Southern Link Inland Port

Stormwater Assessment

Prepared for:
Southern Link Property Limited

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Prepared by:
Stantec New Zealand

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Stantec New Zealand

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Disclaimer

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Acronyms and Abbreviations

Acronym / Abbreviation	Full Name
AEP	Annual Exceedance Probability
DCC	Dunedin City Council
DCC CoP	Dunedin City Council Code of Subdivision and Development 2010
EPA	Engineering Plan Approval
DEM	Digital Elevation Model
ESNZ (NIWA)	Earth Sciences New Zealand (formerly National Institute of Water and Atmospheric Research)
GPT	Gross Pollutant Trap
HIRDS	NIWA High Intensity Rainfall Design System V4
LiDAR	Light Detection and Ranging
LINZ	Land Information New Zealand
NZBC	New Zealand Building Code
NZS4404:2010	Land Development and Subdivision Infrastructure, NZ Standard
ORC	Otago Regional Council
PCSWMM	Personal Computer Stormwater Management Model
RCP	Representative Concentration Pathway
SCS	Soil Conservation Service, now NRCS) Hydrology Method
SLPL	Southern Link Property Limited
ToC	Time of Concentration
TP108	Auckland Council Technical Publication 108
UPT	Universal Pollutant Trap

Executive Summary

Southern Link Property Limited (SLPL) seeks approval under the Fast-track Approvals Act 2024 to establish the Southern Link Inland Port (SLIP) on a 40-hectare site at 270–292 Dukes Road North on the Taieri Plains. This executive summary presents the stormwater management strategy developed to support the application. The strategy addresses both external flood hazards and internal stormwater management, ensuring that the development exhibits no more than minor effects on the downstream environment, complies with relevant district and regional planning requirements, and remains resilient to future climate change scenarios. The assessment uses industry-standard modelling tools and incorporates both historical NIWA HIRDS v4 rainfall data and climate-adjusted rainfall projections (RCP 8.5 for 2081–2100) as required by Dunedin City Council's (DCC) pre-application advice.

The site is located between Mill Stream to the north and Silver Stream to the south, with both waterways influencing flood behaviour in the area. The DCC 2nd Generation District Plan (2GP) identifies the site as subject to Hazard 1 and Hazard 2 flood overlays, reflecting the known flood pathways and depths of inundation experienced at the site during storm events. These environmental constraints have shaped the integrated stormwater strategy, which is designed to ensure that external catchment flows do not undermine the safety, operability, or environmental performance of the SLIP.

To manage external flooding, the proposal incorporates a network of diversion channels positioned around the site's northern, eastern, and western boundaries to intercept and redirect Mill Stream overflow and local runoff (with some of the associated approvals for these diversion channels proposed in an application outside of the Fast-Track process). The channels may include check dams to slow and temporarily store water, reducing peak inflows to downstream receiving environments. During more extreme events such as the 2% AEP climate-adjusted storm, diversion capacity is intentionally exceeded in a controlled manner, allowing some shallow floodwater to enter the site beneath the planned northern noise wall / acoustic barrier. This water is then temporarily stored in shallow ponding areas and within the proposed stormwater attenuation pond. Hydraulic modelling confirms that this approach avoids increasing flood levels upstream or downstream of the site, with model outputs showing a 0.01-metre reduction in peak water levels at the Silver Stream Gordon Road gauge during the 1% AEP climate-adjusted event. This confirms the proposed strategy will result in neutral or slightly beneficial downstream flood outcomes. Further refinement during detailed design will ensure safe performance up to at least the 1% AEP climate change event and an appropriate site risk management approach for residual risks in rarer storms.

Internal stormwater generated within the SLIP will be collected and managed through a piped primary network, secondary overland flow paths along road corridors, and a central stormwater attenuation pond located at the southwest of the site. The piped system has been sized to convey the 10% AEP climate-adjusted event, while the road network safely conveys the 1% AEP event. All internal flows ultimately discharge to the attenuation pond, which provides approximately 25,000 cubic metres of storage and throttles discharges to pre-development 10% AEP levels for both historic and future rainfall climates. Two controlled orifices, one fitted with a removable orifice plate, provide operational flexibility to meet both current and future rainfall intensity requirements. The pond is designed to drain within approximately 48 hours following major rainfall events, which will help minimise attraction to waterfowl and reduce bird-strike risks at Taieri Aerodrome. Outlets will be conveyed through culverts into

rock-lined impact basins before entering Silver Stream, ensuring erosion protection without significant disturbance of the waterway (with some of the associated approvals for these outlets proposed in an application outside of the Fast-Track process).

Stormwater quality is managed through a combination of source control, treatment devices, and natural polishing processes. Catchpits across the internal roading network will remove coarse sediment and debris, while Gross Pollutant Traps (GPTs) or Universal Pollutant Traps (UPTs) at key discharge locations will capture litter, hydrocarbons, suspended solids, and particulate-bound metals. A fuel-oil separator will be installed near the refuelling area. Downstream of these devices, the attenuation pond provides further treatment through sedimentation, vegetated filtration, and, if geotechnically suitable, limited infiltration through a grassed base. Decentralised treatment across the site was considered but discounted due to operational constraints associated with port activities, safety considerations, and the impracticality of maintaining numerous devices across a large industrial logistics area. Centralised treatment at a small number of outlets allows for efficient maintenance and reliable performance while protecting Silver Stream’s ecological values.

Construction will occur in stages, with stormwater elements installed progressively to ensure runoff is appropriately controlled at each phase. An Erosion and Sediment Control Plan and Construction Management Plan will provide detailed measures to prevent sediment discharge during earthworks.

Overall, the stormwater management approach for the SLIP is technically robust, conservative, and aligned with best-practice engineering, the DCC Code of Subdivision and Development, the 2GP Natural Hazards framework, and Otago Regional Council requirements. The combined external and internal management systems successfully avoid any increase in downstream flood risk, mitigate on-site flood hazards to an acceptable level, and ensure that stormwater discharges do not degrade water quality. The system incorporates resilience to climate change and provides flexibility for future operational adjustments. This integrated approach supports the granting of Fast-track consent for the development.

1 General

1.1 Scope

The stormwater management strategy for the proposed Southern Link Inland Port (SLIP) is divided into two key components: internal and external stormwater systems. The external stormwater analysis considers the broader upstream catchment area and evaluates methods for diverting 'clean' stormwater around the development to the greatest extent practicable. In contrast, the internal stormwater assessment focuses on the conveyance of stormwater within the site and identifies the treatment and attenuation measures necessary to control discharge flows appropriately. The intent of this report is to describe and demonstrate the anticipated stormwater concept design performance associated with acquiring all necessary approvals under the Fast-track Approvals Act 2024.

1.2 Code of Conduct

The Independent Reviewers of this report are Nick Keenan and Andrew Craig.

Nick Keenan is a Chartered Professional Engineer with 27 years of specialised experience in civil engineering, focusing on stormwater and surface water management. He has successfully managed drainage and hydrology components for flood protection upgrades, floodplain modelling, state highway renewals, and stormwater system designs across Australia and New Zealand. His expertise encompasses stormwater drainage design, river engineering, energy dissipation, rock armouring, bridge scour assessments, as well as culvert and bridge design. Additionally, he is experienced in flood mitigation strategies, multi-criteria analysis for project prioritisation, and providing building-level recommendations. Nick is a Chartered Member of Engineering New Zealand and a Registered Professional Engineer of Queensland (refer to CV in Appendix H).

Andrew Craig has focussed primarily on the external stormwater elements, their interaction with the site and potential offsite effects. Andrew has a civil engineering degree and is Chartered Water and Environmental Manager with over 30 years of professional experience, majoring in flood risk management. His experience covers flood risk mapping and mitigation development for strategic infrastructure projects in South Africa, the UK and New Zealand. Recent substantive experience includes Ōtaki to North of Levin Highway Project, where Andrew led the modelling and hydraulic design of transverse drainage (6 waterway bridges and 80 culverts for 24km of new State Highway 1) for Detailed Business Case, Notice of Requirements and Resource Consents, appearing as an Expert Witness before the Environment Court on behalf of Waka Kotahi (refer to CV in Appendix H).

Each have read the Code of Conduct for expert witnesses contained in the Environment Court Practice Note 2023. This report has been prepared in compliance with that Code, as if it was expert evidence presented in proceedings before the Environment Court. Unless stated otherwise, this report is within their respective areas of expertise, and they have not omitted to consider material facts known to them that might alter or detract from the opinions expressed in this report.

1.3 Project Description

The development will occur as described in the Project Description of SLPL's Substantive Fast-track Application which should be referred to for a complete description of the Inland Port development but relates to construction, use and operation of the SLIP (area marked yellow in Figure 1-1). Ancillary activities for the project are also proposed within the KiwiRail corridor (area marked blue in Figure 1-1) but are not being applied for as part of this application. However, as the ancillary activities within the KiwiRail corridor form part of the stormwater servicing of the SLIP, they are discussed in further detail in the following sub-sections of this report. The Master Plan can be seen in Figure 1-2

In summary, the Inland Port will include:

- A new rail siding off the Taieri Branch Line to enable loading, unloading and operation of a rail freight shuttle service to Port Chalmers and the wider rail network;
- Approximately 80,000 m^2 of high stud warehousing (chilled and ambient);
- Truck canopy and unloading areas;
- A 5 ha container depot facility enabling the inspection, cleaning, upgrading and repair of containers including for food grade repacking;
- Up to 5 ha of container terminal for storage of full containers including refrigerated containers;
- Break bulk storage facilities;
- Road widening;
- Ancillary activities to support the above including earthworks, construction of the rail siding, site access, internal roadways and vehicle parking, hardstand areas, landscaping, buildings for storage, administration and maintenance facilities, and associated infrastructure and works including measures necessary to manage stormwater and stabilise the site.

Construction of the Inland Port is anticipated to be undertaken in three stages however the timing of the delivery of each stage, and discrete works within each stage, may change in response to demand for logistics capacity at the Inland Port. Each stage of works will involve site clearance, earthworks, construction of buildings, hardstanding and access, installation of infrastructure, landscaping and works and management activities necessary to manage environmental effects during construction including erosion and sediment controls and construction management activities:

- Stage 1 is estimated to be completed 1 to 3 years following approval of the Project and will include clearance of the southern area of the site and construction of the ‘Stage 1’ container storage concrete pad, rail siding, container service area, warehouses, internal roading, parking and loading, road widening and construction of the new intersection on Dukes Road North, stormwater attenuation pond, Silver Stream stormwater outlets, servicing infrastructure, flood management measures, landscaping, acoustic barriers and eastern bund, and lighting.
- Stage 2 is estimated to be completed 3 to 5 years following approval of the Project and will include clearance of the northern area of the site and construction of the ‘Stage 2’ container storage concrete pad, warehouses, ancillary offices, internal roading, parking and loading, emergency egress onto Dukes Road North, expansion of the stormwater attenuation pond, landscaping, extension of the servicing infrastructure and lighting.
- Stage 3 is estimated to be completed 5 to 10 years following approval of the Project and will include clearance of the eastern area of the site, and construction of the ‘Stage 3’ warehouse and break bulk hardstand areas, internal roading, parking and loading, landscaping, extension of the servicing infrastructure and lighting

Figure 1-1: Site overview

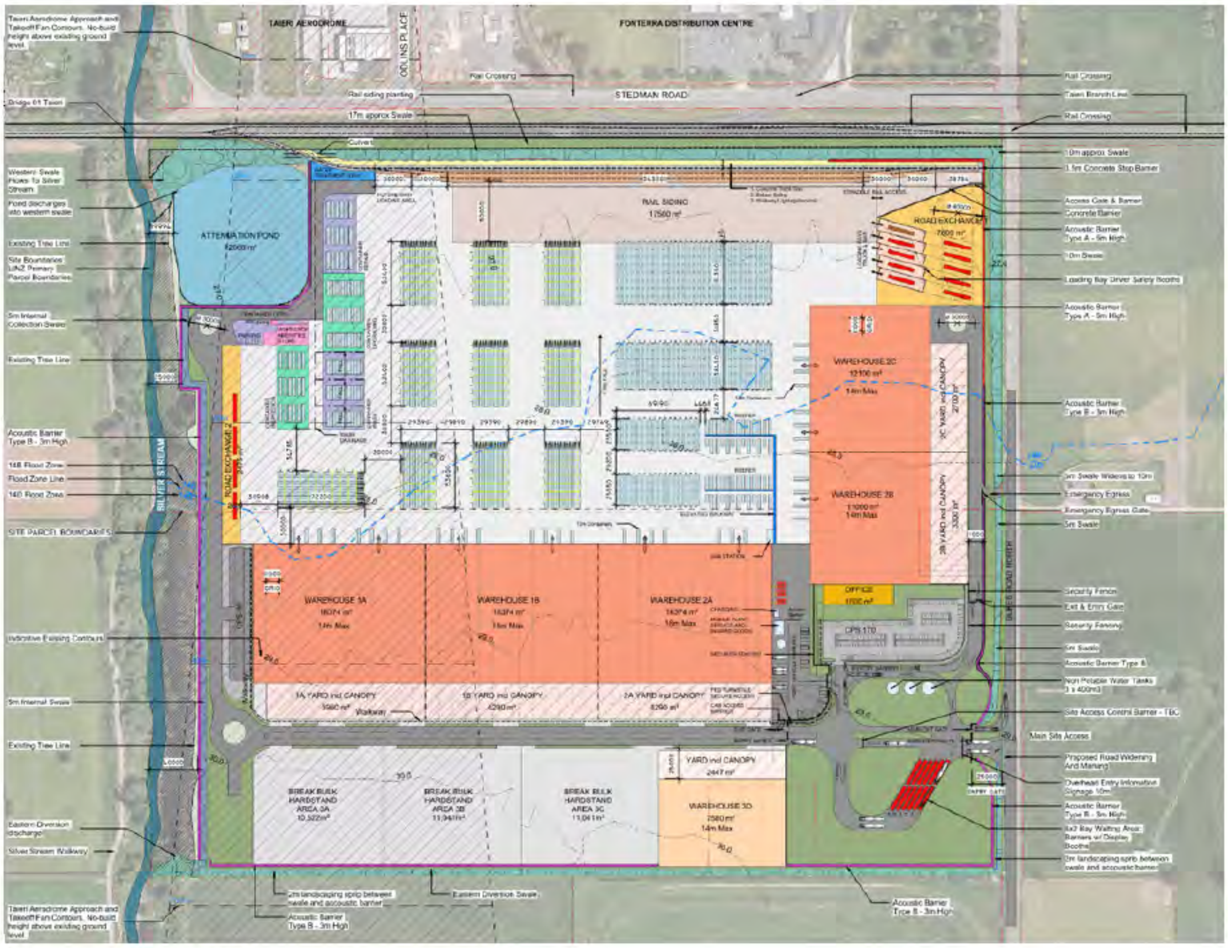

Figure 1-2: Master Plan

1.4 Existing Environment

The site of the proposed SLIP is situated upstream of Mosgiel on the eastern Taieri Plains, downstream of the North Taieri hills (e.g. Powder Hill, Ferny Hill, Swampy Summit). Two significant watercourses pass near the site that drain toward the west-southwest. These are the Silver Stream located immediately adjacent to the southern boundary of the site and Mill Stream located approximately 700m to the north of the site (refer to Figure 1-2).

Overland flow towards and across the proposed site in flood conditions is dominated by excess out of bank flow from the Mill Stream catchment (approximately 12km^2) that cannot fully pass on its main course under the railway line bridge some 700m north of the site. Flows from this catchment begin to overtop Dukes Road and enter the proposed site during a 10% AEP flood event. Between the Mill Stream and the site are some small localised catchments that supplement local overland flow. Mill Stream and the local catchments are illustrated in Figure 1-2. The overland flow path from Mill Stream through the western portion of the site is acknowledged in DCC's 2GP plans as Hazard 1 (flood) as reproduced in Appendix F. The remainder of the site is identified as Hazard 2 (flood), based on the ORC 2015 report "Flood hazard on the Taieri Plain and Strath Taieri" which was based on the simple identification of the entire area as a topographical floodplain rather than detailed modelling. The Hazard 1 and 2 (flood) overlays have associated policies to limit certain types of development unless risk from natural hazards is avoided or is no more than low.

The Silver Stream that flows past the south of the site is incised approximately 7m below the site and remains in bank at this location and does not contribute to overland flow across the site. Nevertheless, the Silver Stream is reflected in the hydraulic modelling associated with the site assessment to enable assessment of potential effects (refer to Stantec Report – Groundwater Assessment).

There is an ORC Scheduled Drain (S3) that runs from the Duke Road North / railway intersection to Silver Stream, between the railway line and Stedman Road.

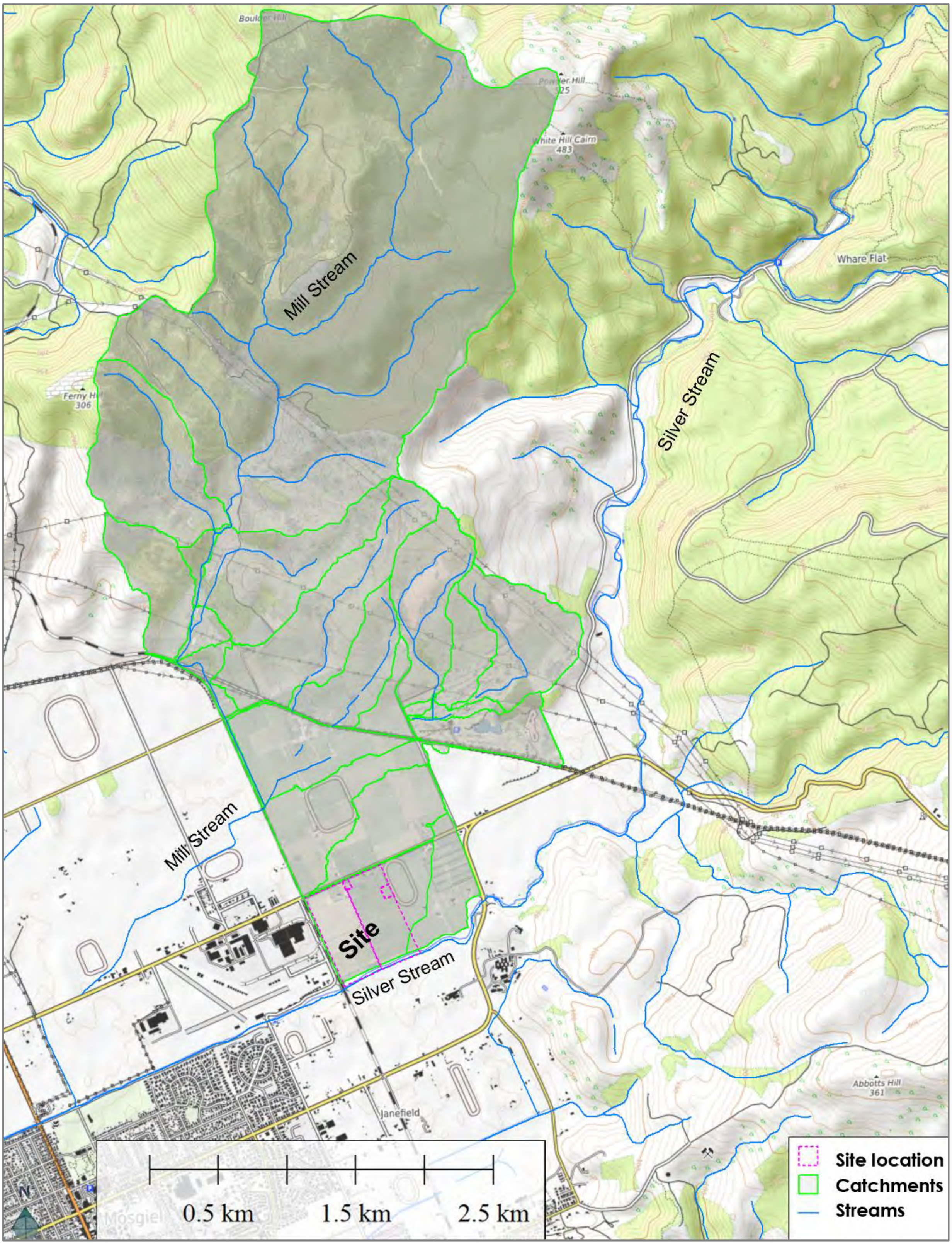

Figure 1-2: Site location and potentially contributing catchment extents

There are actual and potential HAIL sites located within the site (see the report titled "Detailed Site Investigation – 270-292 Dukes Road North Mosgiel" by Environmental Consultants Otago 2025). These HAIL sites comprise a sheep dip, a woolshed / workshop, a burn pile, dwellings, a shed, and a location with elevated concentrations of zinc. As part of the SLIP application, SLPL is proposing to undertake site contamination remediation works prior to the commencement of any stormwater related activities. As such the identified actual and potential HAIL sites will not affect the development from a stormwater perspective.

The proposed development site is presently utilised as farmland. It is recommended that stormwater quality testing be conducted prior to the commencement of construction, in order to assess the existing quality of stormwater leaving the site. This assessment will facilitate the selection and installation of suitable stormwater treatment devices during the detailed design phase, ensuring that there is no additional increase in contaminants discharged from the development.

1.5 Servicing Strategy

The stormwater design for the SLIP seeks to keep internal stormwater separated from external 'clean' stormwater as long as practicable, to allow the internal stormwater to be treated and attenuated on site for controlled release. The design calculations supporting the stormwater management plan are provided in Appendix C and Appendix E. The stormwater scheme plan for the development is shown in Appendix D including the primary system (stormwater pipeline network) layout, contours, and sub-catchment runoff areas draining to defined internal outlets.

The main features of the proposed internal stormwater drainage scheme are:

- Two main trunk pipelines, catchpits, manholes and direct connections with carrying capacity to pass the 10% AEP RCP8.5 2080-2100 climate adjusted design rainfall runoff.
- Internal road network as the secondary overland flow path system to convey the 1%AEP Historic and RCP8.5 2080-2100 climate adjusted design rainfall runoff.
- Stormwater treatment systems to trap contaminants including litter, particulates and hydrocarbons, and remove them from site runoff. This includes proprietary traps and filter systems (Gross Pollutant Trap (GPT) or Universal Pollutant Trap (UPT) devices).
- A 25,000m³ stormwater attenuation pond to attenuate post-development site runoff down to pre-development discharge rates to protect the downstream receiving environment from potential erosion or flooding effects.
- A primary stormwater outlet structure from the stormwater attenuation pond into the Silver Stream in the form of pipe or culvert, with a rock lined spillway to pass the over-design event flows from the site (noting aspects of the rock lined spillway are located within the KiwiRail Corridor and are being applied for in a separate application). This outlet will also convey secondary flows up to the 1% AEP design event (subject to detailed design refinement).
- A second stormwater outlet structure discharging from the eastern diversion swale into the Silver Stream via an open channel discharge structure such as an impact basin, flume, or chute. This outlet will convey secondary flows up to the 1% AEP (including climate change) design event.
- An emergency weir will be designed to direct excess flow out of the pond during events that exceed the climate adjusted 1% AEP design threshold. The water flowing over the weir will then flow into the rock-lined spillway.
- Provisionally stormwater infrastructure within the site boundary will remain private and will not be vested.

The proposed external stormwater drainage scheme includes:

- Diversion channels to the north and east of the Project site to direct external catchment runoff around the Project site as far as practicable, whilst allowing some water onto site in a controlled manner to mitigate potential offsite effects in large flood events.

1.6 Preapplication Correspondence DCC

SLPL has engaged with Dunedin City Council (DCC) during the pre-application phase to confirm that the planned development meets the requirements outlined in the Dunedin Code of Subdivision and Development 2010.

Details of the pre-application advice are provided in Appendix A. The pre-application correspondence has included the request for the following critical stormwater measures:

- *An outline of the event(s) that the stormwater management system for the site is designed for. (3 Waters would expect to see the system be designed to detain a 1% AEP event, and release at no greater than a 10% AEP event).*
- *In the event that retention of stormwater for firefighting is proposed, DCC would expect that this be removed from total detention volume calculations. (Draining the system manually prior to a rainfall event introduces an increased risk that the system will fail.)*

After an initial meeting in February 2025 a follow-up meeting with DCC was held on 27 November 2025 where the development was discussed at a strategic level and the methodology underwent review. During this session, DCC indicated that they may relax the design attenuation requirements with more detailed information at a later stage. In order to maintain a conservative approach at this stage, the current design philosophy will adhere to the initial (conservative) guidance from DCC, with further clarification opportunities available during detailed design and engineering approval processes.

DCC requested additional information (summarised in Appendix B) with the key recommendations from DCC outlined below. It is important to note that these recommendations pertain to stormwater management plans applicable to future design stages; nevertheless, it is crucial that they are considered so the development complies with Dunedin Code of Subdivision and Development 2010 and the DCC stormwater design note (refer to Appendix B).

When pre and post development flows are calculated, it should be done in two steps:

1. *Pre- and post-development flows calculated based on current rainfall intensities – NIWA HIRDS historical data.*
2. *Pre- and post-development flows calculated based on RCP8.5 (2081-2100).* It should be noted that this is allowing for future climate change.

The attenuation volume (if required) should be calculated based on those two scenarios and then:

3. *If there is a difference, the larger attenuation volume should be selected.*
4. *A restricted outlet should be chosen to limit the flows from attenuation, that is equal to or less than pre-development flows, for current rainfall intensities.*
5. *Provision(s) should be made to easily modify restricted outlet(s) to achieve pre-development flows based on RCP8.5 (2081-2100).*

A meeting with DCC was held on 28 January 2026 to discuss water and wastewater requirements. At the conclusion of the meeting, Stantec offered DCC the opportunity to review the current draft of the report; however, DCC indicated they preferred to wait until the report had been finalised.

1.7 Preapplication Correspondence Otago Regional Council

SLPL has engaged with the Otago Regional Council (ORC) during the pre-application phase, focusing on flood risks associated with the site. The ORC has indicated that the project must achieve hydraulic neutrality, ensuring no increase in flood risk beyond the site boundaries as a result of the proposed development.

SLPL will continue to liaise with ORC throughout the application and the project's progression, including matters related to obtaining approval under the Flood Management Bylaw for works within 7 meters of the Scheduled Drain along Stedman Road.

1.8 Regulatory Requirements

The internal stormwater drainage will meet or be in accordance with the requirements of:

- NZS 4404:2010
- Part 4 of the DCC Code of Subdivision and Development:2010
- DCC Pre-application advice (refer to Appendix A)
- DCC Standards for Stormwater Management Plans Memorandum (refer to Appendix G)
- Amendment 1 to memo stormwater design note V3 (refer to Appendix B)
- NZ Building Code E1/VM1 surface water
- District Plan – DCC 2GP – Section 5 – Network Utilities and Section 11 – Natural Hazards
- Otago Regional Plan: Water for Otago – Section 12.B – Discharge of hazardous substances, hazardous wastes, specified contaminants, and stormwater; and discharges from industrial or trade premises and consented dams
- Otago Regional Council Flood Protection Management Bylaw 2012
- NPS Natural Hazards 2025

The stormwater management plan includes provisions to:

- Protect the Project site from external flood flows and manage internal rainfall runoff throughout the site, including providing future climate change allowance.
- Minimise adverse effects on the downstream receiving environment through peak flow attenuation and water quality treatment measures.
- Comply with environmental regulatory requirements.

