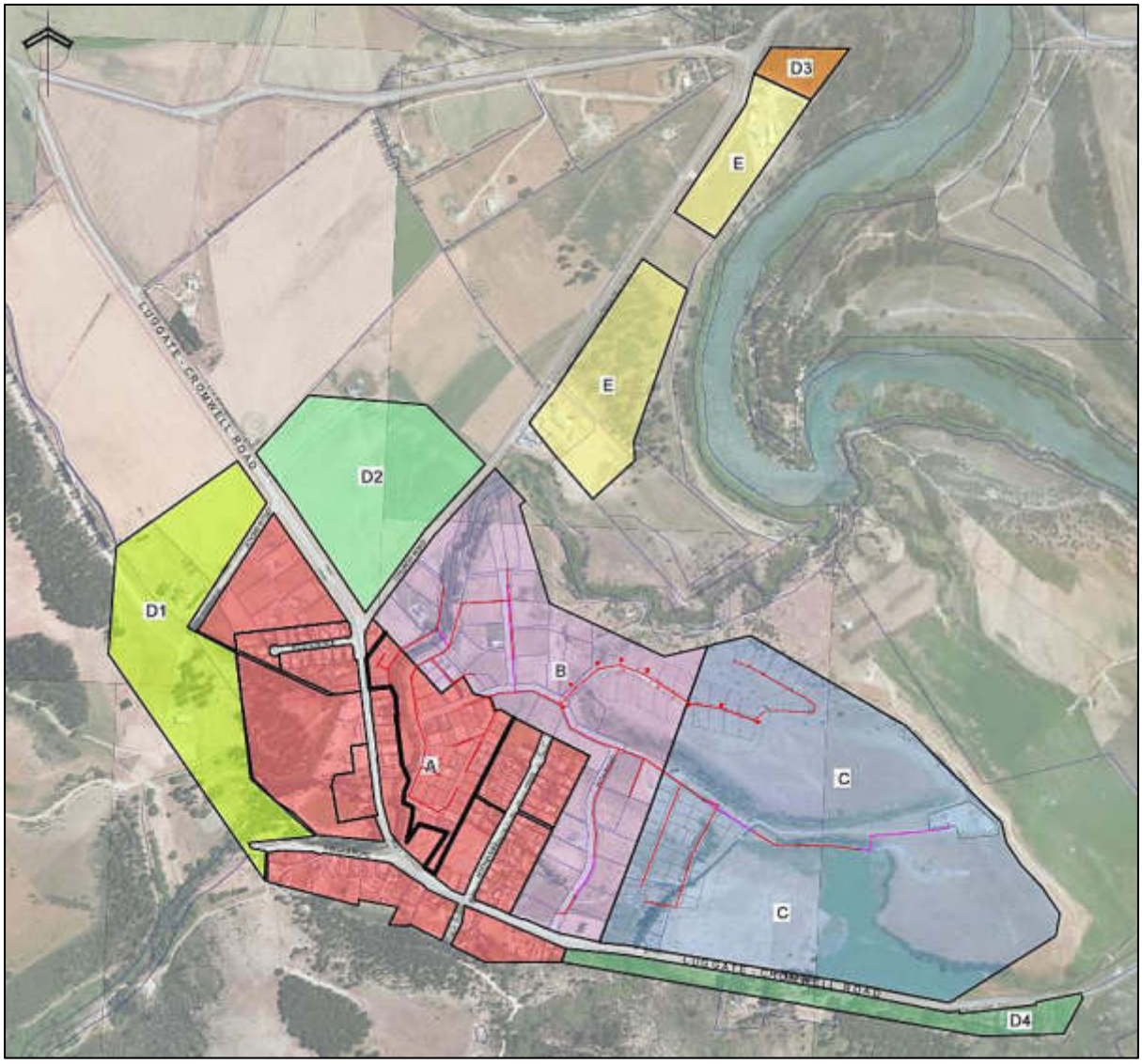

Figure 4.1: Luggate Wastewater Scheme Zones and Boundaries

The area labelled A in Figure 4.1 is currently zoned as Luggate Township (minimum 800m^2 lots). Area B is currently zoned as Rural Residential (minimum 4000m^2 lots), and Area C, also known as Luggate Parks, is zoned for residential housing.

The areas labelled as D1, D2, D3 and D4 are currently zoned as Rural General, but have been included in the scheme boundaries from Yr2033 to be possibly re-zoned in the future to Rural Residential areas in order to allow for growth and expansion of Luggate. Similarly, the areas labelled as E have been included as possible future light industrial zones. The zoning

and scheme boundaries shown in Figure 4.1 have been used to help estimate potential future wastewater flows only. Preliminary cost estimates for pipelines feeding into the D and E areas have not been estimated at this stage. However the township wastewater scheme proposals presented later in this report have taken the topography and potential flows from these areas into consideration to ensure that they can be serviced by the new scheme.

As the new Luggate wastewater scheme will deliver wastewater to the Project Pure scheme in a pipeline passing by the Wanaka airport, the potential growth of the Wanaka airport area has also been taken into consideration in calculations. At this stage, the 2017 Beca report *3-Waters Infrastructure Review of Wanaka Airport* has offered a broad view of options for the Wanaka Airport growth. For the purposes of this report, the wastewater flows estimated in the Beca report for the largest growth option have been used in the design of the wastewater rising main as it is most likely that they will connect to the new pipeline as it passes by.

5.0 Population Growth

For the purposes of estimating future growth in Luggate, a number of sources were investigated. Growth projections were obtained from Rationale Ltd, Census NZ and the QLDC website. The average annual growth rates (AAGR) for dwellings in the area, obtained from the different sources, are summarised below:

NZ Census Data	6.29 % AAGR for the period 2001 – 2006
NZ Census Data	3.86 % AAGR for the period 2006 – 2013
QLDC Website Growth Projections	2.42 % AAGR from 2016 – 2031
Rationale Ltd Growth Projections	2.7 % AAGR from 2018 – 2028

It should be noted that the March 2018 Census data was not available at the time of writing of this report.

As can be seen from the growth figures presented above, a range of average annual growth rates have occurred and are projected. To help assess the impact of this, a range of average annual growth rates from 3% to 6% has been used in this report to determine the possible range of wastewater flows.

As well as the average annual growth rate for the area, Willowridge was contacted regarding the sale of the 62 lots in Luggate Park currently awaiting title. These lots have been sold to individual buyers, the majority of whom will be likely to build a dwelling within, approximately five years of getting title. Local anecdotal information suggests this is likely, so this pocket of 62 lots has had a greater than average growth rate applied to it for flow estimation.

Sensitivity of the proposed schemes has also taken into consideration the possibility of Areas D1 and D2 being developed before the remainder of Luggate Park (Area C). These options have been presented in the Luggate WW Areas Flow Estimates drawings presented in the Appendices with separate tables for flow generation, labelled as “Fill Area C First” and

"Fill Area D First." These figures may be used for the purposes of alternate options for staging the works.

6.0 Estimated Wastewater Flows

6.1 General

It is understood that QLDC are currently investigating the option of improving the water supply to the Luggate township. As a result, wastewater flows for the existing year 2018 and future years up to Yr2048 have been estimated based on the current QLDC Land Development and Subdivision Code of Practice design criteria for two options:

1. **Conventional sewerage system**, comprising of gravity sewer collection for the unreticulated parts of Luggate and for all new future growth areas, excepting the areas of existing Luggate township that will require a pressurised sewer system (approximately 99 lots);
2. **Pressurised sewerage system**, comprising of pressurised sewer collection systems for all parts of Luggate currently on septic tanks and all new future growth areas with the exception of the future Luggate Park area would continue to be serviced by a gravity reticulation.

The basis for the flow estimates are as follows:

Parameter	Value
Number of persons per dwelling	3
Per capita flow allowance	250 L/p/d
Gravity system diurnal peaking factor	2.5
Gravity system dilution/infiltration factor	2.0
Industrial flows, light (includes peaking factors)	0.4 L/s/ha
Pressurised sewer system total peaking factor	1.2 or 2.0

The pressurised sewer peak flows are much lower than gravity peak flows as the pressure sewer pumping stations have their own storage and how they feed into the overall system is controlled hydraulically. Furthermore, the pressurised sewer pumping stations can also be controlled electrically to postpone their operation to try an avoid pumping during peak diurnal periods exhibited by gravity sewer systems. This has the effect of dropping their peaking factors even lower.

As a check, the above parameters were applied to calculate wastewater flow rates for the known existing number of houses currently connected, via gravity connections, to the reticulated scheme in Luggate feeding the existing small WWTP. This estimated flow rate was then compared with the measured flows going into the Luggate WWTP and was found to be a conservative estimate.

6.2 Luggate Township Wastewater Flow Projections

The Luggate township wastewater flow estimates have been calculated based on the parameters shown above, using the range of growth rates and known existing dwelling numbers in Luggate.

It should be noted that these flow projections are based on the combined peak flow from the from the gravity connections wet weather peak flows into the system plus the pressurised sewer connections peak flow at a rate of 2 x Average Dry Weather Flow.

For pressurised sewer installations, it is recommended that the use of smart controllers on the individual pressure sewer units are adopted to allow the flows from these units to be utilised for flushing pipelines if need be in the early stages of the scheme, and to also control the timing of the pumping of the individual units so as not to coincide with the daily gravity peak times. By using the scheme smartly could further reduce the peak flows that are shown below. At this stage however it is recommended that this more in-depth control could be used to extend the scheme' design capacity if required in the future.

6.2.1 Conventional Sewerage System Flow Projections

Figure 6.1 presents a summary of the WW flow estimates per year for the "Conventional Sewerage System" scenario for each of the four different growth rates being considered. A few points should be noted regarding the estimates:

- The flows shown are all peak wet weather flows from all gravity connections in the system, with the addition of a 2.0 x peaking factor applied to the average daily flow from all pressurised sewer connections to existing properties on septic tanks.
- Connection of the properties currently draining to septic tanks are brought in gradually, with 30% connected by Yr2023, 60% connected by Yr2028, and 100% connected by Yr2033.
- It has been assumed that by Yr2023, 80% of the 62 Luggate Park lots (currently untitled) would have a dwelling. The annual growth rate has been applied to the Luggate Park area from this point on.
- The ultimate lot density for Area D was estimated based on a Low Density Residential equivalent density rate of 7.5 lots/Ha.
- Light industrial flows have been applied to Area E gradually, with 10% applied to the area in Yr2028, 20% in Yr2033, 30% in Yr2038, and 50% in Yr2048.
- An increased intensity growth has been applied to 25% of Area B in Yr2048 to allow for additional dwellings being built on these larger lots.
- Figure 6.1 also presents the ultimate wastewater flow projections for the extent of the proposed scheme. It can be seen that by 2048 using a 6% AAGR the scheme is almost at full capacity.

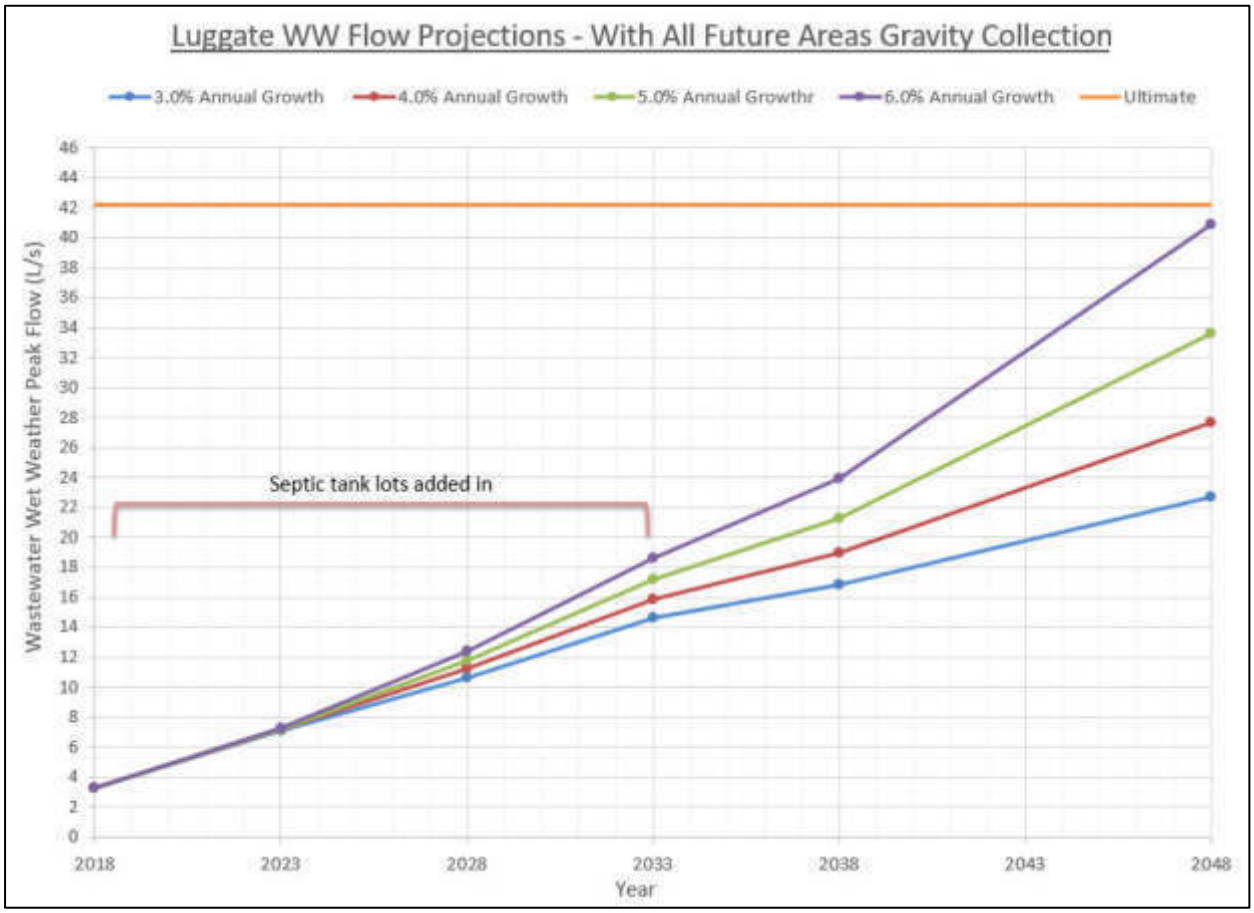

Figure 6.1: Peak Wet Weather Wastewater Flow Projections for Conventional Gravity Sewerage System for Luggate

6.2.2 Pressurised Sewerage System Flow Projections

Figures 6.2 and 6.3 present summaries of the WW flow estimates per year for the "Pressurised Sewerage System" scenario for each of the four different growth rates being considered. In these scenarios it is assumed that all of the existing septic tanks are replaced with pressurised sewer connections, and all new future growth areas are also connected via a pressurised system with the exception of the future lots in Luggate Park that are already set up to have their flows conveyed by gravity reticulations. A few points should be noted regarding the estimates:

- The flows shown are all peak wet weather flows from gravity connections in the system.
- Both a 1.2 x and a 2.0 x peaking factors have been applied to the average daily flow from all pressurised sewer connections for comparison. Information from pressurised sewer product suppliers and designers has shown that a peak factor of 1.1 or 1.2 is realistic. However, a 2.0 peaking factor has been shown to allow for any stormwater infiltration into the pressurised systems, e.g. from cross connections of stormwater pipes, particularly in the older existing houses in Luggate. This infiltration could be detected and reduced with good monitoring and management to reduce the peak flow rates.

- Connection of the properties currently draining to septic tanks are brought in gradually, with 30% connected by Yr2023, 60% connected by Yr2028, and 100% connected by Yr2033.
- It has been assumed that by Yr2023, 80% of the 62 Luggate Park lots (currently untitled) would have a dwelling. The annual growth rate has been applied to the Luggate Park area, Area C, from this point on.
- The ultimate lot density for Area D was estimated based on a Low Density Residential equivalent density rate of 7.5 lots/Ha.
- Light industrial flows have been applied to Area E gradually, with 10% applied to the area in Yr2028, 20% in Yr2033, 30% in Yr2038, and 50% in Yr2048.
- An increased intensity growth has been applied to 25% of Area B in Yr2048 to allow for additional dwellings being built on these larger lots.

Figure 6.2 presents the ultimate wastewater flow projections for the extent of the proposed wastewater scheme based on the future Luggate Park area being developed before Area D.

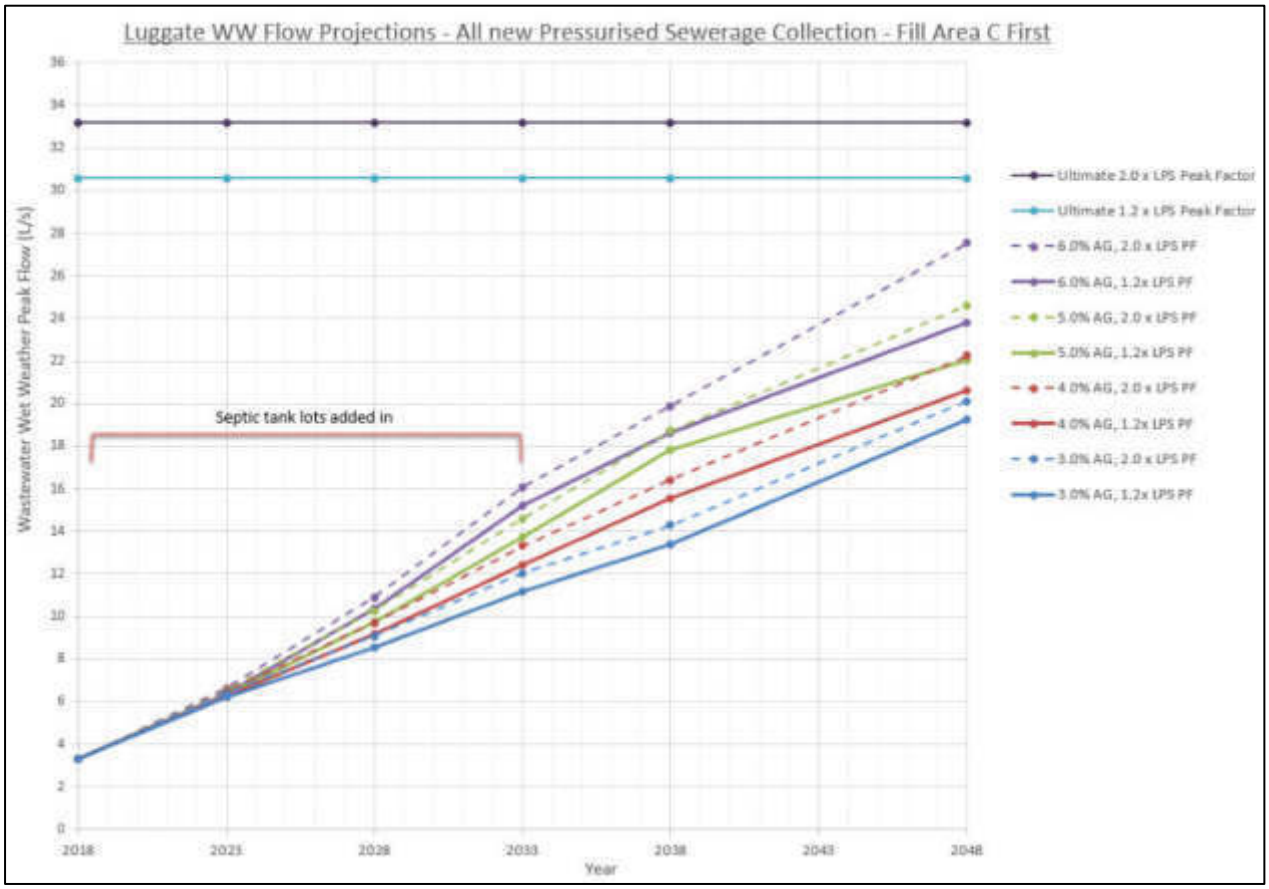

Figure 6.2: Peak Wet Weather Wastewater Flow Projections for Pressurised Sewerage System for Luggate – Fill Area C (Luggate Park) First

By comparison, Figure 6.3 presents the ultimate wastewater flow projections for the extent of the proposed scheme based on future development halting in Luggate Park after the 62 lots have been approved and Area D developing first.

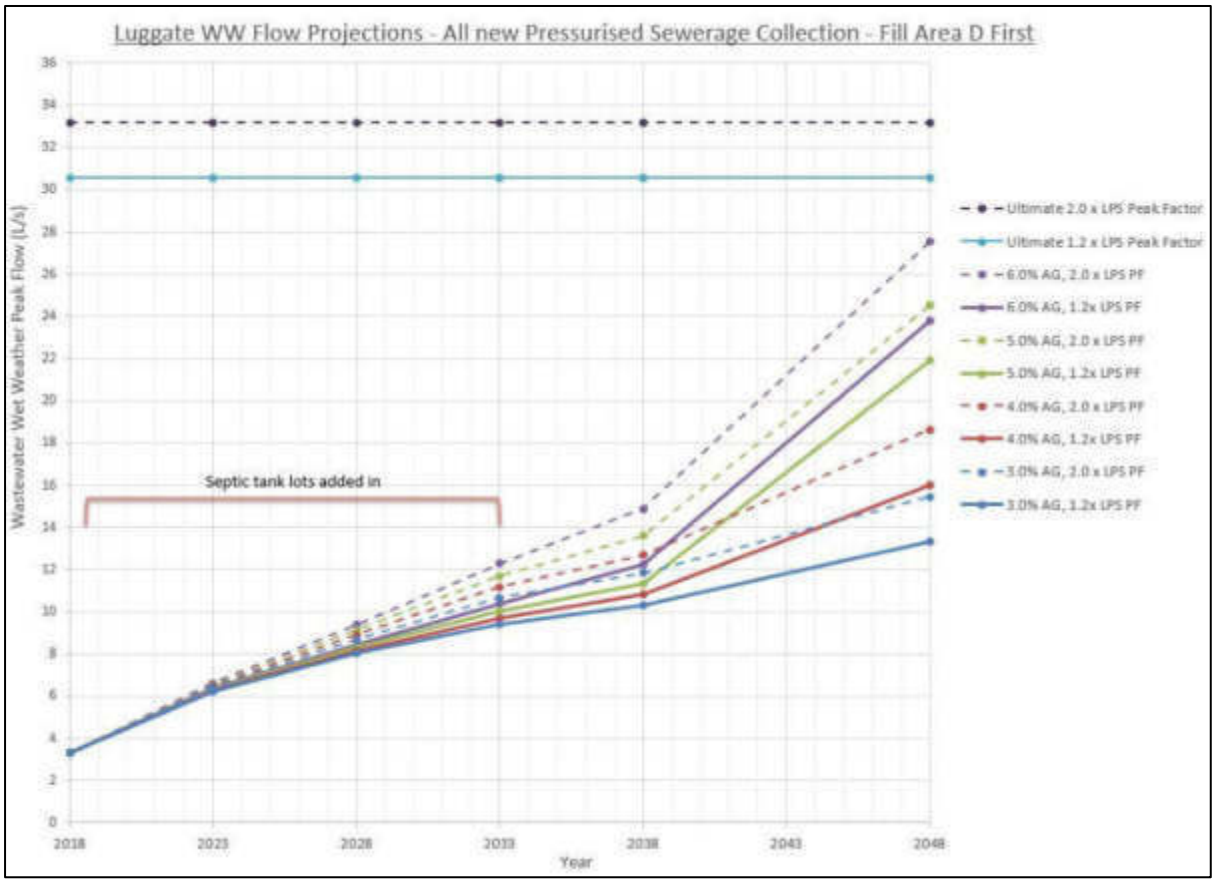

Figure 6.3: Peak Wet Weather Wastewater Flow Projections for Pressurised Sewerage System for Luggate – Fill Area D First

By comparing Figures 6.2 and 6.3 it can be seen that by 2038 the scheme flows are higher (in the order of around 20 L/s) in Figure 6.2 due to the influence of the gravity reticulation development areas feeding in first. The addition of pressure sewer pumping stations in Area D and the timing of the Area D development being brought forward has the effect of lowering the flows up to 2038 (to around 12 L/s) as shown in Figure 6.3.

Furthermore the lower flows effect of introducing pressure sewers for future properties is clearly shown when comparing Figure 6.2 and 6.3 with Figure 6.1.

6.3 Wastewater Design Flows

6.3.1 Conventional Gravity Sewerage System Design Flows

Based on the flows presented in Figure 6.1, the peak wet weather design flow adopted for the initial main pump station design is **21 L/sec**. This flow rate equates to the estimated flow in the year 2038 (20 years from now) based on the 5% annual growth rate. Furthermore this flow figure also covers all of the estimated different growth rates flows out to the year 2033.

If the growth rate in Luggate is slower than expected (≤ 3%p.a), the 21 L/s flow rate may also cover flows out to the year 2046.

Note also that there is a reasonable likelihood that the 2x gravity wet weather peaking factor used may prove to be high (based on observation of Wanaka sewerage flows) and this may mean that future peak flows are lower than predicted in Figure 6.1.

The upper flow rate of 41 L/s (maximum estimated peak wet weather flows at 2048 for a 6% AAGR) was also used to ensure the proposed design options have the ability to meet future extreme growth requirements.

As can also be seen on the graph in Figure 6.1, the existing WW flows are very low compared with the future projected flows. These low flows have also been considered in the wastewater system design to ensure that the infrastructure is operated in a fashion that limits low wastewater flows causing sediment to settle out in the rising main enhancing the potential for blockages.

6.3.2 Pressurised Sewerage System Design Flows

Based on the flows presented in Figures 6.2 and 6.3, the peak wet weather design flow adopted for the initial main pump station and rising main design is **9 L/sec.** This flow rate covers the estimated 4% growth rates flows out to the year 2028 for both options.

An upper flow rate of 24 L/s (maximum estimated peak wet weather flows at 2048 for a 6% AAGR, with 1.2 x peak factor for pressurised sewers) was also used to ensure the proposed design options have the ability to meet future extreme growth requirements.

Note that with ongoing monitoring and management of all pressurised sewer connections, and action to remove and reduce any infiltration into the wastewater system, the 1.2 x LPS peak factor is applicable. Additionally, with smart control and operation of the pressurised sewer components of the network, i.e. to inhibit the LPS units from pumping during daily peak gravity flow times, the future peak flows may be even further reduced and would be lower than predicted in Figures 6.2 and 6.3. Implementing these measures could allow the currently proposed main pumping station and rising main to convey wastewater from even more properties in the future.

6.4 Wanaka Airport Future Wastewater Flows

It is intended that the Luggate WW rising main will have the ability to also convey wastewater from the Wanaka Airport land, when the Airport has completed the reticulation of their development. The 2017 Beca report *3-Waters Infrastructure Review of Wanaka Airport* has offered a broad range of options for the Wanaka Airport growth. For the purposes of the new Luggate rising main and pump station design, the highest estimated flow rate of **14.25 L/s** for the "Directed Model – Jets" option for Yr2045 (Table 4.2 of the Beca report) has been adopted.

7.0 Bulk Reticulation Options, Pump Stations & Rising Main

7.1 General

Multiple options have been considered to collect and convey wastewater from the Luggate township to the Project Pure WWTP delivery pipeline for both the conventional gravity sewer collection and conveyance approach (with some pressurised sewers to service existing septic tanks) and the overall pressurised sewer approach as described above.

The three most promising options for the location and sizing of the main pump station(s) and rising main are presented in this report along with preliminary cost estimates. More detailed drawings of each of the options along with options for reticulating the existing properties as noted below are presented in the Appendices.

- Q000427 / Sheet C10 Existing Luggate Reticulation Plan
- Q000427 / Sheet C11 Luggate Township Option 1
- Q000427 / Sheet C12 Luggate Township Option 2
- Q000427 / Sheet C13 Luggate Township Option 3
- Q000427 / Sheet C14 Old Township Option A – Gravity & Pressure Sewer
- Q000427 / Sheet C15 Old Township Option B – All Pressure Sewer
- Q000427 / Sheet C16 Rising Main Overview Plan
- Q000427 / Sheet C17 Rising Main to Project Pure Long Section
- Q000427 / Sheet C18 Non-Reticulated Township Areas
- Q000427 / Sheet C20 Main WWPS Layout Plan
- Q000427 / Sheet C30 Wanaka Airport Rising Main Route Options

As can be seen from the three options presented, all three have the main pumping station located at the North West corner of the town. Following a check of the capacities of the existing pumping stations and rising mains and existing gravity pipelines it was determined that to convey all the current and future township flows to a main pumping station at the south eastern end of the town through the existing reticulation was impractical as it would require extensive upgrades to a large portion of the reticulation and all the existing pumping stations.

