Waterways Impact Statement

Glenaeon Renewal

80217089

Prepared for
LendLease

27 August 2020

Cardno

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Executive Summary

This Waterway Impact Statement (WIS) has been prepared by Cardno to support an amended Development Application, prepared for an independent living facility at 207 Forest Way, Belrose (Lot 100, DP 1114910).

LendLease propose to build an independent living facility as part of the Glenaeon Retirement Village. LendLease already has approval for the majority of works from Northern Beaches Council (Council), and this WIS refers specifically to Building D of the development, yet to be approved. Building D would be situated in the south-eastern corner of the property and this WIS covers the area impacted by the proposed building, associated landscaped areas and the associated stormwater treatment system.

This WIS describes the environmental values of the land at 207 Forest Way, Belrose. Specifically it describes the flow paths on land located within and adjacent to the proposed works site. It assesses the impact of the proposed development of Building D and associated hydrological works to these values by considering potential changes to the drainage network, habitat area and quality, biodiversity, water quality and hydrology.

A review of information was used to determine the (aquatic) ecological value of the proposed development site, which would in turn determine which Council guidelines would apply to the development. The review considered key studies of habitats found in the project's footprint and surrounds, guidelines for determining value, Council's referral responses to the proposed development as well as historic photographs of the site and surrounds.

The proposed site for Building D does not meet the definition of riparian land, as found by the review of information. This was consistent with the assessment completed by Cardno (2018). The current and historical evidence indicates, that the headwaters of Snake Creek (i.e. a first order stream) and remnants of riparian vegetation occur to the east of Lot 100, however there is no evidence of current or historical riparian vegetation occurring within Lot 100. Within Lot 100, the sediment basins and the general flow paths towards the site boundary are not a watercourse of ecological value and there is no associated riparian corridor or vegetation. The available evidence supports that Cardno's (2018) previous assessment that the subject land did not meet the definition of riparian land is correct.

Lendlease's initial proposal to construct Building D was not supported by Council, although Council did support the proposed stormwater drainage system. This design included the retention of two existing sediment basins currently located within the footprint of the proposed Building D, with stormwater flows circumvented around them and directly into two newly constructed detention ponds downslope (Option A). Under this approved design, the existing two sediment basins would become abandoned infrastructure.

Following referrals from Council, LendLease is proposing a new stormwater management solution that would maximise ecological outcomes (Option B). Analysis indicates that LendLease's preferred option (Option B) would have the greatest ecological benefit compared to the approved Option A given it would provide for improved water quality at the site and downstream, a defined flow path (i.e. good quality aquatic habitat) at the site, good quality native vegetation within the site and direct connection of flow paths at the site with downstream areas. These improvements would have flow on benefits to threatened and native fauna by providing new areas of quality habitat, corridors and foraging areas.

The environmental management of the proposed works under Option B has carefully considered Warringah Council Policy No. 740 *Protection of Waterways and Riparian Land* (Warringah Council, 2000), and incorporates mitigation measures which have regard for the outcomes required in Council's *Guidelines for Preparing a Waterways Impact Statement* (Warringah Council, 2011) for riparian land downstream of the site:

- **Outcome 1:** Protecting native species and communities
- **Outcome 2:** Prevent loss of natural diversity through protecting waterway and riparian vegetation (including non-native vegetation)
- **Outcome 3:** Minimise damage to public and private property by waterway processes through maintaining the relative stability of the bed and banks

- **Outcome 4:** Preserve natural ecological processes
- **Outcome 5:** Create opportunities for public access and recreation in waterway corridors [1]

This WIS has found that the proposed development works have been designed, and incorporate appropriate mitigation measures, to protect, maintain, and enhance the ecological values of the flow paths within the site.

[1] This outcome does not apply to the proposed works, as they will occur on privately owned land.

Table of Contents

Appendices

Tables

Figures

1 Introduction

1.1 Proposed Development

This Waterway Impact Statement (WIS) has been prepared by Cardno to support an Ammended Development Application, by LendLease for an independent living facility at 207 Forest Way, Belrose (Lot 100, DP 1114910).

It is proposed to build a split level 2/3 storey building to contain 5 independent seniors living apartments. The proposed building (Building D) would be situated in the south eastern corner of the property and would cover the area impacted by the proposed building and associated landscaped areas (the site). It is located approximately 400m west of the indicative site location for Snake Creek (Warringah Council, 2004), and 500m west of the field observed head waters of Snake Creek (Cardno, 2018; McTackett & Ashby, 2018).

1.2 Purpose

This WIS describes the environmental values of the land at 207 Forest Way, Belrose, specifically the flow paths within and adjacent to the proposed works site. It assesses the potential impact of the proposed development of Building D and associated hydrological works to these values by considering potential changes to habitat area quality, biodiversity, water quality, and hydrology.

Northern Beaches Council (Council) provided a referral response regarding the approved DA (DA2018/1332) specifying the need for a WIS to be completed prior to resubmission of the amended DA (Warringah Council, 2018a).