2 Catchment Runoff – Outside the Development

2.1.1 Existing Flood Risk to the Site

The existing environment and potential contributing catchments are described briefly in Section 0. The illustrated contributing catchments to Silver Stream at Gordon Road were modelled in HEC-HMS using observed rainfall for the 2017 flood event to confirm calibration at Gordon Road. The HEC-HMS peak simulated flow for a 1% AEP current climate also closely matched the statistical estimated 1% AEP calculated by ORC (2025). After demonstrating a successful calibration, the HEC-HMS model was tested with different duration rainfall inputs from HIRDSv4 for current climate and with climate change (RCP8.5 to 2100).

The assessment of 1% AEP critical duration showed that a single 18 hour storm can be used to adequately represent the critical duration storm for both Mill Stream and Silver Stream for the current climate and with climate change.

The flows from the HEC-HMS model provide inputs to a HEC-RAS 2D hydraulic model covering the site and its immediate environs as discussed in more detail in Appendix C.

Flood risk to the site is primarily driven by out-of-bank flows from Mill Stream that cannot all pass through the railway bridge approximately 700m north of the site. This flow overtops Dukes Road North during a 10% AEP flood event and is conveyed through the existing site towards Silver Stream.

The depth of this existing flow path is typically less than 1m deep, as illustrated in the model results (see Figure 2-1). The overtopping of Dukes Road North occurs when ponding north of Dukes Road North exceeds approximately 27.25m RL. Overtopping of the railway line beings to occur at approximately 27.5m RL, once some flow is already passing through the site. There are culverts underneath the railway intersection with Dukes Road North, that are active before overtopping but cannot convey the full flow to the scheduled drain west of the railway line.

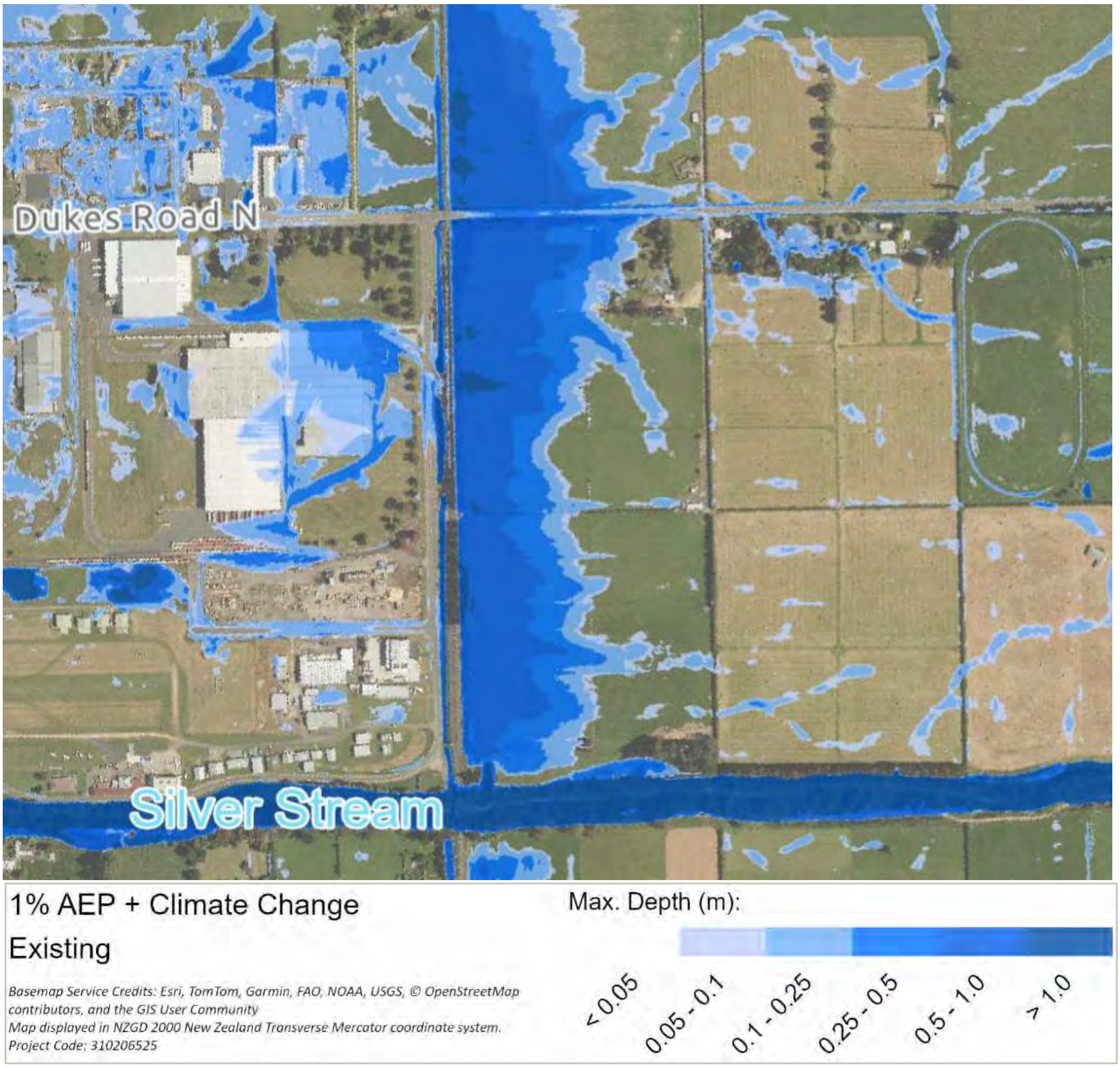

Figure 2-1: Existing condition 1%AEP (RCP8.5 2080-2100) maximum depth results.

2.1.2 Proposed Flood Management Strategy

The SLIP development includes modifying some of the ground levels (refer to Appendix D Sheet 310206525-STN-00-501-DR-090001) to create the proposed storage and operating platform area that is in some places higher than the existing ground level where overland flow or ponding occur in the baseline situation. Without mitigation, the raised ground levels could result in downstream impacts through displacement and modification of overland flow paths. The flood management strategy will therefore employ new diversion channels for overland flows to the east, north and west of the site, as shown on the drawings in Appendix D (noting aspects of the eastern diversion channel are located within the KiwiRail Corridor and are being applied for in a separate application). Both outlet points (refer to Appendix D Sheet 310206525-STN-00-501-DR-020001) are designed to mimic the existing overland flow paths to discharging to the Silver Stream. The majority of existing overland flow paths through the site will join Silver Stream just upstream of the existing railway overbridge as per the existing situation, but at a lower elevation with less potential energy via the proposed new western perimeter swale. There is a very small, poorly defined overland flow path that intersects the south-eastern corner of the site which will join Silver Stream via the proposed eastern swale approximately 75 meters upstream of its existing location.

Culverts will be required for all vehicular entrances over the swales from Dukes Road North, and for the railway siding bifurcation. The diversion channels may require check dams (refer to Appendix D Sheet 310206525-STN-00-401-DR-CI-020001) to help provide some storage and attenuation of moderate sized floods, subject to further design progression (refer Appendix D for indicative details). Check dams and culverts would likely have a small area of apron scour protection before reverting back to grass cover, since flow is not regular and the slope is gradual.

Despite the existing culverts underneath Dukes Road North and the railway line at the intersection, Dukes Road North is overtopped before a 2% AEP current climate event is reached (refer Appendix C for basis of hydraulic modelling assessment). Once this overtopping fills the capacity of the proposed diversion swales, near the 2% AEP event, water will be allowed to flow onto the site in a shallow controlled way under the northern noise wall / acoustic barrier. An example solution is illustrated in Figure 2-2, using horizontal openings near ground level covered with mass loaded vinyl flaps that would be an efficient sound dampener whilst still allowing water through in extreme floods. The structural details and optimal weight of MLV still able to open sufficiently under water pressure needs to be confirmed in detailed design. There would also be security mesh or bars installed to prevent people from climbing underneath.

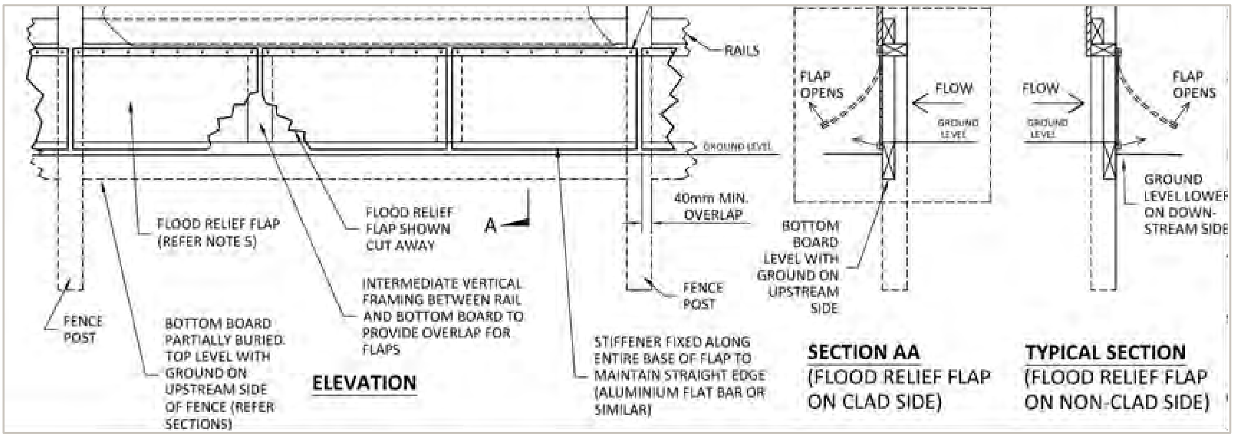

Figure 2-2: Potential MLV flap solution at base of sound wall to allow water passage

It is assumed that this overtopping flow pathway onto the site will extend from the rail bifurcation terminus for approximately 100m east, with a depth ranging from less than 0.1m during the 2% AEP event to less than 0.3m during the 1% AEP climate change event. The flood water will pond on the site within the stormwater attenuation pond and drain slowly to limit downstream impacts. The hydraulic modelling in Appendix C (with highlights presented in Section 2.1.3 below) shows that it is achievable to manage shallow controlled flooding onsite such that risk is no more than low, with less than minor offsite impacts. The detailed design will optimise the performance of these controlling mechanisms, and their relative elevations and sizes, aiming to minimise risk onsite and ensure no increase in peak flood flow passing downstream toward Mosgiel in the 1% AEP climate change event.

In events larger than the 1% AEP climate change event, the stormwater attenuation pond will spill over a controlled spillway near the southwest corner of the pond. The spillway and the receiving swale (between the pond and the railway) will have scour protection provided (rock or possibly localised use of concrete) so that the majority of the energy is dissipated before joining into the Silver Stream at a shallow gradient. Silver Stream will always be flowing strongly when the site's stormwater attenuation pond spillway is active, which further reduces the possibility of erosion. The details of the spillway, scour protection and the geometry of the confluence with the Silver Stream near the railway bridge will be progressed in detail design, to provide a stable combined system whilst avoiding or minimising works in the prevailing wetted bed of the Silver Stream. Works to the river bank to adjust the outflow from the proposed new swale into Silver Stream would be kept separate from the prevailing flowing water as far as practicable to minimise mobilisation of sediment and any potential effects on fish or aquatic ecology. Any works if required within the low flow river bed when finalising the works, for example to shift the lowest flow area away from the true right bank to neaten up the new interface, would be of minimal dimension and likely only last a week or two.

Overview of the external stormwater management features are shown in Appendix D.

2.1.3 Managing potential off-site impacts

The anticipated performance and potential impacts of the project on flood risk are presented in the external hydraulic modelling provided in Appendix C. Key points are as follows:

- The critical storm duration for the model is calculated by an 18 hour storm for current climate and climate change, applicable at the SLIP and at Mosgiel.
- For short duration events (approximately 4 hours or less) the peak out of bank flow from Mill Stream for all AEP events modelled is less than the critical duration event, meaning that external bypass flows can remain separate from internal stormwater for longer, allowing the stormwater pond to be used primarily for onsite stormwater treatment and storage. In the unlikely event of stormwater pond overflows (in excess of 1% AEP climate change), the proposed site modifications will not impact on flood extents at Mosgiel because such short duration storms are not capable of reaching the critical duration AEP storm for the Silver Stream.
- For the critical 18 hour duration 1% AEP climate change event, some external flood water will flow onto the site. The target onset of controlled site flooding, combined volume for onsite and overland stormwater to be stored on site (shallow ponding plus the deep stormwater pond) will be optimised through detailed design whilst retaining no increased flows downstream through Mosgiel. The model results indicate that this is achievable. Figure 2-3 provides a comparison between modelled water surface elevation for the Silver Stream at Gordon Road using the 1% AEP climate change event results. Peak water surface elevation for the scheme results is 0.01m below the baseline case without the scheme. The consistency of hydrograph shape reproduction indicates that there are not likely to be any adverse effects on runoff volume or peak water levels, including for smaller events or any impacts downstream on the Silver Stream and Taieri flood protection schemes. This performance will be monitored during any refinements during detailed design, and check dams can be employed within the bypass swales if required to mitigate any identified effects in smaller events.

For durations greater than the critical duration, the peak out of bank flow from Mill Stream for all AEP events modelled will be significantly less than during the critical duration event, meaning that bypass flows can again remain separate for longer, and the stormwater pond will capture onsite stormwater for treatment and storage thus providing neutrality or a small benefit to downstream flood receptors.

In a flood event larger than the 1% climate change event, the existing surrounding area will likely be heavily inundated with flood water, and railway is also overtopped. The shallow gradient of the railway will mean that water levels in this extreme event will not change dramatically, and with the project in place water levels and flow paths are expected to largely mimic baseline conditions.

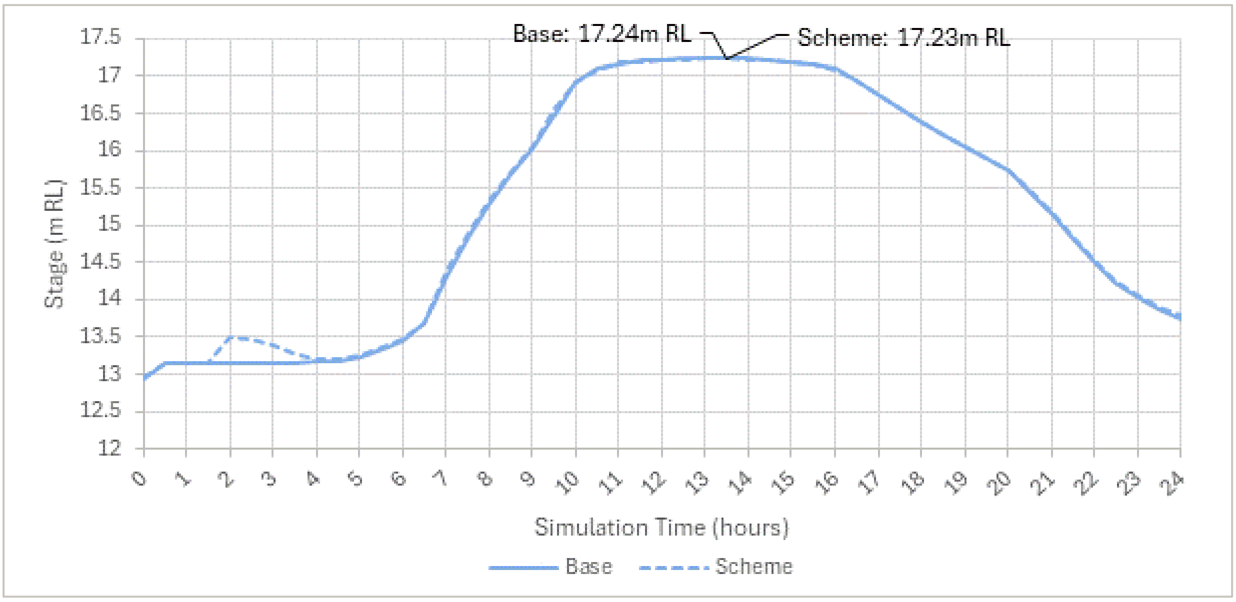

Figure 2-3: Modelled water surface elevation comparison for the Silver Stream at Gordon Road gauge location. 1% AEP climate change event.

3 Internal Site Stormwater Design

The stormwater management system proposed for the development area will be designed in accordance with DCC requirements to mitigate adverse stormwater effects associated with the project, and to minimise potential adverse impacts on adjacent properties and the environment.

A piped reticulation network will be constructed to collect rainfall runoff and direct it to designated discharge points which connect to a 25,000 m^3 proposed stormwater attenuation pond (refer to Appendix D). The overall internal site layout will be graded to ensure secondary flows are diverted to the attenuation pond when the pipes are overwhelmed. The primary function of this attenuation pond is to limit the increased runoff resulting from site paving to pre-development levels, accommodating storm events up to the 1 in 100-year recurrence interval.

The internal stormwater system is proposed to be constructed in phases to align with the staged progression of the development. The 3-waters staging plans can be seen in Appendix D which shows what stormwater infrastructure is required to service each stage. Additional Reference should be made to the Construction Management Plan and the Erosion and Sediment Control Plan (Appendix D for detailed guidance on this process.

Stormwater construction during each stage is as follows:

- Stage 1: construct stormwater attenuation pond, pond outlet, clean water diversion swales, treatment devices, and all other stormwater pipework and manholes included in Stage 1. Stub flange pipe work that intersects Stage 2 and 3 boundaries.
- Stage 2: remove stub flanges and connect to stormwater pipework from Stage 1 entering Stage 2. Construct all remaining stormwater pipework and manholes included in Stage 2.
- Stage 3: remove stub flanges and connect to stormwater pipework from Stage 1 entering Stage 3. Construct all remaining stormwater pipework and manholes included in Stage 3.

Proposed mitigations for increased peak discharge and runoff volumes will include:

- Primary stormwater pipeline network including direct stormwater drainage from building facilities, kerbline and road catchpits, manholes, and outlet structures to drain the 10% AEP (RCP8.5 2080-2100) rainfall runoff event into the proposed stormwater attenuation pond.
- Secondary stormwater network flows along internal road networks to drain the 1% AEP (RCP8.5 2080-2100) rainfall runoff event to the proposed stormwater attenuation pond.
- The proposed stormwater attenuation pond will provide attenuation storage volumes at the southwest corner of the development for holding and throttling peak discharges up to the 1% AEP (RCP8.5 2080-2100) rainfall event.
- Preliminary design anticipates the stormwater attenuation pond will have two pipe outlets with controlled discharge into the Silver Stream from the pond throttling flows to the 10% AEP historic rainfall event.
- Perimeter diversion bunding, channels and drainage (refer to Appendix D).

3.1 Basis of Design

3.1.1 Hydrology

3.1.1.1 Method

The Model has been developed using the PCSWMM Professional 2D software package developed by Computational Hydraulics Inc. (CHI). PCSWMM allows a study area to be subdivided into any number of irregularly shaped sub catchment areas to best capture the effect that spatial variability in topography, drainage pathways, land cover, and soil characteristics have on runoff generation. Stormwater runoff is therefore computed on a sub catchment by sub catchment basin[1].

PCSWMM is a dynamic rainfall-runoff simulation model used for single event or long-term (continuous) simulation of runoff quantity and quality from primarily urban areas. The runoff component of PCSWMM operates on a collection of sub catchment areas that receive precipitation and generate runoff and pollutant loads. The routing portion of PCSWMM transports sub catchment runoff hydrographs through a system of pipes, channels, storage/treatment devices, pumps, and regulators. PCSWMM tracks the quantity and quality of runoff generated within each sub catchment, and the flow rate, flow depth, and quality of water in each pipe and channel during a simulation period comprised of multiple time steps [1].

A high-level preliminary design assessment for this project was carried out using PCSWMM to establish proof of concept. The NZ building Code E1 Rational method approach was selected because it effectively calculates peak discharge, with flood volume adjustments made to allow for storage calculations for specified storm durations. Inflow hydrographs representing extended storms were created and several scenarios were evaluated to determine the critical storm needed for attenuation volume storage design.

For example, Figure 3-1 shows inflow hydrographs for post-development rainfall adjusted for climate. Each hydrograph's rising limb corresponds to a concentration time of 21 minutes in this scenario. The 21-minute storm is brief and intense, with the falling limb (21 minutes) starting after the peak flow. For storms lasting from one to four hours, rainfall intensity decreases as event duration increases which in turn allows storage requirements to be calculated and thus the critical storm to be identified.

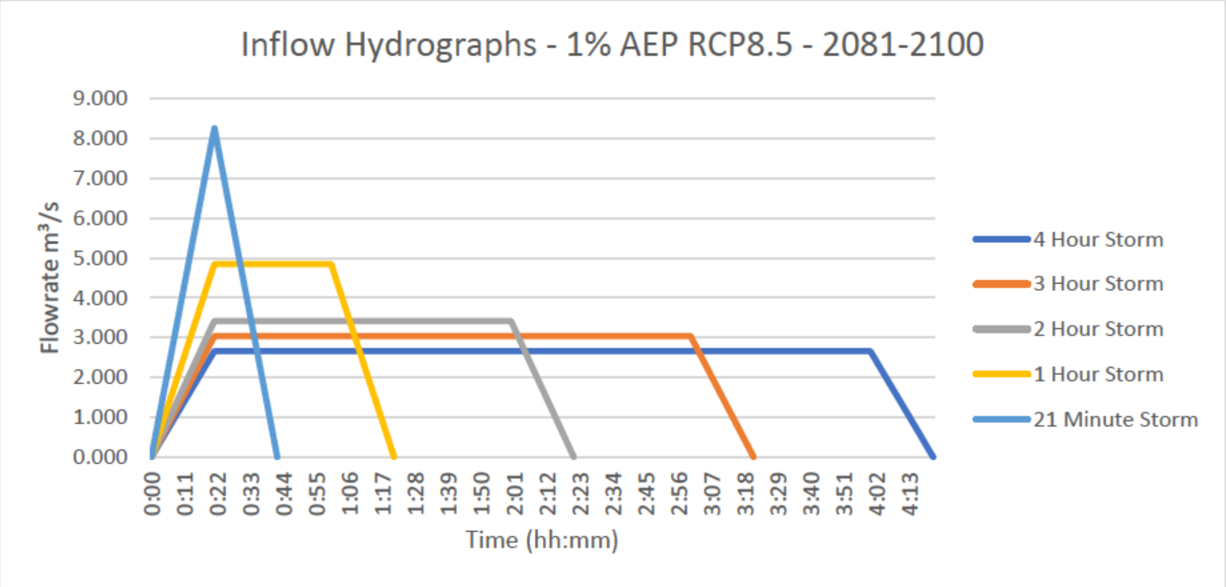

Figure 3-1: Post Development 1% AEP (climate adjusted) inflow hydrographs into the proposed attenuation pond from PCSWMM showing the range of storm durations.

The Rational formula is a widely accepted and widely used hydrologic equation for estimating peak runoff, relating rainfall intensity, catchment area, and a runoff coefficient that reflects surface

[1] Stormwater Management Model Reference Manual, Volume 1 – Hydrology (Revised), EPA United States Environmental Protection Agency

characteristics. This method was therefore chosen for this stage of design because of its straightforward methodology, but in subsequent phases it is anticipated that the Soil Conservation Services (SCS) method will be adopted (as described in Appendix G)). It is important to note that the Rational method is generally considered more conservative than the SCS method and that this is appropriate during the current phase of the design process to size pipelines and attenuation volumes within the Project area.

3.1.2 Model Inputs

The drainage and flood mitigation strategy for the SLIP is underpinned by a robust modelling framework that considers both historic and future climate scenarios as requested by DCC (refer to Appendix A and Appendix B). Two scenarios have been modelled:

- Pre- and post-development using historic rainfall data: The model simulates catchment hydrology and hydraulics based on historical rainfall intensities, using historic National Institute of Water and Atmospheric Research (NIWA) High Intensity Rainfall Design System (HIRDS) data. This allows for an assessment of existing site situation and the ability to determine the increase on runoff volumes and peak flows.
- Pre- and post-development using climate-adjusted rainfall: This accounts for future climate variability; the model also incorporates rainfall projections under Representative Concentration Pathway (RCP) 8.5 (2081–2100). This ensures that the stormwater infrastructure is resilient for future climate events.

Catchment areas within and immediately surrounding, or discharging through, the development have been defined using the ground model data from LINZ and the flowpath definition features inside PCSWMM software.

Inflow hydrographs were generated for various storm events across all catchments under both pre-development and post-development conditions. These hydrographs were entered as time series datasets into the PCSWMM model and routed to determine the necessary storage volume required to reduce post-development flows to the 10% AEP pre-development rate. This methodology ensures adherence to regulatory standards, addresses pre-application advice requests, and provides a conservative foundation for stormwater management during the current design phase.

3.1.2.1 Rainfall

Rainfall inputs are sourced from NIWA HIRD's Design System v4. Four rainfall events have been assessed for predevelopment and post development scenarios:

- 10% AEP Historic Rainfall Data
- 1% AEP Historic Rainfall Data
- 10% AEP Representative Concentration Pathway (RCP) 8.5 2081-2100 Rainfall Data (future climate with high climate change allowance)
- 1% AEP RCP 8.5 2081-2100 Rainfall Data (future climate with high climate change allowance)

Each of the rainfall events is modelled as a nested storm, which allows shorter storm duration events, with higher rainfall intensities, to be embedded inside a 24-hour storm duration.

3.1.2.2 Existing Ground Surface

The model utilises an existing ground surface which has been developed using a combination of both Light Detection and Ranging (LiDAR) data and conventional survey data.

Consultant surveyors Patersons have developed an existing ground surface using a combination of both LiDAR data and conventional survey data. The surface is in terms of New Zealand Geodetic Datum 2000 North Taieri 2000 projection and New Zealand Vertical Datum 2016.

3.1.2.3 Design Surface

The model utilises a design surface which has been developed for the proposed development layout dated 17/10/2025 (Rev C9.001). The proposed development layout is provided in Appendix D.

The design surface was built using the Stantec roading and surface design. The roading design sets the level of the design surface within the road corridor. The design surface has been built by linear interpolation between road corridors and by client requirement. This will be further refined during detailed design.

3.2 Predevelopment

3.2.1 Catchment Areas

The predevelopment catchment areas within the site boundaries have been developed using the PCSWMM built in catchment delineation tool. This tool automates catchment delineation using a Digital Elevation Model (DEM) surface of the existing ground (refer to Section 3.1.2.2).

A catchment plan showing the combined predevelopment catchment areas is provided in Appendix D.

Predevelopment catchment areas have been summarised in Table 3-1 below. Outlet locations are shown in Figure 3-2.

Table 3-1: Predevelopment catchment areas draining to each model outlet

PREDEVELOPMENT CATCHMENTS		
Catchment	**Area (Ha)**	**Outlet Node**
SW CATCHMENT EXISTING 1	65.13	Outlet 1
SW CATCHMENT EXISTING 2	12.14	Outlet 2

Figure 3-2: Outlet locations discharging into the Silver Stream

3.2.2 Catchment Flow Lengths

The catchment flow lengths for predevelopment catchment areas are defined using the built in PCSWMM catchment delineation tool. These catchment areas were verified using ground surface contours.

3.2.3 Infiltration and Runoff Coefficient

Infiltration losses for the predevelopment surfaces have conservatively assumed a heavy clay soil type with complete bush and scrub cover to represent the greenfield site. As outlined in New Zealand Building Code (NZBC) Clause E1 – Surface Water, a runoff coefficient of 0.35 is selected for this analysis.

3.3 Post Development

3.3.1 Catchment Areas

The post development catchment areas have been developed using the proposed development layout dated 17/10/2025. The proposed development layout is provided in Appendix D. The proposed development site has an area of approximately 40ha.