The rising main route from the main pumping station to the Project Pure pipeline is the same for all options. The rising main would travel along the SH6 road reserve until just after the State Highway 8A intersection where it would detour off State Highway 6 into land north of the State Highway 6 to avoid the narrow road cutting going up to the Wanaka Airport plateau. It would then travel along the southern boundary of the airport land before connecting into the Project Pure pipeline in Stevenson Road leading to the Project Pure WWTP.

More detailed descriptions of the design considerations for the pumping stations and rising mains and description of options to collect and convey wastewater from the existing houses currently serviced by septic tanks are presented later in this report.

7.2 Option 1 – Rising Main along State Highway through Town

For Option 1, it is proposed that the gravity reticulation feeding into the Alice Burn 2 WWPS be collected and bypassed with a 225mm dia. gravity main falling through the future Luggate Park area to a new "East Luggate" Lift WWPS. This WWPS would be located within the lower south eastern corner of the Luggate Park subdivision area and be fitted with standard submersible centrifugal pumps similar to the Alice Burn 2 WWPS – but slightly larger.

Future wastewater flows from Luggate Park would be conveyed to the 225mm dia. gravity main and flows from Area D4 south of the State Highway would drain directly to the new "East Luggate" Lift WWPS.

The Alice Burn 2 WWPS currently does not have any wastewater flows arriving at it apart from those coming from the Alice Burn 1 WWPS. It is believed that it was built to service the future Luggate Park subdivision area yet to be developed.

A new 160 OD PE rising main would then travel through the Luggate township within the SH6 road reserve to discharge to the new "West Luggate" Main WWPS at the north west end of town. This new larger main pumping station would be located within the SH6 road reserve to the northwest of the Church Rd intersection. The main pumping station would have surface mounted positive displacement pumps to enable the wastewater to be pumped all the way up to the Project Pure pipeline in a 225mm OD PE rising main. Wastewater flows from future development areas to the north west (Areas D1 and D2) and the industrial land to the north along Church Road will be able to be delivered directly to the new pumping station.

Wastewater flows emanating from the reticulated blue areas in Figure 3.1 will continue to drain as they are currently. Wastewater flows from the houses in the scheme currently serviced by septic tanks will be conveyed to the new scheme as described later in the report.

The Alice Burn 2 WWPS would be decommissioned.

A plan showing the layout of Option 1 is presented in Figure 7.1 below. A larger scale drawing of this option is also presented in the Appendices.

Pros for this option:

- The new East Lift WWPS and gravity main would be constructed in currently undeveloped land in the Luggate Park area.
- The rising main through town would be constructed in the wider State Highway road reserve land possibly allowing easier access for maintenance.
- No significant works would be needed along Alice Burn Drive and Harris Road.

Cons for this option:

- This option has a 300m longer rising main and an additional new pumping station than Option 3.
- Agreement with Willowridge will be required to site the gravity main through the currently undeveloped Luggate Park area.
- The SH6 road reserve is narrow in places.
- There are multiple existing above ground and underground services along the rising main route, particularly underground core telecommunications cables and power poles.
- Extensive NZTA road safety control measures will be required during construction and future maintenance.
- There are two creek crossings – one being a bridge.
- The “East Luggate” Lift WWPS would be located on Willowridge land.
- The “East Luggate” Lift WWPS would be located near to waterways.

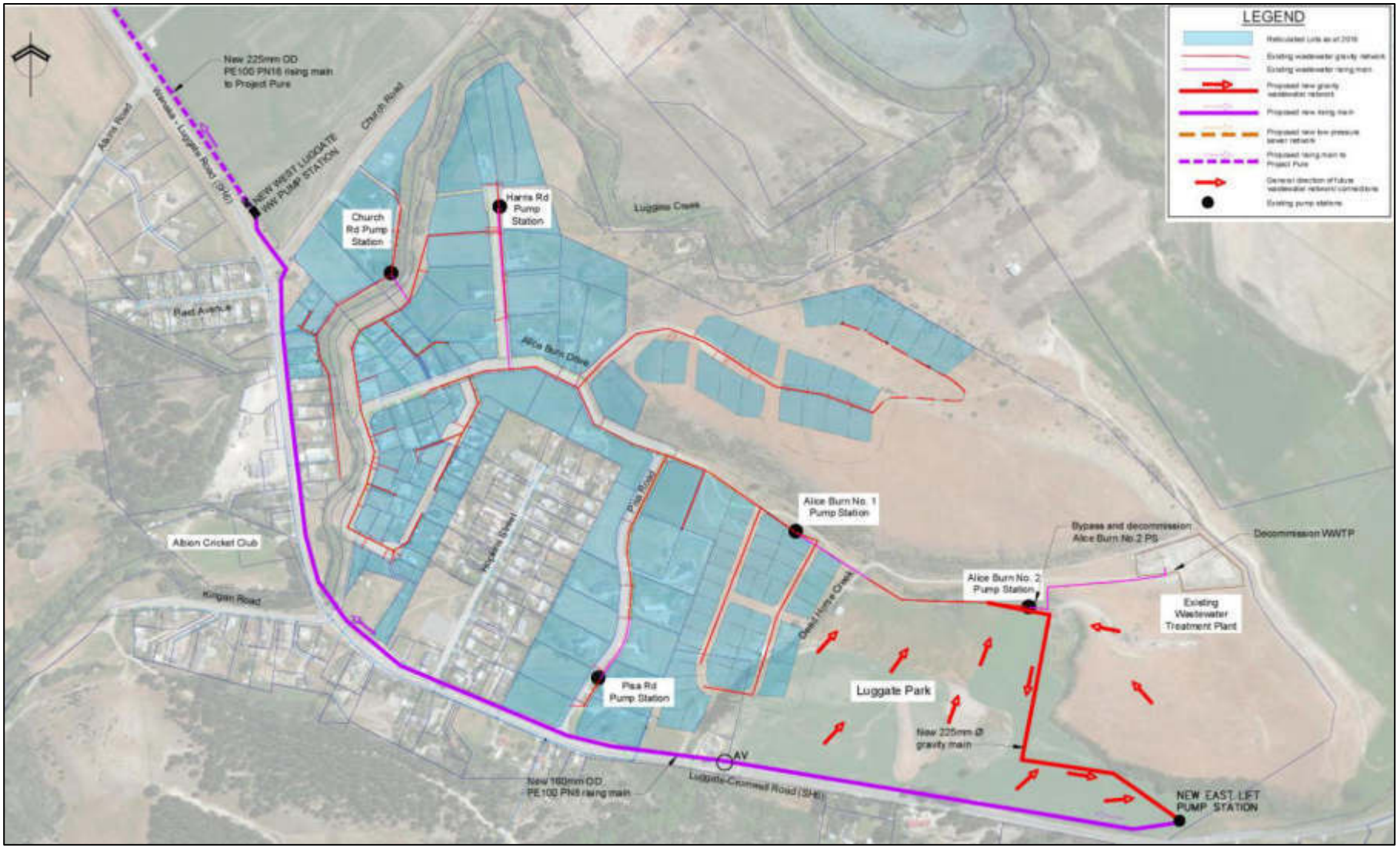

Figure 7.1: Option 1(a) Plan

7.3 Option 2 – Rising Main through Luggate Park

Option 2 is the same as Option 1 with the exception that the rising main route for this option travels through Luggate Park, along Alice Burn Drive and Harris Roads, crosses under Luggate Creek and ends up at the new "West Luggate" Main WWPS on the corner of the State Highway and Church Road.

Wastewater flows would continue to feed into the scheme as described for Option 1 and Alice Burn 2 WWPS would still be decommissioned.

A plan showing the layout of Option 2 is presented in Figure 7.2 below. A larger scale drawing of this option is also presented in the Appendices.

Pros for this option:

- Minimal SH6 works.
- The new "East Luggate" Lift WWPS and gravity main would be constructed in currently undeveloped land in the Luggate Park area.
- A section of the rising main could be located in a shared trench with the gravity main in Luggate Park.
- Albeit the rising main will travel along Alice Burn Drive and Harris Roads road reserves there is minimal disturbance to existing property owners with only a few driveways on the route affected.
- The route is located all along QLDC owned road reserve/right-of-way land excepting the currently undeveloped Luggate Park area.

Cons for this option:

- Agreement with Willowridge will be required to site the gravity and rising mains through the currently undeveloped Luggate Park area.
- There are existing underground services along the rising main route, particularly HV power and some reticulated gas.
- It requires drilling under Luggate Creek.
- The estimated capital cost for this option is similar to Option 1. It has a 300m longer rising main and an additional new pumping station than Option 3.
- The "East Luggate" Lift WWPS would be located near to waterways.
- The "East Luggate" Lift WWPS would be located on Willowridge land.

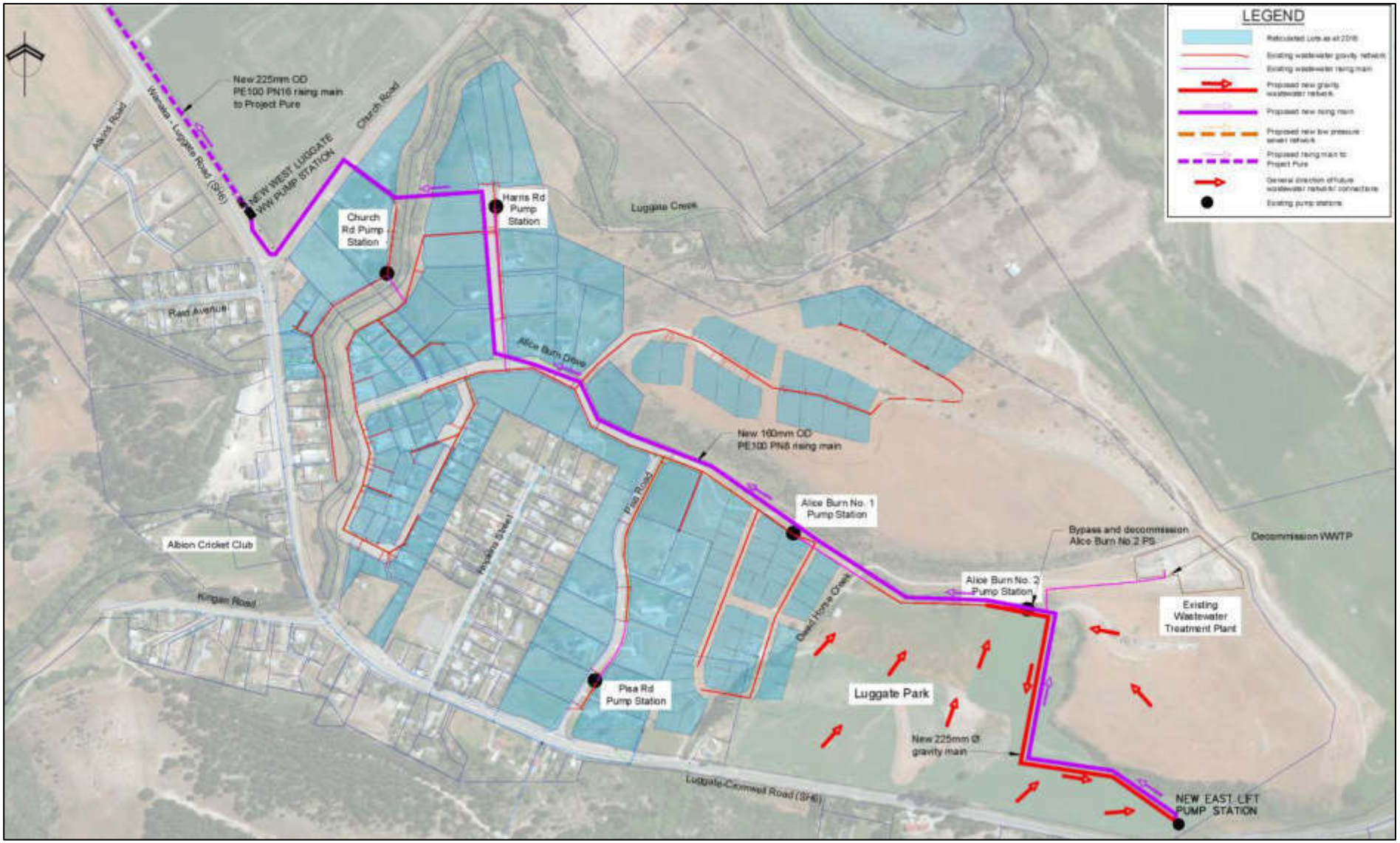

Figure 7.2: Option 2(a) Plan

7.4 Option 3 – Rising Main along Alice Burn Drive and Utilising Alice Burn 2 WWPS

Option 3 has the same rising main route as Option 2 but it is 300m shorter as this option makes use of the existing Alice Burn 2 WWPS and pumps and does not require the construction of the new "East Luggate" Lift WWPS.

For this option the Alice Burn 2 WWPS rising main would be redirected to run west instead of east along Alice Burn Drive with a new 180 OD PE new rising main routed along Alice Burn Drive and Harris Road through reserve areas, under the Luggate Creek and connecting to the new "West Luggate" Main WWPS. The rising main is slightly larger than the 160OD pipeline used for Options 1 and 2 as it takes into consideration the use of the existing pumps in the Alice Burn 2 WWPS.

Wastewater flows from the undeveloped area of Luggate Park would drain to the Alice Burn 2 WWPS (as it was intended in the original Willowridge design). Wastewater flows from Area D4 south of the State Highway would drain directly into the future Luggate Park reticulation and the remaining wastewater flows throughout the township would continue to drain to the new scheme as described in Option 1.

A plan showing the layout of Option 3 is presented in Figure 7.3 below. A larger scale drawing of this option is also presented in the Appendices.

Pros for this option:

- Minimal SH6 works.
- Re-use of the existing Alice Burn No. 2 WWPS.
- Albeit the rising main will travel along Alice Burn Drive and Harris Roads road reserves there is minimal disturbance to existing property owners with only a few driveways on the route affected.
- The route is located all along QLDC owned road reserve/right-of-way land.
- No works are required in the future Luggate Park land.

Cons for this option:

- There are existing underground services along the rising main route, particularly HV power and some reticulated gas.
- It requires drilling under Luggate Creek.

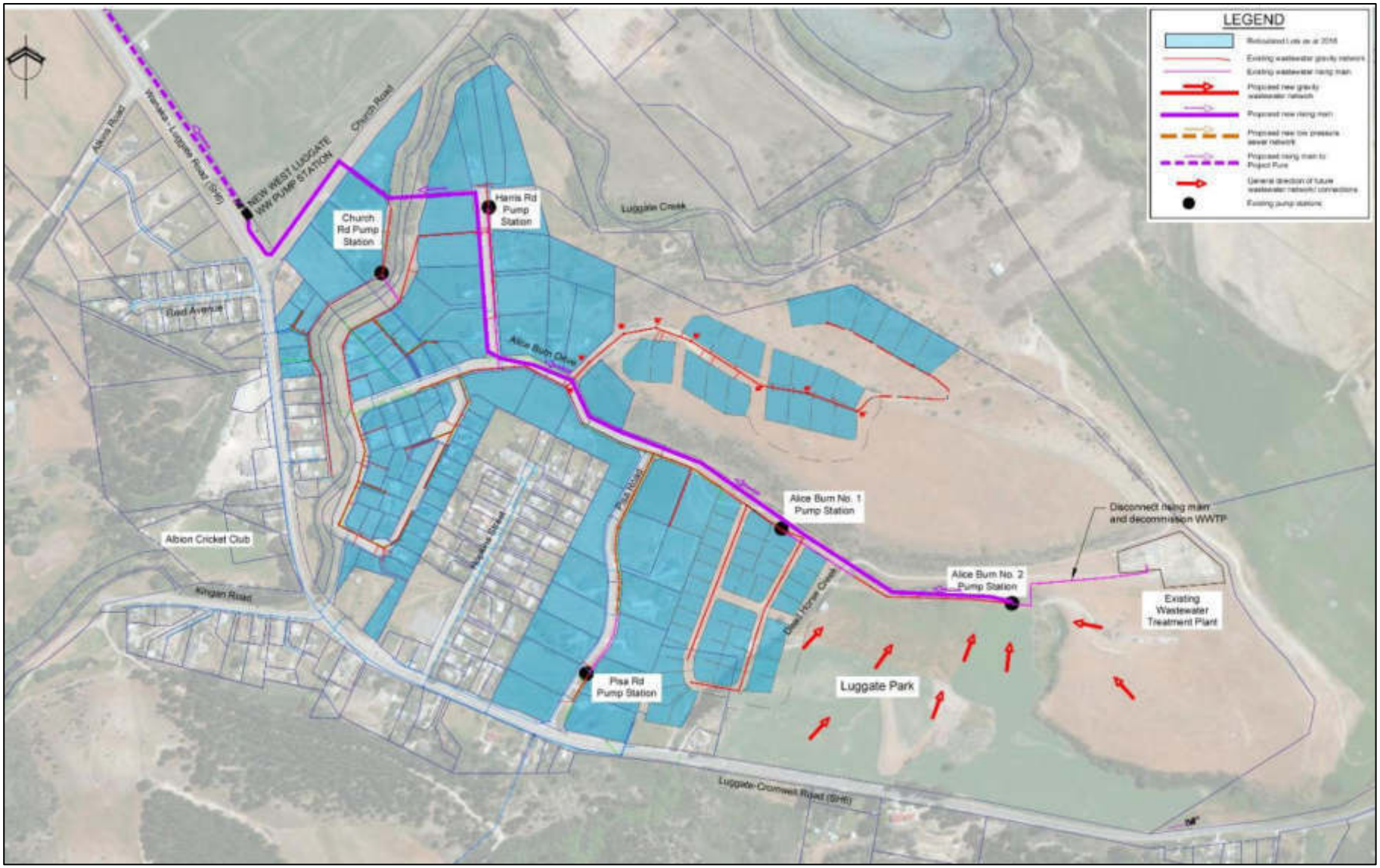

Figure 7.3: Option 3(a) Plan

8.0 West Luggate Main Wastewater Pump Station

8.1 Location

For all options, the "West Luggate" Main WWPS has been located at the north-western corner of Luggate. Refer to Figure 8.1 for a photo of the area proposed for the "West Luggate" Main WWPS.

It is recommended that the WWPS is kept a distance back from the Church Rd intersection so as to avoid reducing site distances for traffic entering the intersection.

Pros:

- Lots of available space within the road reserve.
- HV power nearby.
- Water supply nearby.
- The areas to the north, west and east can gravity feed into the main pump station.
- Located away from waterways.

Cons:

- Trunk Telecommunications cables underground near WWPS location.
- Power poles to avoid.
- Visually prominent area for passing traffic.
- Close to developed areas – may be a concern with odours/noise.

Figure 8.1: Photo of West Luggate Main WWPS site

8.2 Site Layout & Requirements

Refer to Figure 8.2 below and drawing C20 in the Appendices for a proposed layout of the WWPS.

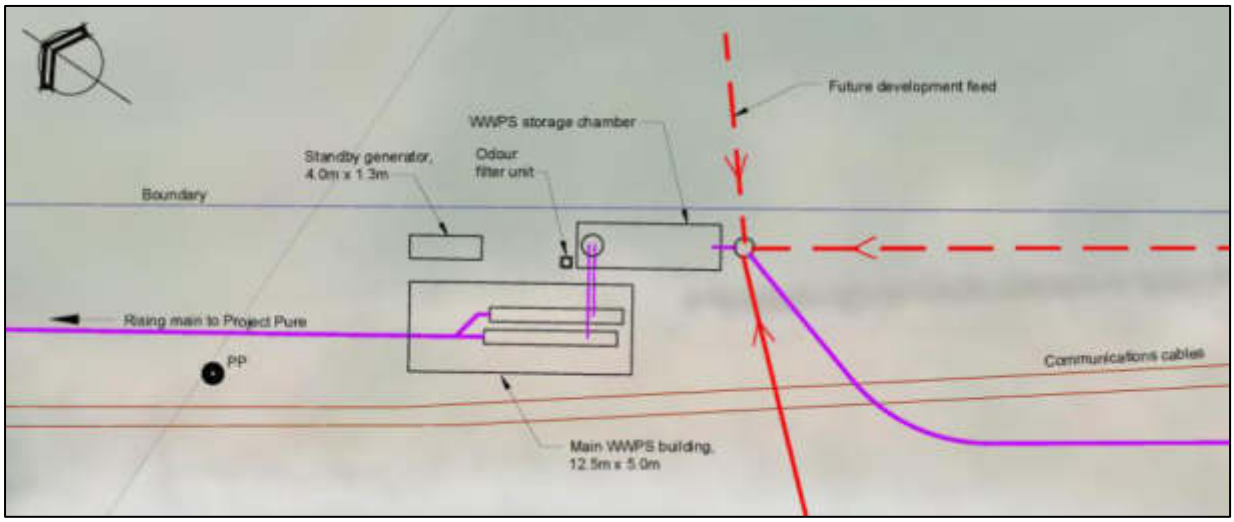

Figure 8.2: West Luggate Main WWPS Site Layout

Requirements for the new Main WWPS will include:

- Pumps and piping arrangement for easy operator access and maintenance.
- Wet well and emergency storage.
- Standby generator.
- Odour control methods and odour filter.
- Surge mitigation measures.
- Flowmeter.
- Water supply & backflow preventer.
- Power requirements – housed within the WWPS building.
- Control and communications – housed within the WWPS building.

8.3 Wastewater Pump Station Building

The pump house building, being in a high profile area would likely require particular architectural attention and a schist clad building similar to that proposed for a water booster pump station in Wanaka (see Figure 8.3) has been allowed for in the preliminary cost estimates.

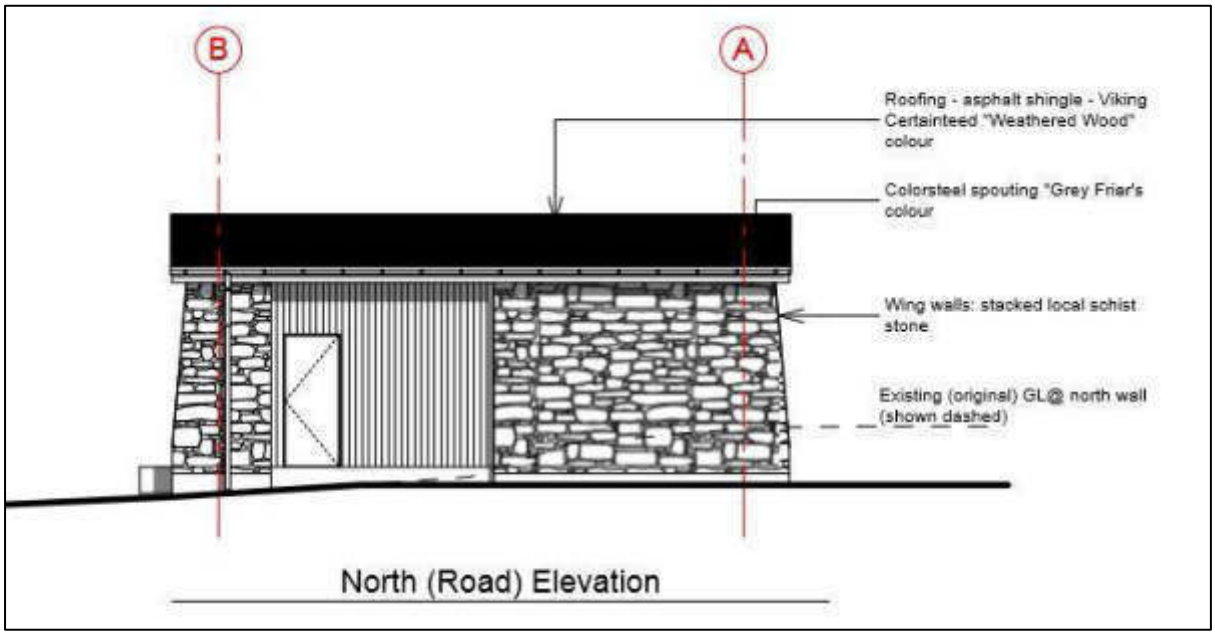

Figure 8.3: Example of Architecturally Designed Pump House Building

9.0 Rising Main Routes

9.1 Main WWPS Rising Main Route to Project Pure

The rising main (or mains) from the proposed site of the West Luggate Main WWPS to the Project Pure gravity wastewater reticulation near the Wanaka Airport has a length of approximately 4.3 km. For much of the proposed route there are reasonably wide verges that give flexibility in siting the pipeline. It is generally envisaged that for the most part the pipeline route would run along the north eastern side of the State Highway, up until the State Highway 8A intersection.

Trunk network telecommunication services run along this side of the road reserve, so it is recommended that cable location and survey are performed before finalising the pipe route for the detailed design. Some underground HV cables are also present along the route, as are overhead power cables on power poles.

The pipeline route would cross to the northern side of the State Highway just north of the State Highway 8A turn-off to Tarras. It is intended that the pipeline route would then cross into the large McKay Station privately-owned farm property and head up a gully to the airport terrace within this property, with permission from the property owner. There are currently two trunk telecommunications network cables located within this property, although it is currently understood that easements do not exist for these. This route was selected as there is not enough room on the eastern side of the section of road up the cutting towards the Wanaka Airport plateau for an excavator to easily work, as the ground slopes away quickly from the road barrier installed along that section of road.

Two options have been considered regarding the rising main route around the Wanaka Airport. The preferred route is shown on drawing sheet C30 in the Appendices which has the rising main located running alongside the State Highway boundary all the way to Stevenson Road.

The alternative option considered involved running along the main access road servicing the buildings in the airport. As well as being a slightly longer route, this alternative option may also restrict future possible development options at the Airport, and hence was not pursued any further.

A number of air/vacuum relief valves would be installed along the pipeline in accordance with normal design practice. These would be offset from the pipeline, against the fence line, to protect them from being hit by traffic. In any built up areas it is recommended that they also be fitted with odour filters.

9.2 Rising Main Route through Luggate Park

For Options 2 & 3, the rising main route travels along Alice Burn Drive, north up Harris Road, and then west through the reserve walkways and across (beneath) the Luggate Creek up to Church Rd to the West Luggate WWPS location. This route is partly in Willowridge Ltd land and then in council vested road and reserve land. The berm on the western side of Harris Road is very wide and has only three existing gravel driveways to cross.

For Option 2 the rising main is also routed through Willowridge land still to be developed, and will require approval from Willowridge as to its location.

For both of these options it is recommended that a connection be made from Alice Burn No. 1 WWPS into the rising main for use in case of emergency where Alice Burn 2 is unable to pump for any extended period. The Alice Burn 1 pumps are the same as the Alice Burn 2 pumps.

9.3 Rising Main Route between East Luggate WWPS and West Luggate WWPS

For Option 1, the rising main route travels along the north and eastern side of State Highway 6. This route has been chosen as the other side of the road has more underground services and power poles. The Luggate pub and carpark is also located on the other side of the road. Running along the eastern side as the pipeline crosses Luggate Creek will also allow the pipeline to cross either the road or pedestrian bridges over the creek.

9.4 Combining Services along the Rising Main Route

QLDC are investigating options for upgrading the water supply to the Wanaka Airport and to Luggate. As a part of this, there will be significant cost savings if a water rising and/or falling main pipe is installed in a shared trench with the wastewater rising main along most of the route. The cost of the additional trench width or the length of a combined trench has not been estimated at this stage as the size and location of the intended water pipeline is not known.

It is recommended that the location and size of the pipeline be determined shortly by QLDC to take advantage of the imminent wastewater pipeline.

10.0 Main Rising Main Design

10.1 Rising Main(s) Sizing

For all options the sizing of the rising mains have been completed to allow appropriate pumps to be selected while at the same time considering scour velocities.

10.1.1 Conventional Gravity Sewerage System Rising Main Sizing

The rising main from the West Luggate Main WWPS to the Project Pure gravity main for this scenario has been selected as a single 225 OD PE100 PN16 for all options where flows are being delivered into the scheme by conventional gravity sewerage systems in the future. A dual pipeline scenario was also considered to try and reduce detention times in the pipeline but offered little advantage over the single pipeline option as the detention times were still large for both options. This is discussed further below.

This size was selected to convey both the 21 L/s design flow and also the future flows up to 41 L/s. The progressive cavity pumps will be powered with variable frequency drives allowing them to pump at scouring velocity flow rates irrespective of the flows coming into the pumping station.

10.1.2 Pressurised Sewerage System Rising Mains Sizing

For all options combined with the Pressurised Sewerage System future collection scenario, a dual rising main option was selected. The rising mains from the West Luggate Main WWPS to the Project Pure gravity main are proposed to be one 125 OD PE100 PN16 pipe and one 160 OD PE100 PN16 pipe.