A catchment plan showing the combined post development catchment areas is provided in Appendix D.

A summary of post development climate adjusted (RCP 8.5 2081-2100) catchment flows to each outlet are given in Table 3-2. Outlet locations are shown in Figure 3-3. The proposed pipeline infrastructure has been sized to convey the climate adjusted 10% AEP event. The historic rainfall event was not evaluated as flows are less compared to climate adjusted.

Table 3-2: 10% AEP Post-development (climate adjusted) internal catchment flows and outlets

Contributing Catchments	Outlet	10% AEP Flow (m^3/s)
SWC PRI POST - 001, 002, 003, 004, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 018, 016, 017	Pond Outlet 1	3.31
SWC PRI POST - 024, 025, 026, 027, 029, 028, 030, 031, 032, 033, 034, 035, 005, 019, 020, 021, 022, 023, 036, 037	Pond Outlet 2	2.37

Figure 3-3: Internal pipeline layout, attenuation pond and Outlet locations discharging into the Silver Stream

3.3.2 Catchment Flow Lengths

The catchment flow lengths for post-development areas within the proposed site during a 10% Annual Exceedance Probability (AEP) rainfall event were not explicitly calculated. Instead, a conservative assumption of a 10-minute time of concentration (ToC) was applied to each sub-catchment. This approach is considered prudent at this design stage. It is anticipated that the ToC for catchments will increase in subsequent design phases, potentially resulting in reduced runoff. PCSWMM aggregates the hydrographs and routes the flows through the piped network accordingly.

The secondary catchment flow lengths (refer to Appendix D drawing No 31020625-STN-00-404-DR-CI-010002) were defined using the PCSWMM catchment delineation tool. Areas and flow lengths were verified using the ground surface contours.

3.3.3 Infiltration and Runoff Coefficient

The impervious area for the proposed development has been determined using runoff coefficients defined in the New Zealand Building Code (NZBC) Clause E1 – Surface Water. The NZBC gives a runoff coefficient of 0.90 for fully roofed and/or sealed developments. Therefore, an impervious area percentage of 90% has been conservatively set for the entire site. This will be refined in further during detailed design.

3.4 Stormwater Runoff

Stormwater runoff has been calculated for both the predevelopment site and the post development site for each of the four design rainfall scenarios (refer to Section 2.1.2.1).

The stormwater discharge hydrograph for each scenario has been calculated at each of the drainage outlets which have been identified by the Model, using the predevelopment surface and the post development DEM surfaces. This allows the difference effects of the development to be compared at locations where flows are modelled to leave the site. A summary of the predevelopment stormwater flows, and post development stormwater flows is provided in Table 3-3. Table 3-3 demonstrates that post-development scenario results in increased runoff compared to the predevelopment scenario, indicating the necessity for onsite attenuation. This requirement is addressed in further detail in Section 3.4.3).

Table 3-3:Predevelopment and post development stormwater flow

Historic Rainfall Model				
Outlet Node	**Predevelopment Historic Rainfall**		**Post development (theoretical peak discharge without attenuation and throttle)**	
	10% AEP (m^3/s)	**1% AEP (m^3/s)**	**10% AEP (m^3/s)**	**1% AEP (m^3/s)**
Outlet 1	1.52	2.74	4.39	6.11
Outlet 2	0.33	0.59	0.81	1.47
Sum Outlets	1.85	3.33	5.20	7.58
Climate Adjusted (RCP8.5 2080-2100) Rainfall Model				
Outlet Node	**Predevelopment Historic Rainfall**		**Post development (theoretical peak discharge without attenuation and throttle)**	
	10% AEP (m^3/s)	**1% AEP (m^3/s)**	**10% AEP (m^3/s)**	**1% AEP (m^3/s)**
Outlet 1	2.04	3.71	5.88	8.25
Outlet 2	0.44	0.80	1.09	1.98
Sum Outlets	2.48	4.51	6.97	10.23

3.4.1 Hydraulics

3.4.1.1 Primary System

3.4.1.1.1 Pipes

The primary system has been sized to convey the 10% AEP event with RCP8.5 2080-2100 climate adjusted rainfall without surcharging above pipe soffit.

Key model inputs that have been applied to hydraulically size the stormwater network are provided below.

- Pipes have been sized using Mannings equation
- A Mannings roughness of 0.011 has been applied to all stormwater pipes. This will be reassessed if necessary during detailed design. It has been assumed that all pipes will be concrete.
- Local losses through manholes have been considered at this stage of design but internal drop through manholes has not. K values used are listed below:
  - 0-30 degrees = 0.25
  - 30-60 degrees = 0.60
  - 60 – 120 degrees = 0.9

3.4.1.1.2 Catchpits

Stormwater catchpits have not been included in hydraulic modelling at this stage of design. Catchpit sizing, spacing and design will be completed during detailed design.

The model conservatively incorporates stormwater flow from adjacent catchment areas into the stormwater manhole node located at the upstream end of the pipe link. This approach aligns with standard methodology for this phase of design, as catchpits are typically incorporated in subsequent design stages.

3.4.1.1.3 Outlets

The stormwater discharge hydrograph for each scenario has been calculated at each of the two drainage outlets (refer to Figure 3-3) which have been identified by modelling, using predevelopment and post development surfaces. This allows the effects of the development to be compared at locations where flows are modelled (and proposed) to leave the site.

Stormwater outlets have been defined in the Model and used to assess predevelopment and post development stormwater flow. A summary of the predevelopment and post development stormwater catchment area and peak flow at each outlet is provided in Appendix E.

3.4.2 Secondary System

For this stage, the Model included a scenario in which the flows from a 1% AEP (historic and RCP8.5 2080-2100) event within the proposed development footprint are directed to the stormwater attenuation pond. This allowed both historical and future 1% AEP stormwater flows to be calculated and attenuation basins to be sized.

3.4.3 Peak Discharge Attenuation

The post development design includes one attenuation basin in the southwest corner of the proposed development. The location of the attenuation basin is shown in Figure 3-4 below:

Figure 3-4: Stormwater attenuation pond location

As per DCC preapplication consultation (refer to section 1.6), the Model has been used to assess the critical attenuation volume for two scenarios:

- Post development has been compared to the pre-development using historical design rainfall intensity
- Post-development has been compared to the predevelopment using future climate change adjusted design rainfall intensity

The attenuation basin has been sized to attenuate stormwater outflows to maintain the 10% AEP and 1% AEP post development peak stormwater discharge to the 10% AEP predevelopment peak flow with historic rainfall, with provision to discharge at the 10% AEP predevelopment peak flow with future climate change (RCP 8.5 2081-2100) in future. To achieve this, two orifices with orifice plates have been designed. This allows the orifice plates to be removed later and aligns with the DCC design standards (refer to Appendix B).

The pond is designed to remain dry between rainfall events. In the case of larger events, it is anticipated that the pond will drain within 48 hours, with exact timing to be confirmed during detailed design. This approach positively contributes to reducing the potential for increased bird activity in the vicinity of the pond.

The critical rainfall runoff event for designing the size of the attenuation basin was a post-development, 1% AEP, flood event with future climate change (RCP 8.5 2081-2100) rainfall intensity.

At this stage of design, the calculated minimum attenuation volume demand for the basin is approximately 25,000 m^3.

3.4.3.1 Historic Rainfall Event

The critical storm for the historical rainfall model is 4 hours (refer to Table 3-4). The cumulative discharge from Outlet 1 and Outlet 2 is approximately 1.760 m^3/s which is less than the maximum allowable peak discharge which is approximately 1.85m^3/s (refer to Table 3-5). For the four-hour design storm, the pond would attenuate approximately 19,140m^3 of stormwater with a maximum depth of approximately 2.48m (refer to Table 3-4).

Table 3-4: Peak outflows and attenuation requirements for historic rainfall

Storm Length	Outlet 1 (m^3/s)	Outlet 2 (m^3/s)	Total Discharge (m^3/s)	Storage (m^3)	Depth (m)
ToC Storm	0.382	1.465	1.847	7103	1.13
1hr	0.567	1.059	1.626	11,350	1.63
2hr	0.903	0.757	1.660	14,740	2.01
3hr	1.100	0.676	1.776	17,890	2.35
4hr	1.165	0.595	1.760	19,140	2.48
5hr	1.153	0.513	1.666	18,910	2.46
6hr	1.083	0.432	1.515	17,580	2.32
12hr	0.950	0.295	1.245	15,400	2.08

Table 3-5: Peak predevelopment outflow (historic rainfall)

10% Pre-development Peak Discharge Rates			
	Outlet 1 (m^3/s)	Outlet 2 (m^3/s)	Total (m^3/s)
Historic Rainfall	1.52	0.33	1.85

Figure 3-5 presents the 1% AEP event results from the PCSWMM model based on historic rainfall data for a four-hour storm. The bottom graph in Figure 3-5 illustrates the inflow at the discharge nodes: the inflow into the pond is 2.011m^3/s (shown as blue line) with a discharge via outlet 1 of 1.165 m^3/s (represented by the purple line), while outlet 2 shows an outflow of 0.595 m^3/s (depicted by the green line). The middle graph displays the pond volume over time, with a maximum required volume of 19,140 m^3. The top graph shows the variation in pond depth over time, reaching a maximum depth of 2.48m.

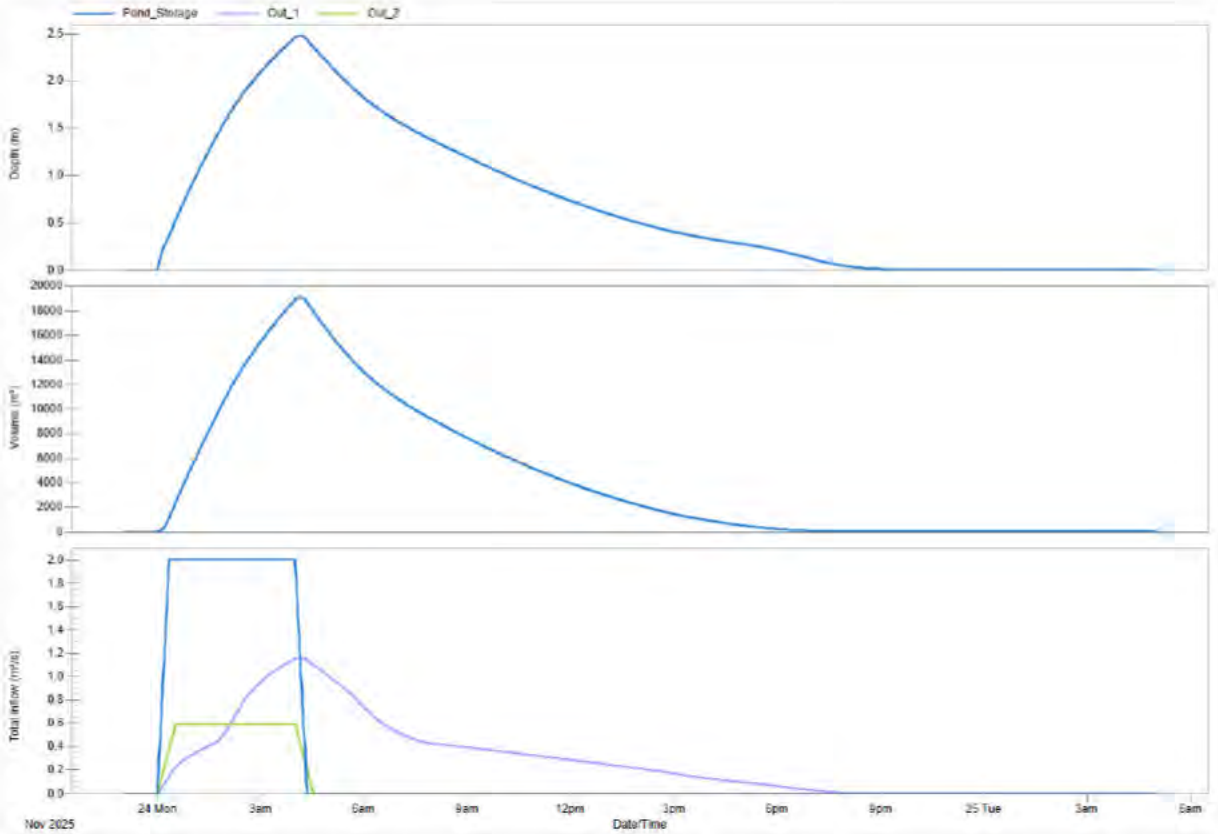

Figure 3-5: PCSWMM Outputs 4-hour critical storm with historic rainfall

DCC has requested that an orifice be sized to accommodate both the historic rainfall event and the climate-adjusted rainfall event (refer to Section 1.6). This analysis has been completed, and the current design intention is to incorporate two outflow orifices; one will utilize an orifice plate to restrict discharge for the historical rainfall scenario. The sizes of the proposed orifices are provided in Table 3-6 and Table (climate adjusted event).

Table 3-6: Pond outlet orifice sizes (historic rainfall event)

	Low Flow Orifice Ø (m)	High Flow Orifice Ø (m)
Historic Rainfall	0.42	0.525

3.4.3.2 Climate Adjusted Rainfall

The critical storm for the climate adjusted rainfall model is 4 hours refer to Table 3-7. The cumulative discharge from Outlet 1 and Outlet 2 is approximately 2.262 m³/s which is less than the maximum allowable peak discharge which is approximately 2.48m³/s (refer to Table 3-8). For the four-hour design storm, the pond would hold approximately 24,930m³ of stormwater with a maximum depth of approximately 3.06m (refer to Table 3-7).

Table 3-7: Peak outflows and attenuation requirements for RCP 8.5 2081-2100 rainfall

Storm Length	Outlet 1 (m^3/s)	Outlet 2 (m^3/s)	Total Discharge (m^3/s)	Storage (m^3)	Depth (m)
ToC Storm	0.486	1.981	2.467	9,649	1.43
1hr	0.982	1.433	2.415	15,120	2.05
2hr	1.229	1.011	2.240	19,270	2.49
3hr	1.415	0.899	2.314	23,380	2.91
4hr	1.476	0.786	2.262	24,930	3.06
5hr	1.456	0.674	2.130	24,400	3.01
6hr	1.083	0.432	1.515	17,580	2.32
12hr	0.950	0.295	1.245	15,400	2.08

Table 3-8: Peak predevelopment outflow (climate adjusted rainfall)

10% Pre-development Peak Discharge Rates			
	Outlet 1	**Outlet 2**	**Total**
RCP 8.5 2081-2100 Rainfall	2.04	0.44	2.48

Figure 3-6 graphically presents the 1% AEP event outputs from the PCSWMM model for the climate adjusted rainfall scenario during a 4-hour storm. The bottom graph in Figure 3-6 illustrates the inflow at the discharge nodes: the inflow into the pond is 2.659m^3/s (shown as blue line) with a discharge via outlet 1 of 1.476 m^3/s (represented by the purple line), while outlet 2 shows an outflow of 0.786 m^3/s (depicted by the green line). The middle graph depicts pond volume over time, indicating a maximum required volume of 24,930 m^3. The top graph shows pond depth over time, with a recorded maximum depth of 3.06 m.

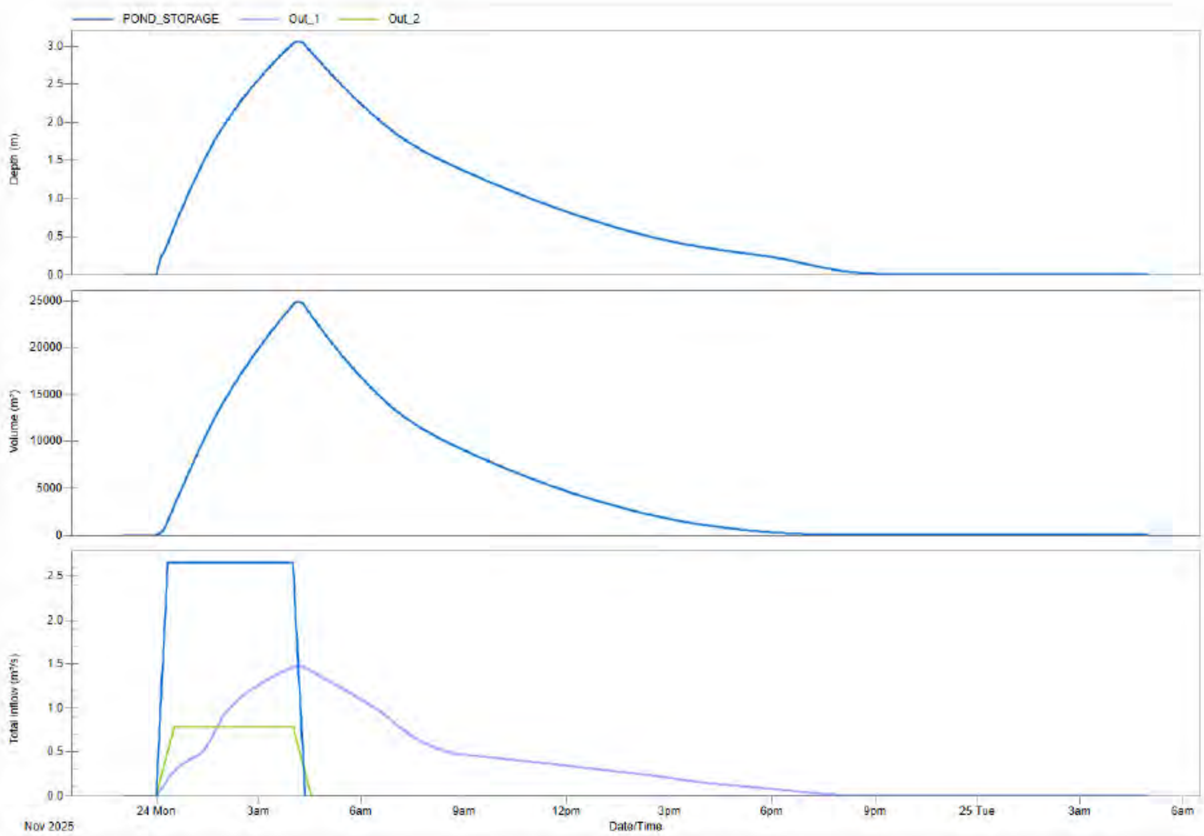

Figure 3-6: PCSWMM outputs 4-hour critical storm with climate adjusted rainfall

The sizes of the proposed orifices for the climate adjusted rainfall event are provided in Table 3-9.

Table 3-9: Pond outlet orifice sizes (climate adjusted rainfall event)

	Low Flow Orifice Ø (m)	High Flow Orifice Ø (m)
RCP 8.5 2081-2100 Rainfall	0.44	0.525

3.4.4 Model Exclusions and Limitations

The Model will be refined and developed during detailed design, and currently excludes the following:

- Stormwater catchpits and catchpit leads.
- Outlet energy dissipation and emergency spillways (which have not been designed in detail).
- Steep pipelines and energy dissipation measures, gully flows to the Silver Stream outlet.
- Optimised secondary stormwater system throughout the finalised layout.
- There is an opportunity for stormwater reuse on site. Roof runoff would be captured via tanks and can be used for the following applications:
  - Firefighting supply
  - Flushing toilets
- The outlet configuration of the attenuation basin has not been designed in detail. This will be confirmed during detailed design.

- In the PCSWMM model it is currently assumed that external and internal stormwater flows remain separate in order to calculate the target outlet sizes to attenuate the critical on-site storm duration. However, during larger AEP events of sufficient duration (typically longer than 6 hours), these flows will combine. Further information can be seen in Appendix C.
- Note that the external HEC-RAS flood model discussed in Appendix C routes all rain falling on the site to the stormwater pond and specifically accounts for the pond outlets to represent their attenuating effect. In the longer critical durations that matter for assessing potential off-site impacts, the model demonstrates that peak flood levels for 1% with climate change are matched by the proposed design solution.

3.4.5 Other Design Considerations

3.4.5.1 Discharge to Silver Stream

The discharge configuration from the attenuation ponds to Silver Stream has not yet been developed at this stage of design. The current design intent is to route flows from the attenuation pond through two culverts functioning as orifices into a rock-lined channel / impact basin. During detailed design, appropriate sizing of the rock within the channel / impact basin will be determined to mitigate erosion risks. Stormwater will subsequently travel along the rock-lined channel prior to entering Silver Stream. This approach minimises the need for direct intervention within Silver Stream and helps reduce potential associated ecological impacts. The existing discharge point (existing outlet 1) will be targeted to mimic a like for like scenario as much as possible (refer to Appendix D). A range of rock sizes have been outlined below which may be used in detailed design once the discharge velocity is confirmed (refer to Table 3-10).

Table 3-10: Indicative rock sizing range[2]

Velocity (m/s)	Rock Class	Median Rock Size (m)	Rock Mass (kg)
2.0-2.6	Facing	0.3	35
2.6-2.9	Light	0.4	100
2.9-3.9	¼ tonne	0.5	250
3.9-4.5	½ tonne	0.7	450

The proposed eastern diversion swale (see Appendix D) will discharge into the Silver Stream via a suitably sized rock-lined channel or impact basin. The precise dimensions of this feature will be determined during the detailed design phase to minimise erosion risk. The intent of this design approach is to reduce the necessity for work within the Silver Stream itself. Existing outlet 2 would be decommissioned, with a new discharge point to be established approximately 50 metres upstream (refer to Appendix D).

3.4.5.2 Stormwater Reuse

The intention is to reuse stormwater on site, but this has not been allowed for as part of the current stage of design which is conservative. When the detailed design is developed, stormwater reuse will be included, which could lead to a smaller attenuation pond and reduced pipe sizes. Details of the non-potable water approach is outlined in the Non-Potable and Potable Water Scheme Report by Stantec, provided with this application.

[2] Bay of Plenty Regional Council Guideline 2012/2, Hydrological and Hydraulic Guidelines

3.5 Stormwater Quality

3.5.1 Introduction

Land use change and development can result in downstream impacts on water quality, including increased contamination, erosion, and sedimentation. When such effects exceed minor thresholds, mitigation measures, such as energy dissipation systems, attenuation storage volumes, and treatment devices or strategies are required.

An assessment has been made of the anticipated quality of onsite stormwater (Section 3.5.2) with associated and appropriate stormwater treatment measures identified (Section 3.5.3).

3.5.2 Requirements for Stormwater Treatment

For the SLIP stormwater treatment must address contaminants typically associated with freight and industrial activities, including sediment, hydrocarbons, and heavy metals. The treatment approach should:

- Minimise contaminant generation by keeping sites clean, controlling spills, and managing materials so contaminants are stopped at the source before they can enter the stormwater system.
- Incorporate proprietary treatment devices suitable for high-traffic areas.
- Comply with regional and national guidelines (such as Stormwater Management Devices in the Auckland Region GD01 which is commonly used throughout New Zealand or similar) to ensure discharges meet environmental standards and protect the Silver Stream and surrounding environment.

The implementation of a treatment approach which adheres to each of these considerations will ensure stormwater generated at the site, or stormwater that transits the site will be appropriately managed to mitigate risks to the surrounding environment.

3.5.2.1 Baseline environmental monitoring

Establishing a stormwater quality baseline is essential for accurately evaluating the water quality exiting the site during and post development. e3 Scientific has provided preliminary data from water samples collected at Silver Stream, adjacent to the proposed development area. Gathering additional site-specific samples will strengthen the baseline and support the detailed design process. This approach will facilitate the development of effective stormwater treatment measures, thereby ensuring that contaminant levels discharged from the new development do not increase.

3.5.3 Proposed Stormwater Treatment

3.5.3.1 Overview

- All catchments: Install roadside catchpits across the internal road network to capture coarse grits, solid debris, and natural leaf litter. Catchpits serve as the initial onsite treatment of stormwater.
- All discharge points: Install GPTs or similar at each outlet to capture floating plastics, hydrocarbons, and suspended sediments with sizes down to approximately 100–150 microns. These traps are typically proprietary manhole units installed below the road corridor surface, equipped with short bypass pipelines running parallel to the main primary system pipelines. This configuration enables water quality runoff—up to 10 mm/hr of rainfall—to be directed through the GPT or similar devices, while higher flow volumes during larger storms will bypass the traps via the primary pipeline.
- Stormwater will be diverted and discharged to an onsite stormwater attenuation pond, allowing flows to traverse the pond footprint and receive supplementary "polishing" treatment. This process

includes sedimentation, limited soil infiltration and soakage to ground, and slow overland flow through the vegetated base of the basin, facilitating biofiltration and vegetative uptake of contaminants.

3.5.3.1.1 Catchpits / Sumps

Catchpits play a crucial role in capturing contaminants and are essential for managing rainfall runoff on internal roads. During detailed design, sumps will be strategically placed at intervals following the DCC CoP guidelines. Serving as the first stage of stormwater treatment, catchpits also help ensure efficient road drainage.

3.5.3.1.2 Gross Pollutant Traps and Universal Pollutant Traps

Treating water quality is essential to remove floating litter and large pollutants like oils before they enter natural waterways. GPTs are valuable tools for efficiently eliminating visible contaminants from stormwater. A range of proprietary GPT products are currently available and are being utilised more frequently around Dunedin.

For this project, it is proposed that each outlet discharging to the stormwater attenuation pond will have at minimum a GPT or UPT installed near to the pond outlets. A GPT or UPT is designed vertically for hydraulic head loss through the device where it is sited in the pipeline network and horizontally sited for ease of maintenance.

The anticipated performance of a GPT is outlined in proprietary product documentation. Generally, a GPT is engineered to remove approximately 75% of total suspended solids (TSS) down to particle sizes of 100–150 microns during water quality storm events, such as those associated with a 10 mm/hr rainfall intensity—an event typically representing the 90th percentile of annual occurrences. The effectiveness of GPTs also extends to other contaminants, including particulate metals, soluble metals, nutrients, and hydrocarbons, which are often partially bound to TSS and thereby retained within the system. Floating plastics and hydrocarbons, being lighter than water, are captured behind baffles incorporated within the GPT design. All collected contaminants remain contained within the device, even under high intensity rainfall events, preventing their re-mobilisation. Maintenance schedules for GPTs are determined based on operational practices but generally occur one to two times per year.

Figure 3-7:Typical proprietary GPT[3]

UPTs have recently been introduced in New Zealand. For instance, the HyndsFilter (see Figure 3-8) is engineered as a multi-stage treatment system featuring primary screening, media absorption, and membrane filtration. If suitable, this filter may be incorporated at the detailed design phase. Anticipated results include an 89% reduction in total suspended solids (TSS), 75% reduction in phosphorus, 50% reduction in total nitrogen, 57% reduction in metals, and 64% reduction in zinc.

[3] https://stormwater360.co.nz/projects/bupa-retirement-village-gpt/

Figure 3-8: HyndsFilter[4]

3.5.3.1.3 Fuel / Oil Separators

Fuel will be stored onsite; therefore, installation of a fuel/oil separator is anticipated near the fuel storage area. Should it be determined necessary during detailed design, the separator would be incorporated offline from the main stormwater system.

3.5.3.1.4 Attenuation Basin as Additional Treatment

The entire SLIP site drains to a central stormwater attenuation pond. The pond is primarily designed to attenuate peak stormwater discharges during high-flow events. For water quality flows downstream of the GPT, the pond floor may provide incidental opportunities for vertical infiltration through the topsoil, biofiltration and nutrient uptake via grass or vegetated linings and their root systems, as well as sedimentation resulting from reduced flow velocities. This methodology will be validated in the detailed design phase, where geotechnical engineering recommendations will establish whether the pond is suitable for grass lining or if an impermeable lining is necessary.

[4] https://www.hynds.co.nz/product/hyndsfilter

Figure 3-9: Example of a stormwater attenuation basin showing grass coverage (image courtesy of aqualisco.com)

3.5.3.1.5 Additional Stormwater Treatment Devices

In the detailed phase, monitoring or investigations will be conducted to identify water quality values discharging from site to the downstream receiving waters. Once this information is determined, further steps for water quality design will be implemented if required.

3.5.3.1.6 Decentralised versus Centralised Approach

A decentralised approach would mean using distributed devices throughout the reticulation network to serve smaller catchment areas. Due to the nature of the development a decentralised treatment approach is not practically feasible due to the port activities and access / health and safety constraints to maintain decentralised devices. Therefore, a centralised approach will most likely be adopted during detailed design with the exception of providing a fuel/ oil separator near the fuel storage area (refer to Appendix D).

A centralised strategy leverages significant land and pipeline gradients, as well as the servicing of the entire development area by two internal outlets. Minimising the number of water quality outlets was deemed most conducive to achieving sustainable, cost-effective maintenance for the client, without adversely affecting stormwater treatment outcomes.

3.5.3.1.7 Potential for Impacts in Receiving Environment

The initial ~25mm or ~5mm/h of any rainfall event (i.e., the “first flush”) will either be directed to the trade wastewater system (if arising from the wash bay) or pass directly through sumps and proprietary stormwater treatment devices and the storage pond, so that the majority of pollutants are captured and stored within the site for periodic removal through a maintenance regime. This treatment train approach provides the best practicable output water quality, and aligns with current New Zealand good practice for stormwater runoff treatment from contaminant sources such as roads, carparks, highways and commercial/industrial land uses.

When evaluating potential for impacts on volume or temperature, context is required in terms of existing ecological environment (covered in more detail in the e3 Scientific Ecology Report) and the relative magnitude of the site's stormwater discharge compared to the receiving environment:

- In terms of 'prevailing baseflow' conditions in the Silver Stream, that occur approximately 90-95% of the time while it is not raining significantly, the stormwater pond will be dry. There will be no standing water, and no discharge. Therefore, the system will not have any impact on the flow regime in the river in terms of either volume or temperature.
- The catchment area to Silver Stream at Gordon Road is 94km^2, and the catchment area to Silver Stream immediately downstream of the railway bridge (scheduled drain s3 confluence, depending on assumptions regarding overland flow from Mill Stream) is approximately 86km^2. The maximum new paved area from the fully developed site (excluding stormwater pond and swales) is <38 hectares (<0.38km^2), i.e., in the order of 0.4% of the catchment area at the effective discharge location.
- During a 10% AEP current climate rainfall event, the peak flow in the Silver Stream reaches 164m^3/s (refer Table 4-3 in Appendix C model build report, which references ORC 2025 analysis). The stormwater pond outflow is constrained in this event to 1.85m^3/s, which is in the order of 1% of the flow in the Silver Stream near the site. The captured volume of storage, above the 1.85m^3/s threshold, is released over a period of 24-48 hours depending on magnitude/volume stored, which is relatively similar for the time taken by elevated flows in the Silver Stream to recede, therefore the stormwater discharge is still well diluted.
- During more frequent events (smaller peaks than the 10% AEP current climate event), the increased impervious area on the site may contribute to an increase in the volume of treated stormwater being discharged, although this also occurs when flows in the Silver Stream are proportionately elevated. Two scenarios are described below for winter and summer respectively:
    - If a flood event less than 10% AEP current climate occurs in **winter**, the entire catchment is generally more saturated and baseflows in the Silver Stream are typically higher (in the order of 0.5-1m^3/s). Baseline temperatures in the stream in winter are in the order of 5 degrees, and stormwater is less likely to be very hot, therefore any transient (short duration) heat injected into the river at the start of a rainfall event is likely to be very diluted and short lived, and will not contribute significantly to peak or sustained elevated water temperatures in the stream.
    - If a flood event less than 10% AEP current climate occurs in **summer**, Silver Stream baseflows are lower (typically in the order of 0.1-0.2m^3/s, acknowledging that such low flows may be hard to measure accurately) and stream temperatures can vary from about 15 to as high as 25 degrees on a very hot day. If a light shower occurs under these conditions, the initial temperature of stormwater runoff may be high, due to shallow runoff from hot surfaces. A proportion of this heat may be removed through contact with the pipes and below-ground elements in the treatment train. This initial warm water will be a very short duration discharge with limited ability to cause sustained elevated temperatures in the stream. The stream flow will also respond to the rainfall providing broadly proportionate dilution. In moderate intensity or longer duration summer rainfall, the rainfall will cool surfaces and stormwater discharge temperatures will rapidly reduce after the first flush, therefore will not increase stream temperatures by a significant margin or long period. The evaluation of existing ecological receptors, and their potential sensitivity to temperature changes, is discussed in the e3 Scientific Ecology Report.

3.5.3.2 Erosion Controls

Implementing effective erosion controls will be essential to prevent bank erosion and sediment discharge into the Silver Stream. Post-development flow rates at the site are expected to closely replicate pre-development runoff, indicating a low increased risk of erosion compared to existing conditions. This assessment will be validated during the detailed design phase; however, if necessary, appropriate erosion mitigation measures may include but not be limited to the following:

- Impact basins – a fixed feature energy dissipation device installed at an outlet to reduce water velocity and scour potential. These structures slow and spread out high-velocity discharge by forcing the flow through a controlled basin, thereby reducing downstream erosion and protecting receiving channels.
- Rocked lined flumes or chute – these are constructed channels lined with rock that safely convey concentrated runoff down steep slopes, preventing erosion by armouring the surface and reducing flow velocity.
- Gabian baskets – wire-mesh cages filled with angular rock line channels beds and/or banks to resist erosion, dissipate energy, and retain/shape channels. These baskets remain permeable and flexible under settlement and hydraulic loading.
- Rock bags – rock bags consist of durable mesh sacks filled with stone that can be quickly placed to provide temporary or semi-permanent stabilisation, dissipating flow energy and preventing scour around outlets or along drainage paths.

3.5.4 Spills

3.5.4.1 Spill Event and Immediate Response

If a spill occurs on-site, the primary objective is to prevent contaminants from entering the stormwater system and ultimately discharging into the Silver Stream. Therefore, the site must implement rapid containment measures such as deploying spill kits, temporary bunding, and isolating the affected area. These actions would be supported by trained personnel following an established Spill Response Plan, which includes notifying the site manager and relevant authorities (e.g., DCC and ORC) as required under local bylaws and consent conditions. These measures will be confirmed in the detailed design stage.

3.5.4.2 Containment and Treatment Measures

The stormwater network for the SLIP is designed to convey runoff to an attenuation basin, but these systems are not intended for large-scale spill containment. In the event of a spill, the spill shall be contained to prevent contaminated water from entering the Silver Stream. Collected spill material should be removed using vacuum trucks or absorbent media and disposed of in accordance with appropriate standards. Where residual contamination remains, on-site treatment such as temporary filtration or controlled discharge to a trade waste system may be required to comply with the Dunedin Code of Subdivision and Development and other appropriate standards.

4 Summary

The stormwater management strategy for the SLIP has been developed to address both external catchment flows and internal site runoff, ensuring robust flood protection, regulatory compliance, and environmental stewardship. The approach integrates advanced modelling, conservative design principles, and future climate change allowances to safeguard the site, surrounding properties and downstream environments.

4.1 External Stormwater

The external stormwater management strategy for the SLIP has been developed in response to the flood risk posed by upstream catchments, particularly out of bank overflows from Mill Stream. Hydraulic modelling has demonstrated that during major rainfall events, out-of-bank flows from Mill Stream, which cannot be fully conveyed under the railway bridge north of the site, may overtop Dukes Road North and traverse the existing site toward Silver Stream. This is broadly consistent with the Hazard 1 (flood) overlay in the DCC 2GP.

To mitigate the flood risk, the proposed development incorporates diversion channels and potentially check dams designed to redirect and attenuate external flows around the periphery site for moderate events, while allowing controlled flow across the western portion of the site during extreme events to reduce potential for offsite impacts. The approach aims to avoid increasing peak flood levels either upstream or downstream of the site. Modelling (refer to Appendix C) confirms that the approach, subject to detailed design refinements, will be able to achieve less than minor effects on flood levels offsite in both historic and climate-adjusted rainfall scenarios.

Model results indicate a minor (0.01m) reduction in peak water surface elevation for the Silver Stream at Gordon Road gauge location following development of the site. Flood risk within the site, from overland flow approaching the site, can be managed to only occur in rare events. Detailed design will further refine the optimal performance of the internal and external stormwater design features to ensure no more than minor increases in flood level, and to ensure safe operating area up to at least the 1% AEP event with climate change and a flood response strategy to manage shallow paths and any residual risks onsite during more extreme events in line with the NPS Natural Hazards.

4.2 Internal Stormwater

Internally, the site's stormwater system consists of a piped reticulation network, secondary overland flowpaths via the internal road network, and a consolidated stormwater attenuation pond. This system is designed to convey and attenuate runoff from both historic and future climate rainfall scenarios, in accordance with DCC requirements. The attenuation pond is sized to throttle post-development peak discharges to pre-development rates for both 10% and 1% AEP events, with provision for future climate change, at the internal site critical duration. Two outlet orifices allow for flexible management under different rainfall scenarios, ensuring that the site's discharge does not adversely affect downstream environments. Water quality is addressed through a combination of catchpits, gross pollutant traps, and vegetated attenuation pond floor, targeting sediment, hydrocarbons, and heavy metals. The centralised approach to treatment ensures efficient maintenance and compliance with environmental standards.

4.3 Integrated Stormwater Outcomes

The integration of external and internal stormwater management is a key feature of the overall strategy. The design intent is to keep external 'clean' stormwater separate from internal site runoff for as long as practicable, enabling effective treatment and attenuation of internal flows before controlled release to Silver Stream. During large flood events in the order of 2% AEP or higher, some external water will be allowed onto the site in a controlled manner, with the shallow flow paths and the stormwater attenuation pond optimised to minimize risk onsite whilst avoiding any offsite increase in flood risk (refer to Appendix C). The combined strategy of diverting external flows, managing controlled site flow paths, and robust internal attenuation minimises flood risk to the site and downstream areas, even under future climate scenarios and different storm durations. It is our understanding that this approach meets all relevant regulatory requirements, with conservative assumptions and flexibility for future refinement.

Appendices

Appendix A DCC Pre Application Advice

20 February 2025

Southern Link – Logistics Park
C/- Ms Joanne Dowd
Port Otago
[redacted]

Via email: [redacted]

Dear Joanne

DCC FEEDBACK FOLLOWING PRESENTATION

Following the consultation meeting on 12 February, the following comments from various DCC departments comprise a preliminary (and not exclusive) indication of the matters the DCC would like to see included in the Southern Link – Logistics Park proposal.

Transportation Matters
DCC Transport will require the section of Duke's Road North north of Stedman Road to be widened and a right run bay implemented, as identified in the integrated transport assessment that was circulated prior to the meeting on the 12th. As part of this, a footpath connection should be added to connect to the existing footpath on Stedman Road. This will require liaison with KiwiRail as part of the level crossing upgrade to make sure there is appropriate provision for pedestrians. Duke's Road North is a high productivity motor vehicle ("HPMV") route and to the south of Stedman Road is formed to an appropriate standard. There are known issues on the Mosgiel network around travel time delay, safety and the volume of heavy vehicles traveling through the centre. The volumes of heavy vehicle movements identified in the ITA are unlikely to significantly worsen these issues. The overall objective of shifting more freight to rail is likely to have a positive effect, especially on carbon emissions, safety and amenity on SH88.

There are aspects of the ITA that are not clear, or where further information would be helpful to understand the impacts on the transport network. Specifically:

- The ITA should include a little more information about the proposed new rail movements, including any identified impacts on other level crossings including Beach St and Wickliffe Terrace in Port Chalmers and St Andrew Street. The ITA alludes to increased rail movements south from the site but doesn't identify if this will be new rail services, or can be accommodated on existing services.
- The assessment of truck volumes would benefit from clearly stating the assumptions around what growth in freight volume is expected from the existing Dynes/Icon logistics movements, and what movements are anticipated from other companies using the site. Currently the ITA doesn't appear to show any growth in Icon logistics movements using heavy vehicles.
- The existing Icon logistics movements outlined in the ITA don't clearly show which heavy vehicle movements will shift to rail, which will remain on road and which are no longer be needed due to more efficient operation. This assessment could be presented more clearly and would benefit from including vehicles per day and well as annualised volumes. It is unclear at present how much of the existing icon heavy vehicle movements to and from the south via SH1 will travel on SH87, or can be shifted by rail.

- The assessment of freight volumes assumes that all movements associated with Sawyers Bay, 88 Parry St, T'Shed and the container depot on Strathallan will shift. If these sites are no longer used by Dynes/Icon logistics, other logistics or industrial uses may operate from these sites and some assessment of the potential for new uses to generate heavy vehicle movements should be included in the ITA.
- Clearer timing for the different stages would be helpful in assessing impacts on the overall transport network.
- The ITA indicates that 250 vehicles per day will be associated with the site, but only provides information about the anticipated 20-25 heavy vehicle movements. Some information about how the 250 vehicles per day figure was reached and what light vehicles movements are anticipated should be included in the ITA.
- Details of whether the internal site roads will be public or private, and what standards these will be constructed to would be helpful.

DCC contact: Helen Chapman, senior transport planner
Email: [redacted]

Noise and Light Spill
The DCC would appreciate seeing an acoustic assessment for the site/proposal as soon as possible, and anticipates that this will address construction noise and construction noise standards, with modelling for the site over various stages of development, and details of the mitigation measures proposed. It is expected that the acoustic assessment will detail the types and levels of construction and operational noise; and will include a draft noise management/mitigation plan.

Information regarding sources and levels of light-spill would also be helpful, together with details of the measures proposed to manage these.

DCC contact: Tanya Morrison, acting team leader Environmental Health and Alcohol Licensing
Email: [redacted]

3 Waters
Information regarding the following matters would be helpful:

(Water)
- Details of anticipated treated water consumption, excluding fire flows. Estimated average daily consumption (annual average), daily peak use (maximum daily use) and peak hour use.
- A description of what treated water would be used for on site.
- An estimated number of people on site after full establishment of site.

(Stormwater)
- An outline of the event(s) that the stormwater management system for the site is designed for. (3 Waters would expect to see the system be designed to detain a 1% AEP event, and release at no greater than a 10% AEP event).
- In the event that retention of stormwater for firefighting is proposed, DCC would expect that this be removed from total detention volume calculations. (Draining the system manually prior to a rainfall event introduces an increased risk that the system will fail.)

(Wastewater)
- An estimate of daily wastewater flow from site (including any trade waste).
- A description of what items on-site would be connected to wastewater from the site.

(General)
- Clarify firefighting provisions.
- How much onsite tank storage is planned?

- Is pond stormwater retention required to meet firefighting requirements?
- How much extra tank storage would be required in the event stormwater retention wasn't viable?
- 3 Waters would like to see provisions made for stormwater to be utilised for non-potable applications on site.

DCC contact: Andrew Budd, subdivision support officer City Growth Team
Email: [redacted]

Geotechnical / Natural Hazards
The DCC notes that, from a natural hazards perspective, the underlying soils are alluvial flood sediments, with deep soils. The site lies to the east of any areas mapped as potentially liquefiable, so it is likely that normal foundation design from relatively shallow investigation is all that would be required.

Stormwater flows are a significant issue, and there are recognized overland flow paths, both flood and ephemeral. While any stormwater controls and amendments to existing overland flow will need to be reviewed by the Otago Regional Council, the DCC is likely to have a number of requirements for any earthworks on site. Details of how such works will be undertaken so as to avoid displacing stormwater onto neighboring properties, or creating undue concentrated flows would be helpful (noting that any bunding would have to be lower than the true left flood bank to avoid increasing risk to the residential zone on the south side of Silver Stream). Information about proposed flood protection works would be appreciated.

DCC contact: to be confirmed, but in the interim Karen Bain, associate senior planner
Email: [redacted]

Hopefully this summary is helpful to you. Please keep in touch – the DCC would appreciate early and ongoing involvement as you progress your proposal.

Ngā mihi

Karen Bain
Associate Senior Planner

Appendix B DCC Stormwater Design Note

DUNEDIN CITY COUNCIL | kaunihera a-rohe o Ōtepoti

03/02/2023

To whom it may concern

This is to advise that there are new operative rules for stormwater management in the Second Generation District Plan (2GP) which mean, DCC 3 Waters is now taking a modified approach to Stormwater Management Plans (SWMP).

We ask that you familiarise yourself with Rule 9.9.X of the 2GP when stormwater management plans are required.

When pre and post development flows are calculated, it should be done in two steps:

1. Pre- and post-development flows calculated based on current rainfall intensities – NIWA HIRDS historical data.
2. Pre- and post-development flows calculated based on RCP8.5 (2081-2100).

The attenuation volume (if required) should be calculated based on those two scenarios and then:

3. If there is a difference, the larger attenuation volume should be selected.
4. A restricted outlet should be chosen to limit the flows from attenuation, that is equal to or less than pre-development flows, for current rainfall intensities.
5. Provision(s) should be made to easily modify restricted outlet(s) to achieve pre-development flows based on RCP8.5 (2081-2100).

These rules are the result of mediation between the DCC, ORC and developers to find middle-ground that is practical and takes into consideration projected rainfall intensities.
This approach has the following benefits:

6. Using only RCP8.5 for pre- and post-development calculated flows increases the post-development flows in the present. Flows will increase due to a larger impermeable area and stormwater management system outlets that are sized for RCP8.5 intensities/future flows. This potentially makes current stormwater issues worse in the near term.
7. In a number of cases, we were requesting to calculate the pre-development flows based on historical data and post development flows based on projected data - RCP8.5
This was often resulting in non-feasible attenuation volumes. The above changes will remedy this situation.

I will be happy to discuss this should you have any questions?

The above approach will be formalized more in the due course (guidance memo), however this approach is what we will be expecting from the consultants, designers, developers from now on.

Please feel free to circulate this information among your colleagues.

Thank you.

Yours sincerely

Jakub Kochan
Subdivision Engineer
3 Waters

Appendix C External Hydraulic Modelling

Southern Link Inland Port:

Hydraulic Model Build

Stantec

Prepared for:
Southern Link Property Limited

Date:
18 February 2026

Prepared by:
Stantec New Zealand

Project/File:
310206525

Stantec New Zealand

Revision Schedule

Revision No.	Date	Description	Prepared by	Quality Reviewer	Independent Reviewer	Project Manager Final Approval
1	2/02/2026	DRAFT	C Bradbury	M Barber	A Craig	S Lloyd
2	18/02/2026	Final	C.Bradbury	M.Barber N. Keenan	A.Craig	S.Lloyd

Disclaimer

Prepared by: CBradbury Andrew Craig
Signature

Calum Bradbury / Andrew Craig
Printed Name

Reviewed by:
Signature

Matt Barber / Nick Keenan
Printed Name

Approved by:
Signature

Sarah Lloyd
Printed Name

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1 Introduction

Stantec prepared a hydraulic model to inform design and assessment of potential effects for a proposed development at Southern Link Inland Port (SLIP). This model build report sits as an appendix to the Stormwater report, to collectively underpin the application for fast-track consent. The project description is provided in the stormwater report, with design drawings as separate appendices. The location of the site north-east of Mosgiel is shown below.

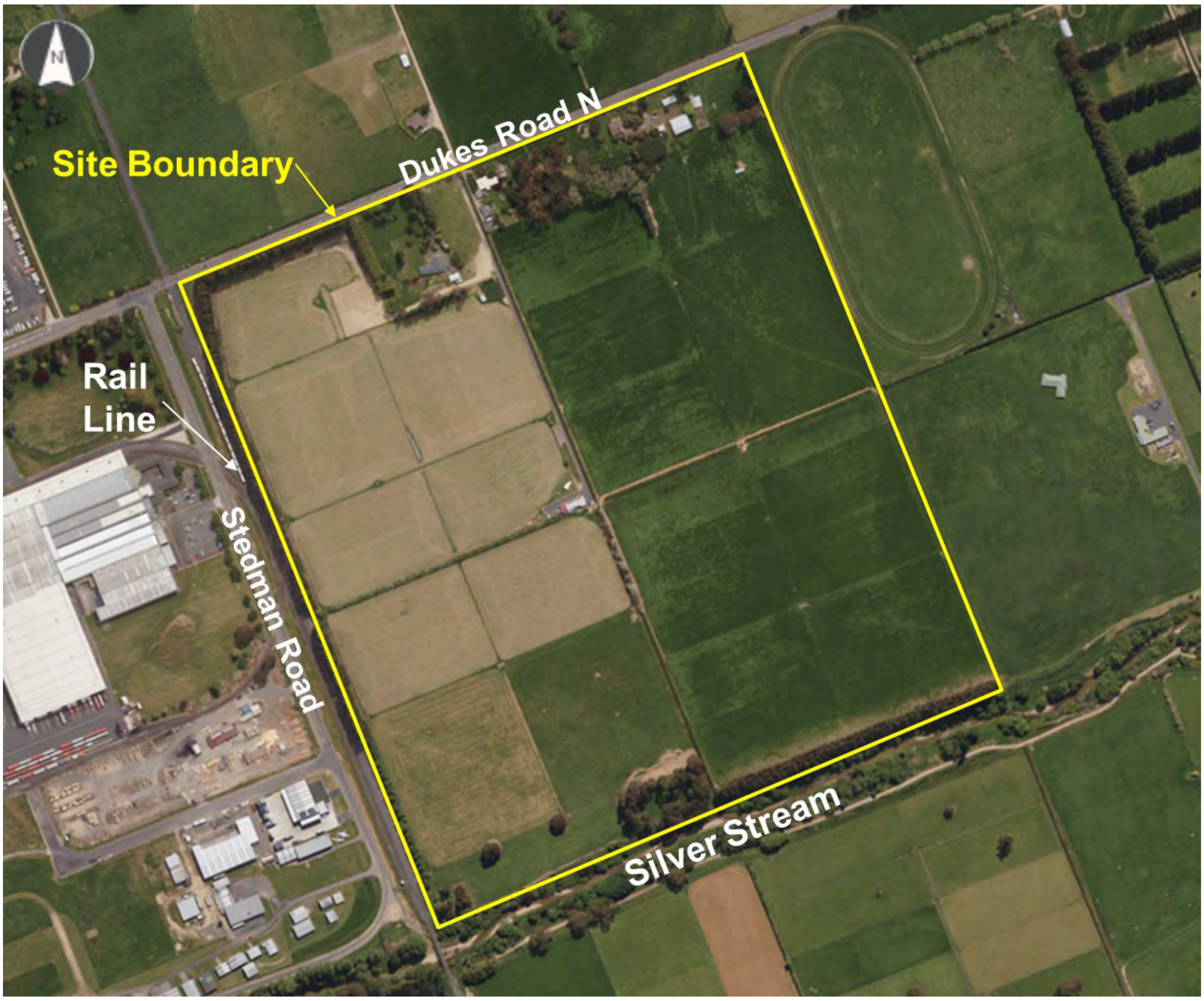


Figure 1-1: Site overview

2 Hydraulic Model Software

The modelling has been undertaken using HEC-RAS 2D modelling software (version 6.6).

The HEC-RAS model projection has been selected as NZ Transverse Mercator 2000 (EPSG:2193) and New Zealand Vertical Datum 2016 (NZVD2016). Any data received in different coordinate reference systems or datums was converted to the model system.

3 Catchment and Model Extent

Based on the requirement to represent different flood mechanisms impacting or potentially impacting SLIP, and downstream areas where it could potentially impact, it is necessary to represent the Silver Stream with its tributaries and floodplains east of Riccarton Road West. The contributing catchments of the Silver Stream to Riccarton Road West were sourced from the River Environment Classification (REC2 v5) and aggregated upstream of the selected 2D model inflow locations.

The perimeter of the hydraulic model 2D computational domain was informed by the prevailing elevation at which the steep valley rivers or streams flatten out onto the low gradient floodplains. This was selected as approximately 50m around the eastern end of the Silver Stream floodplain.

All catchment contributions above these elevations are represented by inflows, and direct rainfall (rain on grid) is then applied within the 2D model domain. The 2D model extent is shown below in Figure 3-1, including the short boundary lines where relevant inflows are applied along the edges of the 2D domain. For each boundary line, flow is distributed along the line using Manning's equation, so flow is concentrated towards the lowest available terrain elevations on the line. For context, Silver Stream at Gordon Road has a catchment area of approximately 93.7 km^2.

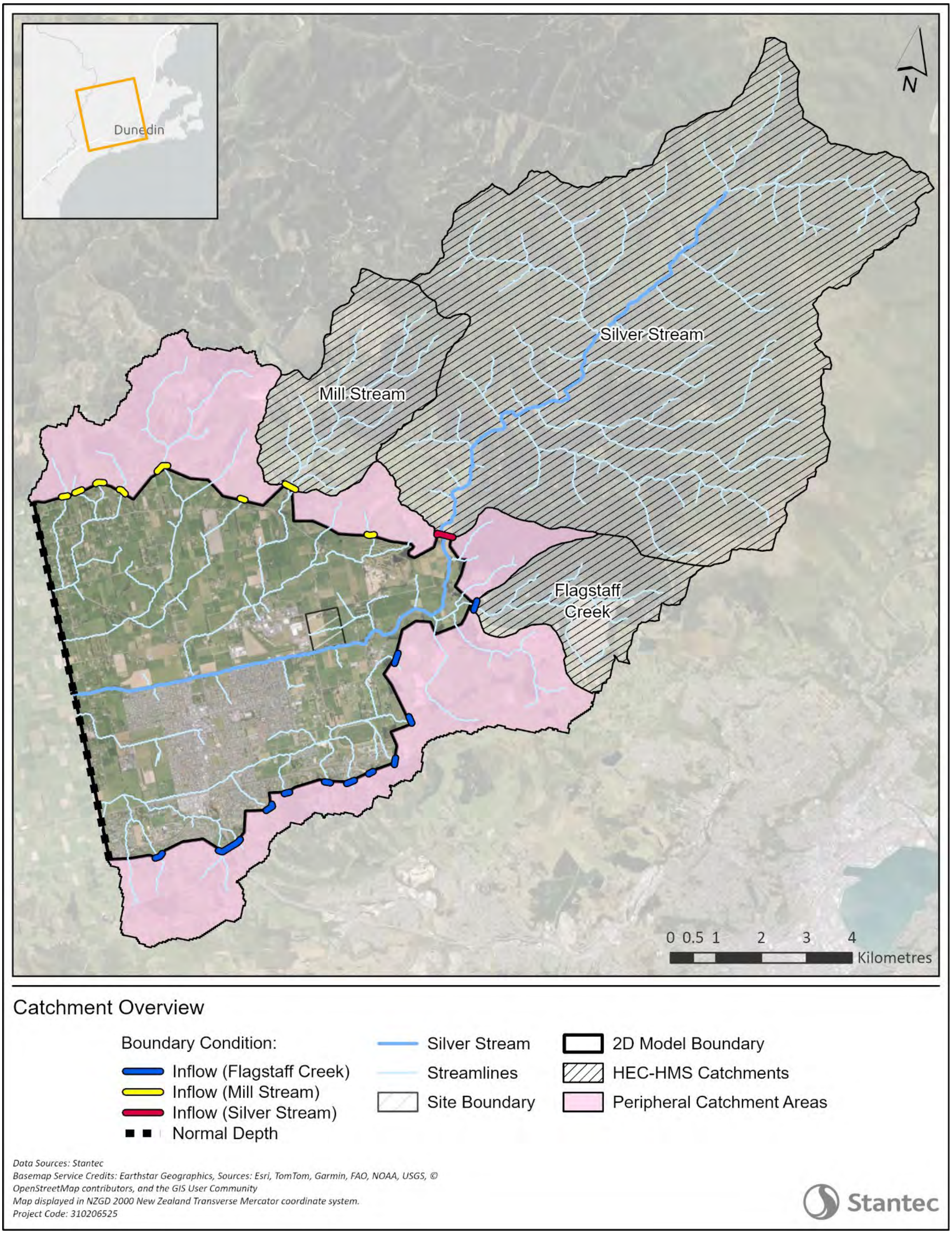


Figure 3-1: Catchment context and external catchment inflow lines.