These sizes were selected to have only the smaller 125 OD pipe initially convey up to 9 L/s flow, then switch over to using just to the 160 OD PE pipe which can convey up to 17.4 L/s flow. Combined, the dual pipelines can convey future flows up to 26 L/s, greater than the 24 L/s maximum design flow. This dual pipeline selection offers operational variability and will initially help reduce detention times within the rising main due to the smaller volume contained within the smaller diameter pipe.

A rising main size smaller than a 125 OD (e.g. a 110 OD) has not been considered as the progressive cavity pump selected is capable of passing soft solids up to 98mm and the 110 OD pipeline has an internal diameter of 89mm.

The progressive cavity pumps will be powered with variable frequency drives allowing them to pump at scouring velocity flow rates irrespective of the flows coming into the pumping station.

Maintaining scouring velocities in long rising mains is often an issue due to the significant frictional heads developed. The use of progressive cavity pumps with their high head

pumping capacity is a particular advantage in these cases. A minimum velocity of 1m/s (1.2m/s is preferable) is desirable in a wastewater rising main to lift and convey any settled material off the base of the rising main. To achieve this scouring velocity, the pump motor can be set to run at the speed required to achieve the desired pipeline velocity.

10.2 Wastewater Septicity Occurrence and Mitigation

10.2.1 General

The management and mitigation of septicity, and the effects thereof, within the Luggate Sewerage Scheme is important, and is of particular focus here regarding the condition of the sewage discharged to the Project Pure Scheme. Septicity of sewage is generally related to extended retention within the wastewater transfer system. The main effects due to septicity are:

- Potential infrastructure degradation due to the formation of corrosive compounds, and
- Generation and emission of malodour,
- Potential effects on the downstream treatment system.

Septicity in a sewerage system develops when microorganisms use up all the dissolved oxygen and nitrates in the sewage. Such bacterial activity in the sewage and on submerged pipework surfaces, leads to anaerobic conditions and sulphate reducing and fermentation processes in the wastewater. Soluble organics (e.g. BOD) become volatile organic acids and sulphates reduce to sulphides/hydrogen sulphide, all of which cause malodorous gases.

Key factors contributing to these processes include the wastewater retention time, the wastewater temperature and the wastewater characteristics, particularly the levels of BOD and sulphates. Septicity is more an issue in summer months when wastewater is warmer, where a 10 degree increase in temperature can double the rate of sulphate reduction and subsequent hydrogen sulphide generation. Under such warm conditions septicity can develop within periods as low as six hours, or even less.

Typically, the development of septicity occurs more in closed pipe systems (not in contact with the atmosphere, e.g. rising mains) than in gravity sewer systems, where the turbulence of gravity flow will often keep the sewage aerobic. However once the wastewater has become anaerobic and sulphides are being generated, the wastewater in the presence of air can then become quite corrosive to downstream infrastructure, particularly concrete pipework and structures. Odour release associated with these conditions is another serious issue.

The most effective strategy to minimising septicity is to reduce detention times, particularly in rising mains. Reducing pipe diameters as much a practically possible is a key target. Sometimes, depending on future growth, staging the construction of two rising mains can be an effective strategy – as with the Project Pure pipeline.

In many circumstances, the prevention of septicity is not practical or economical. Hence, containment to avoid creating an odour nuisance, controlled discharge/treatment of odours, and use of corrosion resistant materials are usually the most effective strategies.

Where septicity control/mitigation is important, various chemical treatments can be applied to the wastewater to control septicity. Historically, chemical treatments such as oxygen injection/aeration and nitrate addition have been employed to prevent anaerobic conditions developing. More recently, magnesium hydroxide or ferrous chloride dosing has become popular, with its use focusing more on 'binding' up the sulphate (to prevent hydrogen sulphide release) through an increase in the wastewater pH, rather than preventing anaerobic conditions per se. Dosing either of these chemicals also has the potential advantage of adding alkalinity to the wastewater which can be beneficial at the treatment plant.

Adding water to decrease detention times is another strategy sometimes used to reduce septicity occurring. In the case of Luggate, this would require volumes of the order of 500m^3/d of water to be added in the early years – reducing over time to perhaps around 100m^3/d. This water could be better used elsewhere.

10.2.2 Conventional Gravity Sewerage Scenario – Single & Duplicate Rising Main Options

Where flows were being collected and conveyed to the new scheme by conventional gravity sewerage reticulations a 225 OD PE 100 PN16 pipe was selected to be able to convey flows of up to 42 L/s to allow the pipe to operate through to Yr2048 and beyond. The total length of rising main is 4,280m, in this case then having a volume of 112m^3.

A dual pipeline option was also considered for this scenario to reduce detention times by allowing the use of one of the smaller pipelines initially and then to use the duplicate pipeline as well in the future when flows were higher. Duplicate 200 OD PE100 PN16 pipes were selected, each having a volume of 88.7m^3 for the length of the rising main.

Table 10.1 below, presents a comparison of these two scenarios for the main rising main (4280m rising main length) for various time periods into the future, based on a 4% annual growth rate. For the dual rising main option it is assumed that growth will require the second main to be used in Yr2033. The detention times given are average detention times based on the average day flows. Actual detention times over the day will vary either side of these values.

Table 10.1: Detention Time Comparison for Single and Duplicate Pipe Rising Main Options

Year	ADWF with 4% Growth Rate (m^3/d)	Detention Time (hrs)		
		Single Larger 225OD Rising Main	Dual Pipe Rising Main	
			1 x 200 OD PE	2 x 200 OD PE
Current 2018	57	47	37	-
2028	202	14	11	-
2033	288	10	-	15.5
2038	341	8.3	-	13
2048	491	5.8	-	9

Given that septicity can develop within 6 hours (in warmer conditions), Table 10.1 demonstrates that septicity is likely to occur at times for both single and dual pipe scenarios for this "gravity collection" scenario. In fact, the table shows that beyond Yr2033, the dual main option makes matters worse. From a septicity reduction perspective, it is concluded that the single rising main approach is simplest and most effective, and that there is no benefit to the duplicate main approach.

10.2.3 Pressure Sewer Collection Scenario – Dual Pipe Rising Main with Differing Diameters

Where flows were being collected and conveyed to the new scheme by new pressure sewer reticulations a dual pipeline rising main option was considered using one 125 OD PE100 PN16 pipe and one 160 OD PE100 PN16 pipe. The smaller pipe would be used to convey the initial lower flows, the second pipe to convey flows once they increased beyond 9 L/s and then both pipes used together once flows exceeded 17 L/s.

Table 10.2 below, presents a comparison of these two scenarios for the main rising main (4280m rising main length) for various time periods into the future, based on a 4% AGR. For the dual rising main option it is assumed that growth will require the second larger diameter rising main to be used by itself after Yr2028, and both rising mains are used when flows dictate from around Yr 2038. The detention times given are average detention times based on the average day flows. Actual detention times over the day will vary either side of these values.

Table 10.2: Detention Time Comparison for Differing-Sized Dual Pipe Rising Main Options

Year	ADWF with 4% Growth Rate (m^3/d)	Detention Time (hrs)	
		Dual Pipe Rising Main	
		1 x 125 OD PE	1 x 160 OD PE
Current 2018	57	14	-
2028	202	4.1	-
2033	288	-	4.7
2038	341	-	4.0
2048	491	4.5	4.5

Table 10.2 shows that, from a septicity reduction perspective, there are definite benefits to the dual rising main option, particularly with the smaller diameter pipe operating in the initial years, although septicity may still be an issue with the current 2018 low daily flows. This clearly shows that the pressure sewer option for future growth in the township offers a significant advantage in relation to wastewater detention times.

10.2.4 Septicity Management at Luggate

Given that septicity can develop within 6 hours (in warmer conditions), Tables 10.1 and 10.2 demonstrate that septicity is likely to occur at times for both single, duplicate and dual pipe scenarios.

It is concluded then, that for the Luggate Sewerage Scheme, it is best to recognise that septicity will occur at times and to take measures to manage and mitigate these conditions. Typical strategies include:

- Scrubbing of vented gases to remove malodours, particularly at pump stations, air release valve installations, and at all downstream manholes where anaerobic wastewater may be discharged into or through
- Avoiding turbulent conditions to avoid excessive odour loss to the atmosphere
- Use of corrosion resistant materials.

An additional septicity mitigation strategy, particularly if the dual rising main option is adopted, may be to initially set up a regime where the smaller rising main drains back into the main pump station wet well to pump it back up again, reducing standing times in the rising main, aerating the wastewater, and providing wastewater volume for increasing the daily total pumping times.

Magnesium hydroxide or Ferrous chloride dosing could also be added to the flows leaving the main pumping station to reduce odour. Cost estimates for the inclusion of this type of odour mitigation have been included in the West Luggate main pumping station breakdown for all options. Note that this system should not be required beyond Year 2028 for Options 1a, 2a and 3a (with dual pipe rising main) as identified in Table 10.2.

For the West Luggate and East Luggate pumping stations, static ‘McBerns’ type activated carbon based odour filters have been allowed for. The need for odour control at the other existing pump stations is unlikely but could be dealt to in the future if malodour problems were to arise, particularly as the pump stations are located close to developed areas.

For the rising main to Project Pure, the installation of McBerns filters at air valve locations will be considered especially in built up areas.

11.0 West Luggate Main Pump Station Design

11.1 West Luggate Main Pump Station Design

A key design consideration for the Main Pump Station design is the approximately 75m static lift required. The assumed operating level of the pump station is RL272m (3m below assumed ground level of RL275m). The receiving sewer level at the Project Pure gravity MH is approximately RL347m. This means that the pumping duty is beyond that of conventional submersible sewerage pumps. This then leads to the use of surface mounted progressive cavity pumps sucking from a below-ground pump chamber. These pumps are sensitive to the solids size passing through them and firstly require measures to prevent stones and similar sharp debris being sucked up, and secondly measures to either intercept 'soft' debris (like towels, disposable nappies, etc.) before the pump, or otherwise macerate them before passing through the pump.

There are at least two such pump stations operating in the Queenstown Lakes District, one pumping wastewater from Arthurs Point to Gorge Road in Queenstown (installed around 2000) and a more recent one serving the Shotover Country Development, pumping wastewater up to Ladies Mile.

The Arthurs Point pump station intercepts soft and hard debris beforehand and has proven to work very well. It is understood that the original rotor and stator are still installed, noting that these are potentially high wear parts if design is not undertaken correctly.

The Shotover Country pump station utilises macerating sewerage 'Mono Munchers' prior to the Mono progressive cavity pumps.

It is recommended that the West Luggate Main WW Pump Station be fitted with Mono Munchers at the pump inlet pipe to remove any undesirable solids, and total buried storage of 105m^3 (or 20m^3 in the case of a full pressurised sewer pumping station option) to provide both emergency storage and operational storage in the one tank for the ultimate flow scenario. The surface mounted Mono pumps (located in a building adjacent the storage tank) would suck from the storage tank and deliver directly into the rising main.

The progressive cavity pumps will require priming with water, with the water supply coming via a backflow preventer.

Furthermore it is also recommended that, where required, the emergency storage be provided in 2 stages (discussed later in the report) with the initial stage only requiring a 55m^3 tank (for the conventional gravity sewer option).

11.2 West Luggate Main Pump Station Pump Selection

11.2.1 Conventional Gravity Sewerage System Main Pump Station Pump

A 225 OD PE100 PN16 rising pipeline has been selected for the Conventional Sewerage System scenario pipeline between the West Luggate WWPS and the Project Pure Scheme. Taking into consideration a static lift of 75m and a 4280m long pipeline requires a nett

pumping head of approximately 90m for 21 L/sec and 135m for the 41 L/sec future flow both including the airport flows entering the pipeline near the end.

The pump selected for this duty, then, is a Mono E1BB (Two Stage) 59kW for the first approximately 20 years and a Mono E1BD (Four Stage) 75kW for the remainder of the scheme's life.

The solids passing capacity of the two pumps are noted below.

Pump Code	Soft Solids Passing (mm)	Hard Solids Passing (mm)
Mono E1BB (Two-stage)	82	21
Mono E1BD (Four-stage)	98	25

11.2.2 Pressurised Sewerage System Main Pump Station Pump

A dual rising pipeline has been selected for the Pressurised Sewerage System scenario pipeline between the West Luggate WWPS and the Project Pure Scheme. Taking into consideration a static lift of 75m and a 4280m long pipeline requires a nett pumping head of approximately 132m for the combined pipelines flow of 26 L/sec, including the airport flows entering the pipeline near the end.

The pump selected for this duty, then, is a Mono E1BD (Four Stage) 75kW.

The solids passing capacity of the selected pump is noted below.

Pump Code	Soft Solids Passing (mm)	Hard Solids Passing (mm)
Mono E1BD (Four-stage)	98	25

12.0 East Luggate Lift Pump Station Design and Rising Main Sizing

Should this pumping station be required (Options 1 and 2) the East Luggate Lift Pump Station is proposed to be a traditional precast concrete in-ground chamber with grinder pumps.

The proposed rising main design for both options requires a 160mm OD PE100 PN8 rising main.

A suitable pump selected to meet the duty required, for the purposes of the preliminary cost estimate, is the Flygt FP3153 SH cutter pump.

The motor size for the required duty would be approximately 11kW.

13.0 Emergency Storage

Emergency storage requirements at the pump stations were assessed for "ultimate" Yr2048, (with 6% growth rate) wastewater flows, using the QLDC recommended 9 hours ADWF for wastewater pump stations with no permanently installed standby generator, and 5 hours ADWF for the new West Luggate Main WWPS with a permanently installed standby generator.

The emergency storage volumes are calculated from the volume required for the total wastewater flowing into the WWPS's, less the flows pumping in from upstream pumping stations, as the control for the operation of the wastewater scheme allows downstream pumping stations to inhibit flows arriving from upstream pumping stations should there be a problem.

13.1 Conventional Gravity Sewerage System Emergency Storage

The required emergency storage volumes noted in Table 13.1 below also take into account the existing useable wet well storage within the wet wells. A breakdown of the flow distribution throughout the proposed network is presented in the Appendices.

Table 13.1: Emergency Storage Volume Estimates for the Luggate WW Scheme with Conventional Gravity Sewerage System

	Emergency Storage Volume Required (for 6% Annual Growth Rate Flows) (m^3)		
Year	2028	2038	2048
Church Rd WWPS	0	0	2
Harris Rd WWPS	9	9	12
Pisa Rd WWPS	0	0	0
Alice Burn 1 WWPS	8	8	12
Alice Burn 2 WWPS (if needed)	6	45	58
East Luggate WWPS (if needed)	6	45	58
West Luggate Main WWPS	14	34	82

Further to the emergency storage volumes noted above, to allow the West Luggate Main WWPS pumps to deliver adequate scouring velocities it will be necessary to store up wastewater at the pumping station to allow slugs of wastewater to be pumped to achieve the required scouring velocities. This is particularly important in the early stages of the wastewater scheme operation. The preliminary design of the West Luggate Main WWPS has allowed therefore allowed for a further operating volume of $20m^3$ of wastewater to help flush the rising main.

13.2 Pressurised Sewerage System Emergency Storage

The required emergency storage volumes noted in Table 13.2 below take into account the existing useable wet well storage within the wet wells and the pressure sewer pumping stations themselves. A breakdown of the flow distribution throughout the proposed network is presented in the Appendices.

Table 13.2: Emergency Storage Volume Estimates for the Luggate WW Scheme with Pressurised Sewerage System

	Emergency Storage Volume Required (for 6% Annual Growth Rate Flows) (m^3)		
Year	2028	2038	2048
Church Rd WWPS	0	0	2
Harris Rd WWPS	9	9	12
Pisa Rd WWPS	0	0	0
Alice Burn 1 WWPS	8	8	12
Alice Burn 2 WWPS (if needed)	6	45	58
East Luggate WWPS (if needed)	6	45	58
West Luggate Main WWPS	0	0	0

As noted in Table 13.2, for the Pressurised Sewerage System options, the West Luggate Main WWPS requires no emergency storage, as all of the inflows to the pump station would be from pressurised sewer systems or from other pumping stations with their own storage. However, to allow the West Luggate Main WWPS pumps to deliver adequate scouring velocities it will be necessary to store up wastewater at the pumping station to allow slugs of wastewater to be pumped to achieve the required scouring velocities. The preliminary design of the West Luggate Main WWPS has allowed therefore allowed for a storage operating volume of $20m^3$ of wastewater to help flush the rising main.

13.3 Luggate Emergency Storage Observations

It should be noted that the Harris Rd WWPS requires 9m³ storage volume now (in 2018), and currently has none. For the existing WWPS, the emergency storage would have to be retrofitted. Space and layout requirements should be investigated to determine the best solution for each PS emergency storage design.

Please note that adding emergency storage to existing pumping stations to meet the first twenty years of demand have been included in the cost estimates presented in this report and any additional storage required to meet the 40 year demand is also estimated in Section 15 of this report.

14.0 Servicing existing Unreticulated Township Areas

Figure 14.1 presents a plan indicating developed areas that are currently serviced by septic tanks. There are approximately 125 lots in the existing Luggate Township that will be required to be connected to new infrastructure to convey the wastewater to the Project Pure WWTP and to remove the partially treated wastewater from being sent into the ground.

The options presented below have been derived following extensive investigations into the ground levels using LIDAR and recently completed topographical surveys to ascertain options as to how to collect and convey flows to the new proposed wastewater scheme.

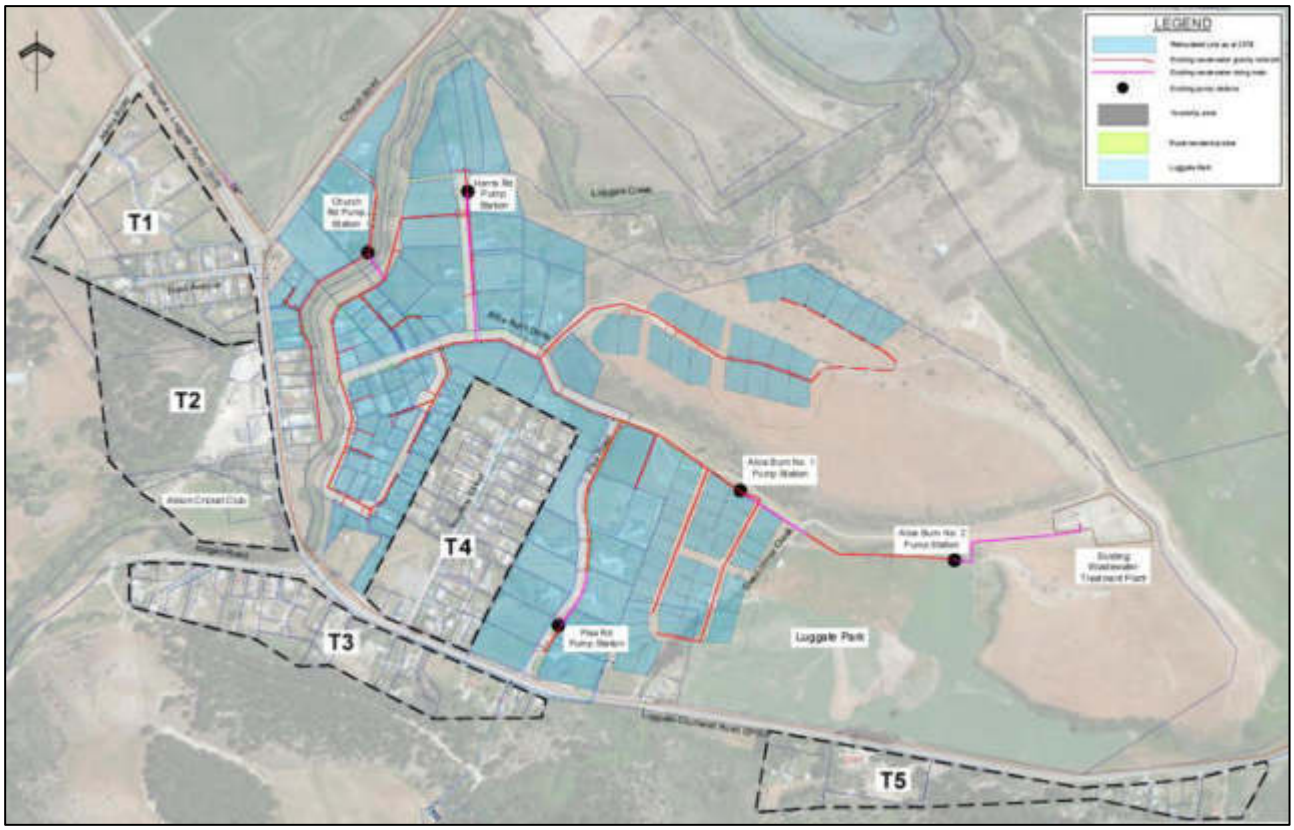

Figure 14.1: Existing Non-Reticulated Luggate Township Areas

Figure 14.1 shows areas labelled T1, T2, T3, T4 and T5.

Two main options to collect and convey the wastewater from these areas are presented below:

Option A

This option provides a mixture of both gravity sewer and low pressure sewer pumping stations at each house to service houses currently on septic tanks. The generally flat (slightly falling) topography of Luggate means that gravity sewers generally need to start at reasonable depth (1.2m to 1.5m) in order to service dwellings set back from the road or up right-of-ways to rear properties. Once in the roads, minimum grades of 1 in 150 (or even 1 in 170) quickly deepen to the extent that not all areas can be connected into the existing

reticulation or into existing pump stations. From the information to date, and from observations made during site visits, not all houses can be connected via conventional gravity schemes. Hence the mixture of sewer collection systems, although not desirable from an operator point of view is one option for Luggate.

Furthermore, as discussed earlier in the report the opportunity to connect future developments to existing wastewater reticulations and pumping stations is limited by the capacities of the existing rising mains, gravity mains and pumping stations.

Investigations were made into the option of retrofitting the existing septic tanks with STEP (Septic Tank Effluent Pumping) systems. However the cost to do this was more expensive than installing pressure sewer systems and it also assumes that the existing septic tanks are in good working order. Given the age of some of the older established houses, this is unlikely.

Option A presented in Figure 14.2 below and on Drawing C14 in the Appendices shows a combination of gravity sewer and pressure sewer options to service the properties currently on septic tanks.

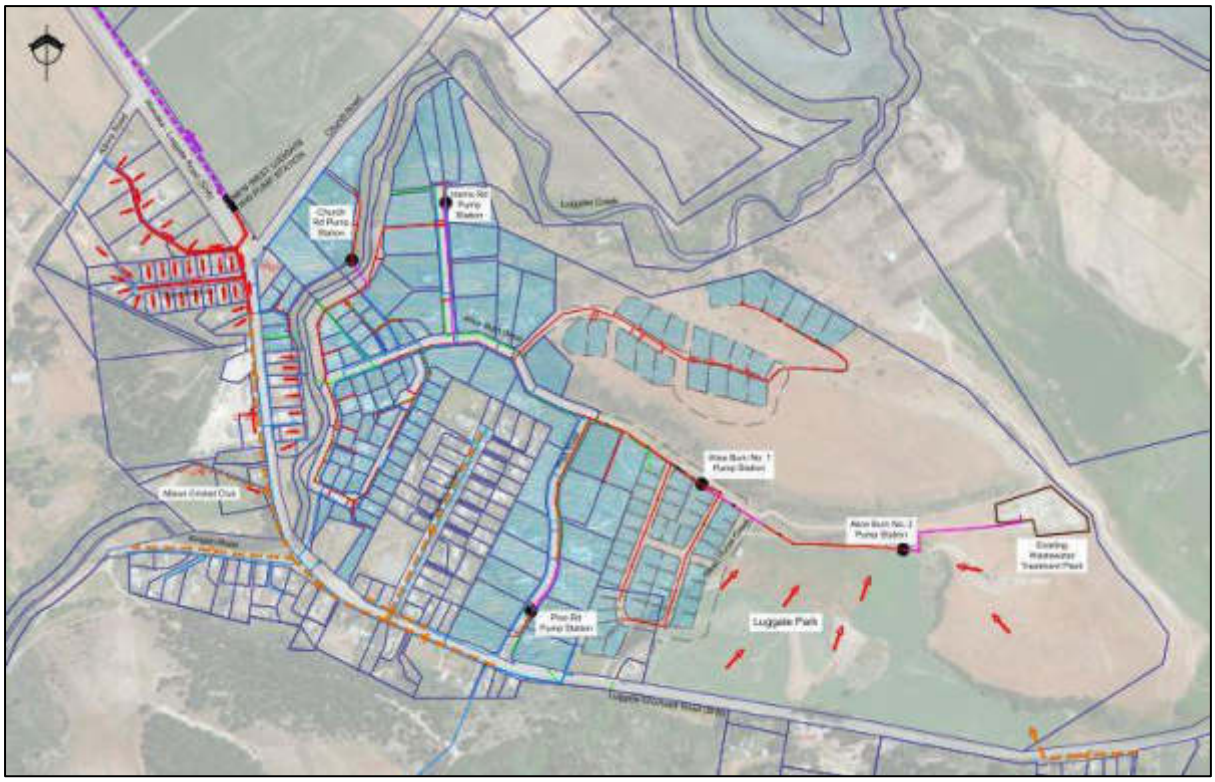

Figure 14.2: Option A – Gravity and Pressure Sewer Combination

The preliminary construction cost estimate for Option A is **$2,179,000 + GST.** This is made up of **$931,000 + GST** for works in the streets and **$1,248,000 + GST** for "on-property" works. A breakdown of the estimated costs is presented in the Appendices.

Option B

This option considers low pressure sewer pumping stations at each house to service houses currently on septic tanks to provide a consistent approach through the township. The new pipelines connect directly to the new pumping station(s) or the Luggate Park reticulation in one instance, as the opportunity to connect future developments to existing wastewater reticulations and pumping stations is limited by the capacities of the existing rising mains, gravity mains and pumping stations.

Option B presented in Figure 14.3 below and on Drawing C15 in the Appendices shows the pressure sewer option to service the properties currently on septic tanks.

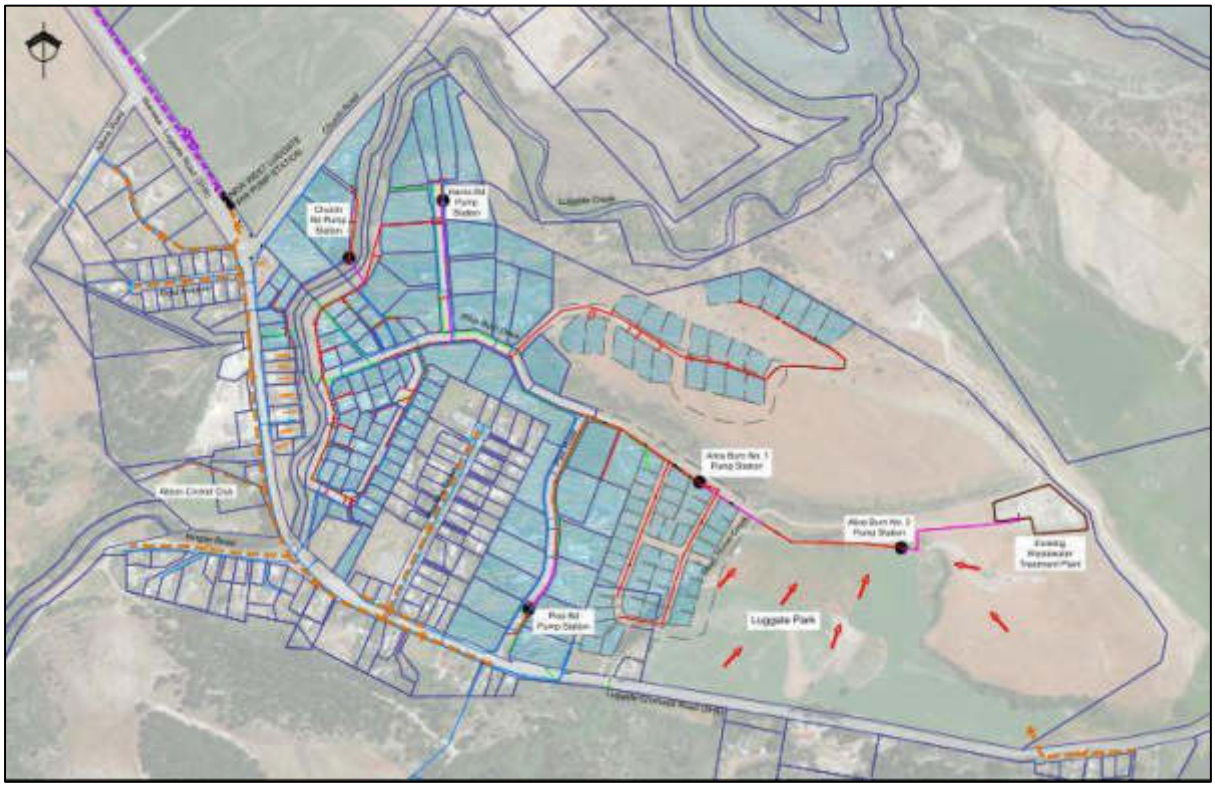

Figure 14.3: Option B – Pressure Sewer Collection System

The preliminary construction cost estimate for Option B is **$2,058,000 + GST.** This is made up of **$508,000 + GST** for works in the streets and **$1,550,000 + GST** for "on-property" works. A breakdown of the estimated costs is presented in the Appendices.