4 External Boundary Preparation

4.1 HEC-HMS Rainfall Runoff Model

In order to assess the critical storm duration at both SLIP and further downstream on the Silver Stream floodplain, a HEC-HMS rainfall runoff model was prepared for the Silver Stream, Mill Stream and Flagstaff Creek catchments (Figure 3-1). The additional catchment areas upstream of Silver Stream at Gordon Road (see Figure 4-2 for gauge locations) were also included in HEC-HMS in order to calculate the total flow at Gordon Road. Catchments were connected at Gordon Road using reach elements in HEC-HMS assuming a flow velocity of 2 m/s. Catchment loss method was defined as "Soil Conservation Service (SCS) Curve Number (CN)" and transform method defined as "SCS Unit Hydrograph". Key model parameters adopted for each catchment are shown in Table 4-1. Lag time was assumed as time of concentration multiplied by 0.6, with time of concentration calculated following TP108. CN was assigned using catchment averaged CN calculated using land cover and soil type datasets (see Section 4.5 for details on assignment of CN values).

Table 4-1: HEC-HMS catchment parameters

Catchment Name	Curve Number	Lag Time (minutes)
Silver Stream	74.1	110.4
Mill Stream	73.5	59.7
Flagstaff Creek	68.2	43.2
2D Area	67.2	92.8

The model was simulated for the July 2017 flood event to confirm the model calibration, using observed rain gauge data from Silver Stream at Swampy Spur and Silver Stream at Taieri Depot (see Figure 4-2 for locations). The calibration performance is shown in Figure 4-1 below. Although the timing of the simulated rising and falling limbs is late, the general shape reproduction and peak magnitude is very good, therefore this model was considered suitable for deriving the inputs to the HEC-RAS 2D model.

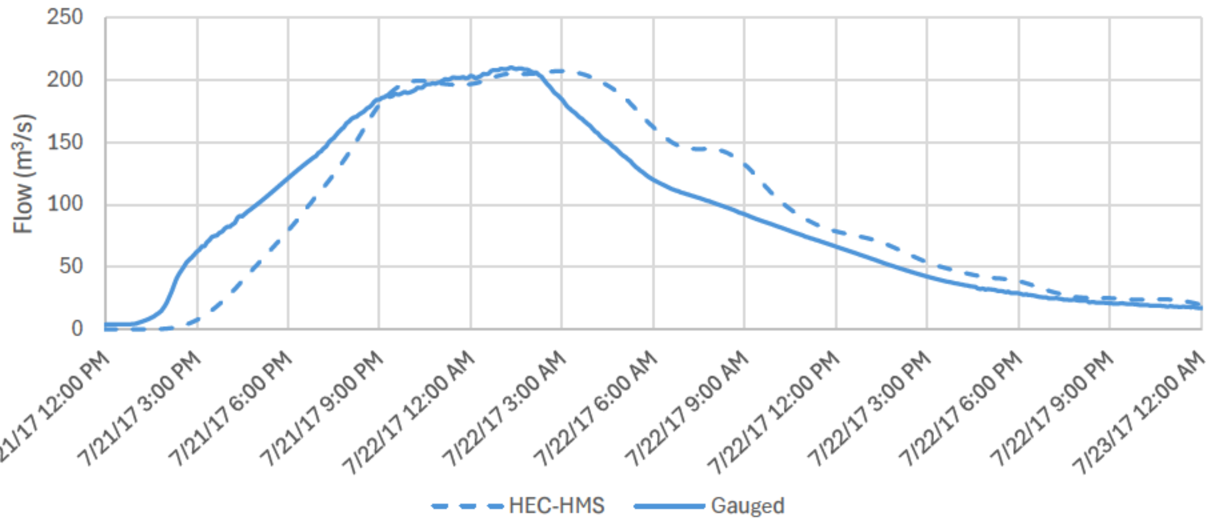


Figure 4-1: HEC-HMS calibration. Silver Stream at Gordon Road, July 2017.

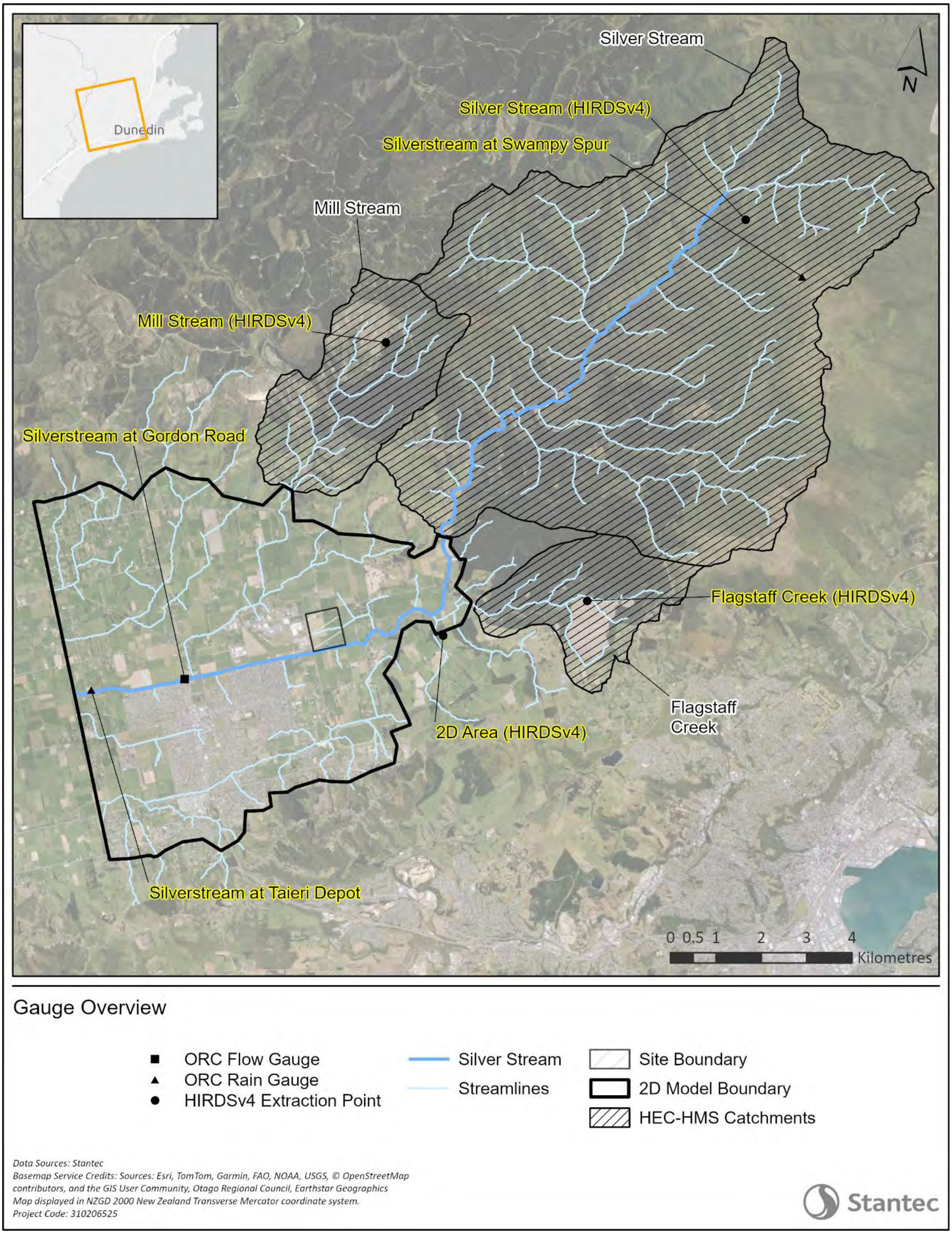


Figure 4-2: Overview of gauge locations and HIRDSv4 extraction points.

4.2 Critical Duration Assessment

The calibrated HEC-HMS model was then simulated with the 2% and 1% AEP HIRDSv4 rainfall for current climate and the chosen future climate RCP8.5-2100. For the future climate change runs, HIRDSv4 RCP 8.5 2080-2100 was adopted as a conservative case. A sample of the HEC-HMS critical duration assessment is shown in Figure 4-3 for the 1% AEP climate change event. Both the Silver Stream at Gordon Road and the Mill Stream catchments were assessed as inundation around the immediate vicinity of the SLIP site typically occurs from Mill Stream, but flows in Silver Stream are important for the testing potential effects further downstream.

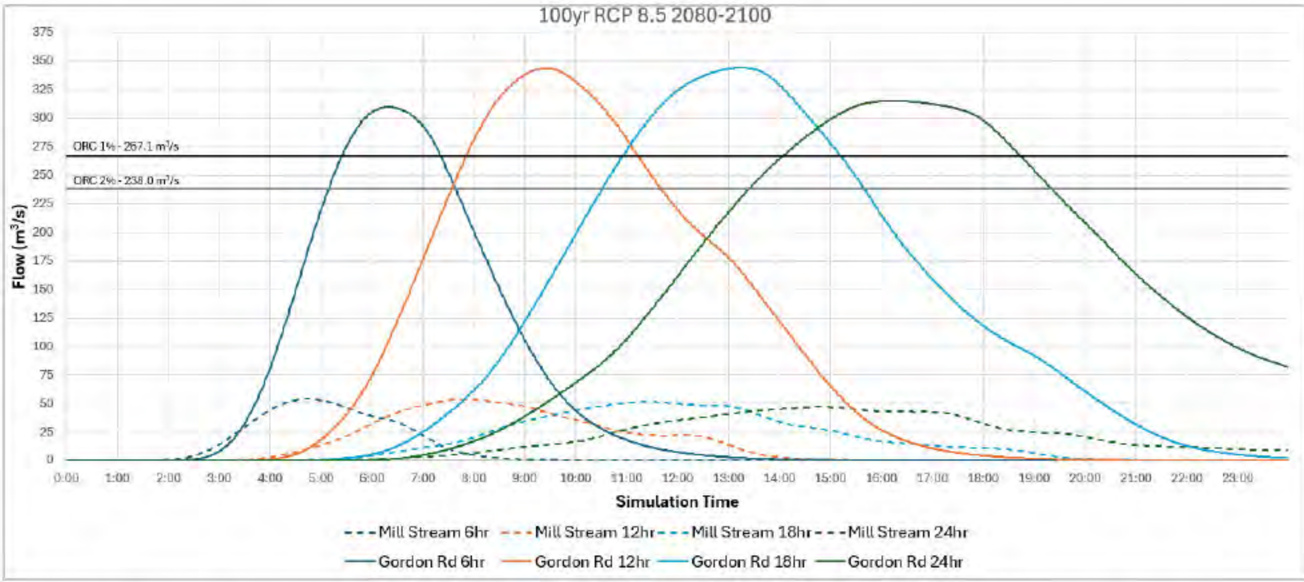


Figure 4-3: Critical duration assessment for Silver Stream at Gordon Road (solid lines) and the Mill Stream inflow catchment (dashed lines). 1% AEP with climate change.

The summary of duration assessment results in Table 4-2 shows that for the current and future climate, a duration of 18 hours can adequately represent the critical duration at both the Inland Port and the Silver Stream at Gordon Road. The Mill Stream climate change peak flow is very similar from 6-hour to 18-hour durations, therefore the 18-hour duration was carried forward for simulation in the HEC-RAS model to allow a single duration to be used across all events.

Table 4-2: Summary of peak flow for Silver Stream at Gordon Road and Mill Stream for events used in determination of critical duration.

Duration (hours)	Gordon Road Flow (m /s)		Mill Stream Flow (m /s)	
	Historical	RCP 8.5	Historical	RCP 8.5
2	-	146	-	37
6	196	310	33	**54**
12	240	**344**	37	**54**
18	**261**	**344**	**39**	**52**
24	238	315	36	47

Further details on the approach to preparing the boundary conditions for current and future climate are provided in Section 4.3.

4.3 Inflows Boundaries

4.3.1 Calibration Event

For the calibration event, the Silver Stream at Swampy Spur and Silver Stream at Taieri Depot rain gauges were used to feed the HEC-HMS model. Silver Stream, Mill Stream and Flagstaff Creek flows were extracted from the HEC-HMS model at the relevant locations to transfer to HEC-RAS as inflows. A series of very small catchments north and south of the 2D model boundary were estimated by scaling from either Mill Stream (northern catchments) or Flagstaff Creek (southern catchments). See peripheral catchment areas included in Figure 3-1. These catchments have minimal influence near SLIP or Silver Stream at Gordon Road but were required for the model completeness. The respective catchment areas were used to derive the scaling factors presented in Appendix C1.

The Silver Stream at Taieri Depot rain gauge data was applied to the 2D model area as rain on grid precipitation.

4.3.2 Design Events

The design event inflows were derived from HEC-HMS and set up using the same approach described above for the calibration event but applying HIRDSv4 rainfall depths to HEC-HMS. The rainfall was extracted from HIRDSv4 at the centre of each HEC-HMS catchment shown in Figure 4-2, in addition to an extraction point for the 2D area. The RCP 8.5 2080-2100 rainfall depths were adopted for the climate change scenarios.

We understand ORC's latest estimates (2025) for Flood Frequency Analysis on the Silver Stream at Gordon Road are represented by the table below. The HEC-HMS 1% AEP current climate value of 261m^3/s from Table 4-2 corresponds closely to the ORC estimate of 267m^3/s, which provides further confidence in the HEC-HMS model parameters.

Table 4-3: Silver Stream at Gordon Road flood flows (from ORC 2025)

AEP	Peak flow (m^3/s) Current Climate
50%	72
20%	127
10%	164
5%	198
2%	238
1%	**267**
0.5%	294
0.2%	327

4.4 Downstream Boundaries

Flow is permitted to leave the 2D model domain via 'normal depth' (Manning's equation) downstream boundaries just west of Riccarton Road West. The model is not necessarily attempting to accurately represent water levels at or west of Riccarton Road West, but this is far enough from SLIP to not be of any significance to the assessment of potential effects from the development.

4.5 Infiltration Losses

Infiltration losses were represented using the SCS method via the Hydrologic Soil Group (HSG) and the CN parameter. The hydrologic soil group was derived from the soil drainage classification from LINZ mapped to SCS hydrologic soil group as presented in Table 4-4.

CN behaves in a similar way to the runoff coefficient from the rational method, but with the underlying soil type also taken into account. The CN value (Table 4-5) was based on the Wellington Water[1] guideline and applied to the Land Cover Database (LCDBv5). Road parcel and building footprint were downloaded from LINZ and supplemented to generate the merged infiltration layer.

Table 4-4: Soil drainage classification equivalence to SCS hydrologic soil group

Soil Drainage Class	Hydrologic Soil Group[2]
Well drained	A. Deep sand, deep loess, aggregated silts *Soils with high infiltration rates (low runoff potential) even when thoroughly wetted. These consist chiefly of deep, well-drained sands and gravels. These soils have a final infiltration rates greater than 7.6 mm/hr.*
Moderately well drained	B. Shallow loess, sandy loam *Soils with moderate infiltration rates when thoroughly wetted. These consist mostly of soils that are moderately deep to deep, moderately well drained to well drained with moderately fine to moderately coarse soil textures. These soils have final infiltration rates of 3.8–7.6 mm/hr.*
Imperfectly drained	C. Clay loams, shallow sandy loam, soils low in organic content, and soils usually high in clay *Soils with slow infiltration rates when thoroughly wetted. These consist chiefly of soils with a layer that impedes downward movement of water or soils with moderately fine to fine textures. These soils have final infiltration rates of 1.3 – 3.8 mm/hr.*
Poorly drained	D. Soils that swell significantly when wet, heavy plastic clays, and certain saline soils *Soils with very slow infiltration rates (high runoff potential) when thoroughly wetted. These consist chiefly of clay soils with a high swelling potential, soils with a permanent high-water table, soils with a claypan or clay layer at or near the surface, and shallow soils over nearly impervious materials. These soils have final infiltration rates of less than 1.3 mm/hr.*
Very poorly Drained	Assumed HSG: D
No Data	Water bodies (river, lake, sea) - assumed HSG: D

[1] Wellington Water Reference Guide for Design Storm Hydrology. Table 3.
[2] USACE.HEC-RAS 2D User's Manual.

Table 4-5: Curve Number values

Land Cover		**Hydrologic Soil Group**			
WWL class	**LCDBv5**	**A**	**B**	**C**	**D**
Alpine tussock/grass	High Producing Exotic Grassland Gorse and/or Broom Low Producing Grassland Tall Tussock Grassland	66	77	87	87
Bare	Gravel or Rock Herbaceous Freshwater Vegetation Herbaceous Saline Vegetation Sand or Gravel Surface Mine or Dump	66	77	87	87
Forest	Broadleaved Indigenous Hardwoods Deciduous Hardwoods Exotic Forest Forest – Harvested Indigenous Forest Manuka and/or Kanuka	28	46	63	71
Impervious	Building Outlines Channels Open Sea Lake or Pond Roads Transport Infrastructure	98	98	98	98
Pasture-Crop	Orchard, Vineyard or Other Perennial Crop Short-rotation Cropland	37	59	72	78
Scrub-Flax	Fernland Flaxland Mixed Exotic Shrubland	33	54	68	75
Urban Open Space	Built-up Area (settlement) Urban Parkland/Open Space	37	59	72	78

Figure 4-4 presents the soil drainage classification, whereas Figure 4-5 shows the land cover within the 2D domain.

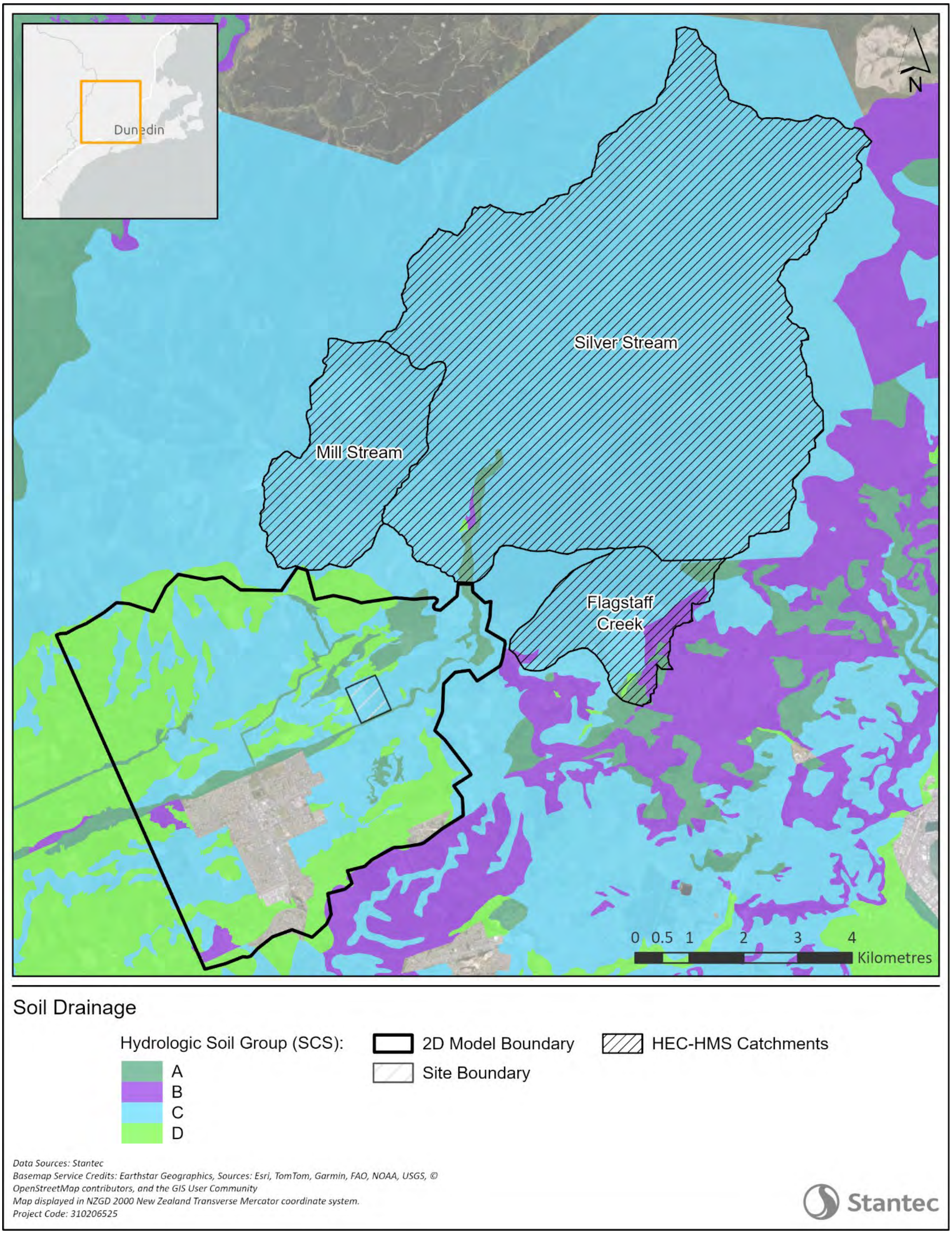


Figure 4-4: Soil drainage classification across the model extent.

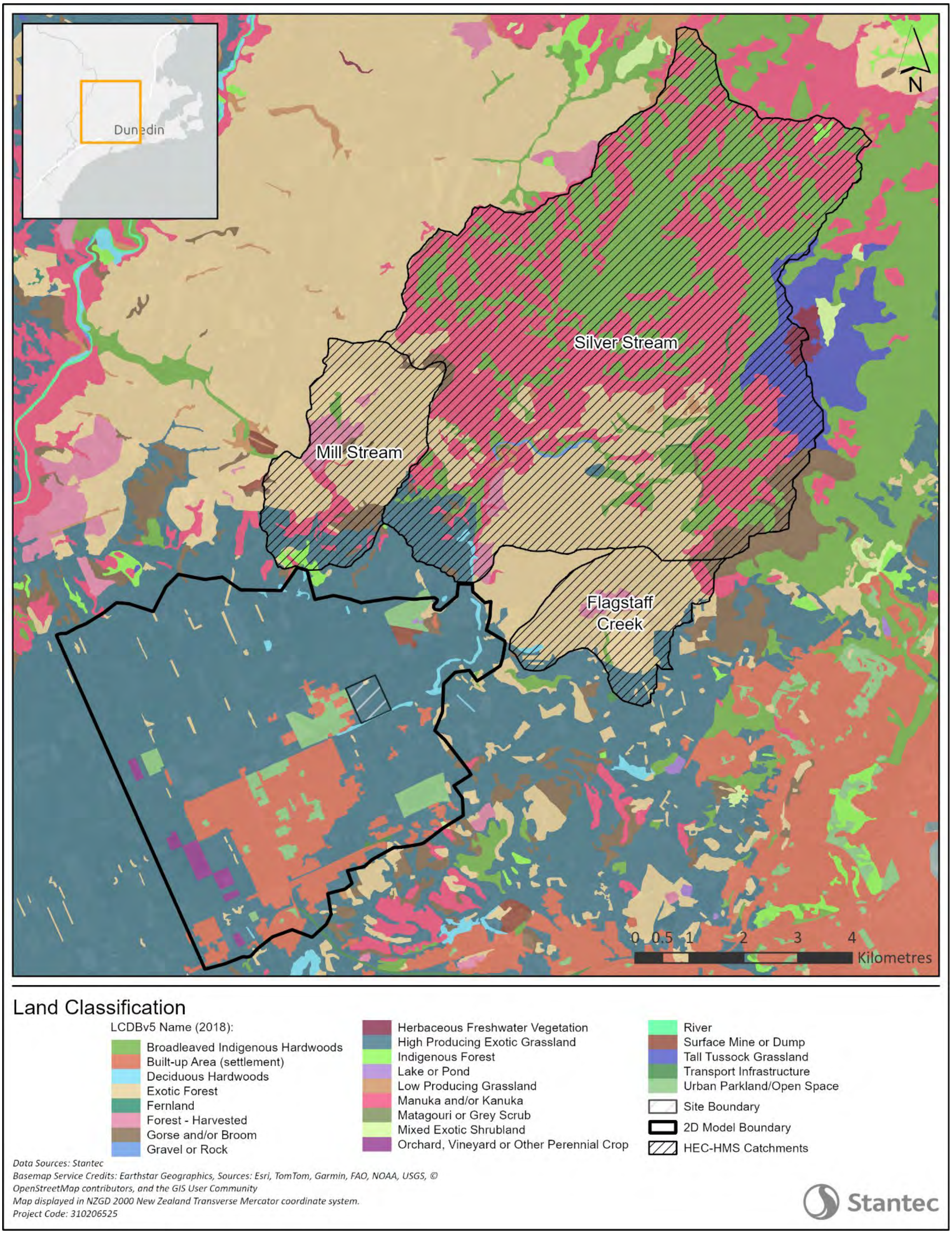


Figure 4-5: Land classification across the model extent.

5 Topography

5.1 Foundation LiDAR Layer

The foundation topographic layer is LINZ Otago - Coastal Catchments LiDAR 1m DEM (2021), referenced to NZVD2016 vertical datum. On that basis, the model is constructed in NZVD2016, and any datasets provided in other datums are converted before applying to the model.

5.2 Terrain Modifications

Surveyed river cross sections provided by ORC within the Silver Stream catchment area (Figure 5-1) were converted to NZVD2016 and merged into the terrain using an indicative longitudinal alignment (in plan view) to create a Triangulated Irregular Network (TIN). Elevations were only lowered where the TIN was below the LiDAR.