Note that these options presented in this section of the report have not used exact levels and locations of individual house wastewater collection points, and exact locations of existing services. For detailed design of the selected reticulation option, a pipeline route survey and individual house wastewater survey should be undertaken.

15.0 Options Preliminary Cost Estimates

15.1 General

Cost estimates for the options considered in this report have been prepared following the completion of preliminary designs to service the proposed Luggate wastewater scheme.

On top of the estimated supply and construction costs, the cost estimates include:

- 10% for the contractor's Preliminary and General costs
- 5% QLDC's Project Management
- 20% Contingencies as estimates are based on a preliminary design
- Engineering fees as quoted (or 10% where not quoted)

Breakdowns of the preliminary cost estimates for each of the options are presented in the Appendices.

A summary of the cost estimates presented in this report is presented in the Sections below.

15.2 Trunk Wastewater Scheme Options Preliminary Construction Cost Estimates

The following preliminary cost estimates for the trunk wastewater scheme options considered in this report are as follows:

Option 1 – Rising Main (for conventional gravity sewerage system feeds) along State Highway Through Town and building West and East Luggate WWPS's = **$3,292,000 + GST.**

Option 1a – Dual Rising Main (for Pressurised Sewerage System) along State Highway Through Town and building West and East Luggate WWPS's = **$3,314,000 + GST.**

Option 2 – Rising Main (for conventional gravity sewerage system feeds) through Luggate Park and along Alice Burn Drive and building West and East Luggate WWPS's = **$3,283,000 + GST.**

Option 2a – Dual Rising Main (for Pressurised Sewerage System) Through Luggate Park and along Alice Burn Drive and building West and East Luggate WWPS's = **$3,305,000 + GST.**

Option 3 – Rising Main (for conventional gravity sewerage system feeds) along Alice Burn Drive, using Alice Burn 2 WWPS and building new West Luggate WWPS = **$2,713,000 + GST.**

Option 3a – Dual Rising Main (for Pressurised Sewerage System) Along Alice Burn Drive, using Alice Burn 2 WWPS and building new West Luggate WWPS = **$2,736,000 + GST.**

15.3 Future Trunk Wastewater Scheme Works

As noted earlier in the report the preliminary cost estimates are based on works performed now to provide a good level of service up to 2038.

There are some minor additional works that will be required to meet the wastewater demands beyond that date.

It is suggested that all these works be budgeted for and completed at the same time.

Emergency Storage additions in 2038:

- Alice Burn 1 WWPS – an additional 12m^3 @ **$30,000 + GST**
- Alice Burn 2 WWPS or East Luggate WWPS – an additional 30m^3 @ **$58,000 + GST**
- West Luggate WWPS – an additional 50m^3 @ **$100,000 + GST** (only required for Conventional Sewerage System options 1, 2 and 3.

Replacing Pumps and Drives in the Pumping Stations in 2038

- Alice Burn 2 WWPS or East Luggate WWPS – an additional **$120,000 + GST** to replace existing pumps and drive with similar pumps
- West Luggate WWPS – an additional **$200,000 + GST** for new larger pumps and drives for Conventional Sewerage System options 1, 2 and 3.

15.4 Net Present Value Cost Comparison

A Net Present Value cost comparison has not been prepared to evaluate one option against another as the operational and maintenance costs for each option are similar.

15.5 Preliminary Cost Estimates to Service existing Unreticulated Township Areas

Preliminary cost estimates for two options to service the existing properties currently on septic tanks are as follows:

Option A – Mixture of Gravity reticulation and Low Pressure Sewers Pumping Stations = **$2,179,000 + GST** made up of **$931,000 + GST** for works in the streets and **$1,248,000 + GST** for “on-property” works.

Option B – All New Pressure Sewer Pumping Stations = **$2,058,000 + GST.** This is made up of **$508,000 + GST** for works in the streets and **$1,550,000 + GST** for “on-property” works.

16.0 Project Risks

Risks associated with this project are itemised in the Risk Register presented in the Appendices.

A brief summary of the main risks and potential remedies associated with the implementation of a new wastewater scheme for Luggate are as follows:

1. Growth in Luggate is dependent on an improved water supply. It is understood from QLDC that the water supply options are being investigated at present. The Wanaka Airport water supply is also included in these investigations. If no viable option is found there is little purpose in increasing the size of the wastewater network.
2. If a viable water supply option is decided on by mid-May 2018, enough to have selected a pipe size and route, then cost savings can be had for both this wastewater project and the water upgrade project by having a common trench from Luggate up to the airport for the WW and water pipe.
3. There is the potential that Willowridge will not give permission to allow QLDC to reconfigure Alice Burn 2 WWPS. This should not be an issue as QLDC and Willowridge Ltd have a Heads of Agreement as to a way forward, it is understood that the pumping station is now owned and maintained by QLDC and Options 1 and 2 do not require its use.
4. There is the potential that Willowridge will not allow the placing of a gravity main and rising main in Luggate Park. This seems unlikely as they would be to Willowridge's benefit. Furthermore Option 3 does not require them.
5. Landowners such as McKay Station not allowing the rising main on their land. The pipeline can be re-routed up the State Highway.
6. Individual "Old Luggate" households not connecting in – this could be mitigated with imposing time frames, payments spread out, connection incentives or subsidies from the Wanaka ward.

17.0 Conclusions and Recommendations

This report presents options for a new wastewater collection and pumping system to take wastewater from the Luggate community for the next 40 years and deliver it to the Project Pure WWTP to the north of Wanaka airport.

The report discusses the basis of design, the intended design components and other works that are required to be completed alongside the project. Preliminary construction cost estimates are presented for three options for a trunk wastewater system consisting of pumping stations and rising mains as well as preliminary cost estimates for the collection and transfer of wastewater from the existing houses to the trunk wastewater system. The three main options also have a variation depending on whether the future growth areas will be collected via a conventional sewerage system or a pressurised sewerage system.

The most cost-effective scheme for the trunk wastewater system is Option 3 or 3a as shown in Figure 17.1 below.

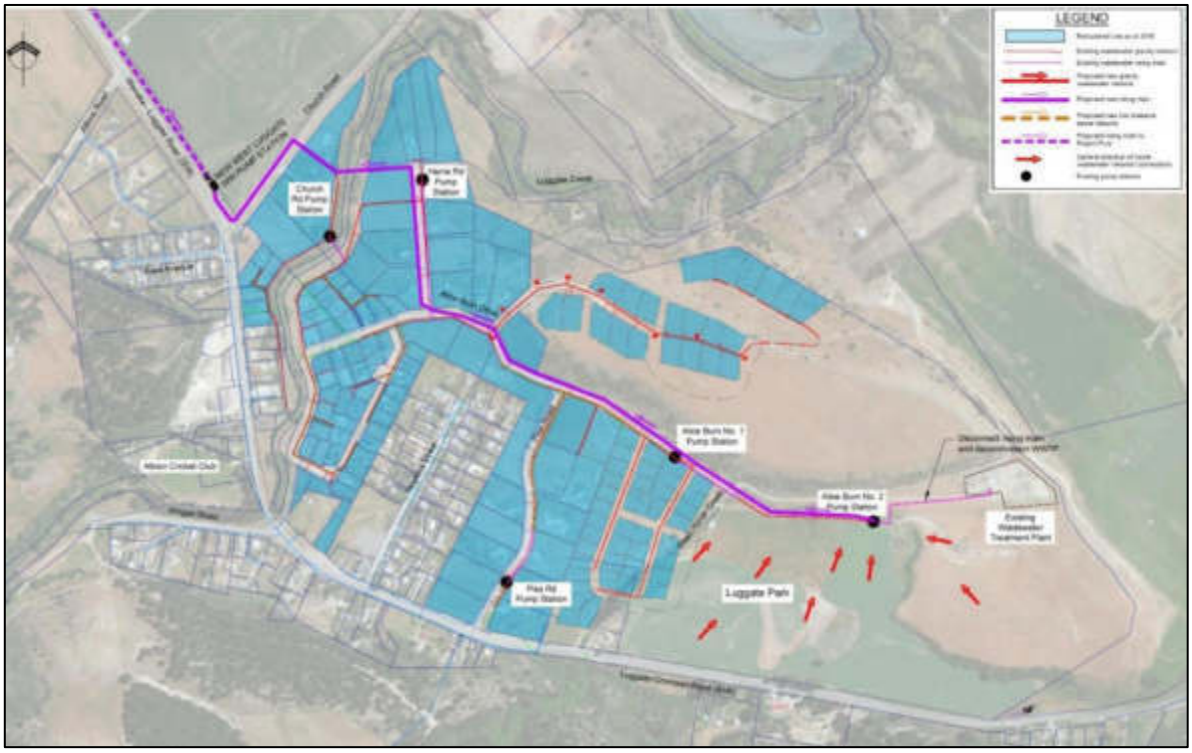

Figure 17.1: Preferred Trunk Main Option

This option makes use of the existing Alice Burn 2 WWPS to collect flows from the Luggate Park development area (as is currently intended by Willowridge Ltd) and a small section of land south of the State Highway. The wastewater is then pumped along Alice Burn Drive and Harris Road, through Council reserve, under Luggate Creek and to a new main West Luggate WWPS located near the corner of Church Road and State Highway 6.

The West Luggate WWPS then pumps flows all the way up to the existing gravity main on Stevenson Road feeding into the Project Pure WWTP. Future wastewater flows from the Wanaka airport will also be able to connect into the rising main as it passes the airport.

The preliminary capital cost estimate including a 20% contingency allowance for this Option 3 with a conventional sewerage system for future growth areas is **$2,713,000 + GST.**

The preliminary capital cost estimate including a 20% contingency allowance for this Option 3a with a pressurised sewerage system for future growth areas is **$2,736,000 + GST.**

The Option 3a includes a dual rising main with two different-sized pipes. This option allows for better initial operation of the main pump station in terms of meeting scouring velocities and minimising septicity. The dual pipeline also provides flexibility in the scheme operation as growth occurs. For this option, it is recommended that the two pipelines are installed at the same time.

Given the advantages that the dual rising main option offers in relation to reducing wastewater septicity and the potential for the addition of further lots to be connected in the future it is recommended that this option be considered further even though it is slightly more expensive. QLDC do however need to consider whether they wish to impose on future developers that their lots be fitted with pressure sewer pumping stations (with the exception of Luggate Park).

In determining the most effective wastewater trunk main options, careful consideration was also made to the ways and means of connecting existing properties, currently serviced by septic tanks, to the new system. This report also presents options and preliminary cost estimates to connect these existing properties to the new system.

This report has presented two possible options:

- A mixture of gravity collection and pressure sewer pumping stations for each of the properties currently serviced by septic tanks
- The supply and installation of pressure sewer pumping stations for all the septic tank properties.

The preliminary cost estimates for both options are very similar at approximately **$2.1M + GST**. The difference between the two is how much is allocated directly to the property owner versus the cost shared by the community. At this stage the entire pressure sewer pumping stations option has less impact on QLDC's costs, and, with smart management, has the ability to reduce the total peak flows to the Luggate West Main Pump Station.

It is recommended that this concept design report be read and the options considered. If QLDC are happy with the proposed solutions then the detailed design of the preferred option should be started as soon as Willowridge Ltd have agreed the way forward with QLDC.

Works should start with documentation being issued to the community describing the proposed scheme, the intention to survey their properties to locate their current wastewater pipelines and septic tanks for future designs and the ways and means of recovering the capital cost expenditure from the ratepayers.

The timing of requiring connection to the new scheme is something that needs to be discussed at a political level and is not covered in this report.

APPENDIX A

Cost Estimates

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 1

(with Conventional Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
1A	**Line 1 - Gravity main from before Alice Burn 2 to East Lift PS**				
	Excavate, bed supply and lay and backfill 225 dia. uPVC SN8 gravity pipelines in private land	m	537	200	$107,400
	Supply and install 1050 dia concrete manholes	No.	5	6000	$30,000
	Line 1 Subtotal				**$137,400**
1B	**East Luggate Lift Wastewater Pumping Station**				
	Wet well, pumps, pipework, fitting and electrics	LS	1	220000	$220,000
	Emergency Storage 30m3	LS	1	49000	$49,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	East Lift Wastewater Pumping Station Subtotal				**$275,000**
1C	**Line 2 - Rising main from East Lift PS to West Luggate Main WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 160 OD PE100 PN8	m	1815	55	$99,825
	Welding of pipes (18m lengths)	No.	101	145	$14,621
	Supply of Pipe (Iplex) + 10% Contractor's Markup 160 OD PE100 PN8	m	1815	23.1	$41,927
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	18.15	1000	$18,150
	Air Valves	No.	3	4814.3	$14,443
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Remove and Decommission Alice Burn 2 PS and pipework	LS	1	10000	$10,000
	Line 1 Subtotal				**$230,465**
1D	**Line 3 - Rising main from main West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 225 OD PE100 PN16	m	3510	55	$193,050
	Excavate, bed and backfill pipelines in private land 225 OD PE100 PN16	m	770	50	$38,500
	Welding of pipes (18m lengths)	No.	238	145	$34,478
	Supply of Pipe (Iplex) + 10% Contractor's Markup 225 OD PE100 PN16	m	4280	69.3	$296,604
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$666,875**

1E	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
1F	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**
1G	**West Luggate Wastewater Pumping Station**				
	Pumps - 2-stage positive displacement E1BB, 59kW	No.	2	75900	$151,800
	Pipework, valves and fittings	LS	1	50000	$50,000
	Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
	Building services	LS	1	10000	$10,000
	Power cabling and switchboard	LS	1	47000	$47,000
	Variable frequency drives and harmonic filter	LS	1	70000	$70,000
	Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
	Controls and SCADA	LS	1	21000	$21,000
	Electrical installation	LS	1	30000	$30,000
	Standby generator	LS	1	100000	$100,000
	Emergency Storage 55m3	LS	1	88000	$88,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Ferrous chloride dosing installation	No.	1	60000	$60,000
	Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
	West Luggate Wastewater Pumping Station Subtotal				**$858,949**
	Total Scheme SubTotal				**$2,220,689**
	Preliminary & General (10% of Subtotal)	LS			$222,069
	Concept Design	LS			$95,000
	Detailed Design	LS			$97,500
	Construction Supervision	LS			$101,500
	Project Management (5% of Subtotal)	LS			$111,034
	Contingencies (20% of Subtotal)	LS			$444,138

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 1a

(Option 1 with Pressurised Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
1A	**Line 1 - Gravity main from before Alice Burn 2 to East Lift PS**				
	Excavate, bed supply and lay and backfill 225 dia. uPVC SN8 gravity pipelines in private land	m	537	200	$107,400
	Supply and install 1050 dia concrete manholes	No.	5	6000	$30,000
	Line 1 Subtotal				**$137,400**
1B	**East Luggate Lift Wastewater Pumping Station**				
	Wet well, pumps, pipework, fitting and electrics	LS	1	220000	$220,000
	Emergency Storage 30m3	LS	1	49000	$49,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	East Lift Wastewater Pumping Station Subtotal				**$275,000**
1C	**Line 2 - Rising main from East Lift PS to West Luggate Main WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 160 OD PE100 PN8	m	1815	55	$99,825
	Welding of pipes (18m lengths)	No.	101	145	$14,621
	Supply of Pipe (Iplex) + 10% Contractor's Markup 160 OD PE100 PN8	m	1815	23.1	$41,927
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	18.15	1000	$18,150
	Air Valves	No.	3	4814.3	$14,443
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Remove and Decommission Alice Burn 2 PS and pipework	LS	1	10000	$10,000
	Line 1 Subtotal				**$230,465**
1D	**Line 3 - Rising main from main West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	3510	60	$210,600
	Excavate, bed and backfill pipelines in private land 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	770	55	$42,350
	Welding of pipes (18m lengths)	No.	476	145	$68,956
	Supply of Pipe (Iplex) + 10% Contractor's Markup 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	4280	62.15	$266,002
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$692,151**

1E	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
1F	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**
1G	**West Luggate Wastewater Pumping Station**				
	Pumps - 4-stage positive displacement E1BD, 75kW	No.	2	105600	$211,200
	Pipework, valves and fittings	LS	1	50000	$50,000
	Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
	Building services	LS	1	10000	$10,000
	Power cabling and switchboard	LS	1	47000	$47,000
	Variable frequency drives and harmonic filter	LS	1	70000	$70,000
	Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
	Controls and SCADA	LS	1	21000	$21,000
	Electrical installation	LS	1	30000	$30,000
	Standby generator	LS	1	100000	$100,000
	Operating Storage 15m3	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Ferrous chloride dosing installation	No.	1	60000	$60,000
	Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
	West Luggate Wastewater Pumping Station Subtotal				**$850,349**
	Total Scheme SubTotal				**$2,237,365**
	Preliminary & General (10% of Subtotal)	LS			$223,736
	Concept Design	LS			$95,000
	Detailed Design	LS			$97,500
	Construction Supervision	LS			$101,500
	Project Management (5% of Subtotal)	LS			$111,868
	Contingencies (20% of Subtotal)	LS			$447,473

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 2

(with Conventional Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
1A	**Line 1 - Gravity main from before Alice Burn 2 to East Lift PS**				
	Excavate, bed supply and lay and backfill 225 dia. uPVC SN8 gravity pipelines in private land	m	537	200	$107,400
	Supply and install 1050 dia concrete manholes	No.	5	6000	$30,000
	Line 1 Subtotal				**$137,400**
1B	**East Luggate Lift Wastewater Pumping Station**				
	Wet well, pumps, pipework, fitting and electrics	LS	1	220000	$220,000
	Emergency Storage 30m3	LS	1	49000	$49,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	East Lift Wastewater Pumping Station Subtotal				**$275,000**
1C	**Line 2 - Rising main from East Lift PS to West Luggate Main WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 160 OD PE100 PN8	m	1459	55	$80,245
	Lay pipe in shared trench 160 OD PE100 PN8	m	537	20	$10,740
	Welding of pipes (18m lengths)	No.	111	145	$16,079
	Supply of Pipe (Iplex) + 10% Contractor's Markup 160 OD PE100 PN8	m	1996	23.1	$46,108
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	14.59	1000	$14,590
	Air Valves	No.	3	4814.3	$14,443
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Remove and Decommission Alice Burn 2 PS and pipework	LS	1	10000	$10,000
	Line 2 Subtotal				**$223,704**
1D	**Line 3 - Rising main from main West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 225 OD PE100 PN16	m	3510	55	$193,050
	Excavate, bed and backfill pipelines in private land 225 OD PE100 PN16	m	770	50	$38,500
	Welding of pipes (18m lengths)	No.	238	145	$34,478
	Supply of Pipe (Iplex) + 10% Contractor's Markup 225 OD PE100 PN16	m	4280	69.3	$296,604
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$666,875**

1E	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
1F	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**
1G	**West Luggate Wastewater Pumping Station**				
	Pumps - 2-stage positive displacement E1BB, 59kW	No.	2	75900	$151,800
	Pipework, valves and fittings	LS	1	50000	$50,000
	Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
	Building services	LS	1	10000	$10,000
	Power cabling and switchboard	LS	1	47000	$47,000
	Variable frequency drives and harmonic filter	LS	1	70000	$70,000
	Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
	Controls and SCADA	LS	1	21000	$21,000
	Electrical installation	LS	1	30000	$30,000
	Standby generator	LS	1	100000	$100,000
	Emergency Storage 55m3	LS	1	88000	$88,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Ferrous chloride dosing installation	No.	1	60000	$60,000
	Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
	West Luggate Wastewater Pumping Station Subtotal				**$858,949**
	Total Scheme SubTotal				**$2,213,928**
	Preliminary & General (10% of Subtotal)	LS			$221,393
	Concept Design	LS			$95,000
	Detailed Design	LS			$97,500
	Construction Supervision	LS			$101,500
	Project Management (5% of Subtotal)	LS			$110,696
	Contingencies (20% of Subtotal)	LS			$442,786
	TOTAL				**$3,282,803**

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 2a

(Option 2 with Pressurised Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
1A	**Line 1 - Gravity main from before Alice Burn 2 to East Lift PS**				
	Excavate, bed supply and lay and backfill 225 dia. uPVC SN8 gravity pipelines in private land	m	537	200	$107,400
	Supply and install 1050 dia concrete manholes	No.	5	6000	$30,000
	Line 1 Subtotal				**$137,400**
1B	**East Luggate Lift Wastewater Pumping Station**				
	Wet well, pumps, pipework, fitting and electrics	LS	1	220000	$220,000
	Emergency Storage 30m3	LS	1	49000	$49,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	East Lift Wastewater Pumping Station Subtotal				**$275,000**
1C	**Line 2 - Rising main from East Lift PS to West Luggate Main WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 160 OD PE100 PN8	m	1459	55	$80,245
	Lay pipe in shared trench 160 OD PE100 PN8	m	537	20	$10,740
	Welding of pipes (18m lengths)	No.	111	145	$16,079
	Supply of Pipe (Iplex) + 10% Contractor's Markup 160 OD PE100 PN8	m	1996	23.1	$46,108
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	14.59	1000	$14,590
	Air Valves	No.	3	4814.3	$14,443
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Remove and Decommission Alice Burn 2 PS and pipework	LS	1	10000	$10,000
	Line 2 Subtotal				**$223,704**
1D	**Line 3 - Rising main from main West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	3510	60	$210,600
	Excavate, bed and backfill pipelines in private land 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	770	55	$42,350
	Welding of pipes (18m lengths)	No.	476	145	$68,956
	Supply of Pipe (Iplex) + 10% Contractor's Markup 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	4280	62.15	$266,002
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$692,151**

1E	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
1F	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**
1G	**West Luggate Wastewater Pumping Station**				
	Pumps - 4-stage positive displacement E1BD, 75kW	No.	2	105600	$211,200
	Pipework, valves and fittings	LS	1	50000	$50,000
	Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
	Building services	LS	1	10000	$10,000
	Power cabling and switchboard	LS	1	47000	$47,000
	Variable frequency drives and harmonic filter	LS	1	70000	$70,000
	Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
	Controls and SCADA	LS	1	21000	$21,000
	Electrical installation	LS	1	30000	$30,000
	Standby generator	LS	1	100000	$100,000
	Operating Storage 15m3	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Ferrous chloride dosing installation	No.	1	60000	$60,000
	Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
	West Luggate Wastewater Pumping Station Subtotal				**$850,349**
	Total Scheme SubTotal				**$2,230,604**
	Preliminary & General (10% of Subtotal)	LS			$223,060
	Concept Design	LS			$95,000
	Detailed Design	LS			$97,500
	Construction Supervision	LS			$101,500
	Project Management (5% of Subtotal)	LS			$111,530
	Contingencies (20% of Subtotal)	LS			$446,121
	TOTAL				**$3,305,315**

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 3

(Conventional Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
3A	**Line 1 - Rising main from Alice Burn 2 to West Luggate WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 180 OD PE100 PN8	m	1517	50	$75,850
	Welding of pipes (18m lengths)	No.	84	145	$12,220
	Supply of Pipe (Iplex) + 10% Contractor's Markup 180 OD PE100 PN8	m	1517	25.3	$38,380
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	15.17	1000	$15,170
	Air Valves	No.	1	4814.3	$4,814
	Excavate and build 30m3 emergency storage at Alice Burn 2	LS	1	48500	$48,500
	Reconfiguration and connect to Alice Burn 2 WWPS - includes 100 dia. Wye, 2x gates valves, reducer & bends and connecting to existing rising main	LS	1	6000	$6,000
	Line 1 Subtotal				**$214,435**
3B	**Line 2 - Rising main from West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 225 OD PE100 PN16	m	3510	55	$193,050
	Excavate, bed and backfill pipelines in private land 225 OD PE100 PN16	m	770	50	$38,500
	Welding of pipes (18m lengths)	No.	238	145	$34,478
	Supply of Pipe (Iplex) + 10% Contractor's Markup 225 OD PE100 PN16	m	4280	69.3	$296,604
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$666,875**
3C	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
3D	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**

3E **West Luggate Wastewater Pumping Station**

Pumps - 2-stage positive displacement E1BB, 59kW	No.	2	75900	$151,800
Pipework, valves and fittings	LS	1	50000	$50,000
Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
Building services	LS	1	10000	$10,000
Power cabling and switchboard	LS	1	47000	$47,000
Variable frequency drives and harmonic filter	LS	1	70000	$70,000
Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
Controls and SCADA	LS	1	21000	$21,000
Electrical installation	LS	1	30000	$30,000
Standby generator	LS	1	100000	$100,000
Emergency Storage 55m3	LS	1	88000	$88,000
Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
Ferrous chloride dosing installation	No.	1	60000	$60,000
Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
West Luggate Wastewater Pumping Station Subtotal				**$858,949**
Total Scheme SubTotal				**$1,792,259**
Preliminary & General (10% of Subtotal)	LS			$179,226
Concept Design	LS			$95,000
Detailed Design	LS			$97,500
Construction Supervision	LS			$101,500
Project Management (5% of Subtotal)	LS			$89,613
Contingencies (20% of Subtotal)	LS			$358,452
TOTAL				**$2,713,549**

Luggate Wastewater to Project Pure - Preliminary Cost Estimate - OPTION 3a

(Option 3 with Pressurised Sewerage Systems)

Main Collection/Rising Main

	Item	Unit	Quantity	Rate	Total
3A	**Line 1 - Rising main from Alice Burn 2 to West Luggate WWPS**				
	Excavate, bed and backfill pipelines in roads/reserve 180 OD PE100 PN8	m	1517	50	$75,850
	Welding of pipes (18m lengths)	No.	84	145	$12,220
	Supply of Pipe (Iplex) + 10% Contractor's Markup 180 OD PE100 PN8	m	1517	25.3	$38,380
	Luggate Creek Crossing	m	30	350	$10,500
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	15.17	1000	$15,170
	Air Valves	No.	1	4814.3	$4,814
	Excavate and build 30m3 emergency storage at Alice Burn 2	LS	1	48500	$48,500
	Reconfiguration and connect to Alice Burn 2 WWPS - includes 100 dia. Wye, 2x gates valves, reducer & bends and connecting to existing rising main	LS	1	6000	$6,000
	Line 1 Subtotal				**$214,435**
3B	**Line 2 - Rising main from West Luggate WWPS to Project Pure (total length = 4280 m)**				
	Excavate, bed and backfill pipelines in road reserve 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	3510	60	$210,600
	Excavate, bed and backfill pipelines in private land 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	770	55	$42,350
	Welding of pipes (18m lengths)	No.	476	145	$68,956
	Supply of Pipe (Iplex) + 10% Contractor's Markup 125 OD PE100 PN16 plus 160OD PE100 PN16 pipes	m	4280	62.15	$266,002
	Traffic Control (road crossings)	No.	2	1500	$3,000
	Traffic control along the road	Days	35.1	1000	$35,100
	Air Valves	No.	10	4814.3	$48,143
	Odour Control GM375 McBerns odour unit	No.	3	6000	$18,000
	Line 2 Subtotal				**$692,151**
3C	**Construction of emergency storage at Alice Burn 1 Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Alice Burn 1 PS Subtotal				**$26,000**
3D	**Construction of emergency storage at Harris Road Pumping Station**				
	Excavate, construct and connect 12m3 emergency storage at the pumping station including odour control	LS	1	20000	$20,000
	Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
	Harris Road PS Subtotal				**$26,000**

3E **West Luggate Wastewater Pumping Station**

Pumps - 4-stage positive displacement E1BD, 75kW	No.	2	105600	$211,200
Pipework, valves and fittings	LS	1	50000	$50,000
Building - 12.5m by 5m, schist clad	LS	1	215000	$215,000
Building services	LS	1	10000	$10,000
Power cabling and switchboard	LS	1	47000	$47,000
Variable frequency drives and harmonic filter	LS	1	70000	$70,000
Instrumentation - flowmeter, pressure transducers, level probe	LS	1	9000	$9,000
Controls and SCADA	LS	1	21000	$21,000
Electrical installation	LS	1	30000	$30,000
Standby generator	LS	1	100000	$100,000
Operating Storage 20 m3	LS	1	20000	$20,000
Odour Control GM375 McBerns odour unit	No.	1	6000	$6,000
Ferrous chloride dosing installation	No.	1	60000	$60,000
Water supply (67 m of pipe to pump station, includes SH6 road crossing, share trench with new WW retic pipes)	m	67	17.15	$1,149
West Luggate Wastewater Pumping Station Subtotal				**$850,349**
Total Scheme SubTotal				**$1,808,934**
Preliminary & General (10% of Subtotal)	LS			$180,893
Concept Design	LS			$95,000
Detailed Design	LS			$97,500
Construction Supervision	LS			$101,500
Project Management (5% of Subtotal)	LS			$90,447
Contingencies (20% of Subtotal)	LS			$361,787
TOTAL				**$2,736,061**