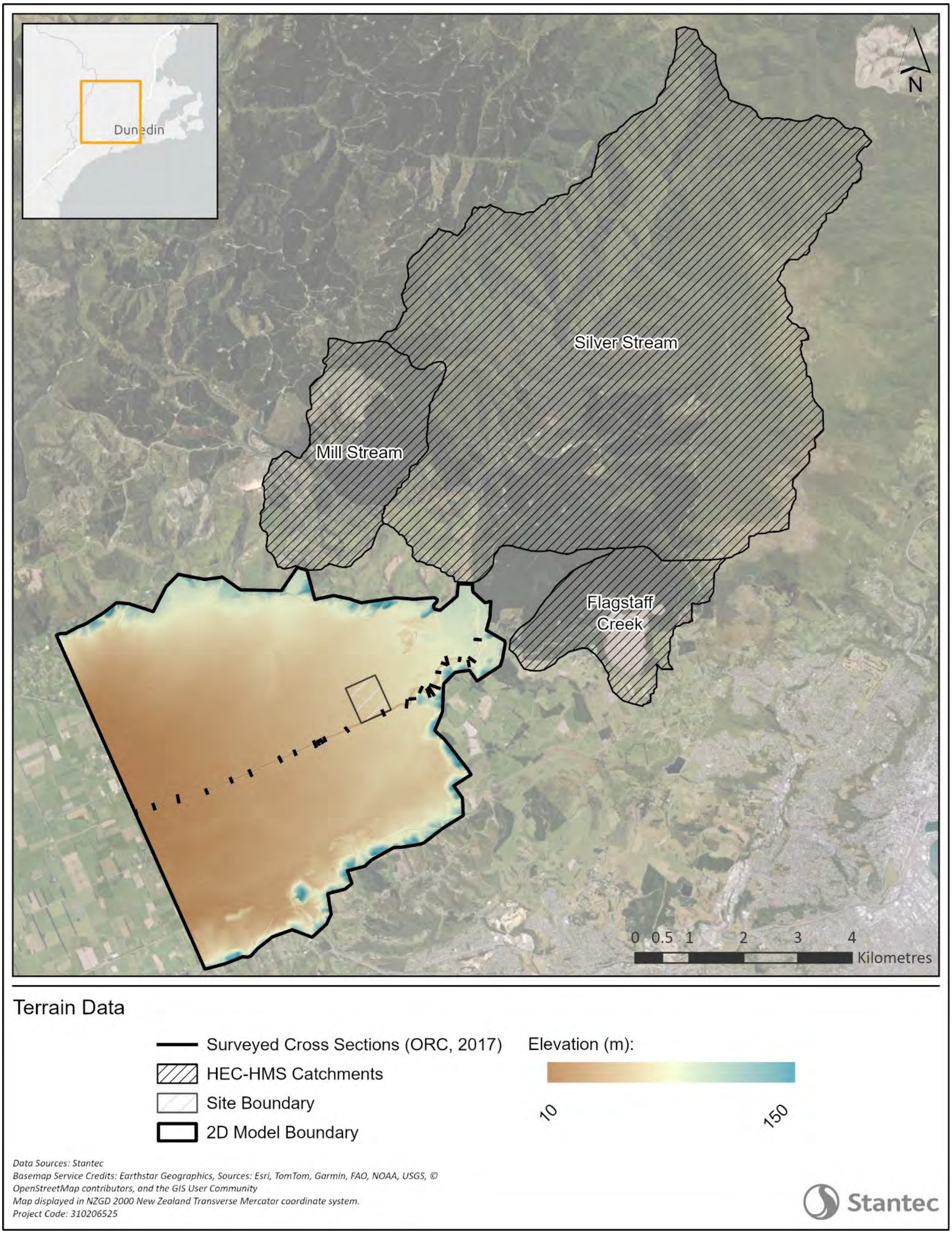


Figure 5-1: Overview of topography and location of surveyed cross sections for the Silver Stream.

5.3 Computational Mesh

The computational mesh was set to a default of 40m by 40m, with cell size reduced to 25m, 10m or 5m where required based on local topography. Breaklines were used to align cell boundaries with topographic high points likely to impact overland flow paths such as road and rail centrelines, as shown in Figure 5-2. Reduced cell sizes were used within part of the SLIP site in order to better capture local topography.

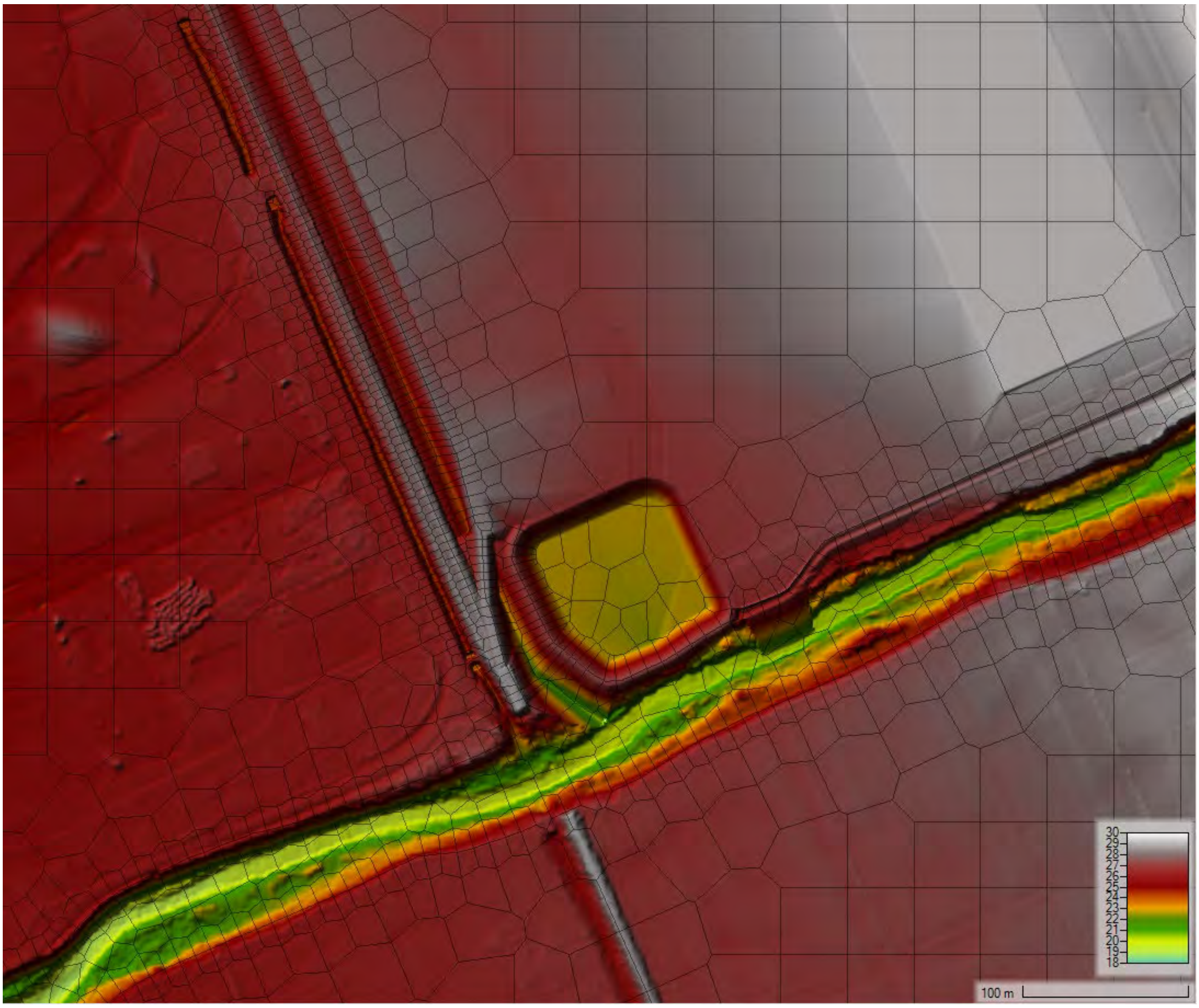


Figure 5-2: Example of cell alignment enforced to follow stream banks and the rail centreline.

6 Roughness

Land use was sourced from Land Cover Database (LDCBv05). Manual adjustments were made to digitize some noticed missing buildings and improve alignment along key features, such as channels, floodbanks and roads. Table 6-1 below presents the Mannings 'n' values assigned to the prevailing land use categories, consistent with the ORC 2021 model. As the land cover layer has been updated with building footprint and road parcels, the Manning's 'n' values for these surfaces are specified following Wellington Water modelling guideline.

Table 6-1: Manning's roughness coefficient 'n' values[3]

Land Cover	n	Land Cover	n
Broadleaved indigenous hardwoods	0.05	Manuka and/or Kanuka	0.15
Built-up area	0.15	Mixed exotic shrubland	0.05
Deciduous hardwoods	0.09	Orchard, vineyard or other perennial crop	0.05
Exotic forest	0.09	River	0.03
Flax land	0.1	Short-rotation cropland	0.04
Forest-harvested	0.05	Surface mine or dump	0.03
Gorse and /or broom	0.2	Tall tussock grassland	0.05
Gravel or rock	0.02	Transport infrastructure	0.016
Herbaceous freshwater vegetation	0.06	Urban parkland/open space	0.035
High producing grassland	0.035 - 0.05	Culverts concrete	0.013
Indigenous forest	0.09	Culverts corrugated	0.03
Lake or pond	0.01	Road parcel*	0.013
Low producing grassland	0.035	Building footprint*	0.5
**modified per Wellington Water modelling guideline*			

[3] Lower Taieri River Model Development Report

7 Internal Hydraulic Controls

Note that any 2D ‘overflow’ features such as roads and the railway embankment are addressed using breaklines as outlined in Section 5.2.

7.1 Bridges

Bridges are currently reflected as 2D terrain modifications (burned openings in the DEM), assuming deck soffits are generally above max modelled water levels. The simplified approach of only representing bridge abutments with openings burned through the terrain is unlikely to impact significantly on the current assessment of water levels near the SLIP site. Modelled water surface elevations in the highest flow event (1% AEP climate change) do not reach the bridge soffit at the Three Mile Hill Road, Puddle Alley, Railway, Wingatui Road or Gordon Road crossings.

7.2 Culverts and Piped Drainage Assets

Similar to bridges, very large culverts are burned into the DEM assuming a constant channel width informed by the upstream and downstream channel width.

Localised piped drainage assets in roads, the industrial area or Mosgiel are not represented in the model with the exception of four culverts at the Dukes Road railway crossing and three culverts on the scheduled drain between Dukes Road and Silver Stream, as shown in Figure 7-1. These culverts were included in HEC-RAS as SA 2D connections, with dimensions sourced from Paterson’s survey data.

Figure 7-1: Overview of culverts modelled at the Dukes Road railway crossing and along the scheduled drain.

8 Calibration Results

As discussed in Section 4.1, the calibrated HEC-HMS hydrological model was considered suitable for deriving the upstream inputs to the HEC-RAS 2D model. Comparison of simulated vs observed stage at Gordon Road in Figure 8-1 shows that simulated levels are slightly delayed relative to the observed but otherwise show a very good correlation. Therefore, the model is considered adequate to reflect the main flooding mechanisms and to test for relative effects of the SLIP site.

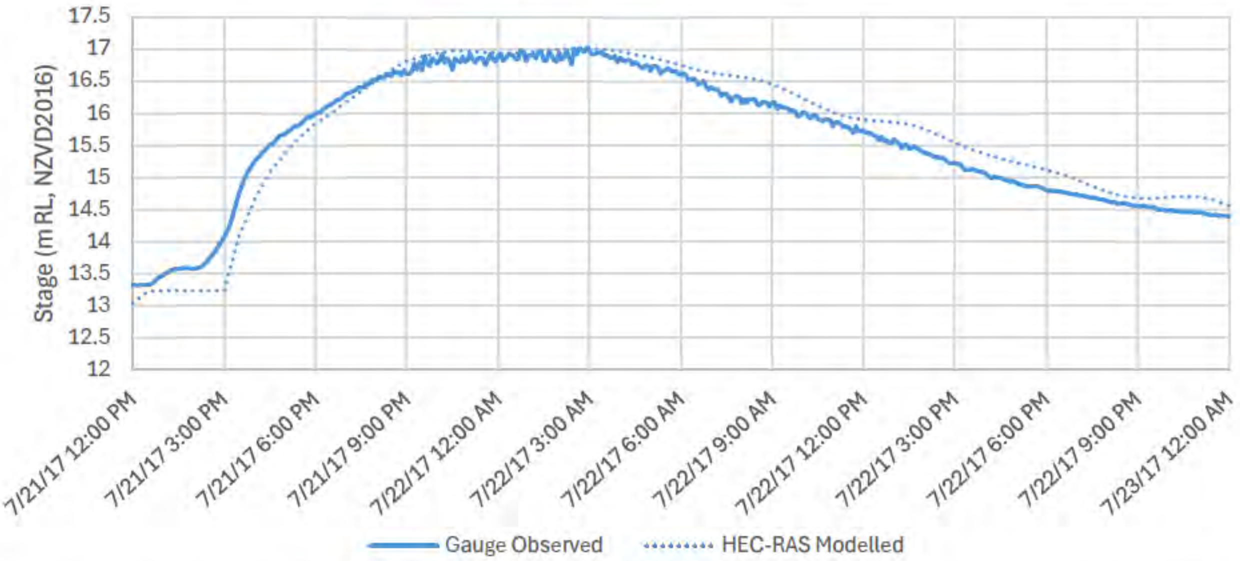


Figure 8-1: Calibration results. Comparison of observed and modelled stage for Silver Stream at Gordon Road.

9 Proposed Scheme Representation

A design surface elevation model was provided to represent the proposed SLIP site topography (as at 10/12/2025), as shown in Figure 9-1. The design scenario is referred to as “scheme” in the results discussion, with features summarised as:

- The proposed swale has generally been designed to maximise conveyance capacity and storage between the Southern Link site, Dukes Road and the existing rail embankment.
- The site area has generally been raised above existing ground levels, with the northern elevations (at the Dukes Road North noise wall) set at 27.2m RL to allow minor inundation of the site in the 2% AEP design event (existing climate).
- The proposed culvert (A) connecting the proposed swale to the Silver Stream has been included provisionally as a box culvert (5m by 2.5m) and is currently sized so it does not control flow in the proposed culvert. This will require further engineering and cost optimisation through detailed design.
- Proposed culverts B and C provide controlled release from the stormwater pond represented as circular culverts with dimensions of 0.44m and 0.525m at invert elevations of 22.6m and 24.0m respectively.
- The stormwater pond spillway elevation is set at 27.0m.
- A bund has been included along the southern site boundary with elevations marginally above the spillway to direct water toward the controlled spillway rather than potentially allowing uncontrolled spills to the Silver Stream.

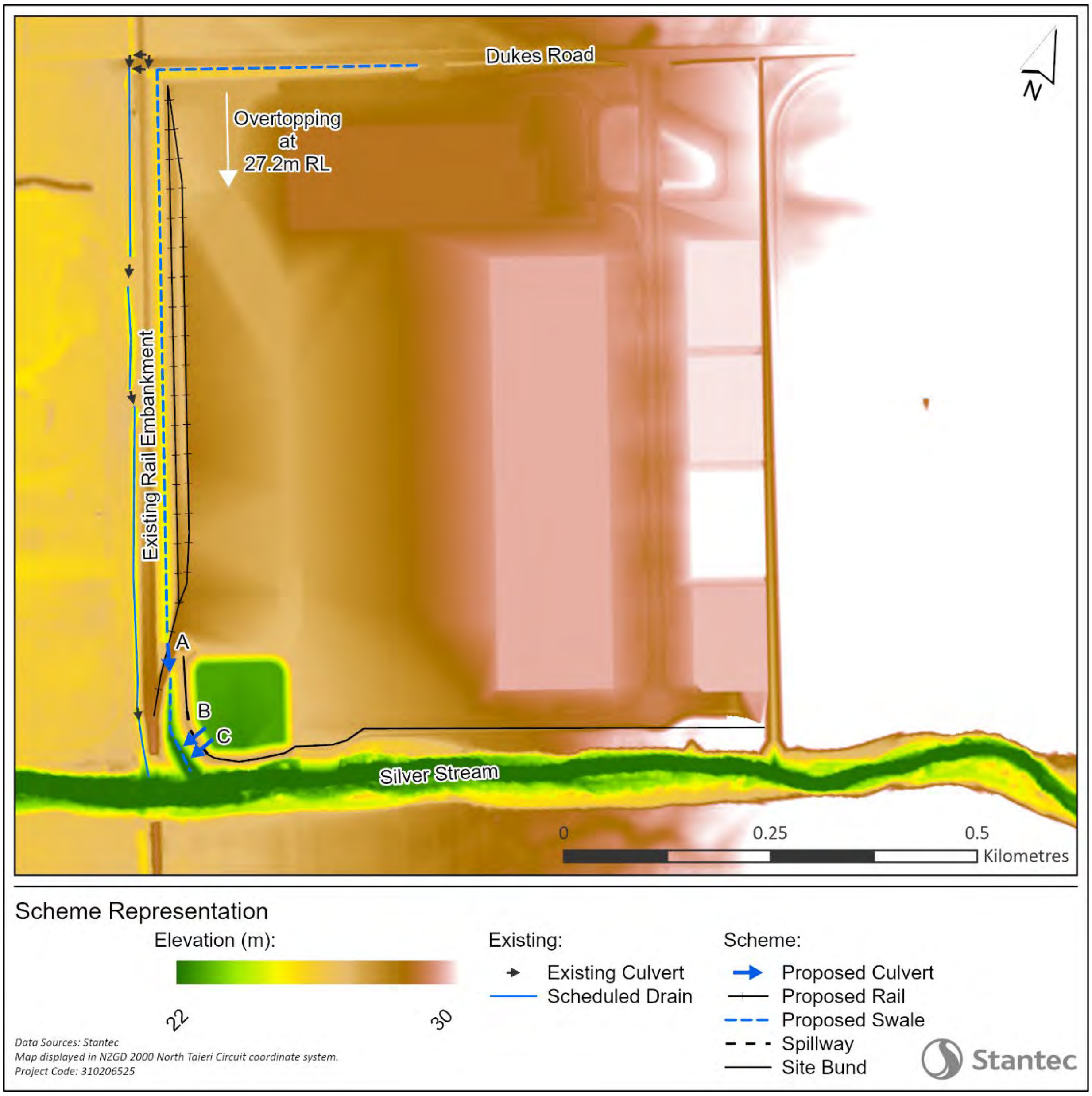


Figure 9-1: Proposed terrain as included in the HEC-RAS model.

10 Design Event Results

Results have been prepared using the base and scheme (SLIP site) geometry for the following events:

- 2% AEP (existing climate)
- 2% AEP (climate change RCP8.5-2100)
- 1% AEP (existing climate)
- 1% AEP (climate change RCP8.5-2100)

Maximum depth mapping for the 1% AEP (climate change) base and scheme results is included in Appendix C2. Inundation mapping and water surface elevation (WSE) differences (scheme minus base) are included in Appendix C2 for all four design events. Comparison of WSE differences indicates that for the 1% AEP (climate change) scheme impact beyond the site boundary is generally below 0.05m (i.e., mimics status quo), with some localised increases in the range of 0.05m to 0.25m east of the site. These will likely be addressed by detailed design adjustments to the cutoff drain along the eastern site boundary that is not currently well represented in the HEC-RAS model. There are some reductions in WSE west of the site (less than 0.25m). The magnitude of the reductions east of the site may change through detailed design, but no adverse impacts are expected. Remote from the site the mapping shows some very localised changes in water levels in places where the project is not expected to have any effects, likely on account of minor transient model instabilities rather than being real impacts. This is likely to be resolved through model improvements in detailed design.

A comparison of modelled WSE time series for the Silver Stream at Gordon Road gauge location is presented in Figure 10-1. This confirms less than minor impacts of the scheme on levels within the Silver Stream. A minor decrease in peak WSE is modelled when comparing scheme to base (0.01m). The very slight increases in the rising and falling limbs occur when there is no out-of-bank flooding from the Silver Stream.

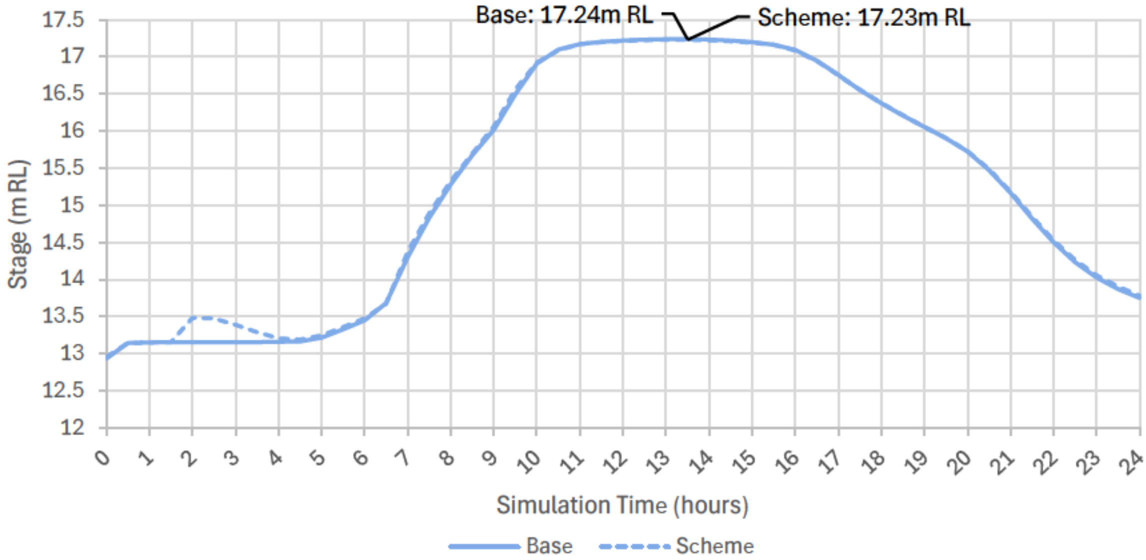


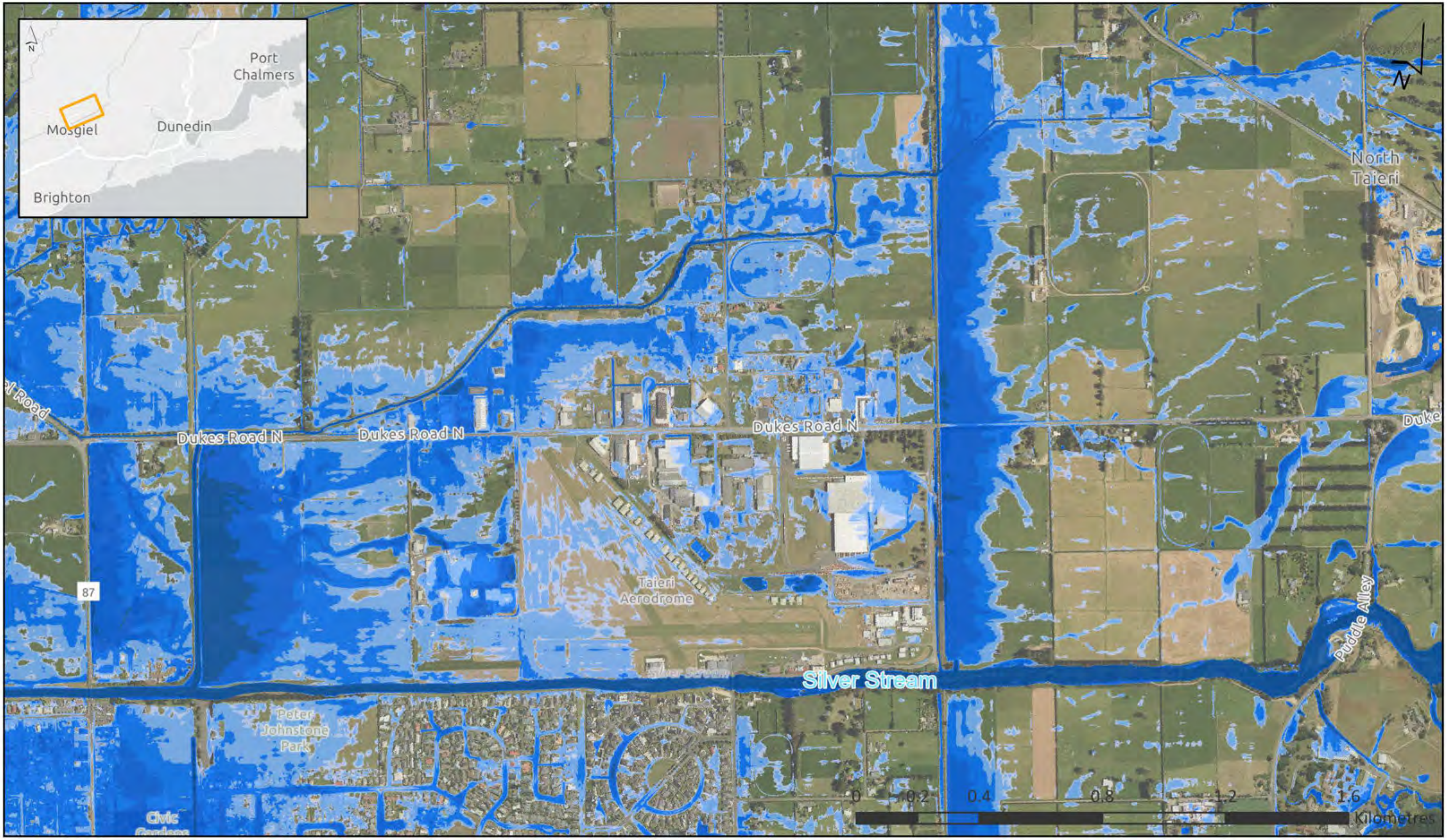
Figure 10-1: Modelled WSE comparison for the Silver Stream at Gordon Road gauge location. 1% AEP (climate change).