Luggate wastewater to Project Pure - Preliminary Cost Estimate - Township Reticulation Option A

Township Reticulation Option A

OPTION A **- Gravity & Low Pressure Sewer**

Item	Unit	Quantity	Rate	Total
Line 1 - Gravity mains				
Excavate, supply, install, test, backfill sewer pipelines in road reserve/easement incl. traffic control				
Area T1:				
150 PVC SN8 gravity mains	m	630	450	$283,500
1050 dia Concrete MH*	No.	9	6000	$54,000
Area T2:				
90 OD PN16 PE100	m	356	85	$30,260
Area T3:				
63 OD PN16 PE100	m	448	65	$29,120
90 OD PN16 PE100	m	185	85	$15,725
Area T4:				
63 OD PN16 PE100	m	450	65	$29,250
Area T5 (future - not currently in zoning, not priced)				
SH6 Road Crossings -Gravity Main with 63 OD PN16 PE - drill under the road	No.	1	5000	$5,000
SH6 Road Crossings with 90 OD PN16 PE100 - drill under the road	No.	1	5000	$5,000
Non SH Road Crossings with 63 OD PN16 PE	No.	1	2000	$2,000
Bridge Crossing with 90 OD PN16 PE100	No.	1	6000	$6,000
Supply & install laterals from property to gravity main (allow x 5m average length)	No.	28	2000	$56,000
Supply & install Flushing Points	No.	5	1500	$7,500
Supply & install Boundary kits	No.	88	700	$61,600
Supply & install laterals from Boundary kits to LPS main	No.	88	750	$66,000
Additional 7 lots adjacent Luggate Creek gravity lateral connections?	No.	7	2000	$14,000
Subtotal				**$664,955**
Private Property Works to Connect (property Owner Cost?)				
Pump out and decommission existing septic tanks	No.	116	500	$58,000
Supply & install 100mm uPVC gravity line from household gully trap (allowing average 10m)	m	280	120	$33,600
Supply & install 40OD PE pressure sewer pipe from pump chamber to boundary (allowing average 10m)	m	880	40	$35,200
Residential Pressure Sewer Unit: pump, chamber & controller	No.	85	8500	$722,500
Commercial Pressure Sewer Unit: pump, chamber & controller	No.	3	14000	$42,000
Private Property Owner Costs Total				**$891,300**
Total Scheme SubTotal				**$1,556,255**
Preliminary & General (10% of Subtotal)	LS			$155,626
Engineering (10% of Subtotal)	LS			$155,626
Contingencies (20% of Subtotal)	LS			$311,251
TOTAL				**$2,178,757**

Luggate wastewater to Project Pure - Preliminary Cost Estimate - Township Reticulation Option B

Township Reticulation

OPTION B - Low Pressure Sewer all properties

Item	Unit	Quantity	Rate	Total
Low Pressure Sewer Mains				
Excavate, supply, install, test, backfill sewer pipelines in road reserve/easement incl. traffic control				
Area T1:				
63 OD PN16 PE100 pipe, fittings and valves	m	438	65	$28,470
90 OD PN16 PE100 pipe, fittings and valves	m	223	85	$18,955
Area T2:				
90 OD PN16 PE100 pipe, fittings and valves	m	356	85	$30,260
Area T3:				
63 OD PN16 PE100 pipe, fittings and valves	m	448	65	$29,120
90 OD PN16 PE100 pipe, fittings and valves	m	185	85	$15,725
Area T4:				
63 OD PN16 PE100 pipe, fittings and valves	m	450	65	$29,250
Area T5 (future - not currently in zoning, not priced)				
SH6 Road Crossings with 63 OD PN16 PE - drill under the road	No.	2	5000	$10,000
Non SH Road Crossings with 63 OD PN16 PE	No.	2	2000	$4,000
Bridge Crossing with 90 OD PN16 PE100	No.	1	6000	$6,000
Supply & install Flushing Points	No.	6	1500	$9,000
Supply & install Boundary kits	No.	116	700	$81,200
Supply & install laterals from Boundary kits to LPS main	No.	116	750	$87,000
Additional 7 lots adjacent Luggate Creek gravity lateral connections?	No.	7	2000	$14,000
Subtotal				**$362,980**
Private Property Works to Connect (property Owner Cost?)				
Pump out and decommission existing septic tanks	No.	116	500	58000
Supply & install 40OD PE pressure sewer pipe from pump chamber to boundary (allowing average 10m)	m	1160	40	$46,400
Residential Pressure Sewer Unit: pump, chamber & controller	No.	113	8500	$960,500
Commercial Pressure Sewer Unit: pump, chamber & controller	No.	3	14000	$42,000
Private Property Owner Costs Total				**$1,106,900**
Total Scheme SubTotal				**$1,469,880**
Preliminary & General (10% of Subtotal)	LS			$146,988
Engineering (10% of Subtotal)	LS			$146,988
Contingencies (20% of Subtotal)	LS			$293,976
TOTAL				**$2,057,832**

APPENDIX B

Options Drawings

Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	dd/mm/yy
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Existing Township Reticulation

Scale (A1 Original): 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
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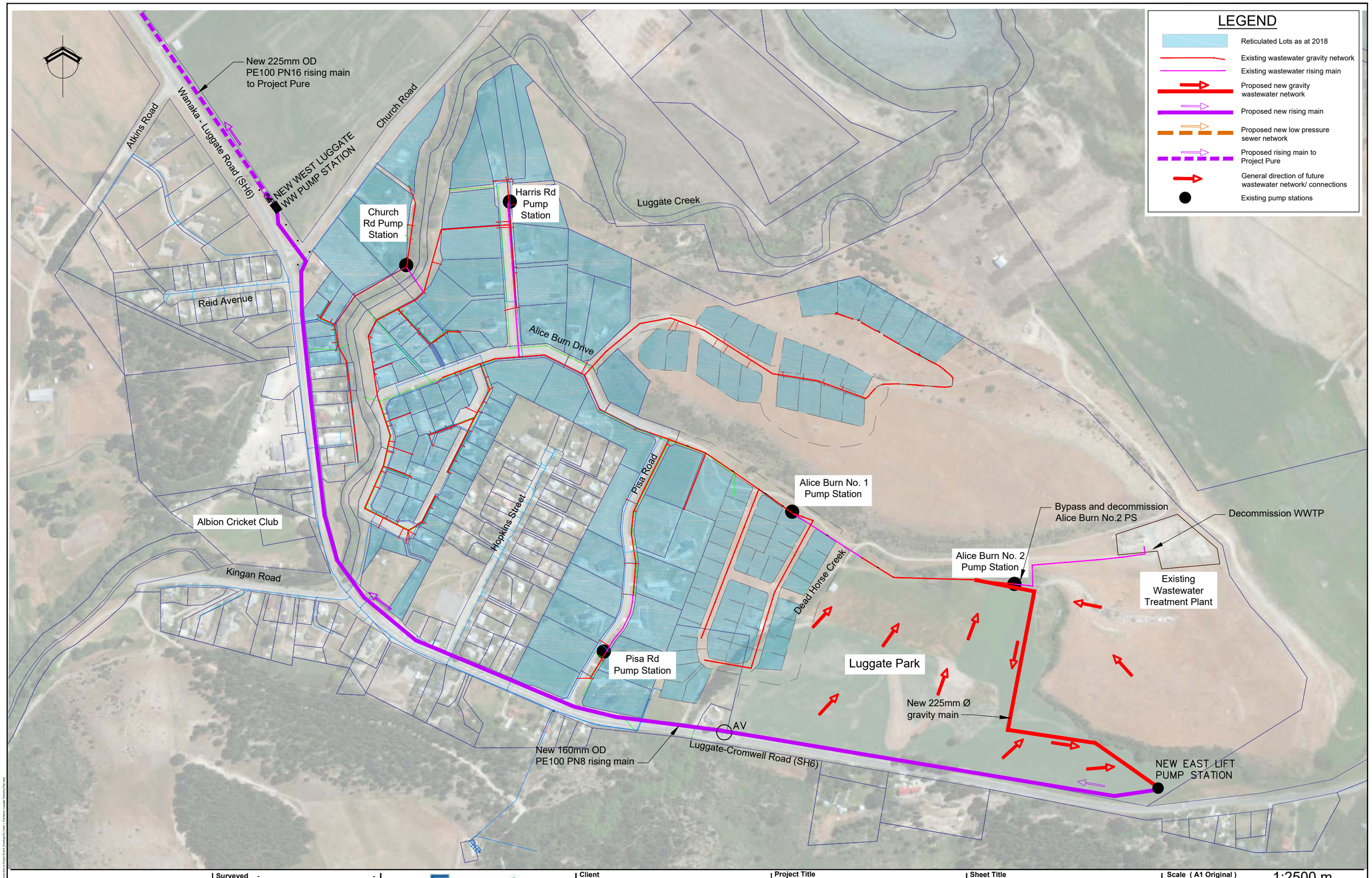

Revision	App	Date
A Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

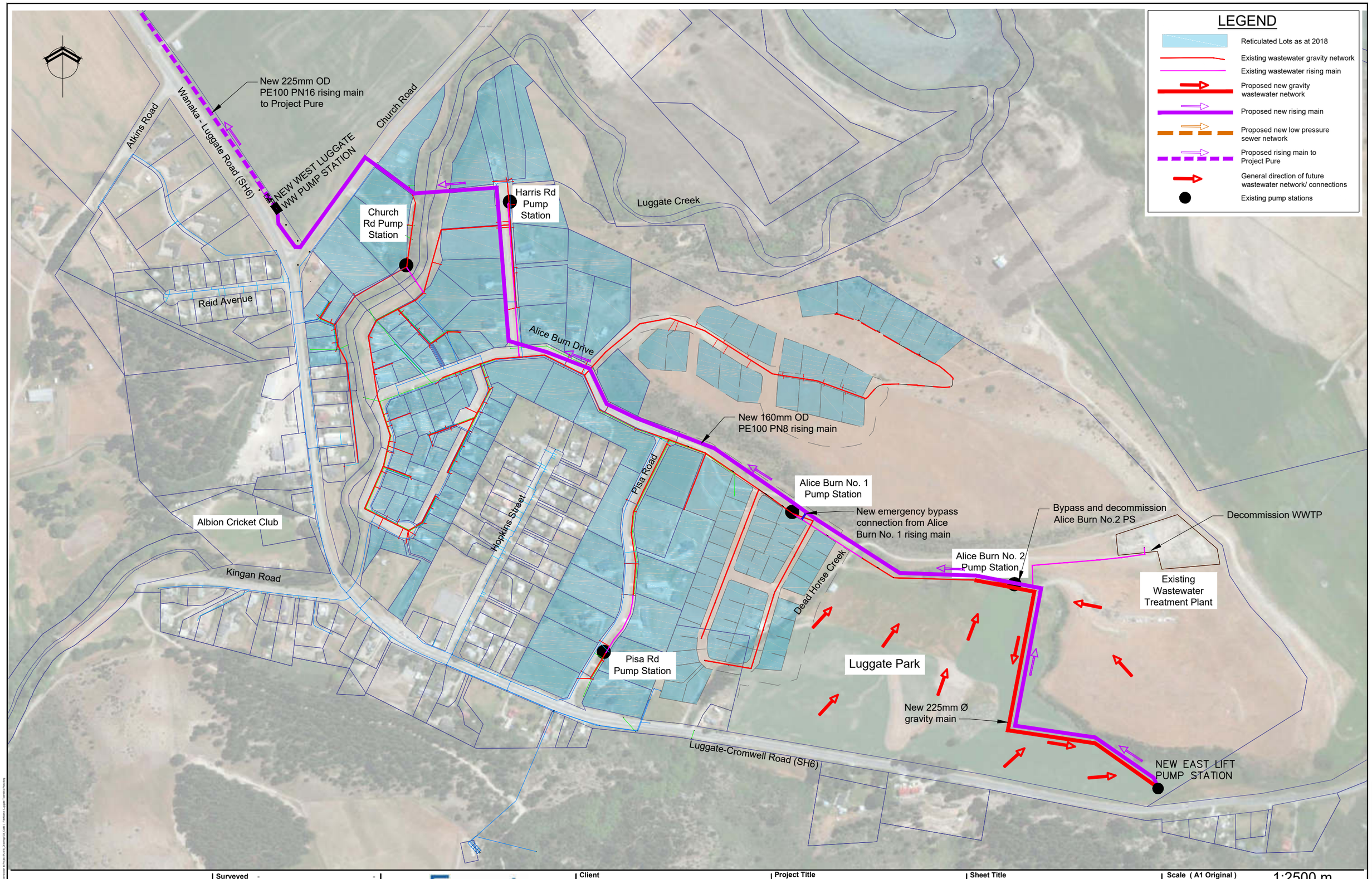
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Township Option 1

Scale (A1 Original) 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C11	A



Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

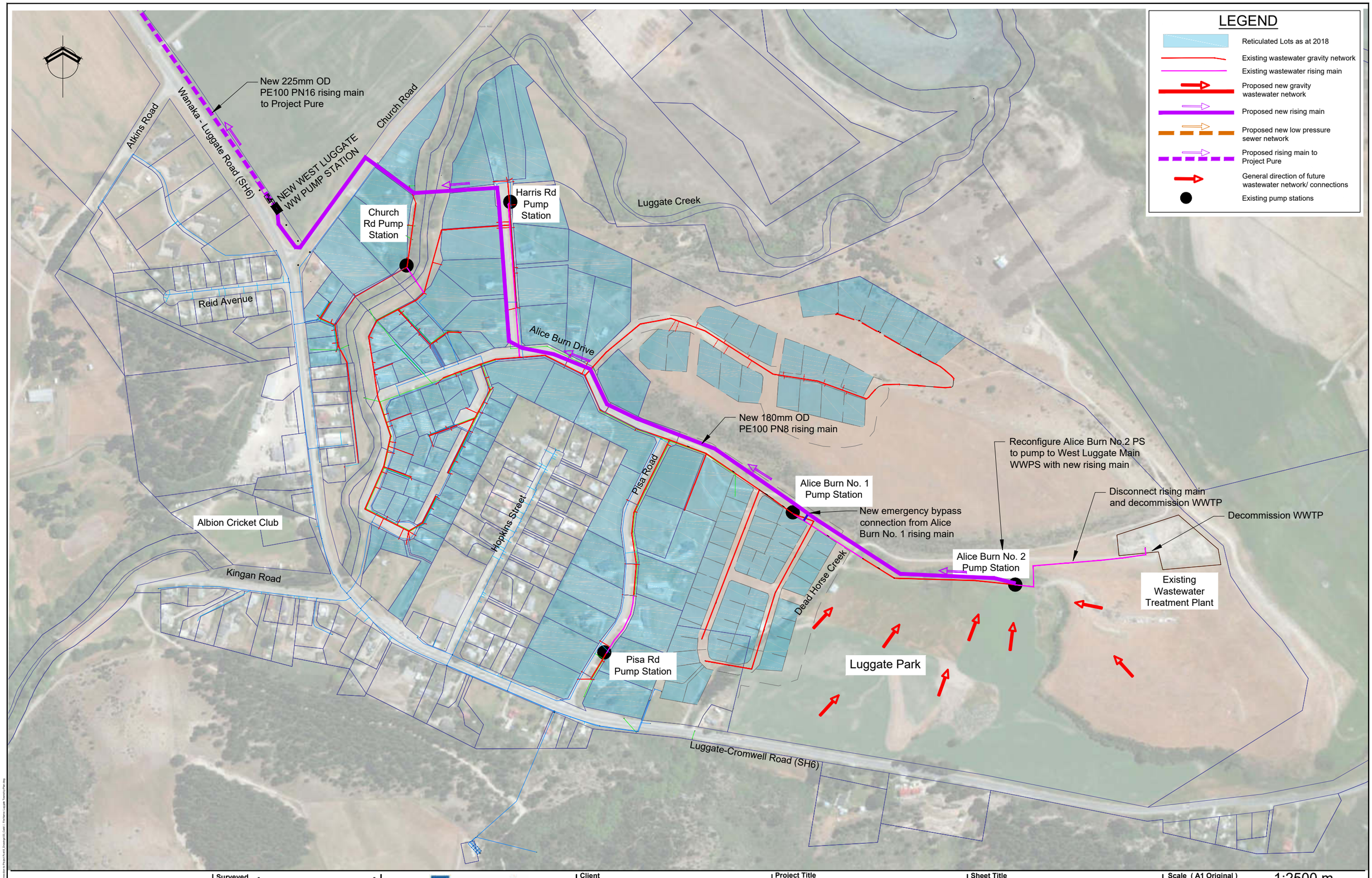
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Township Option 2

Scale (A1 Original) 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C12	A



Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

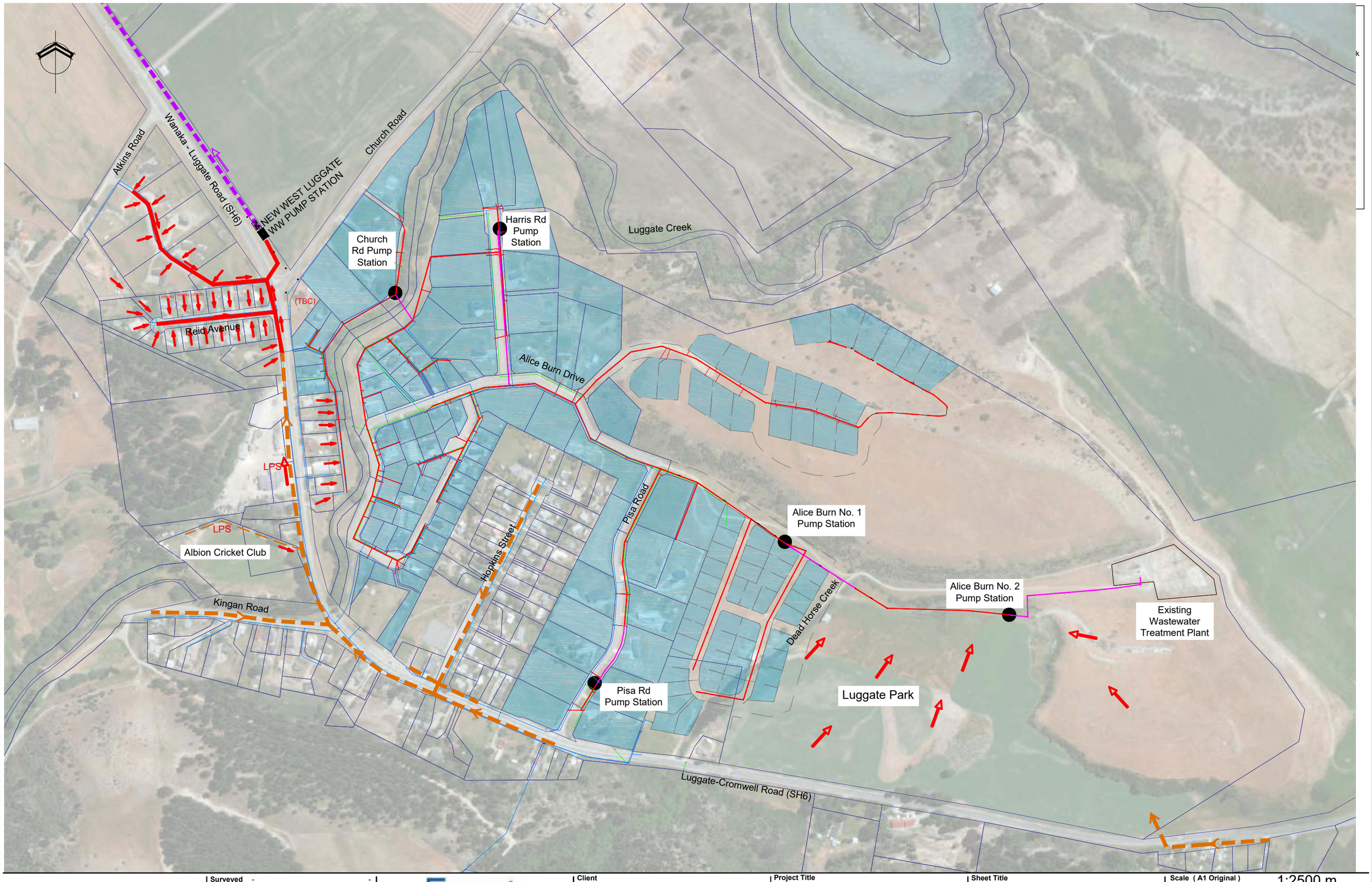
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Township Option 3

Scale (A1 Original): 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C13	A



Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	dd/mm/yy
Drawn	E. Cowie	dd/mm/yy
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

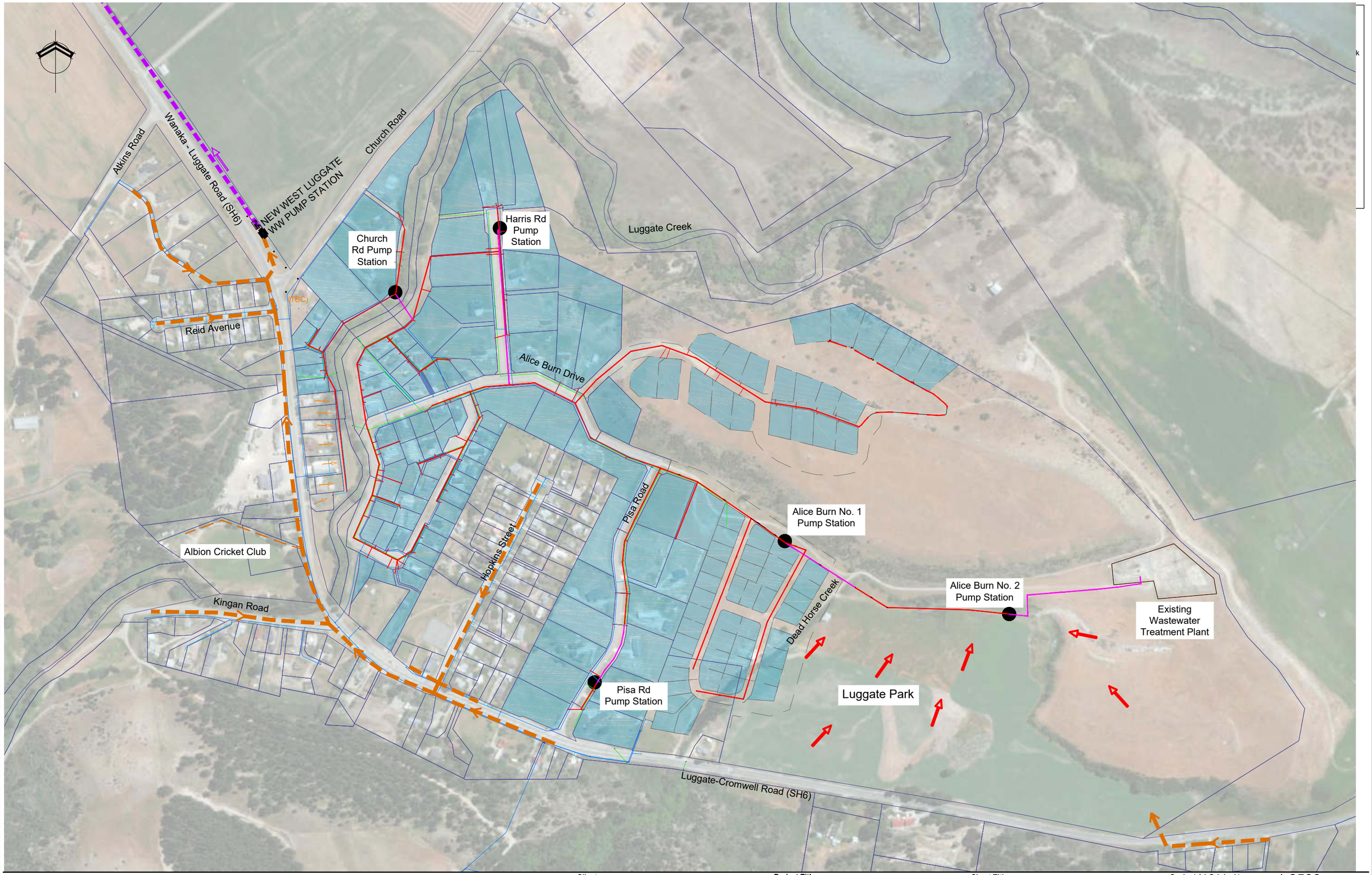
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Old Township Option A Mixed reticulation

Scale (A1 Original): 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C14	A



		Surveyed	-	-
		Designed	A. Steel	dd/mm/yy
		Drawn	E. Cowie	dd/mm/yy
A	Preliminary Only - For Review	**Reviewed**	-	-
Revision		**Approved**	-	-

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Client
QUEENSTOWN LAKES DISTRICT COUNCIL

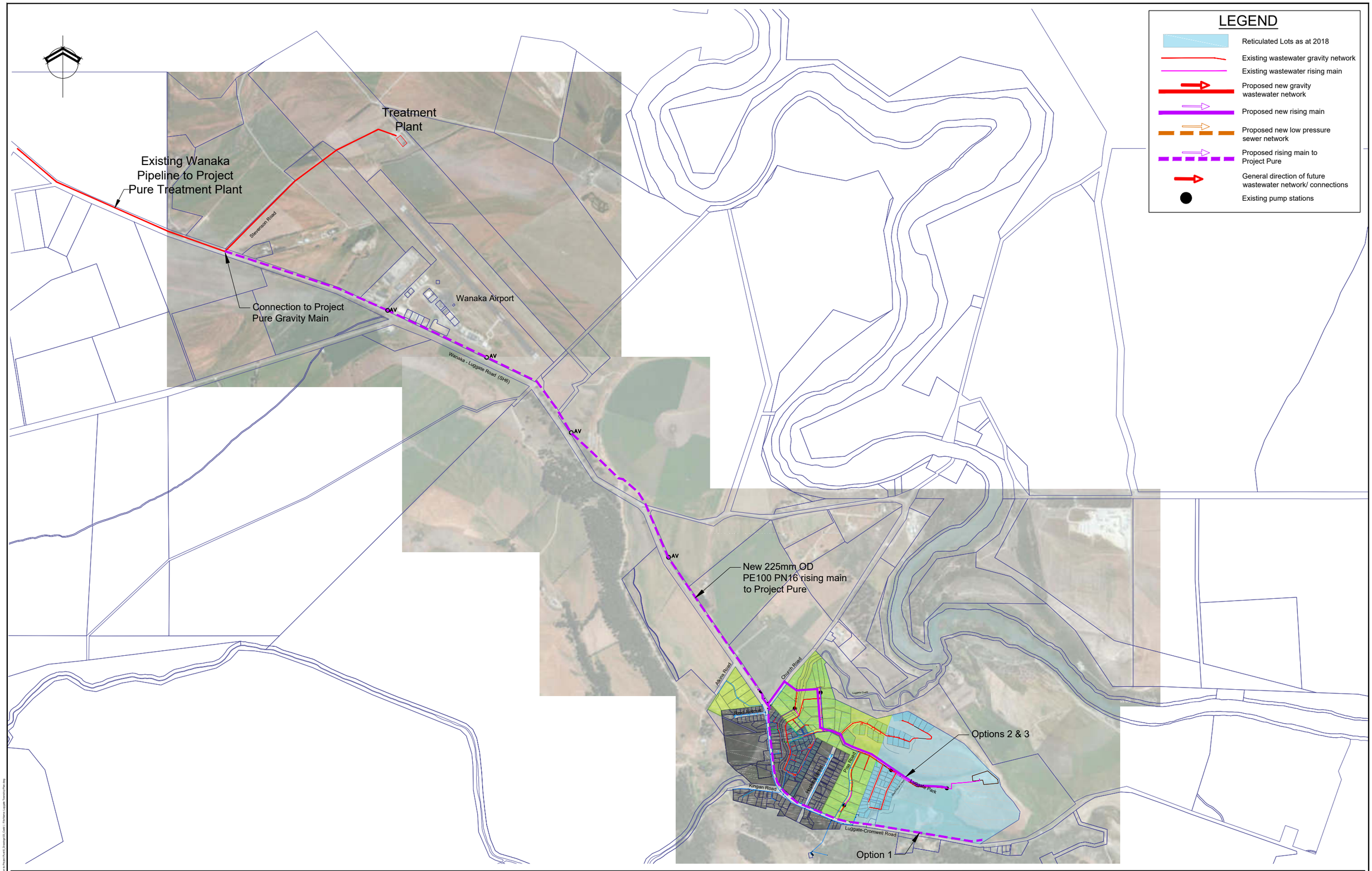
Project Title
Luggate Wastewater To Project Pure Concept Design

Sheet Title
Luggate Wastewater Scheme Old Township Option B All Pressure Sewer Option

Scale (A1 Original) 1:2500 m

Issue Preliminary For Review

Project No	**Sheet**	**Revision**
Q000427	C15	A



	Surveyed	-	-
	Designed	H. Wightman	MAR 2018
	Drawn	H. Wightman	MAR 2018
A Preliminary Only - For Review ACS 20Apr'18	**Reviewed**	-	-
Revision **App** **Date**	**Approved**	-	-

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Client
QUEENSTOWN LAKES DISTRICT COUNCIL

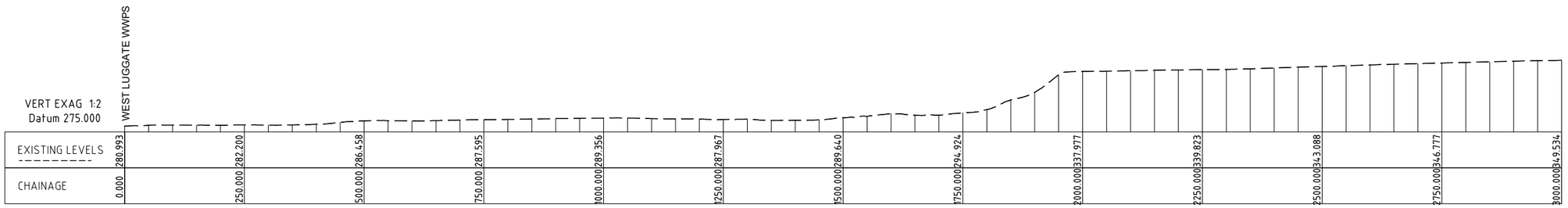
Project Title
Luggate Wastewater To Project Pure
Concept Design

Sheet Title
Rising Main Overview Plan

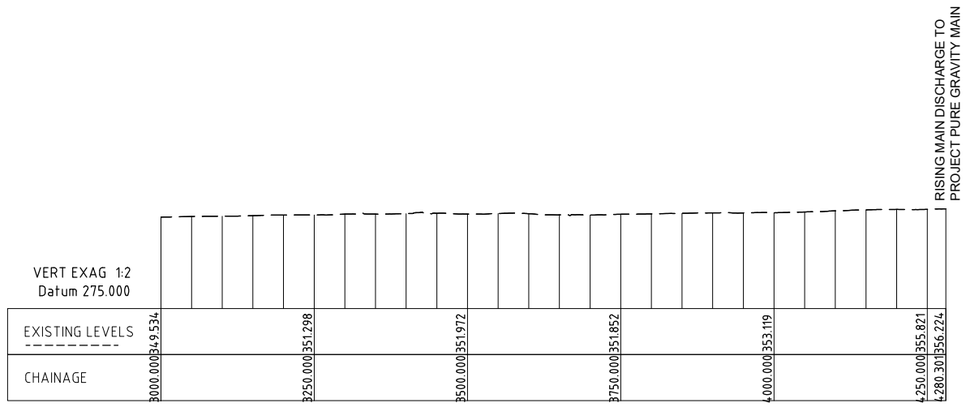
Scale (A1 Original) 1:10,000 m

Issue Preliminary For Review

Project No	Sheet	Revision
Q000427	C16	A



WW RISING MAIN LONG SECTION



WW RISING MAIN LONG SECTION

Revision	App	Date
A Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	H. Wightman	MAR 2018
Drawn	H. Wightman	MAR 2018
Reviewed	-	-
Approved	-	-

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Client
QUEENSTOWN LAKES DISTRICT COUNCIL

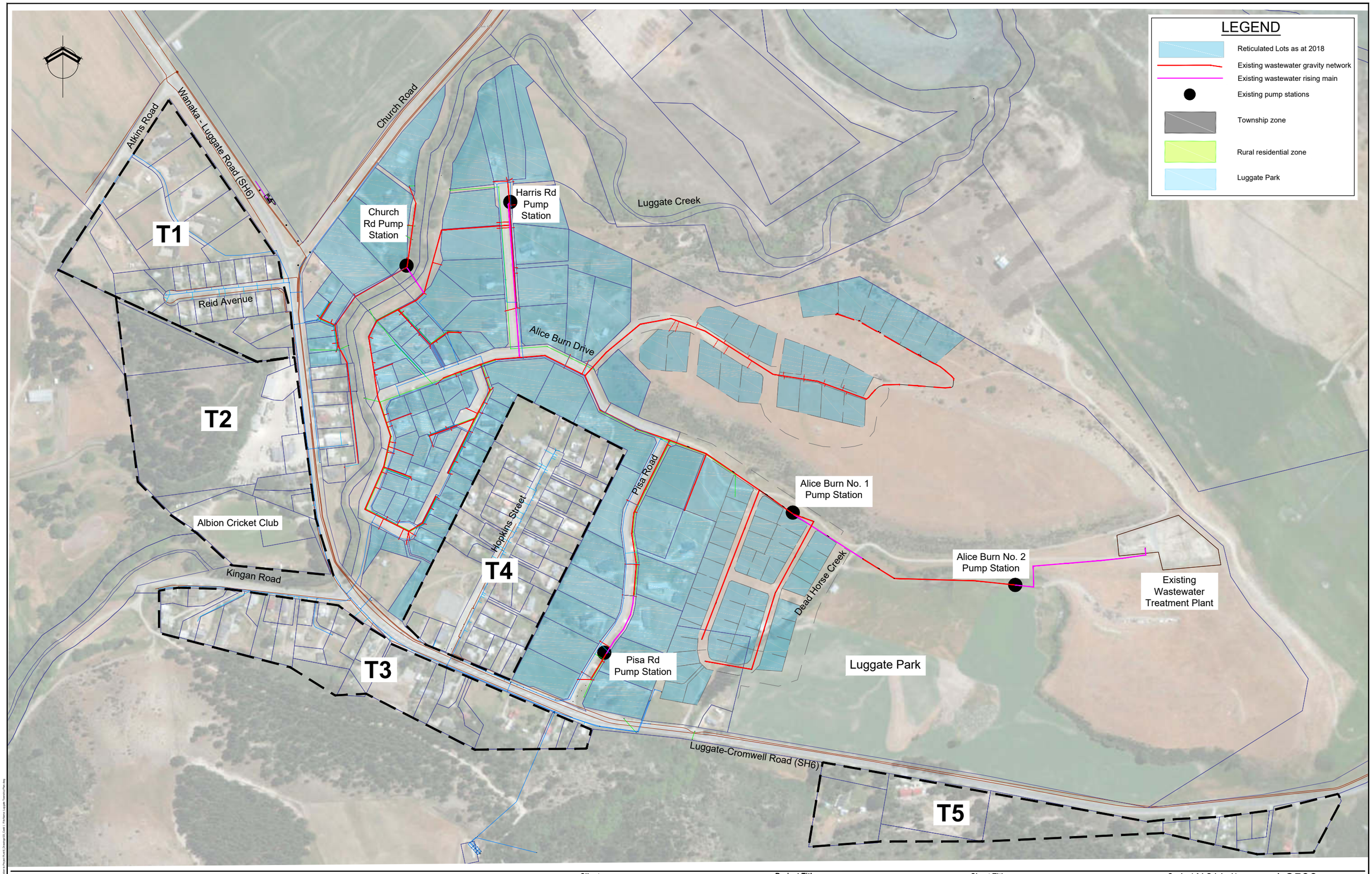
Project Title
Luggate Wastewater To Project Pure Concept Design

Sheet Title
Rising Main to Project Pure Long Section

Scale (A1 Original) 1:5000 m

Issue
Preliminary For Review

Project No	Sheet	Revision
Q000427	C17	A



Revision	App	Date
A Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

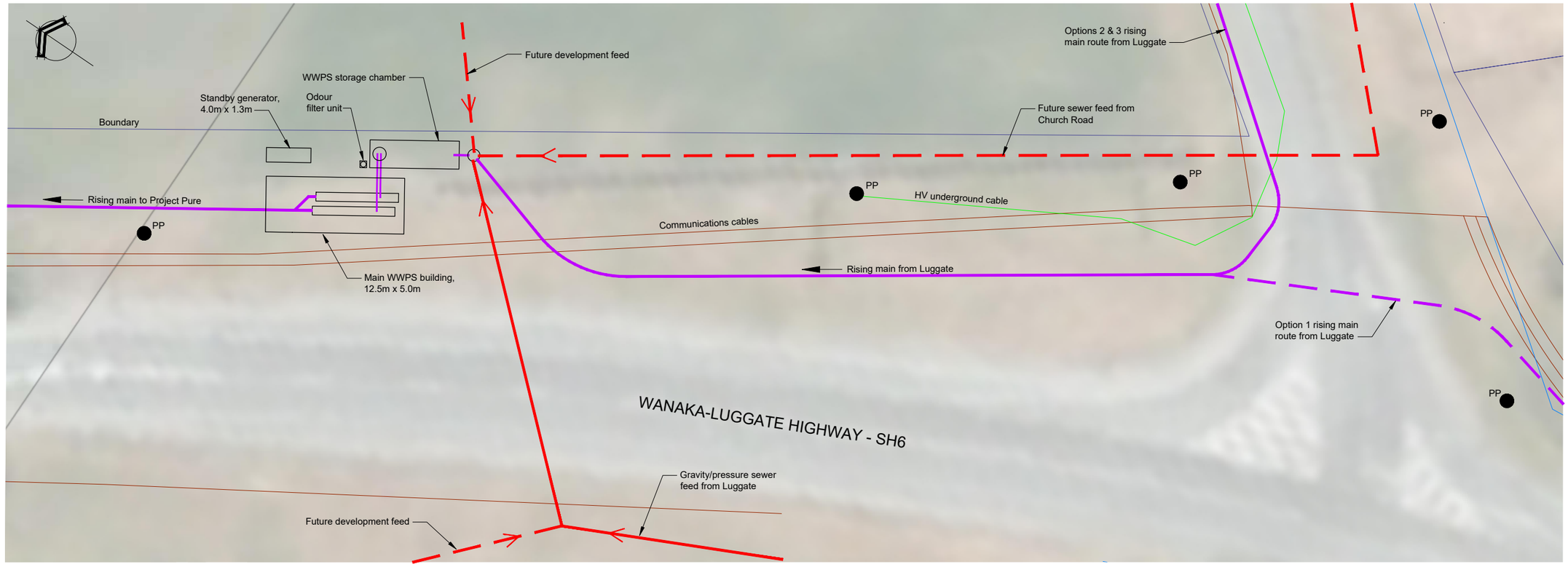
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate Wastewater Scheme Non-reticulated Township Areas

Scale (A1 Original) 1:2500 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C18	A



WEST LUGGATE WW PUMP STATION LAYOUT PLAN

1:200 @ A1
1:400 @ A1

Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman	Mar '18
Reviewed	-	-
Approved	-	-

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Client
QUEENSTOWN LAKES DISTRICT COUNCIL

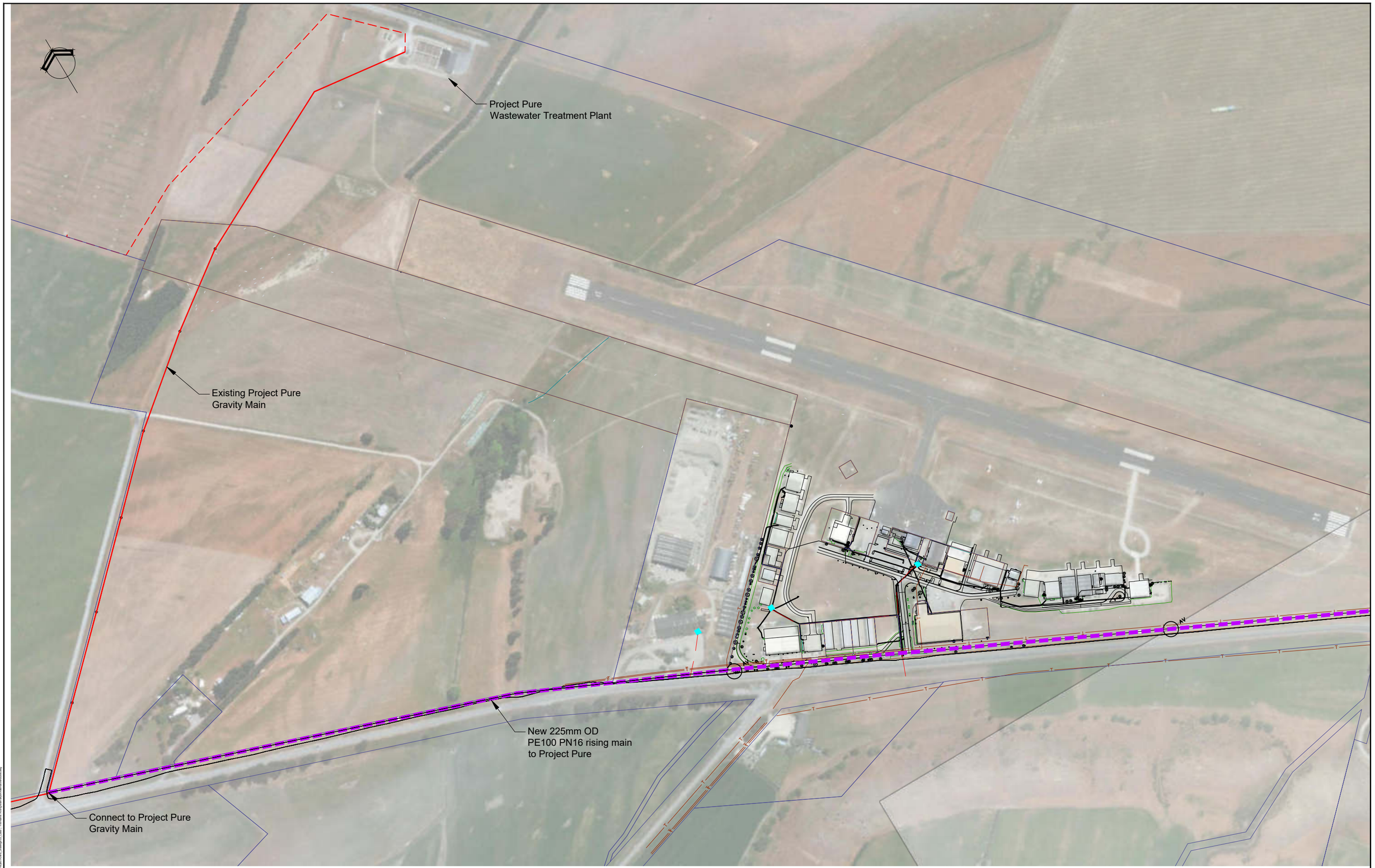
Project Title
Luggate Wastewater To Project Pure Concept Design

Sheet Title
Main Wastewater Pump Station Layout Plans

Scale (A1 Original) 1:200 m

Issue Preliminary For Review

Project No	Sheet	Revision
Q000427	C20	A



Revision		App	Date
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	H. Wightman	dd/mm/yy
Drawn	E. Cowie	dd/mm/yy
Reviewed	-	-
Approved	-	-

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Client
QUEENSTOWN LAKES DISTRICT COUNCIL

Project Title
Luggate Wastewater To Project Pure Concept Design

Sheet Title
Wanaka Airport Rising Main Alternative Route Options

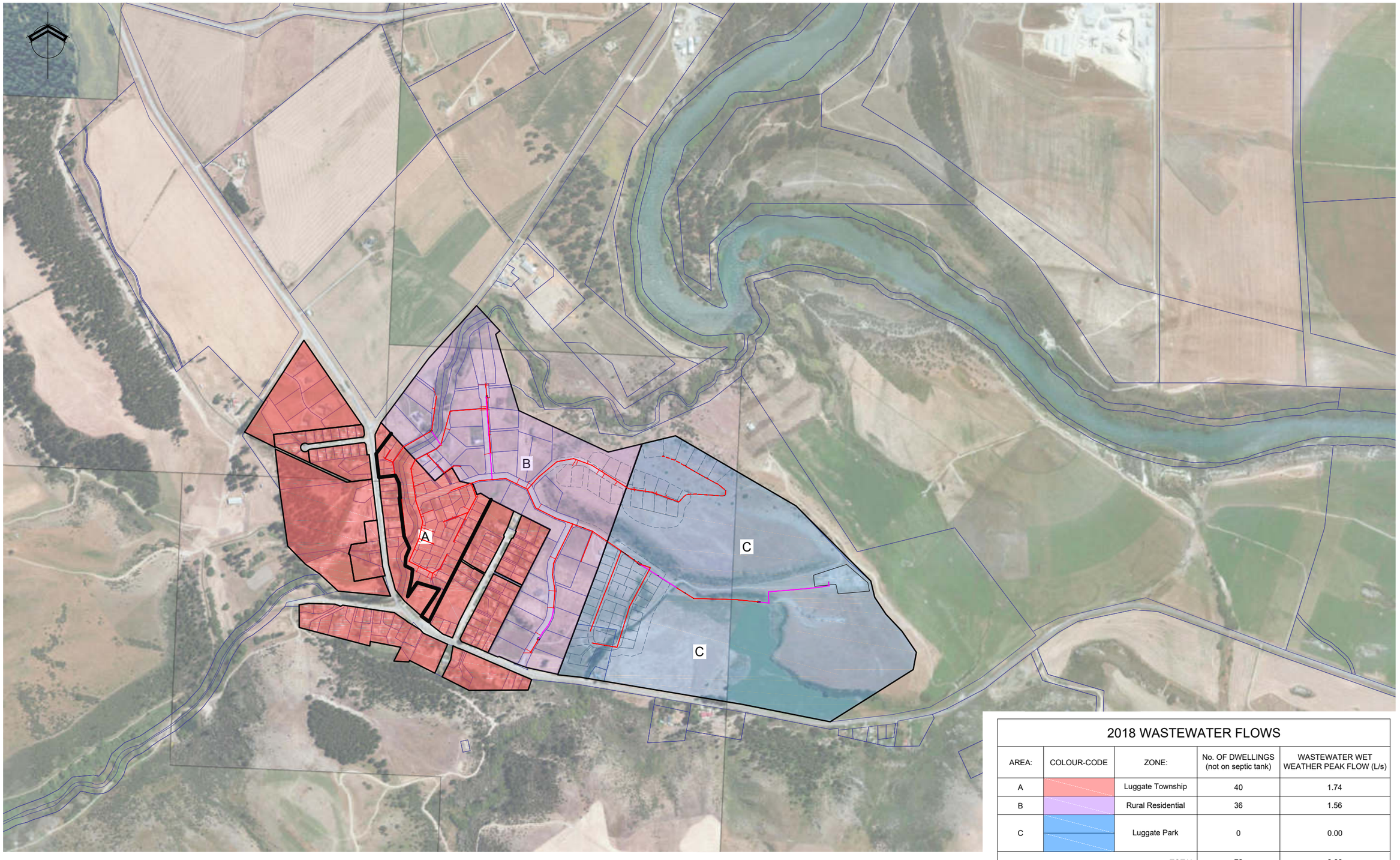
Scale (A1 Original) 1:2500 m

Issue
Preliminary For Review

Project No	Sheet	Revision
Q000427	C30	A

APPENDIX C

Population Flows Drawings



2018 WASTEWATER FLOWS

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS (not on septic tank)	WASTEWATER WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	40	1.74
B		Rural Residential	36	1.56
C		Luggate Park	0	0.00
		TOTAL	76	3.30

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman & J.Pringle	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

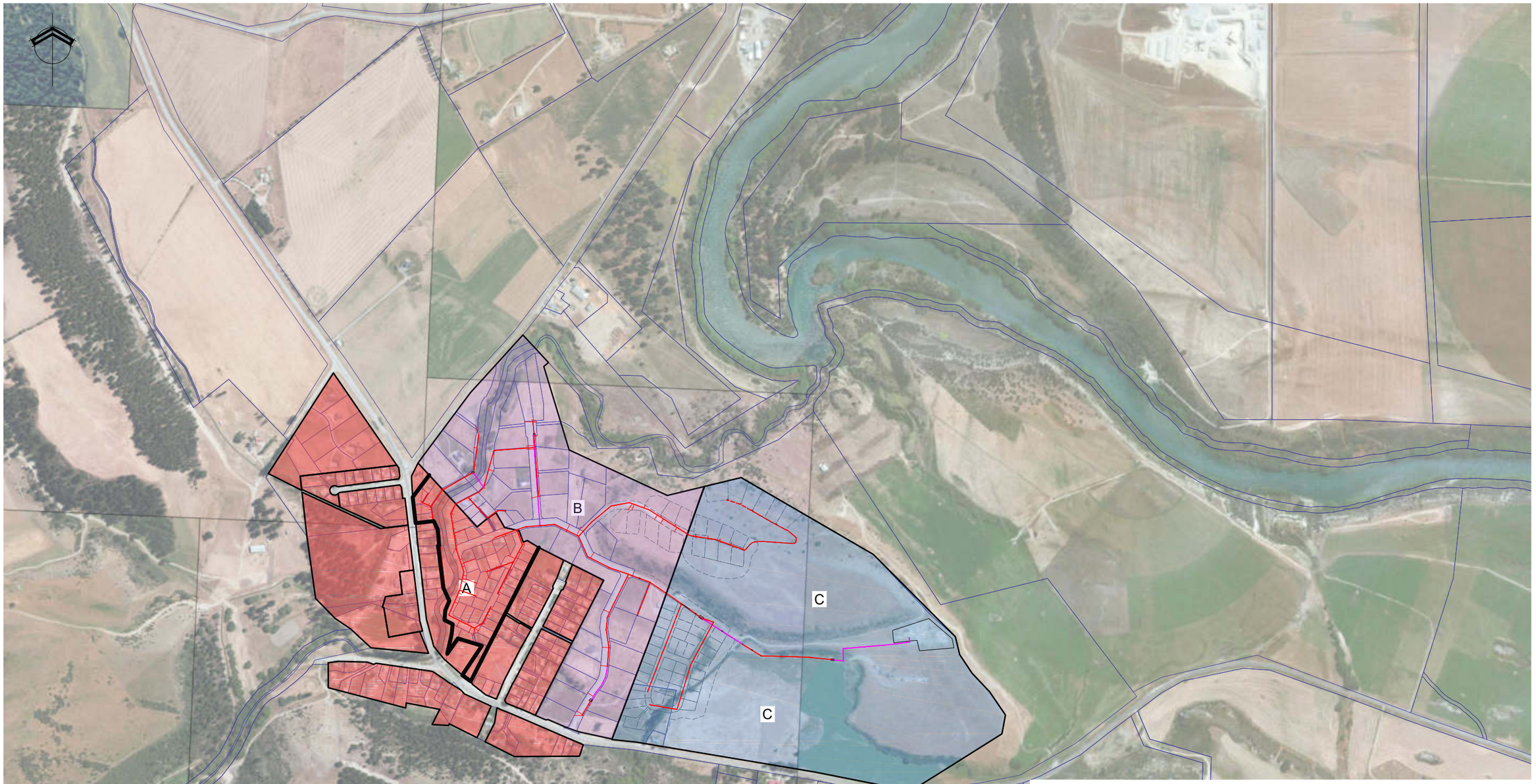
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate 2018 Wastewater Areas WW Flow Estimates

Scale (A1 Original): 1:5000 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C01	B



2023 WASTEWATER FLOWS with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS (not on septic tank)	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	77	3.15	2.51
B		Rural Residential	42	1.82	1.82
C		Luggate Park	50	2.17	2.17
		TOTAL	169	7.15	6.50

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman & J.Pringle	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

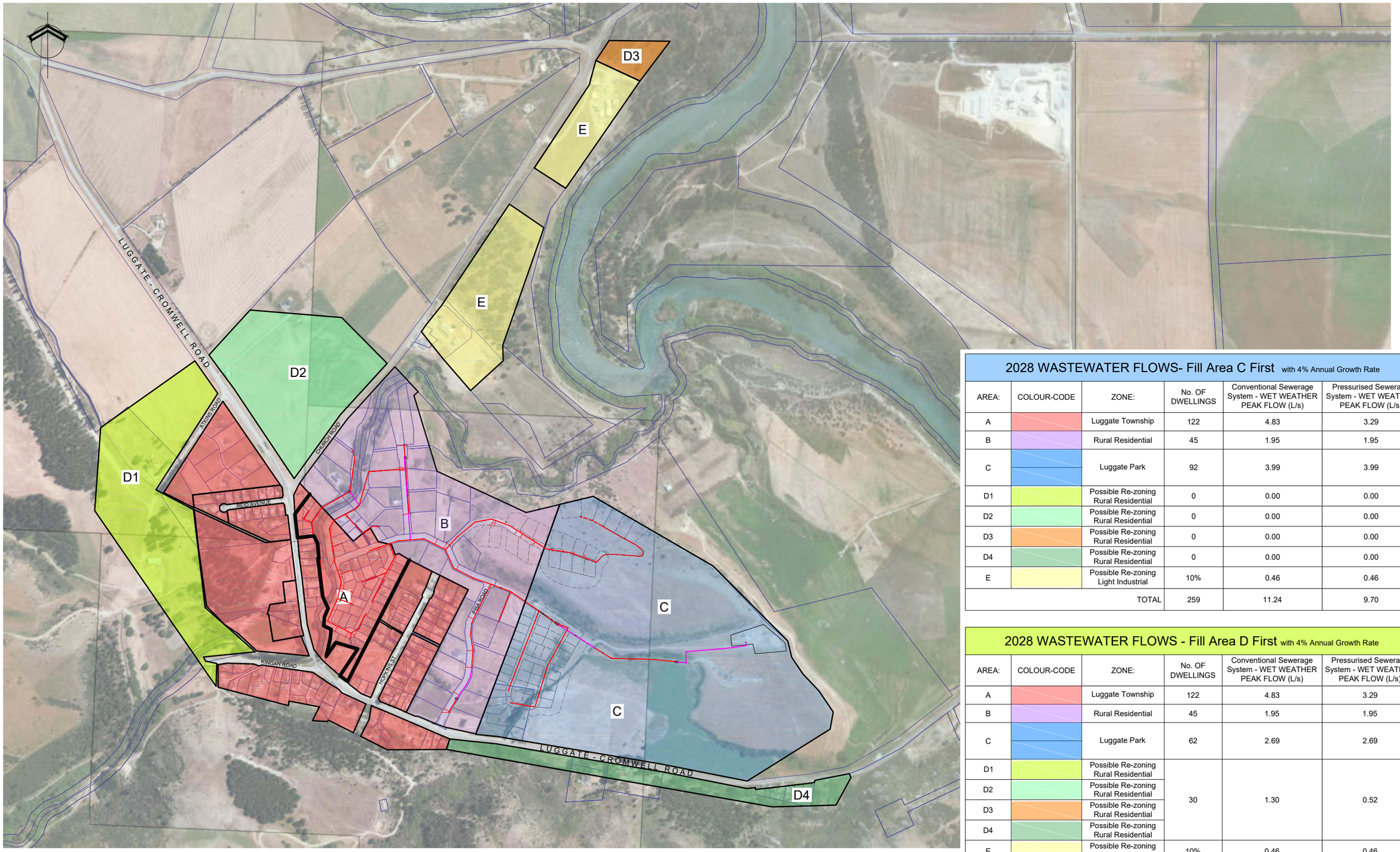
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate 2023 Wastewater Areas WW Flow Estimates

Scale (A1 Original): 1:5000 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C02	B



2028 WASTEWATER FLOWS- Fill Area C First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	122	4.83	3.29
B		Rural Residential	45	1.95	1.95
C		Luggate Park	92	3.99	3.99
D1		Possible Re-zoning Rural Residential	0	0.00	0.00
D2		Possible Re-zoning Rural Residential	0	0.00	0.00
D3		Possible Re-zoning Rural Residential	0	0.00	0.00
D4		Possible Re-zoning Rural Residential	0	0.00	0.00
E		Possible Re-zoning Light Industrial	10%	0.46	0.46
		TOTAL	259	11.24	9.70