Appendices

Appendix C1: Boundary Scaling Factors

Class01	Area (km^2)	BC Line Name	Catchment	Flow Scale Factor
Mill Stream	0.59	MillStream07	Mill Stream	0.095
Mill Stream	0.35	MillStream08	Mill Stream	0.063
Mill Stream	0.23	MillStream09	Mill Stream	0.044
Mill Stream	1.01	MillStream10	Mill Stream	0.146
Mill Stream	6.06	MillStream11	Mill Stream	0.620
Mill Stream	0.30	MillStream12	Mill Stream	0.057
Owhiro Stream	0.48	OwhiroStream01	Flagstaff Creek	0.050
Owhiro Stream	0.45	OwhiroStream02	Flagstaff Creek	0.045
Owhiro Stream	0.42	OwhiroStream03	Flagstaff Creek	0.045
Owhiro Stream	0.19	OwhiroStream04	Flagstaff Creek	0.025
Owhiro Stream	0.40	OwhiroStream05	Flagstaff Creek	0.045
Owhiro Stream	0.29	OwhiroStream06	Flagstaff Creek	0.035
Owhiro Stream	0.34	OwhiroStream07	Flagstaff Creek	0.040
Owhiro Stream	0.27	OwhiroStream08	Flagstaff Creek	0.030
Owhiro Stream	2.24	OwhiroStream09	Flagstaff Creek	0.169
Owhiro Stream	1.79	OwhiroStream10	Flagstaff Creek	0.139
Silver Stream	56.63	SilverStream00	Silver Stream	1.000
Silver Stream	9.36	SilverStream01	Mill Stream	1.000
Silver Stream	1.74	SilverStream02	Mill Stream	0.259
Silver Stream	12.65	SilverStream03	Flagstaff Creek	1.000

Appendix C2: Model Results Maps



1% AEP + Climate Change

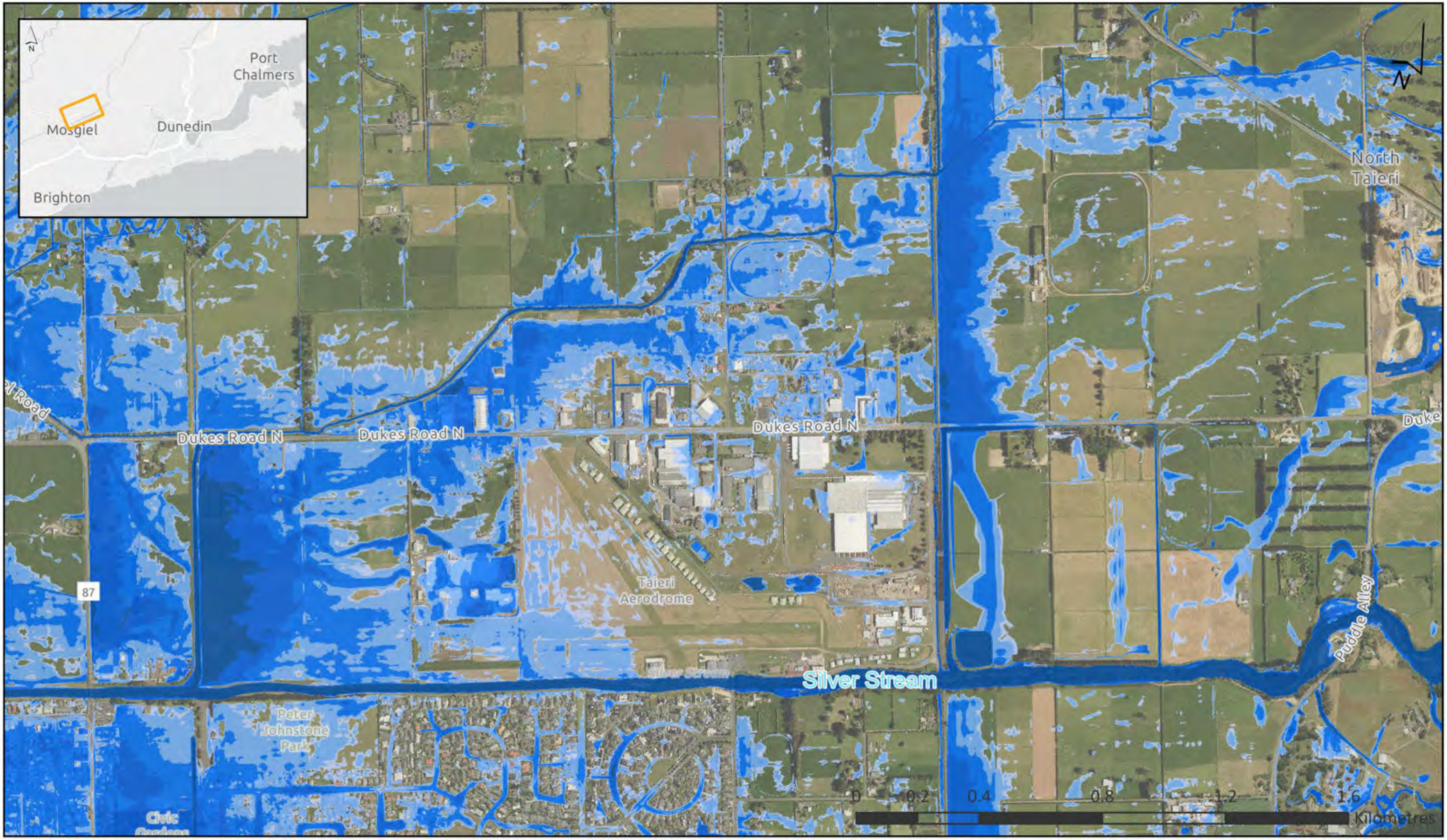
Existing

Max. Depth (m):

< 0.05 | 0.05 - 0.1 | 0.1 - 0.25 | 0.25 - 0.5 | 0.5 - 1.0 | > 1.0

Basemap Service Credits: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Project Code: 310206525

Stantec



1% AEP + Climate Change

Proposed

Max. Depth (m):

< 0.05

0.05 - 0.1

0.1 - 0.25

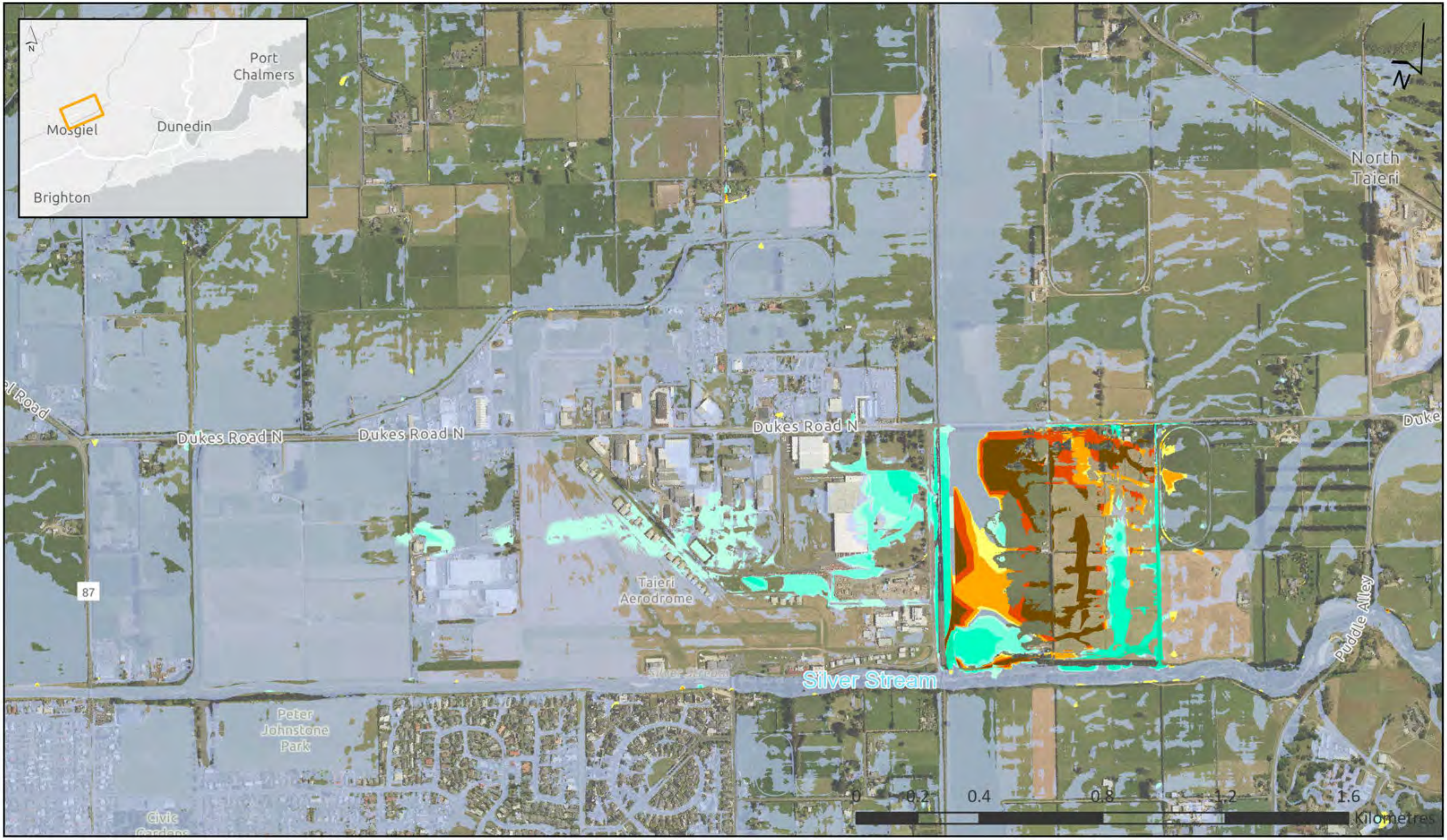
0.25 - 0.5

0.5 - 1.0

> 1.0

Basemap Service Credits: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Project Code: 310206525

Stantec



1% AEP + Climate Change

Proposed minus existing

WSE Difference (m):

< -1
-1.0 - -0.25
-0.25 - -0.1
-0.1 - -0.05
No Change
0.05 - 0.1
0.1 - 0.25
0.25 - 0.5
> 0.5

Max Inundation Extent (base)

Basemap Service Credits: Esri, TomTom, Garmin, FAO, NOAA, USGS, © OpenStreetMap contributors, and the GIS User Community
Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Project Code: 310206525

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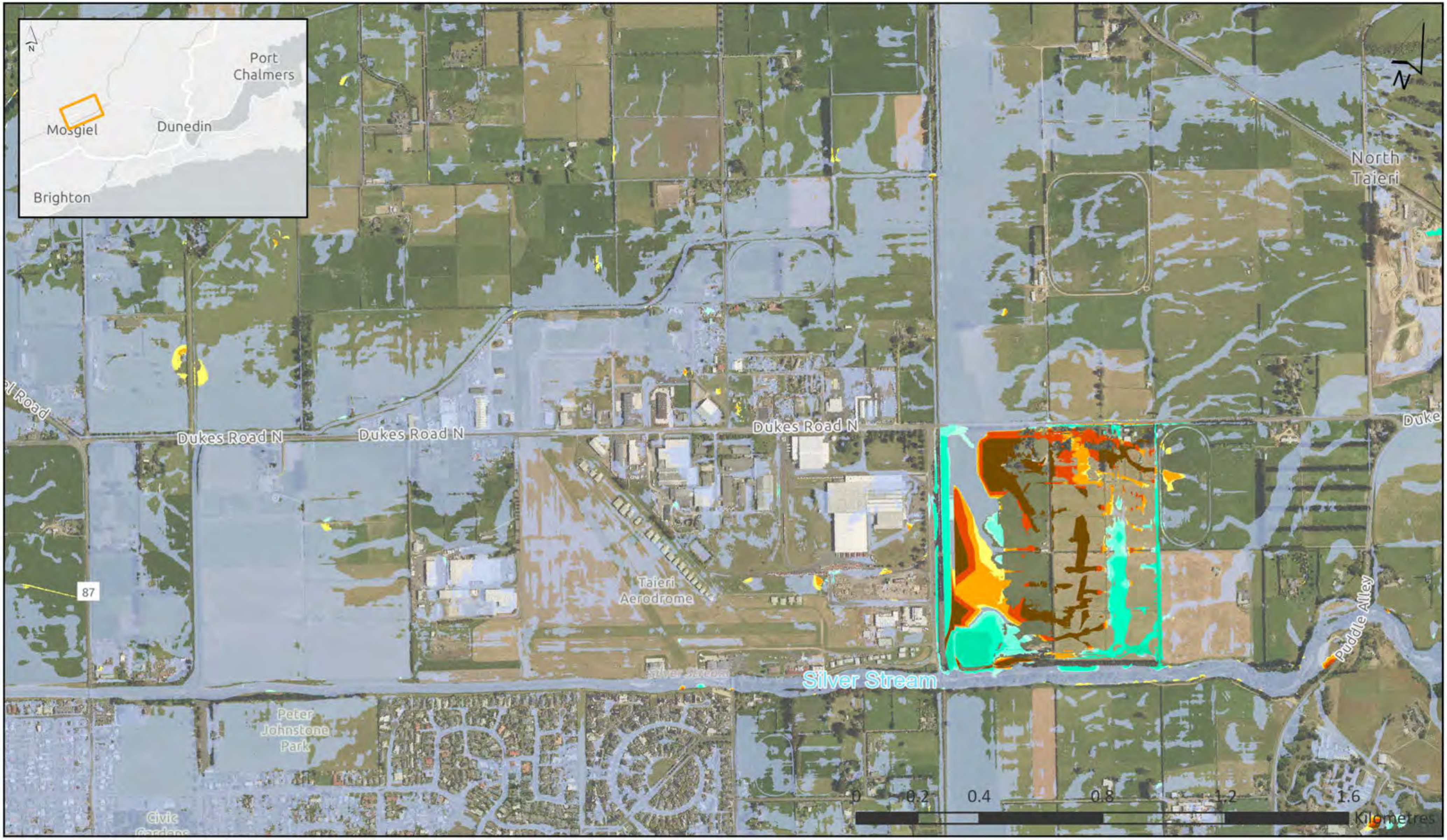

1% AEP Existing Climate

Proposed minus existing

WSE Difference (m):

< -1

-1.0 - -0.25

-0.25 - -0.1

-0.1 - -0.05

No Change

0.05 - 0.1

0.1 - 0.25

0.25 - 0.5

> 0.5

Max Inundation Extent (base)

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Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Project Code: 310206525

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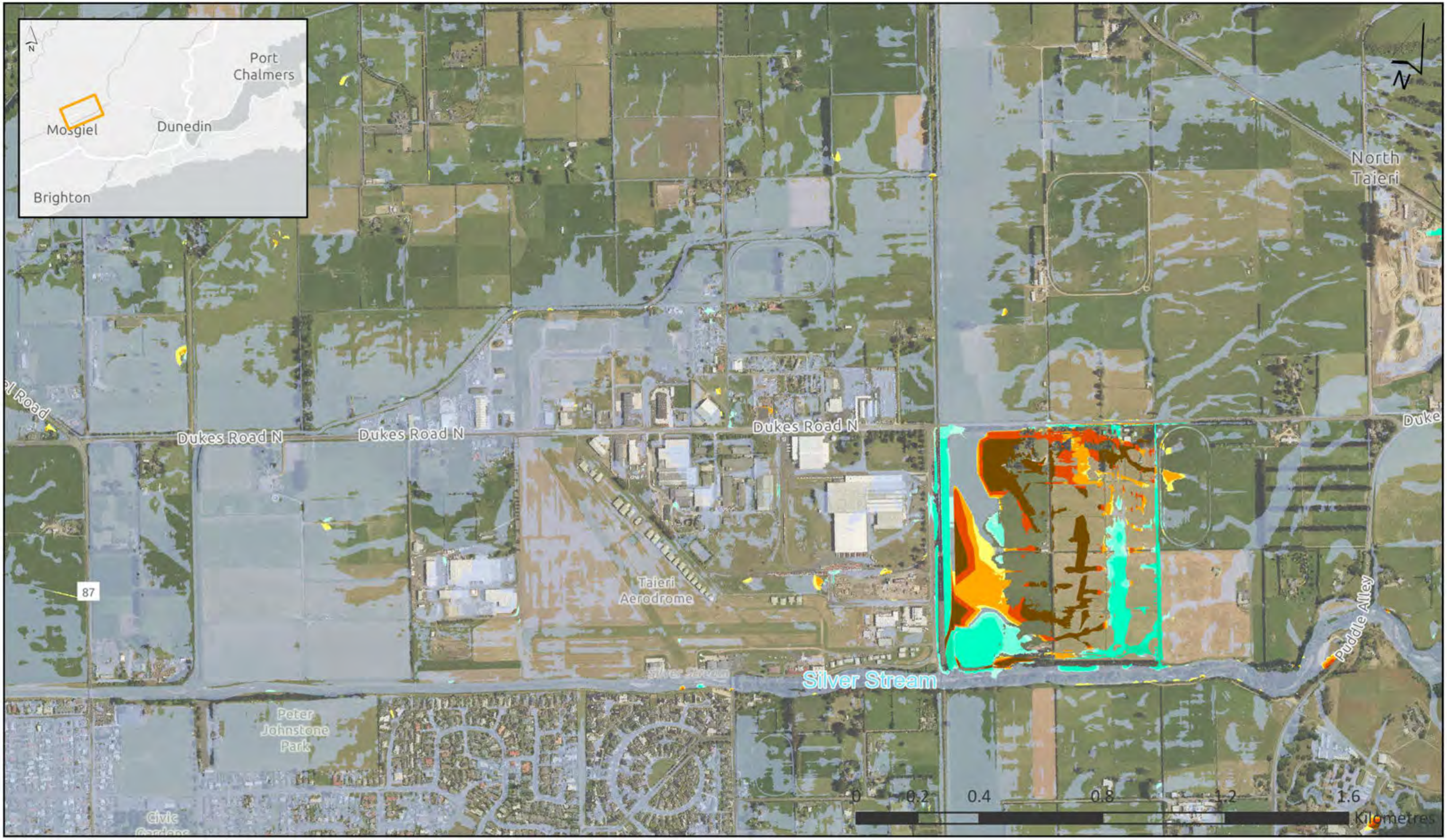

2% AEP + Climate Change

Proposed minus existing

WSE Difference (m):

< -1

-1.0 - -0.25

-0.25 - -0.1

-0.1 - -0.05

No Change

0.05 - 0.1

0.1 - 0.25

0.25 - 0.5

> 0.5

Max Inundation Extent (base)

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Map displayed in NZGD 2000 New Zealand Transverse Mercator coordinate system.
Project Code: 310206525

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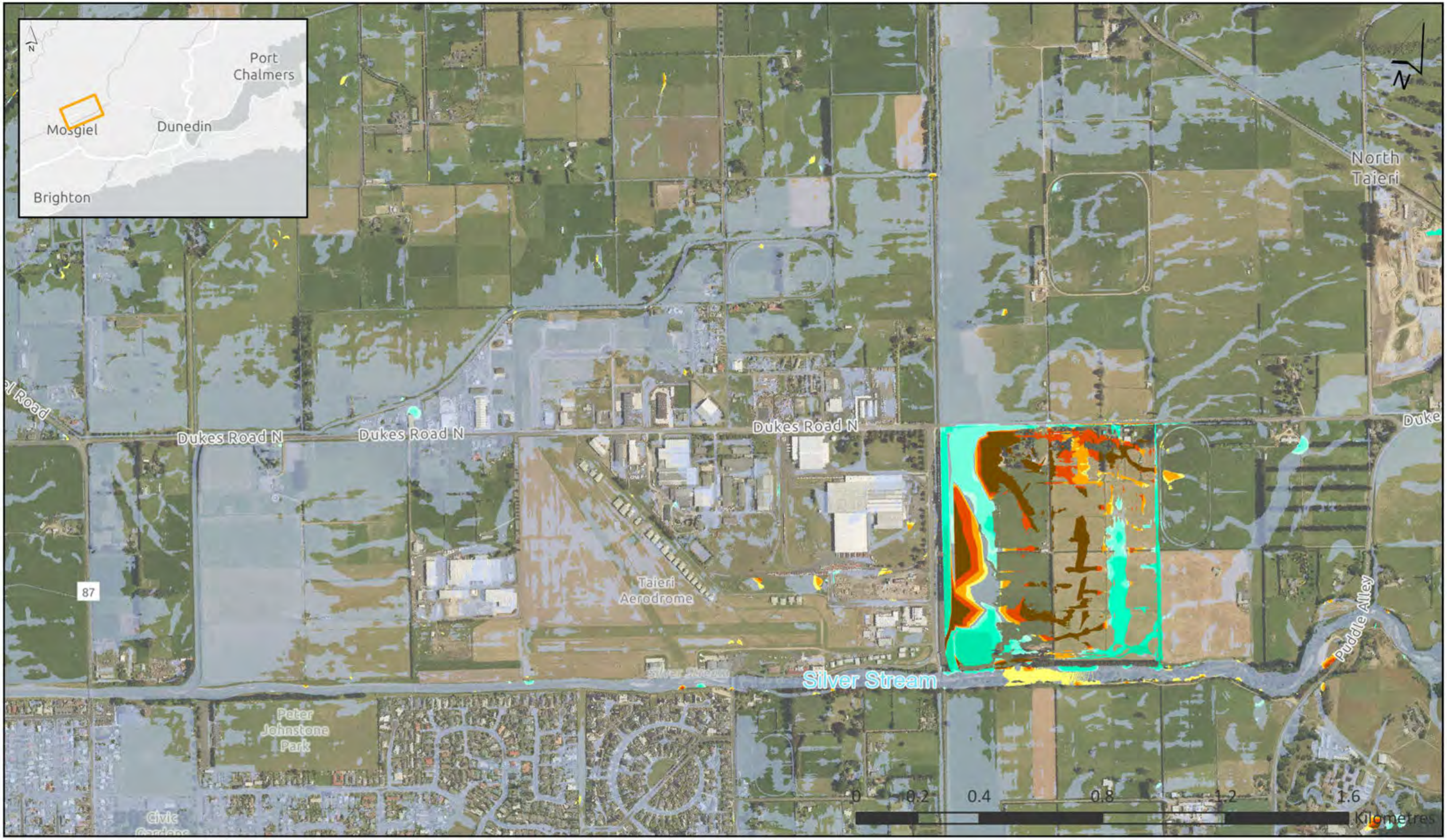

2% AEP Existing Climate

Proposed minus existing

WSE Difference (m):

< -1, -1.0 - -0.25, -0.25 - -0.1, -0.1 - -0.05, No Change, 0.05 - 0.1, 0.1 - 0.25, 0.25 - 0.5, > 0.5

Max Inundation Extent (base)

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Project Code: 310206525

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Appendix D Drawings

SOUTHERN LINK INLAND PORT

DEVELOPED CONCEPT DESIGN

COVER SHEET

DUKES ROAD NORTH, EAST TAIERI

Project Number: 310206525

SCHEDULE OF DRAWINGS	
DRAWING No.	DESCRIPTION
31020625-STN-00-000-DR-AA-000001	SOUTHERN LINK INLAND PORT DEVELOPED CONCEPT DESIGN COVER SHEET
31020625-STN-00-000-DR-AA-000002	DRAWING INDEX
31020625-STN-00-000-DR-AA-000101	EXISTING SITE FEATURES AND SERVICES OVERALL
31020625-STN-00-000-DR-AA-000102	EXISTING SITE FEATURES AND SERVICES SHEET 01 OF 08
31020625-STN-00-000-DR-AA-000103	EXISTING SITE FEATURES AND SERVICES SHEET 02 OF 08
31020625-STN-00-000-DR-AA-000104	EXISTING SITE FEATURES AND SERVICES SHEET 03 OF 08
31020625-STN-00-000-DR-AA-000105	EXISTING SITE FEATURES AND SERVICES SHEET 04 OF 08
31020625-STN-00-000-DR-AA-000106	EXISTING SITE FEATURES AND SERVICES SHEET 05 OF 08
31020625-STN-00-000-DR-AA-000107	EXISTING SITE FEATURES AND SERVICES SHEET 06 OF 08
31020625-STN-00-000-DR-AA-000108	EXISTING SITE FEATURES AND SERVICES SHEET 07 OF 08
31020625-STN-00-000-DR-AA-000109	EXISTING SITE FEATURES AND SERVICES SHEET 08 OF 08
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31020625-STN-01-000-DR-AA-000151	STAGING PLAN STAGE 1
31020625-STN-03-000-DR-AA-000152	STAGING PLAN STAGE 2
31020625-STN-03-000-DR-AA-000153	STAGING PLAN STAGE 3
31020625-STN-00-210-DR-CI-070001	PAVEMENTS LAYOUT PLAN OVERALL
31020625-STN-00-210-DR-CI-070011	ROADING PLAN OVERALL
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31020625-STN-00-210-DR-CI-070050	ROADING & PAVEMENTS LAYOUT PLAN ENTRANCEWAYS
31020625-STN-00-210-DR-CI-070051	TYPICAL ROADING CROSS SECTIONS SHEET 01 OF 02
31020625-STN-00-210-DR-CI-070052	TYPICAL ROADING CROSS SECTIONS SHEET 02 OF 02
31020625-STN-00-210-DR-CI-070053	SITE CROSS SECTIONS
31020625-STN-00-210-DR-CI-070054	TYPICAL DETAILS
31020625-STN-00-210-DR-CI-070055	TYPICAL CROSS SECTIONS RAIL SIDING AND WEST SWALE
31020625-STN-00-210-DR-CI-070056	TYPICAL CROSS SECTIONS RAIL SIDING AND WEST SWALE PLANTING
31020625-STN-00-401-DR-CI-010001	STORMWATER CATCHMENTS AREA WIDE
31020625-STN-00-401-DR-CI-010002	STORMWATER CATCHMENTS PRE - DEVELOPMENT
31020625-STN-00-401-DR-CI-010003	STORMWATER CATCHMENTS POST - DEVELOPMENT SECONDARY
31020625-STN-00-401-DR-CI-010004	STORMWATER CATCHMENTS POST - DEVELOPMENT PRIMARY
31020625-STN-00-401-DR-CI-020001	STORMWATER LAYOUT PLAN OVERALL
31020625-STN-00-401-DR-CI-020002	STORMWATER LAYOUT PLAN SHEET 01 OF 08
31020625-STN-00-401-DR-CI-020003	STORMWATER LAYOUT PLAN SHEET 02 OF 08
31020625-STN-00-401-DR-CI-020004	STORMWATER LAYOUT PLAN SHEET 03 OF 08
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31020625-STN-00-401-DR-CI-020006	STORMWATER LAYOUT PLAN SHEET 05 OF 08
31020625-STN-00-401-DR-CI-020007	STORMWATER LAYOUT PLAN SHEET 06 OF 08
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31020625-STN-00-401-DR-CI-040001	WASTEWATER LAYOUT PLAN - OVERALL
31020625-STN-00-401-DR-CI-040002	WASTEWATER LAYOUT PLAN - PUMPSTATION
31020625-STN-00-401-DR-CI-060001	WATER SCHEME LAYOUT PLAN - OVERALL
31020625-STN-00-401-DR-CI-060002	WATER SCHEME LAYOUT PLAN - TANKS AND PUMPS
31020625-STN-00-501-DR-CI-090001	EARTHWORKS PLAN - FINISHED GROUND SURFACE
31020625-STN-00-501-DR-CI-090002	EARTHWORKS PLAN - SUBGRADE SURFACE
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31020625-STN-00-501-DR-CI-090302	EARTHWORKS PLAN STAGE 2
31020625-STN-00-501-DR-CI-090303	EARTHWORKS PLAN STAGE 3
31020625-STN-00-501-DR-CI-090402	EROSION & SEDIMENTATION CONTROL PLAN STAGE 1
31020625-STN-00-501-DR-CI-090403	EROSION & SEDIMENTATION CONTROL PLAN STAGE 2
31020625-STN-00-501-DR-CI-090404	EROSION & SEDIMENTATION CONTROL PLAN STAGE 3
31020625-STN-00-501-DR-CI-090405	EROSION & SEDIMENTATION CONTROL PLAN - TYPICAL DETAILS
31020625-STN-00-400-DR-CI-511002	3 WATERS PLAN - STAGE 1
31020625-STN-00-400-DR-CI-511003	3 WATERS PLAN - STAGE 2
31020625-STN-00-400-DR-CI-511004	3 WATERS PLAN - STAGE 3
31020625-STN-00-501-DR-CI-511005	POWER AND COMMUNICATION PLAN - STAGE 3

Rev	Issued/Revision	By	Appd	YYYY.MM.DD
D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
A	ISSUED FOR CONCEPT DESIGN	MS	FZ	25.12.19

Issue Status

A1

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Coordinate System
NZGD North Taieri Circuit 2000
Datum
NZVD 2016

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Client/Project Logo

Client/Project
SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Drawn	Designed	Reviewed	Approved	YYYY.MM.DD
Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15