2028 WASTEWATER FLOWS - Fill Area D First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	122	4.83	3.29
B		Rural Residential	45	1.95	1.95
C		Luggate Park	62	2.69	2.69
D1		Possible Re-zoning Rural Residential	30	1.30	0.52
D2		Possible Re-zoning Rural Residential			
D3		Possible Re-zoning Rural Residential			
D4		Possible Re-zoning Rural Residential			
E		Possible Re-zoning Light Industrial	10%	0.46	0.46
		TOTAL	259	11.24	8.91

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	dd/mm/yy
Drawn	E. Cowie	dd/mm/yy
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

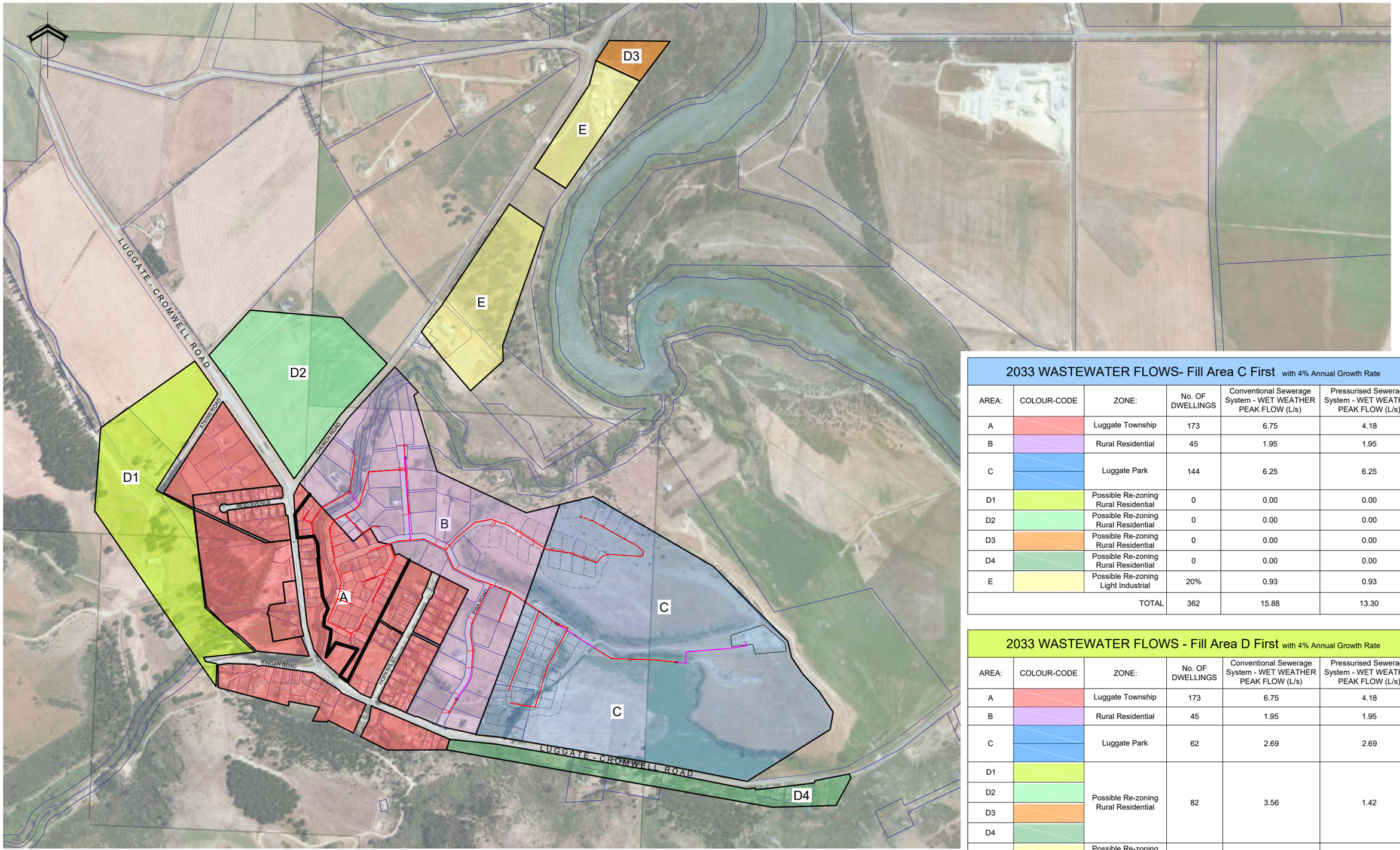
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate 2028 Wastewater Areas WW Flow Estimates

Scale (A1 Original): 1:5000 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C03	B



2033 WASTEWATER FLOWS- Fill Area C First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	45	1.95	1.95
C		Luggate Park	144	6.25	6.25
D1		Possible Re-zoning Rural Residential	0	0.00	0.00
D2		Possible Re-zoning Rural Residential	0	0.00	0.00
D3		Possible Re-zoning Rural Residential	0	0.00	0.00
D4		Possible Re-zoning Rural Residential	0	0.00	0.00
E		Possible Re-zoning Light Industrial	20%	0.93	0.93
		TOTAL	362	15.88	13.30

2033 WASTEWATER FLOWS - Fill Area D First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	45	1.95	1.95
C		Luggate Park	62	2.69	2.69
D1		Possible Re-zoning Rural Residential	82	3.56	1.42
D2					
D3					
D4					
E		Possible Re-zoning Light Industrial	20%	0.93	0.93
		TOTAL	362	15.88	11.17

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	Mar '18
Drawn	H.Wightman & J.Pringle	Mar '18
Reviewed	-	-
Approved	-	-

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Client
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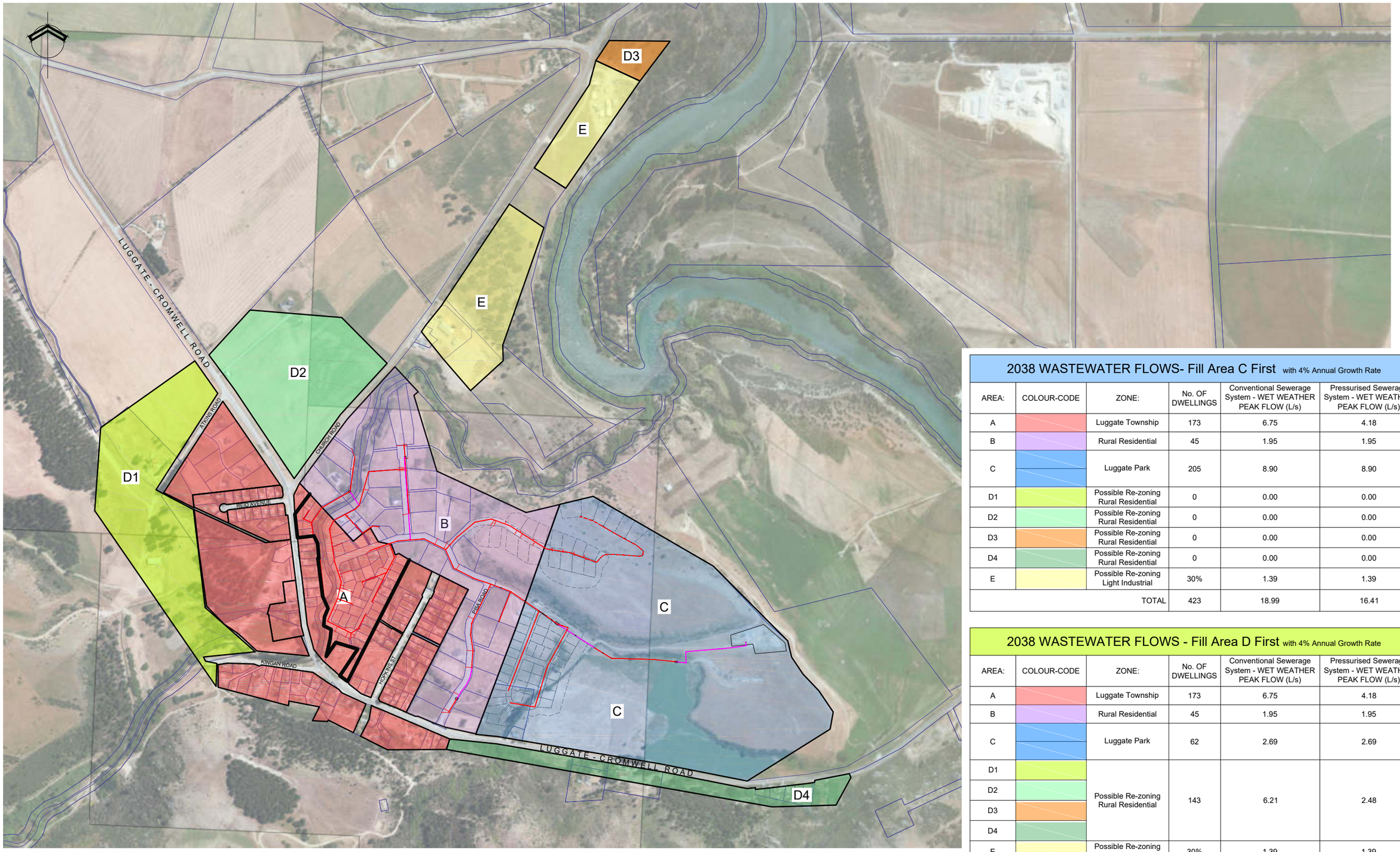
Project Title
Luggate Wastewater To Project Pure Concept Design

Sheet Title
Luggate 2033 Wastewater Areas WW Flow Estimates

Scale (A1 Original) 1:5000 m

Issue Preliminary For Review

Project No	Sheet	Revision
Q000427	C04	B



2038 WASTEWATER FLOWS- Fill Area C First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	45	1.95	1.95
C		Luggate Park	205	8.90	8.90
D1		Possible Re-zoning Rural Residential	0	0.00	0.00
D2		Possible Re-zoning Rural Residential	0	0.00	0.00
D3		Possible Re-zoning Rural Residential	0	0.00	0.00
D4		Possible Re-zoning Rural Residential	0	0.00	0.00
E		Possible Re-zoning Light Industrial	30%	1.39	1.39
		TOTAL	423	18.99	16.41

2038 WASTEWATER FLOWS - Fill Area D First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	45	1.95	1.95
C		Luggate Park	62	2.69	2.69
D1		Possible Re-zoning Rural Residential	143	6.21	2.48
D2					
D3					
D4					
E		Possible Re-zoning Light Industrial	30%	1.39	1.39
		TOTAL	423	18.99	12.69

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

Surveyed	-	-
Designed	A. Steel	dd/mm/yy
Drawn	E. Cowie	dd/mm/yy
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

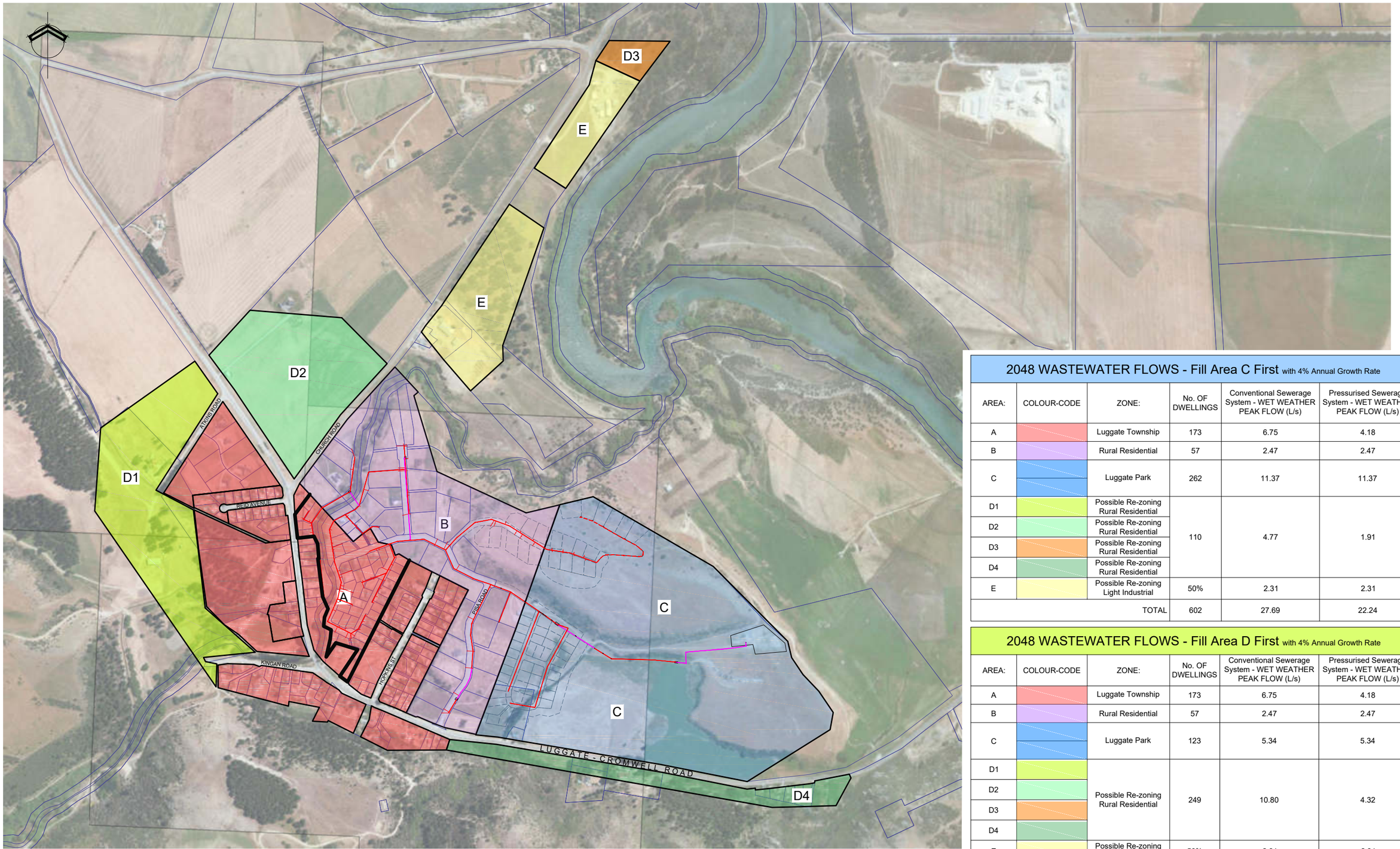
Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate 2038 Wastewater Areas WW Flow Estimates

Scale (A1 Original): 1:5000 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C05	B



2048 WASTEWATER FLOWS - Fill Area C First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	57	2.47	2.47
C		Luggate Park	262	11.37	11.37
D1		Possible Re-zoning Rural Residential	110	4.77	1.91
D2		Possible Re-zoning Rural Residential			
D3		Possible Re-zoning Rural Residential			
D4		Possible Re-zoning Rural Residential			
E		Possible Re-zoning Light Industrial	50%	2.31	2.31
		TOTAL	602	27.69	22.24

2048 WASTEWATER FLOWS - Fill Area D First with 4% Annual Growth Rate

AREA:	COLOUR-CODE	ZONE:	No. OF DWELLINGS	Conventional Sewerage System - WET WEATHER PEAK FLOW (L/s)	Pressurised Sewerage System - WET WEATHER PEAK FLOW (L/s)
A		Luggate Township	173	6.75	4.18
B		Rural Residential	57	2.47	2.47
C		Luggate Park	123	5.34	5.34
D1		Possible Re-zoning Rural Residential	249	10.80	4.32
D2		Possible Re-zoning Rural Residential			
D3		Possible Re-zoning Rural Residential			
D4		Possible Re-zoning Rural Residential			
E		Possible Re-zoning Light Industrial	50%	2.31	2.31
		TOTAL	602	27.69	18.62

Revision		App	Date
B	Flows revised - For Review	ACS	03May'18
A	Preliminary Only - For Review	ACS	20Apr'18

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Designed	A. Steel	Mar '18
Drawn	H.Wightman & J.Pringle	Mar '18
Reviewed	-	-
Approved	-	-

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Client: QUEENSTOWN LAKES DISTRICT COUNCIL

Project Title: Luggate Wastewater To Project Pure Concept Design

Sheet Title: Luggate 2048 Wastewater Areas WW Flow Estimates

Scale (A1 Original): 1:5000 m

Issue: Preliminary For Review

Project No	Sheet	Revision
Q000427	C06	B

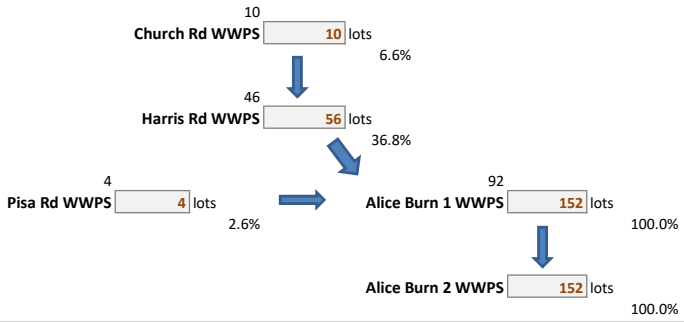
APPENDIX D

Flow Distribution and Emergency Storage Estimates

Luggate Wastewater Flows Distribution and Emergency Storage Estimates

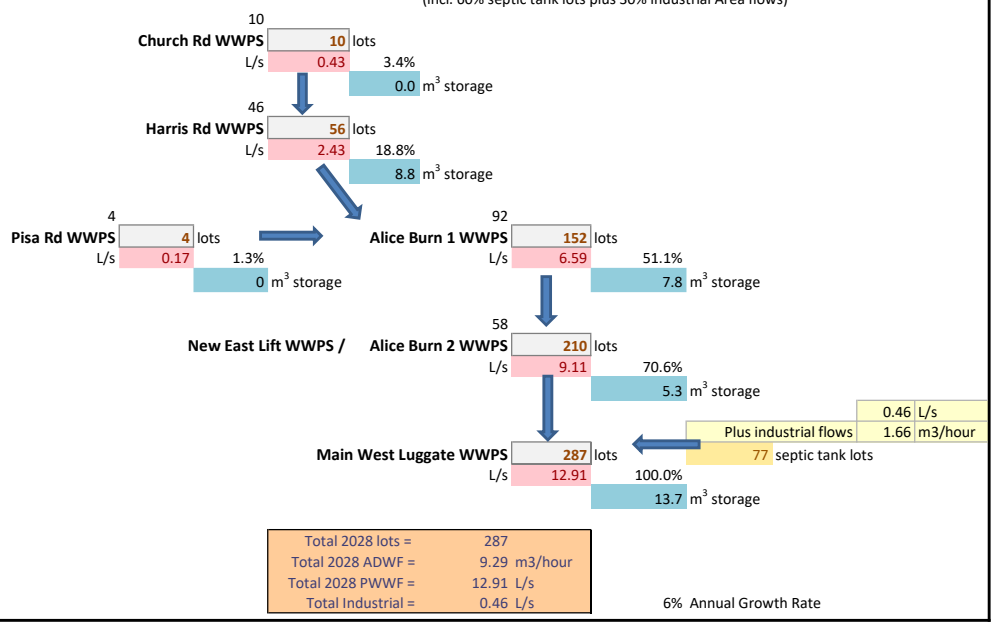
Existing Luggate WW reticulation distribution

152 total lots connected to existing reticulation



2028 Luggate WW flows distribution

287 total lots connected 0.043 L/s per lot
(incl. 60% septic tank lots plus 30% industrial Area flows)

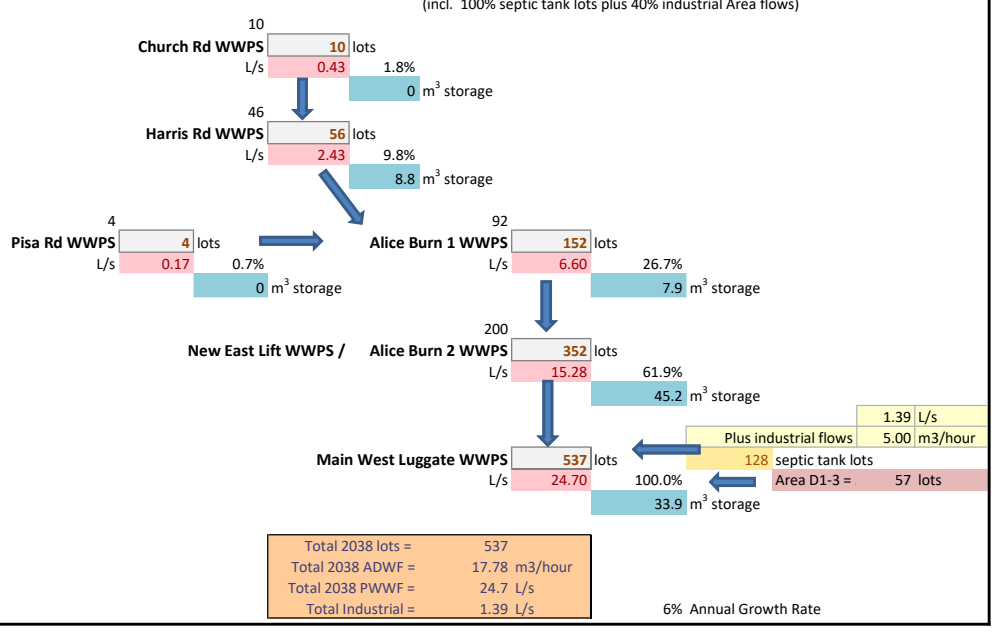


Total 2028 lots =	287	
Total 2028 ADWF =	9.29	m3/hour
Total 2028 PWWF =	12.91	L/s
Total Industrial =	0.46	L/s

6% Annual Growth Rate

2038 Luggate WW flows distribution

537 total lots connected 0.043 L/s per lot
(incl. 100% septic tank lots plus 40% industrial Area flows)

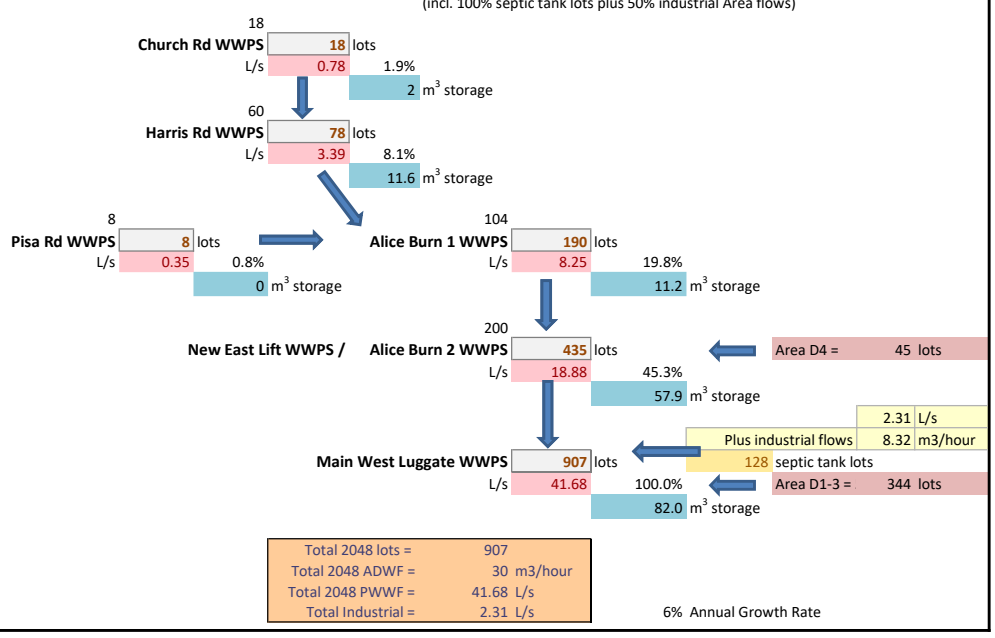


Total 2038 lots =	537	
Total 2038 ADWF =	17.78	m3/hour
Total 2038 PWWF =	24.7	L/s
Total Industrial =	1.39	L/s

6% Annual Growth Rate

2048 Luggate WW flows distribution

907 total lots connected 0.043 L/s per lot
(incl. 100% septic tank lots plus 50% industrial Area flows)



Total 2048 lots =	907	
Total 2048 ADWF =	30	m3/hour
Total 2048 PWWF =	41.68	L/s
Total Industrial =	2.31	L/s

6% Annual Growth Rate

Emergency Storage	9 hours ADWF
With Standyby power (eg at main PS)	5 hours ADWF

Pumping Stations useable wet well storage estimates

Church Rd	3 m^3
Harris Rd	3 m^3
Pisa Rd	3 m^3
Alice Burn 1	18 m^3
Alice Burn 2	11 m^3

Note: emergency storage at a WWPS is calculated from the volume required for the total lots less lots pumping in from upstream pumps stations, less the estimated useable wet well storage at the PS

ULTIMATE Luggate + Future Areas WW retic distribution

884 total lots connected
(incl. all 125 septic tank lots) Plus industrial area flows

APPENDIX E

Risk Register

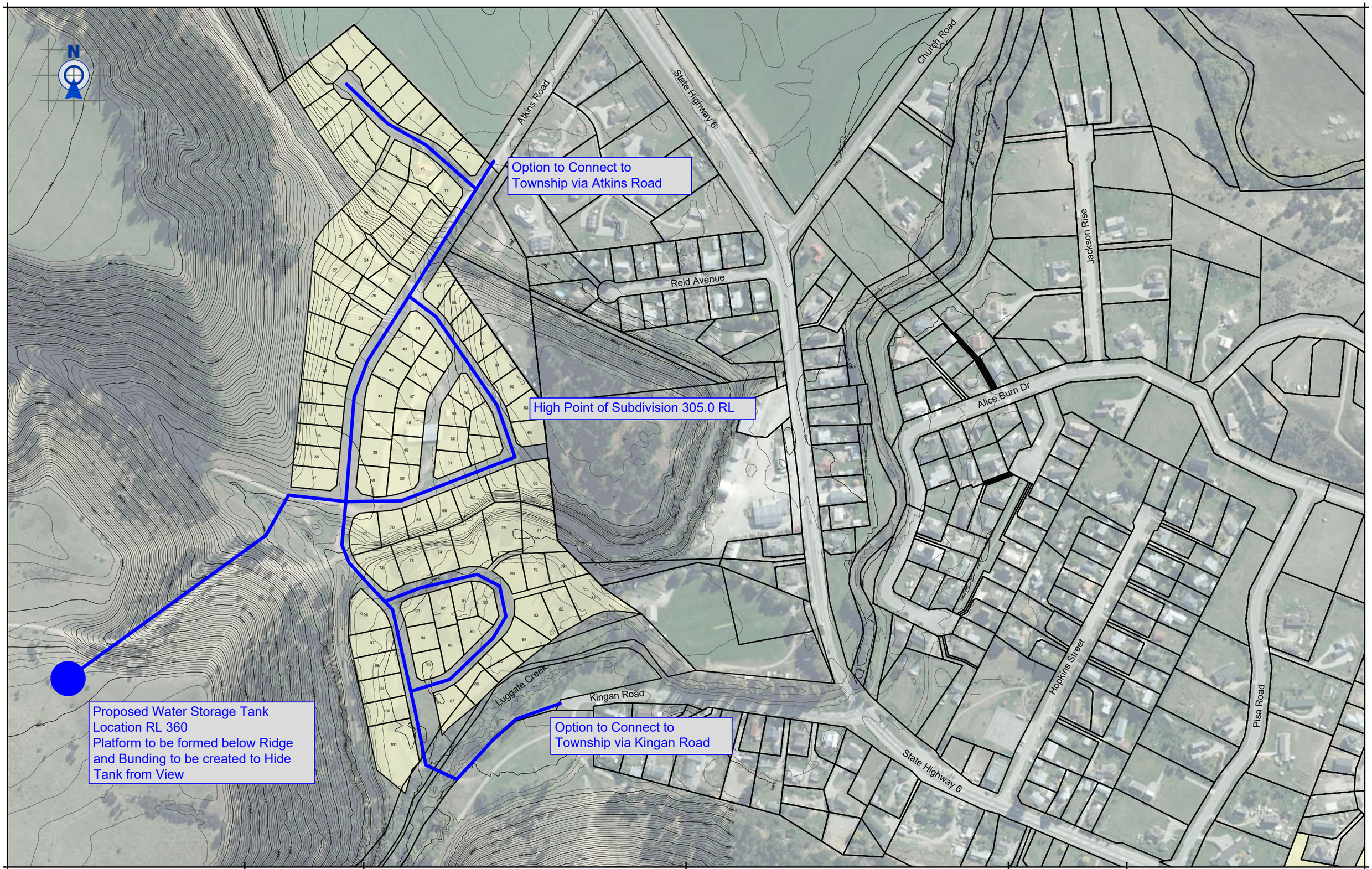
Risk Register -

Risk Headings
* Resource Consents
* Easements
* Stakeholders
* Land Needs
* Trials/Investigations
* Demand Assumptions

STAGE 1 - RISK IDENTIFICATION					STAGE 2 - ANALYSIS OF UNCONTROLLED RISK										STAGE 3 - RISK CONTROLS AND ANALYSIS OF CONTROLLED RISK										STAGE 4 - RISK CLASS	Stage 5 - RISK ACCEPTANCE	
RISK DETAILS						Consequence Score						Uncontrolled Risk Score			Risk Controls		Consequence Score					Controlled Risk					
Risk ID	Date	Risk Title There is a chance that...	Risk Causes Because...	Risk Owner	Consequences Resulting in...	Political	Economic	Social	Technical	Legal	Environmental	Consequence Score	Likelihood	Level of risk 1(low) to 25 (high)	Risk Control Options	Selected Control From one of the options identified	Political	Economic	Social	Technical	Legal	Environmental	Consequence Score	Likelihood	Level of risk 1(low) to 25 (high)	Risk Class (Very Low to Very high)	Responsibility for accepting the risk	Accepted by Name and Position
STAKEHOLDERS												0		0														
1.1	11/4/17	**Design will be impacted by development at Wanaka Airport**	A new WW connection may be provided for Wanaka Airport and associated reticulation		Inefficient / Insufficient design of new sewer main	3	1	2	2	1	1	3	3	9	Mitigate	Wanaka airport are a major stakeholder in the process and shall be engaged with throughout the project programme. Their preferred option at present is to connect into our sewer pipeline.	3						3	2	6	Low	S&P Group	S Pile
1.2	11/4/17	**Community object to proposed infrastructure**	Costs associated and properties already have connections to septic tanks		Affordability of infrastructure not viable	2	1	2	2	1	1	2	2	4	Mitigate	Luggate Community Association are keen to decommission the existing Luggate WWTP due to the financial costs they incur for its O & M.							2	1	2	Very Low	S&P Group	
1.3	10/10/2017	**NZTA not consulted (despite pipeline route along highway)**	NZTA are responsible for managing stat highway and associated berm / carriageway and reserve.		Interuption of construction programme if NZTA halt work halfway through project. Breakdown in relationship.	3				2		3	2	6	Mitigate	Engage with NZTA early on to see if pipeline route along highway is feasible.	3						3	1	3	Very Low	PD Group	
1.4	10/10/2017	**QLDC still waiting on signed agreement re wastewater servicing from Willow Developments Ltd**	Until an agreement is signed, there is a risk that Willow Developments Ltd may manage their wastewater in a manner that doesn't utilise pumping through to Project Pure.		Anticipated flows / load less than designed for. Benefits of new infrastructure not fully utilised. Existing treatment plant required to remain.	2				2		2	2	4	Mitigate	Low risk issue. New pipeline and pump station not dependant on Willow Ridge Development. Existing Luggate WWTP consent expires in 2021 so this will likely motivate them to connect to the new pumping system.	2				2		2	1	2	Very Low	S&P Group	
1.5	19/04/2018	**Land access for ideal pipe route is denied**	Ideal pipe route involves going through private property		Increase in cost to find alternative route	3				2		3	2	6	Mitigate	Engage with stakeholders early on to see if pipeline route is accepted	3						3	1	3	Very Low		
DEMAND ASSUMPTIONS												0		0														
2.1	11/4/17	**High costs per person**	Growth / development does not occur as per forecast		Poorly performing infrastructure that has a high cost per user.	3	1	2	2	1	1	3	2	6	Mitigate	Design costs for the new pipeline are to be met through the 2017/18 LTP. Construction costs require approval through the LTP process.							0		0	Very Low	S&P Group	
2.2	11/4/17	**Connection of Luggate to P Pure exceeds current WWTP capacity**	Project Pure WWTP will reach capacity at 2025 (even without proposed connection of Luggate and Hawea)		Insufficient capacity to treat effluent. Failure of LoS at plant and failure of consent compliance.	3	3	3	2	2	3	3	2	6	Mitigate	Capacity upgrades at P Pure are planned for in 2020/21 to cater for additional loads from Luggate and Hawea.						3	3	1	3	Very Low	S&P Group	
2.3	10/10/2017	**Wastewater loads from Wanaka airport add to capacity requirements**	Projected growth of Wanaka airport means pipeline reaches capacity too early.		Pipeline reaches capacity before its anticipated end date. Ability for airport to connect into pipeline may depend on ability to time				3			3	2	6	Mitigate	Wanaka airport have engaged Beca to complete at infrastructure report to quantify their future wastewater requr				3			3	1	3	Very Low	S&P Group	
2.4	10/10/2017	**Wastewater loads from those properties on septic tanks are hard to quantify**	This load will not immediately be pumped along the new pipeline but will be serviced at some point in the future.		Pipeline reaches capacity before its anticipated end date.	2			3			3	2	6	Mitigate	Capacity calculations to include those houses in Luggate with septic tanks that will be connected in the future.				3			3	1	3	Very Low	Asset Planning	
2.5	10/10/2017	**Wastewater loads from future development in Luggate add to capacity requirements**	Pipeline dia and capacity needs to be designed in advance of this development		Pipeline reaches capacity before its anticipated end date.	2			2			2	1	4	Mitigate	Ensure demand forecasting is up to date and incorporates all known developments planned for Luggate so that these can be built into capacity design.	2			2			2	1	2	Very Low	Asset Planning	
2.6	10/10/2017	**Initial concept design / pipe sizing done prior to 2017 demand forecast**	Pipe sizing calculations may have used incorrect or out of date data.		Original concept design / proposed pipeline diameter may be either too small or too large.				3			3	3	9	Mitigate	Ensure demand forecasting used to calculate capacity / diameter of pipeline uses 2017 wastewater demand forecast model numbers.				3			3	2	6	Low	PD Group	
LAND ACQUISITION & EASEMENTS FOR PIPELINE ROUTE																												
3.1	10/10/2017	**Pipeline route from Luggate - P Pure requires land purchase / easements**	Pipeline is approx 5km long and may need to cross private land in addition to along existing legal roads.		Easements and land agreements will take time and may delay start of construction.					3		3	3	9	Mitigate	Develop a concept design with key stakeholders to agree a preferred route for the pipeline.					3		3	2	6	Low	PD Group	
3.2	10/10/2017	**Pipeline route proposed to run for approx 4km along SH6**	Installation of pipeline alongside SH6 will require approval from NZTA		Specific design considerations need to be built into alignment and proposed route.				3	3		3	3	9	Mitigate	Engage early to understand all design considerations and requirements from NZTA.					3		3	1	3	Very Low	PD Group	
3.3	10/10/2017	**Pipeline route requires wider corridor for proposed new water pipeline**	Design of pipeline installation needs to allow for 2 x pressure mains (sewer & water) side by side.		Wider corridor required may cause issues on some parts of the proposed route along SH6 where there is limited berm available.				3	3		3	3	9	Mitigate	Engage early to understand all design considerations and requirements from NZTA.				3			3	2	6	Low	PD Group	
3.4	10/10/2017	**Location of pump station has yet to be agreed**	Land will need to be secured for construction of pump station and civil features.		Delay in development of detailed design. Delay in construction.				3	3		3	3	9	Mitigate	Feasibility works / investigations / land assessment needs to be undertaken with WWPS location approved early in project timeline.				3	3		3	2	6	Low	S&P Group	
LINKS AND DEPENDENCIES																												
4.1	10/10/2017	**Negotiations regarding ownership and O&M for Luggate WWTP affects project programme.**	Potential to affect project programme. May delay start of construction work.		Unlikely to affect pipeline design and construction. May affect the future of Luggate WWTP.	2			2			2	2	4	Mitigate	Ensure S Burns, U Glasner are kept up to date on progress of project.	2			2			2	2	4	Very Low	S&P Group	
4.2	10/10/2017	**Water supply project delayed / deferred which affects sewer main installation**	Ability to achieve costs savings through shared trench for water and wastewater pipelines not realised.		Relative construction costs of the two projects increase. Some loss of reputation with need to re trench same route later down the line	3	3					3	2	6	Mitigate	Strategic objectives for sewer pipeline remain different to water supply project. Funding for project is ringfenced and should be unaffected by water project.	3	3					3	2	6	Low	S&P Group	
4.3	10/10/2017	**Capacity upgrades to Project Pure are delayed**	Affects the ability of P Pure WWTP to receive extra load from Luggate		May need to retain existing Luggate WWTP if Project Pure cannot handle extra load. Benefits of pipeline not realised.						2	2	2	4	Mitigate	Ensure P Pure WWTP capacity upgrades proceed to allow for future Luggate and Hawea connections. Funding allowed for in LTP. PCG set up to ensure progress with all inter linked projects continue.							0		0	Very Low	S&P Group	

4.4	19/04/2018	**Water supply project delayed / deferred which affects growth/development**	Ability to allow future dvelopment in Luggate is dependent on an improved water supply.		No growth could halt or delay project.	3	3				3	2	6	Mitigate														
FUNDING AND TIMING											0		0															
5.1	10/10/2017	**Proposed construction budget for 2018/19 needs LTP approval by councillors**	Project can only proceed if the current draft LTP is adopted.		Project cannot proceed if budget is pulled.		2				2	2	4	Accept	Ring fence money to ensure project can proceed. Other projects to be sacrificed to ensure project is unaffected by budget cuts.		2				2	1	2	Very Low	PD Group	
5.2	10/10/2017	**Proposed construction budget for pipeline & pump station is not enough**	Engineer's estimates were too light. These estimates were used to set the construction budget written into the LTP for 2018/19		Shortfall in funding.		2				2	2	4	Mitigate	Current estimates look realistic and includes contingency; Pipeline est $2,413,125. Pump station est $790,913 Contingency: 15% TOTAL: $2,413,125.		2				2	1	2	Very Low	PD Group	
5.3	10/10/2017	**Construction budget allocated in 2018/19 means detailed design needs completing 2017/18**	As at Oct 2017, detailed design hasn't commenced. Need approx 3 months for design work.		Delay in development of detailed design. Delay in construction.	2					2	3	6	Mitigate	PCG group allows tracking of major milestones and deadlines. Some design work already completed. Detailed design scheduled for 7 months (target finish is May 2018)	2					2	1	2	Very Low	S&P Group	
CONCEPT AND DESIGN RISK											0		0															
6.1	10/10/2017	**Location of pump station has yet to be agreed**	Final design cannot be completed until location of WWPS is confirmed and ground profile of pipeline route known.		Delay in development of detailed design. Delay in construction.				2		2	2	4	Accept	Location of pump station unlikely to affect design. Pipeline can still be constructed whilst location of PS is confirmed.				2		2	2	4	Very Low	PD Group	
6.2	10/10/2017	**Point of connection at Wanaka airport yet to be confirmed**	Pipeline needs to allow for future connection from Wanaka airport		Delay in development of detailed design. Delay in construction.				2		2	2	4	Accept	Wanaka airport currently developing master plan strategy and already have a preferred location / strategy for their wastewater conveyance and connection.				2		2	2	4	Very Low	PD Group	
											0		0															

Appendix E – Subdivision Water Supply Concept



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Wanaka 9343
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E wanaka@ppgroup.co.nz

Client & Location:

Lake McKay Ltd
Atkins Road
Luggate

Purpose & Drawing Title:

Proposed Water
Storage Tank Location

Surveyed by:	QLDC	Original Size:	Scale:
Designed by:	-	A3	1:2500 @ A3
Drawn by:	EGH		
Checked by:	MJB		DO NOT SCALE
Approved by:	MJB		
Job No: W6068	DWG No: 009	Sheet No: 101	Revision No: 1
			Date Created: 28/04/20

C:\12DS\DATA\WKSBSSVR02\W6068 - LAKE MCKAY_10237\5 - DRAWINGS\1 - DWG\W6068 LAKE MACKAY OVERVIEW PLAN.DWG

Appendix F – ORC Water Permit

WATER PERMIT

Pursuant to Section 104C of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: Luggate Irrigation Company Limited

Address: C/- Gallaway Cook Allan, 276 Princess Street, Dunedin

Purpose: To take and use water as primary and supplementary allocations from Luggate Creek and Alice Burn for the purposes of irrigating up to 293 hectares of land, animal drinking water and communal domestic supply.

Term: Expiring 12 April 2045.

Location of Point of Abstraction:

- Site 1: Approximately 1.74 km west of the intersection of Kingan Road and Luggate Cromwell Road (State Highway 6).
- Site 2: Approximately 2.00 km west of the intersection of Kingan Road and Luggate Cromwell Road (State Highway 6).

Legal Description of land at point of abstraction: Lot 1 DP 534249 Section 1 SO 300466.

Legal Description of land(s) where water is to be used: Various within the Luggate Irrigation Company Limited Command Area, as shown on the plan attached as Appendix 1 to this consent.

Map Reference at Point of Abstraction:

- Site 1: NZTM 2000 E1302961 N5037944
- Site 2: NZTM 2000 E1302755 N5037562

Conditions

Rates and Volumes of Abstraction

1. This resource consent does not commence until 2 October 2021.

2. If this resource consent is not given effect to within a period of two years from its date of commencement it must lapse under Section 125 of the Resource Management Act 1991.

3. The take and use of surface water as primary and supplementary allocation from Luggate Creek and Alice Burn must be carried out in accordance with the plans and all information submitted with the application in September 2018 as amended by the "Amendment of Application" letter from Gallaway Cook Allan dated 19 September 2019.

4. If there are any inconsistencies between the plans and information referred to in Condition 3 and the conditions of this resource consent, the conditions of this resource consent prevail.

5. The rates and volumes of abstraction must not exceed the values set out in "Table 1: Authorised Abstractions" and the primary and supplementary abstractions must not cause the flow in Luggate Creek to fall below the respective primary and supplementary minimum flows at the SH6 flow monitoring site (located at map reference NZTM 2000:E1304656 N5038199).

Table 1: Authorised Abstractions

	Primary Allocation	First Supplementary Allocation	Second Supplementary Allocation	Total
Irrigation				
Maximum abstraction rate (L/s)	77.5	27	42	n/a
Maximum monthly volume (m^3)	192,092	269,660		461,752
Maximum annual volume (m^3)	918,620	1,225,170		2,143,790
Minimum flow (L/s) 1 November to 30 April 1 May to 30 October	 180 500	 788 788	 1038 1038	n/a
Animal drinking water				
Maximum abstraction rate (L/s)	1.5	n/a		
Maximum monthly volume (m^3)	4,018			
Maximum annual volume (m^3)	48,216			
Minimum flow (L/s)	n/a			
Communal Domestic Needs				
Maximum abstraction rate (L/s)	8.0	n/a		
Maximum monthly volume (m^3)	21,427			
Maximum annual volume (m^3)	182,500			
Minimum flow (L/s)	n/a			

Residual Flows

6. The consent holder must maintain a residual flow of no less than 100 litres per second in the North Branch Luggate Creek immediately downstream of the intake weir (NZTM 2000 E1302961 N5037944).

7. The consent holder must maintain a residual flow in the Alice Burn immediately downstream of the intake weir (NZTM 2000 E1302755 N5037562) that visually connects to the confluence with the North Branch Luggate Creek.

8. Prior to the exercise of this resource consent, the consent holder must install, maintain and calibrate a water monitoring staff gauge to enable the determination of the residual flow specified in Condition 6.

Fish Screen

9. With three months following the commencement of this resource consent, a fish screen must be designed, installed and maintained in sound working order across the full width of the water race, at a location approximately 10 m upstream of the flow measuring flume, that meets the following requirements:
   (a) A mesh size or maximum slot width of 3 mm;
   (b) A calculated average through-screen velocity not exceeding 0.12 m/s if a self-cleaning mechanism is in place; and
   (c) The sweep velocity parallel to the face of the screen must exceed the design approach velocity.

10. Prior to installation of fish screen required under Condition 9 the consent holder must submit a report prepared by a suitably qualified and experienced person to the Consent Authority, for certification that contains:
   (a) Fish screen design plans;
   (b) Confirmation that the criteria in Condition 9 will be met; and
   (c) A fish screen maintenance schedule.

11. If the fish screen required by Condition 9 is not self-cleaning then any detritus that accumulates on the fish screen must be manually removed at least once every seven days.

12. The consent holder must keep records all inspections and maintenance of the intake and fish screen and the records must be provided to the Consent Authority annually and also supplied upon request.

Abstraction Reductions at Times of Low flow

13. Prior to the exercise of this resource consent, the consent holder must develop a Low Flow Rationing Agreement for the Luggate Catchment in collaboration with the holders of Consent Numbers RM16.093.01 and RM18.345.02. The objective of the Agreement is to manage abstractions within the catchment at all times of low flows to ensure compliance with the minimum flows in Table 1. The Agreement must include (but not be limited to) the following;
   (a) A Communications protocol between the consent holder and the holders of Consent Numbers RM16.093.01 and RM18.345.02 for reducing abstractions to ensure compliance with the Table 1 minimum flows as catchment flows drop;
   (b) Giving priority to providing communal domestic supply first in terms of meeting minimum flow requirements;
   (c) A specified flow level (or levels) which triggers the reduction of abstractions;
   (d) An agreed abstraction reduction methodology (e.g. 1:1 flow sharing, pro-rata reductions, or stepped reductions); and
   (e) A process for notifying the Consent Authority when the abstraction reductions trigger flow level or levels are met and for the regular reporting of abstraction reduction actions when flows are below the trigger level (or levels).

14. The Low Flow Rationing Agreement is to be provided to the Consent Authority for certification that it appropriately meets the objective set out in Condition 13, and that the low flow trigger level or levels set under Condition 13(b) are appropriate.

15. The consent holder must review and update the Low Flow Rationing Agreement at three yearly intervals. Each updated Agreement must be provided to the Consent Authority for certification in the month of June of the year in which the review occurs.

16. This resource consent must be exercised in accordance with the certified Low Flow Rationing Agreement.

Monitoring and Reporting

17. The consent holder must install and maintain a water meter at the point of take with an error accuracy range of +/- 5% over the meter's nominal flow range, a telemetry compatible datalogger with at least 24 months data storage, and a telemetry unit to record the rate (L/s), volume (L), date and time of water taken.

18. Data from the water meter must be provided once daily to the Consent Authority by means of telemetry. The consent holder must ensure data compatibility with the Consent Authority's time-series database.

19. The water meter must be installed according to the manufacturer's specifications and instructions. There must be enough space in the pipe to allow for verification of the accuracy of the meter under Condition 22.

20. The consent holder must ensure the full operation of the water meter, datalogger and telemetry unit at all times during the exercise of this resource consent. All malfunctions of the water meter and/or datalogger and/or telemetry unit during the exercise of this resource consent must be reported to the Consent Authority within 5 working days of their observation and appropriate repairs must be performed within 5 working days. Once the malfunction has been remedied, a Water Measuring Device Verification Form completed with photographic evidence must be submitted to the Consent Authority within 5 working days of the completion of repairs.

21. The installation of the water meter, datalogger and telemetry unit must be completed to full and accurate operation prior to the exercise of this resource consent. The consent holder must forward a copy of an installation certificate to the Consent Authority within one month of the completed installation.

22. Any mechanical insert water meter must be verified for accuracy annually from the first exercise of this resource consent. Any electromagnetic or ultrasonic flow meter must be verified for accuracy every five years from the first exercise of this consent.

23. Each verification pursuant to condition 22 must be undertaken by a Council approved operator and a Water Measuring Device Verification Form must be provided to the Consent Authority within 5 working days of the verification being performed, and at any time upon request.

Irrigation Management

24. Within 12 months following the commencement of this resource consent, the consent holder must submit to the Consent Authority for certification a Scheme Management Plan. The objective of the Scheme Management Plan is to ensure the efficiency of use and conveyance of water is improved over time and must include (but not be limited to) the following;
    (a) A plan identifying the irrigation area at the commencement of this consent with the number of hectares specified;
    (b) A plan identifying any new areas of irrigation developed after the commencement of this consent with the number of hectares specified;
    (c) A plan identifying proposed new areas of irrigation still to be developed with the number of hectares specified;
    (d) A description of water use efficiency or conveyance upgrades that have taken place since the commencement of this consent including any:
        (i) Upgrades to existing open races which may including piping;
        (ii) Establishment of any water storage infrastructure;
    (e) A description of water use efficiency or conveyance upgrades that are planned within the next 3 years and the timeframes proposed for their implementation.

25. The consent holder must review and update the Scheme Management Plan at three yearly intervals. Each updated Plan must be provided to the Consent Authority for certification in the month of June of the year in which the review occurs.

26. On the tenth anniversary of the commencement of this resource consent any areas of new irrigation identified within the initial Scheme Management Plan that have not been developed for irrigation must no longer be developed and the water volume set aside for the undeveloped irrigation area must be surrendered by the consent holder by giving notice to the Consent Authority pursuant to section 138(1) of the RMA.

General

27. The consent holder must take all practicable steps to ensure that:
    (a) the volume of water used for irrigation does not exceed soil field capacity of the irrigated areas,
    (b) the irrigation does not cause surface runoff,
    (c) leakage from pipes and structures is avoided,
    (d) the use of water onto non-targeted areas is avoided,
    (e) irrigation induced soil erosion and soil pugging does not occur, and
    (f) soil quality is not degraded as a consequence of irrigation

Review

28. The Otago Regional Council may, in accordance with Sections 128 and 129 of the Resource Management Act 1991, serve notice on the consent holder of its intention to review the conditions of this consent within 3 months of each anniversary of the commencement of this resource consent, or within two months of any enforcement action taken by the Otago Regional Council in relation to the exercise of this resource consent, for the purpose of:
    (a) Determining whether the conditions of this resource consent are adequate to deal with any adverse effect on the environment which may arise from the exercise of the resource consent and which it is appropriate to deal with at a later stage, or which becomes evident after the date of commencement of the resource consent;
    (b) Ensuring the conditions of this resource consent are consistent with any National Environmental Standards, relevant plans, and/or the Otago Regional Policy Statement;
    (c) reviewing the frequency of monitoring or reporting required under this resource consent;
    (d) Varying the consented rates and volumes of take; residual flows and the SH6 minimum flow; and monitoring, operating and reporting requirements to respond to and implement:
        (i) the results of monitoring carried out under this resource consent;
        (ii) water availability, including alternative water sources;
        (iii) actual water use;
        (ii) efficiency of water use;
        (v) surface water allocation limits and minimum flows set out in any future regional plan including any review of the Regional Plan: Water for Otago;
        (vi) surface water quality limits set out in any future regional plan including any review of the Regional Plan: Water for Otago;
        (vii) new statutory requirements for measuring, recording or data transmission.

Advice Notes to the consent holder:

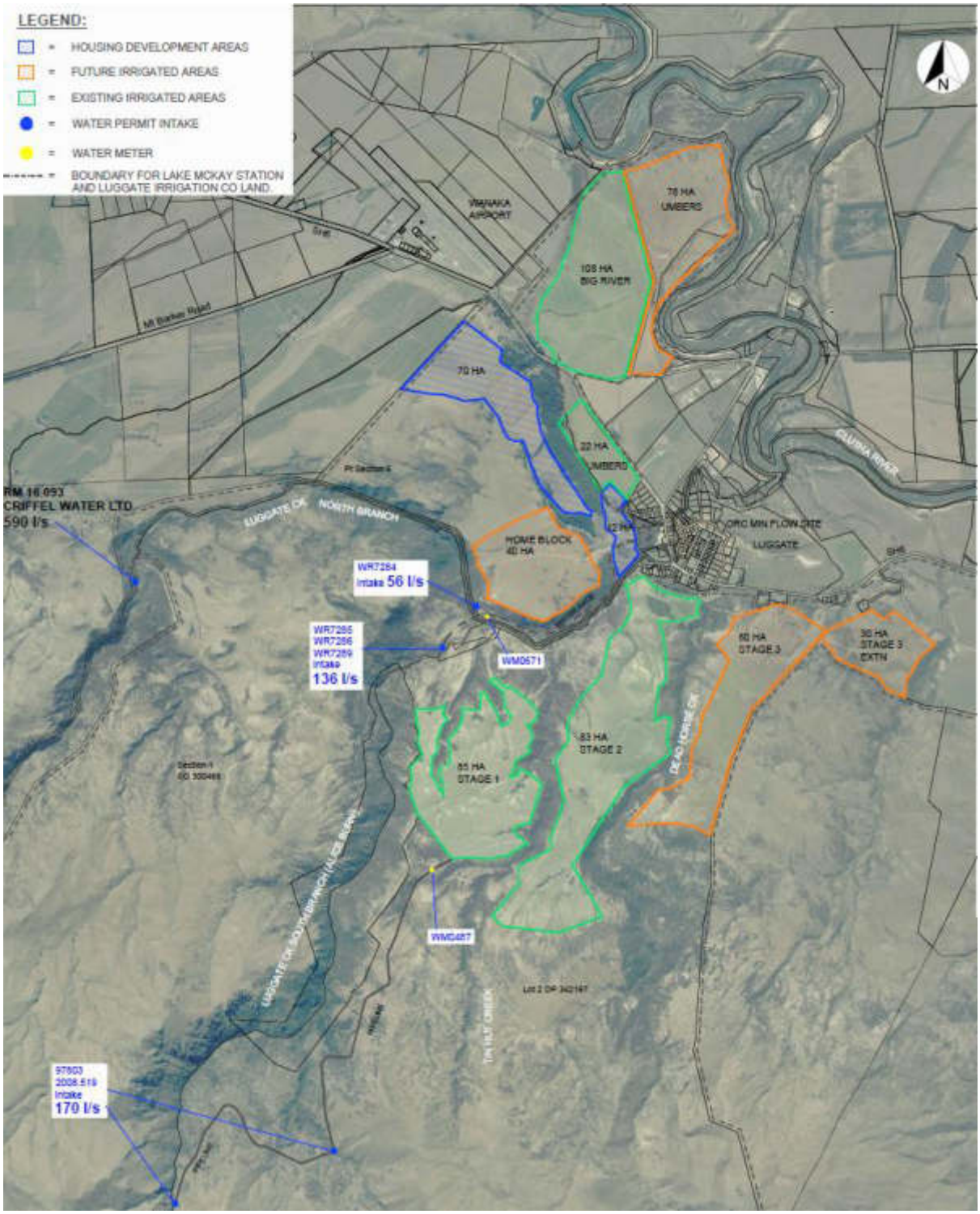
1. *The consent holder is responsible for obtaining any relevant information on minimum flows in the Luggate Creek to ensure compliance with Condition 5 and Table 1.*

2. *If you require a replacement consent upon the expiry date of this consent, any new application should be lodged at least 6 months prior to the expiry date of this consent. Applying at least 6 months before the expiry date may enable you to continue to exercise this consent under Section 124 of the Resource Management Act 1991 until a decision is made on the replacement application (and any appeals are determined). Primary allocation may be lost if an application is not made at least 6 months prior to the expiry and will be lost if an application is not made at least 3 months prior to expiry. A late application will likely result in the application being treated as supplementary allocation if any such allocation is available.*

3. *The Regional Plan: Water for Otago controls runoff and the leaching of nutrients to groundwater. Consent may be required for those discharges. Information about on farm nutrients must also be kept as of May 2014 for providing inputs to OVERSEER which models leaching of nutrients to groundwater.*

4. *The consent holder is responsible for obtaining all other necessary consents, permits, and licences, including those under the Building Act 2004, the Biosecurity Act 1993, and the Heritage New Zealand Pouhere Taonga Act 2014. This consent does not remove the need to comply with all other applicable Acts (including the Property Law Act 2007 and the Health and Safety in Employment Act 1992), regulations, relevant Bylaws, and rules of law. This consent does not constitute building consent approval. Please check whether a building consent is required under the Building Act 2004.*

Appendix 1: Irrigation Command area



Appendix G – Water Supply Correspondence with Council

Mike Botting

From: Richard Powell <richard.powell@qldc.govt.nz>
Sent: Wednesday, 13 May 2020 1:27 PM
To: Mike Botting
Subject: Luggate Water

Hi Mike,

Key info from my meeting this morning:

The existing bore field can sustainably yield **37 l/s for 16h per day**. I'm told this is likely to be enough for future development in Luggate, they are going to confirm if this includes areas outside of the scheme boundary like the WW report does.

The green light has been given to continue aquifer testing at a proposed new site, this will be needed if the airport connects to this system, this is due to be up and running mid 2022. This will trigger decommission of the existing bore field. The new bore field is located by the bridge over the Clutha and I imagine there would be a trunk main down Church Road. So if the timing works out there should be a close by point to connect, all still to be confirmed.

If you can run your numbers with the above yield and if the existing bore field can supply all of Luggate and your development, then we can confirm capacity is available, any upgrades to the network to get the capacity to your site will need to be determined.

Thanks

Rich