Title DRAWING INDEX

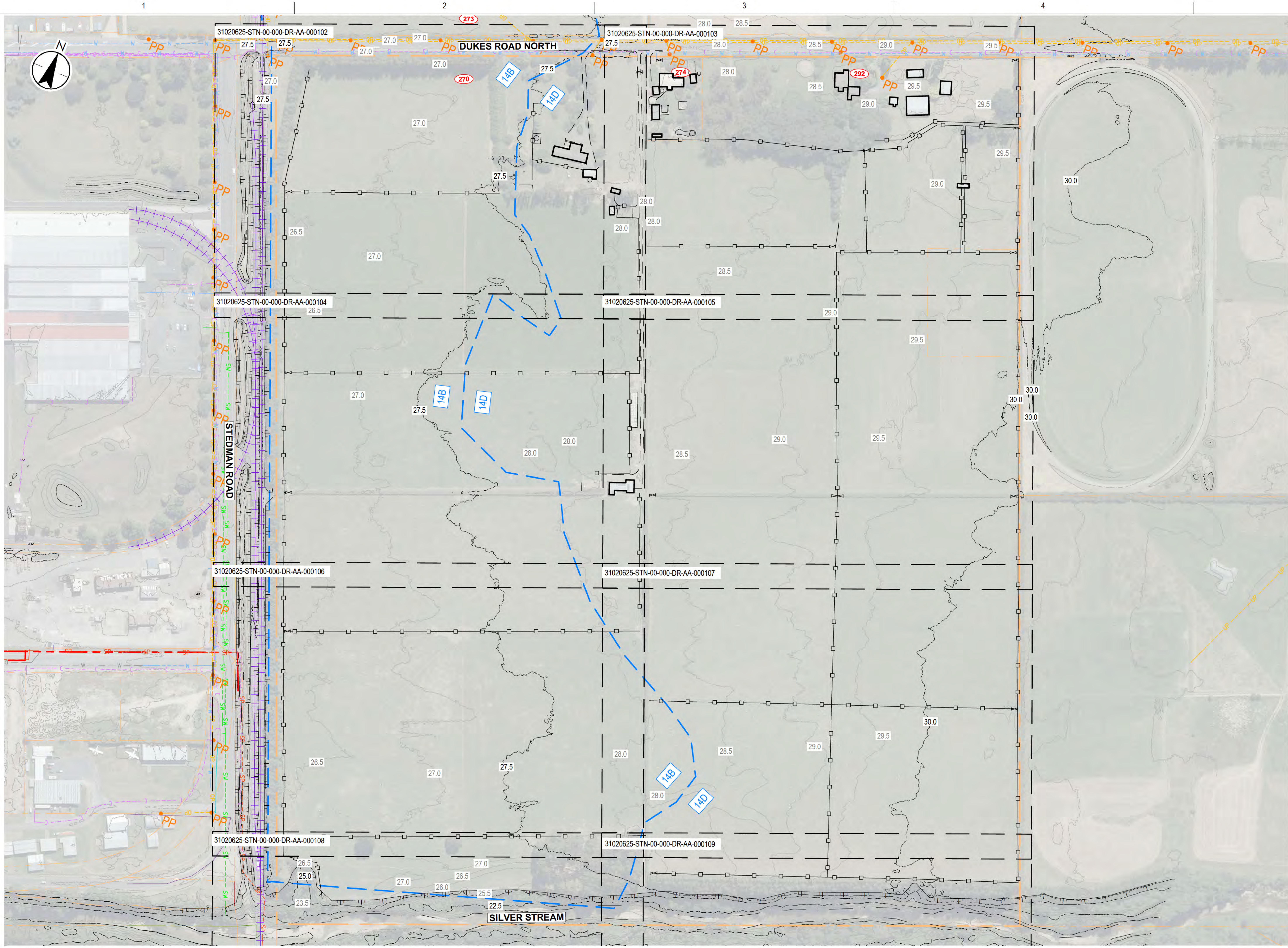
Project No.
310206525

Scale at A1

Revision
D

Drawing No.
310206525-STN-00-000-DR-AA-000002

ORIGINAL SHEET - ISO A1



LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- FLOOD LINE (2GP DCC)
- FENCE
- EDGE OF ACCESSWAY
- GATE
- RAILWAY TRACK
- 01 PROPERTY NUMBER
- OP OVERHEAD POWER
- C TELECOM
- W WATERMAIN
- SW STORMWATER MAIN
- SP SANITARY SEWER PRESSURE MAIN
- UP UNDERGROUND POWER
- PP POWER POLE
- 29.0 MINOR CONTOUR
- 30.0 MAJOR CONTOUR
- EXISTING BUILDINGS

NOTE

1. EXISTING GROUND SURFACE PROVIDED BY OTHERS AND IS A COMBINATION OF LIDAR DATA AND CONVENTIONAL TOPOGRAPHICAL SURVEY.

1:1500 30 20 10 0 30 60 A1
1:3000 A3

	Issued/Revision	By	Appd	YYYY.MM.DD
D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
A	ISSUED FOR CONCEPT DESIGN	MS	FZ	25.12.19

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Coordinate System
NZGD North Taieri Circuit 2000
Datum
NZVD 2016

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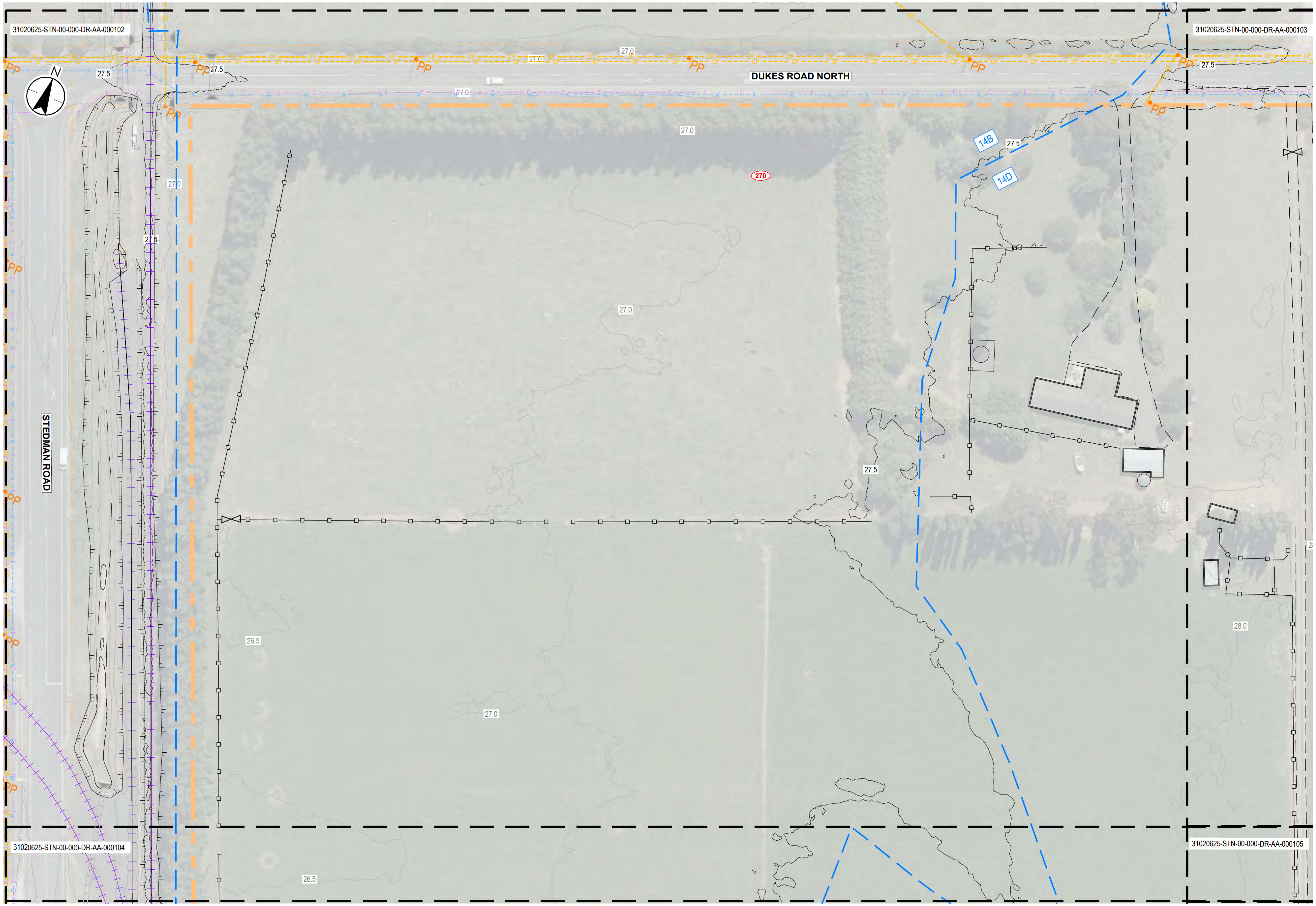
Client/Project Logo
Southern Link LOGISTICS PARK

Client/Project
SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title
EXISTING SITE FEATURES AND SERVICES OVERALL

Project No. 310206525
Scale at A1 1:1500
Revision D
Drawing No. **310206525-STN-00-000-DR-AA-000101**



LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- FLOOD LINE (2GP DCC)
- FENCE
- EDGE OF ACCESSWAY
- GATE
- RAILWAY TRACK
- 01 PROPERTY NUMBER
- OP OVERHEAD POWER
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- W WATERMAIN
- SW STORMWATER MAIN
- SP SANITARY SEWER PRESSURE MAIN
- UP UNDERGROUND POWER
- PP POWER POLE
- 29.0 MINOR CONTOUR
- 30.0 MAJOR CONTOUR
- EXISTING BUILDINGS

NOTE

1. EXISTING GROUND SURFACE PROVIDED BY OTHERS AND IS A COMBINATION OF LIDAR DATA AND CONVENTIONAL TOPOGRAPHICAL SURVEY.

000102	000103
000104	000105
000106	000107
000108	000109

SHEET LAYOUT LOCATION

1:500 10 5 0 10 20 A1
1:1000 A3

PLAN

SCALE 1 : 500

	Issued/Revision	By	Appd	YYYY.MM.DD
D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
A	ISSUED FOR CONCEPT DESIGN	MS	FZ	25.12.19

Issue Status

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Datum
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Client/Project Logo

Southern Link LOGISTICS PARK

Client/Project
SOUTHERN LINK PROPERTY Ltd

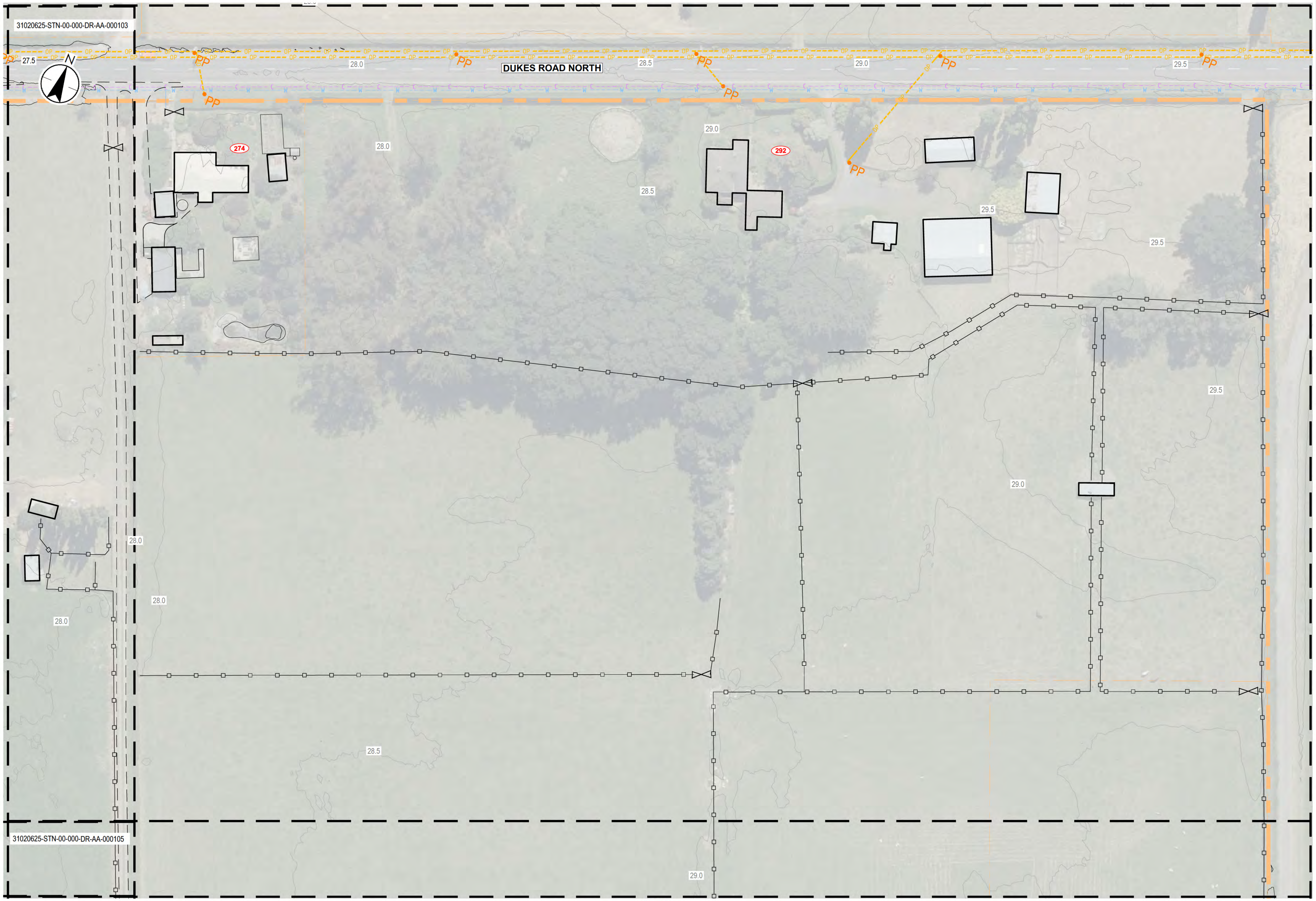
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Drawn	Designed	Reviewed	Approved	YYYY.MM.DD
Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15

Title EXISTING SITE FEATURES AND SERVICES
SHEET 01 OF 08

Project No. 310206525
Scale at A1 1:500
Revision D
Drawing No. 310206525-STN-00-000-DR-AA-000102

ORIGINAL SHEET - ISO A1



PLAN

SCALE 1 : 500

1:500 10 5 0 10 20 A1
1:1000 A3

LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- FLOOD LINE (2GP DCC)
- FENCE
- EDGE OF ACCESSWAY
- GATE
- RAILWAY TRACK
- 01 PROPERTY NUMBER
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- SW STORMWATER MAIN
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- 29.0 MINOR CONTOUR
- 30.0 MAJOR CONTOUR
- EXISTING BUILDINGS

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000102	000103
000104	000105
000106	000107
000108	000109

SHEET LAYOUT LOCATION

Issued/Revision		By	Appd	YYYY.MM.DD
D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
A	ISSUED FOR CONCEPT DESIGN	MS	FZ	25.12.19

Issue Status

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Southern Link LOGISTICS PARK

Client/Project
SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

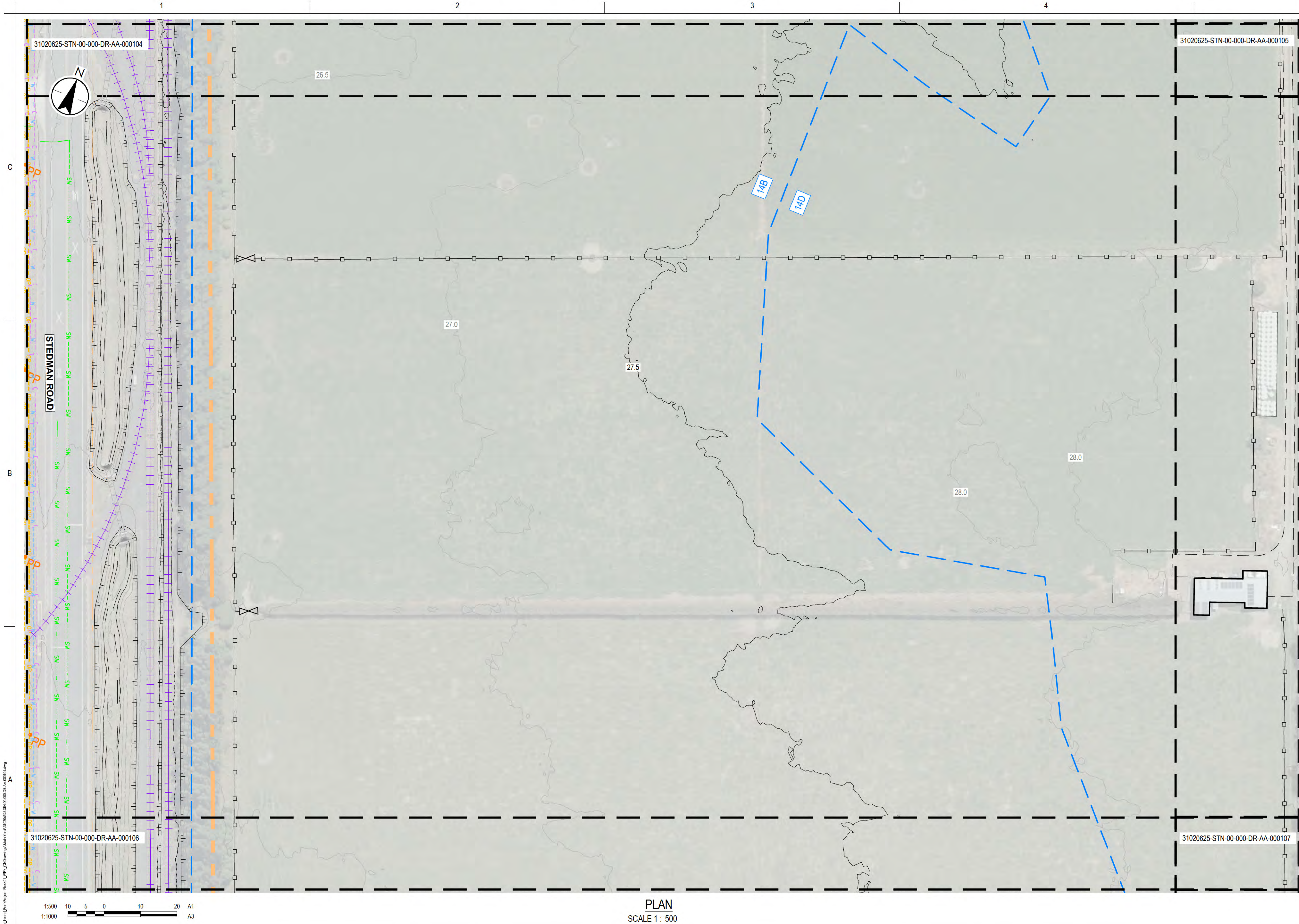
Title EXISTING SITE FEATURES AND SERVICES SHEET 02 OF 08

Project No. 310206525

Scale at A1 1:500

Revision D

Drawing No. **310206525-STN-00-000-DR-AA-000103**



LEGEND

- PROPERTY BOUNDARY
- PARCEL BOUNDARY
- FLOOD LINE (2GP DCC)
- FENCE
- EDGE OF ACCESSWAY
- GATE
- RAILWAY TRACK
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000102	000103
000104	000105
000106	000107
000108	000109

SHEET LAYOUT LOCATION

PLAN

SCALE 1 : 500

Issued/Revision		By	Appd	YYYY.MM.DD
D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
A	ISSUED FOR CONCEPT DESIGN	MS	FZ	25.12.19

Issue Status

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Southern Link LOGISTICS PARK

Client/Project
SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title EXISTING SITE FEATURES AND SERVICES SHEET 03 OF 08

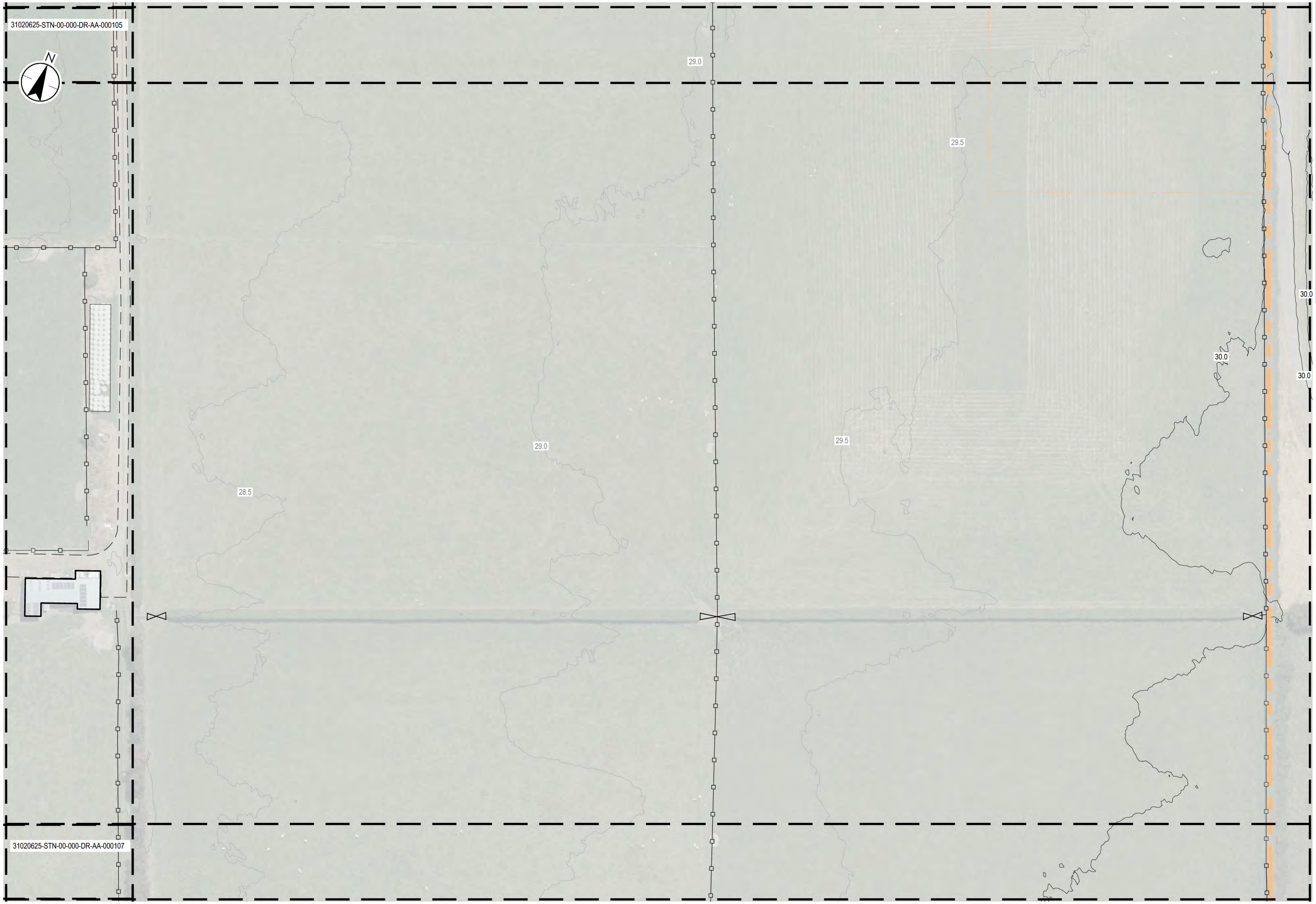
Project No. 310206525

Scale at A1 1:500

Revision D

Drawing No. **310206525-STN-00-000-DR-AA-000104**

ORIGINAL SHEET - ISO A1



LEGEND

- PROPERTY BOUNDARY
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000102	000103
000104	000105
000106	000107
000108	000109

SHEET LAYOUT LOCATION

1:500 10 5 0 10 20 A1
1:1000 A3

PLAN

SCALE 1 : 500

D	UPDATED ISSUE FOR CONSENT	RO	FZ	26.04.15
C	ISSUED FOR CONSENT	BG	SL	26.02.20
B	ISSUED FOR CONCEPT DESIGN	BG	SL	26.02.05
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Southern Link LOGISTICS PARK

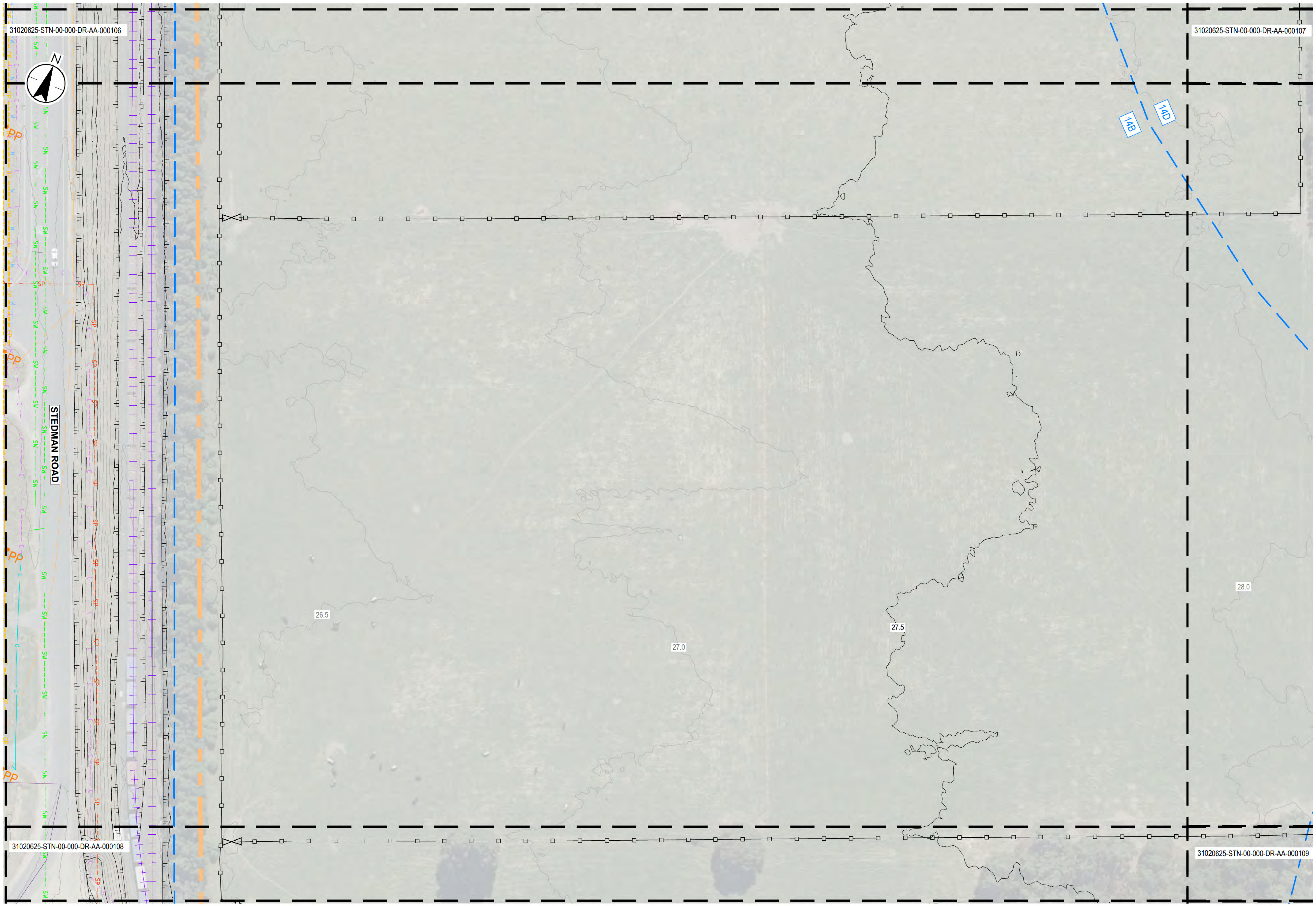
Client/Project
SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

Maninder Singh	Maninder Singh	Matt Barber	Sarah Lloyd	2026.04.15
Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title
EXISTING SITE FEATURES AND SERVICES
SHEET 04 OF 08

Project No. 310206525
Scale at A1 1:500
Revision D
Drawing No. 310206525-STN-00-000-DR-AA-000105

ORIGINAL SHEET - ISO A1



LEGEND

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000102	000103
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SHEET LAYOUT LOCATION

1:500 10 5 0 10 20 A1
1:1000 A3

PLAN

SCALE 1 : 500

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Southern Link LOGISTICS PARK

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SOUTHERN LINK PROPERTY Ltd
SOUTHERN LINK INLAND PORT
DEVELOPED CONCEPT DESIGN

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Drawn	Designed	Reviewed	Approved	YYYY.MM.DD

Title EXISTING SITE FEATURES AND SERVICES
SHEET 05 OF 08

Project No. 310206525

Scale at A1 1:500

Revision D

Drawing No. **310206525-STN-00-000-DR-AA-000106**