1.3 Structure

This WIS complies with the requirements of the relevant former Warringah Local Environmental Plan (LEP) and other relevant Council guidelines, including:

- Warringah Council Policy No PL740 *Protection of Waterways and Riparian Land Policy*; and
- *Guidelines for Preparing a Waterways Impact Statement*

The structure of this WIS includes:

- A waterway analysis documenting the ecological values, the nature and extent of the development and its context in relation to the waterway features, and the waterway site and surrounds (**Chapter 2**);
- An assessment of the likely impacts of the development on the waterway and associated habitats and vegetation, with reference to the requirements of the Warringah Council Policy No. PL 740 *Protection of Waterways and Riparian Land Policy* and relevant LEP. This includes detailed analysis of proposed stormwater management measures, on site detention, and erosion and sediment controls (**Chapter 3**);
- An assessment of compliance with the LEP and the relevant Council guidelines (**Chapter 4**); and
- Provision of mitigation measures. This requires consideration of a number of performance criteria and how measures considered acceptable by Council will be applied (**Chapter 5**).

2 Waterway Analysis

2.1 Site Description and Drainage Pathways

The proposed Building D is located in the south eastern corner of the Glenaeon Retirement Village on land that slopes from west to east in a gradient from 10 %, up to 45% around the existing sedimentation basins. It is located approximately 400m west of the indicative site location for Snake Creek (Warringah Council, 2004), and 500m west of the field observed head waters of Snake Creek (Cardno, 2018; McTackett & Ashby, 2018). The existing drainage network is characterised by the presence of three large gabion wall sediment basins. The upper two of these basins provide the footprint of the proposed Building D and the third is downslope at the site boundary. Design drawings are shown in **Appendix A**. Storm water flows are piped from the existing development into the first sedimentation basin, causing a discontinuation of overland flow. This is shown as in **Figure 2-1**.

Below the first two sediment basins there are general flow paths towards the site boundary and the last sediment basin. The southern embankment of the upper two basins is primarily comprised of fill from previous construction of South Avenue. Construction of the upper two basins required significant earthworks and disturbance to any pre-existing landform. This portion of the site is a constructed landscape for the purposes of stormwater management and no longer a natural landscape feature resembling, in a meaningful way, its pre-developed state. All water flow observed in this area was due to pipes channelling flows through the gabion walls. For these reasons and the absence of features such as bed and banks and presence of riparian vegetation the original assessment concluded that the subject land did not meet the definition of riparian land (Cardno, 2018).

2.2 Ecological Value

A review of information was used to determine the (aquatic) ecological value of the proposed development site. This review considered key studies of aquatic and riparian habitat done in the project's footprint and surrounds (i.e. Warringah Council, 2004; McTackett & Ashby, 2018; Cardno, 2018), guidelines for determinging value (Warringah Council 2011), Council's referral responses (Warringah Council, 2018a, 2018b) as well as historic photographs of the site and surrounds.

Snake Creek is the nearest identified waterway to the proposed works. A stormwater conduit running from Forest Way, through the Glenaeon Retirement Village currently feeds into the naturally occurring headwaters of the Snake Creek, approximately 500m to the south-east of the site, shown in **Figure 2-1**. The ecological value of Snake Creek was assessed in 2004 from a site located on the corner of Morgan Rd, and Hilversum Crescent, downstream of the proposed development (Warringah Council, 2004).

This assessment determined the overall ecological value of Snake Creek at that location to be 2.2, with a value of 2 being 'moderate', and 3 being 'high'. The complete analysis of the ecological value is provided in **Appendix D**.

The Warringah Council Creek Study had no field verification of the waterway upstream of the Snake Creek assessment site. Areas mapped as waterways and riparian zones were marked as 'indicative only', and requiring field verification (Warringah Council, 2004). Council's mapping did not consider that the upstream waterway within the development site and immediately downstream consisted of constructed sediment basins or gabion walls. Cardno (2018) assessed the condition of the mapped 'indicative' watercourse and riparian area within the development footprint and downstream, including field investigations. **Figure 2-2** shows the mapped result of this investigation. However, within the site Cardno (2018) did not identify a defined channel with bed and banks or riparian vegetation or land that would meet criteria of a riparian corridor. Historical aerial photographs show a reduction in the vegetation surrounding the adjacent property over time, most significantly in 2014 (Nearmap). Potential riparian areas as indicated in Council DCP Mapping (North Shore/Warringah) are observed on aerial photographs between 2010 and 2012, before the reduction in vegetation and installation of the downstream sediment basin (Nearmap). The current landscape is a result of significant earthworks over time to construct the sediment basins, and cut and fill South Road.as the area observed by Cardno is predominantly landscaped lawns with no stream flow or defined channel.

The area mapped by Council as 'indicative' of protected riparian zone and with a buffer of over 100m (50 metres each side), is much wider than the 10m protected riparian zone assigned to first order streams by the *Water Management Act 2000*. Additionally, the mapped 'indicative' protected riparian zone incorporates existing buildings, roadways and cleared land (McTackett & Ashby, 2018).

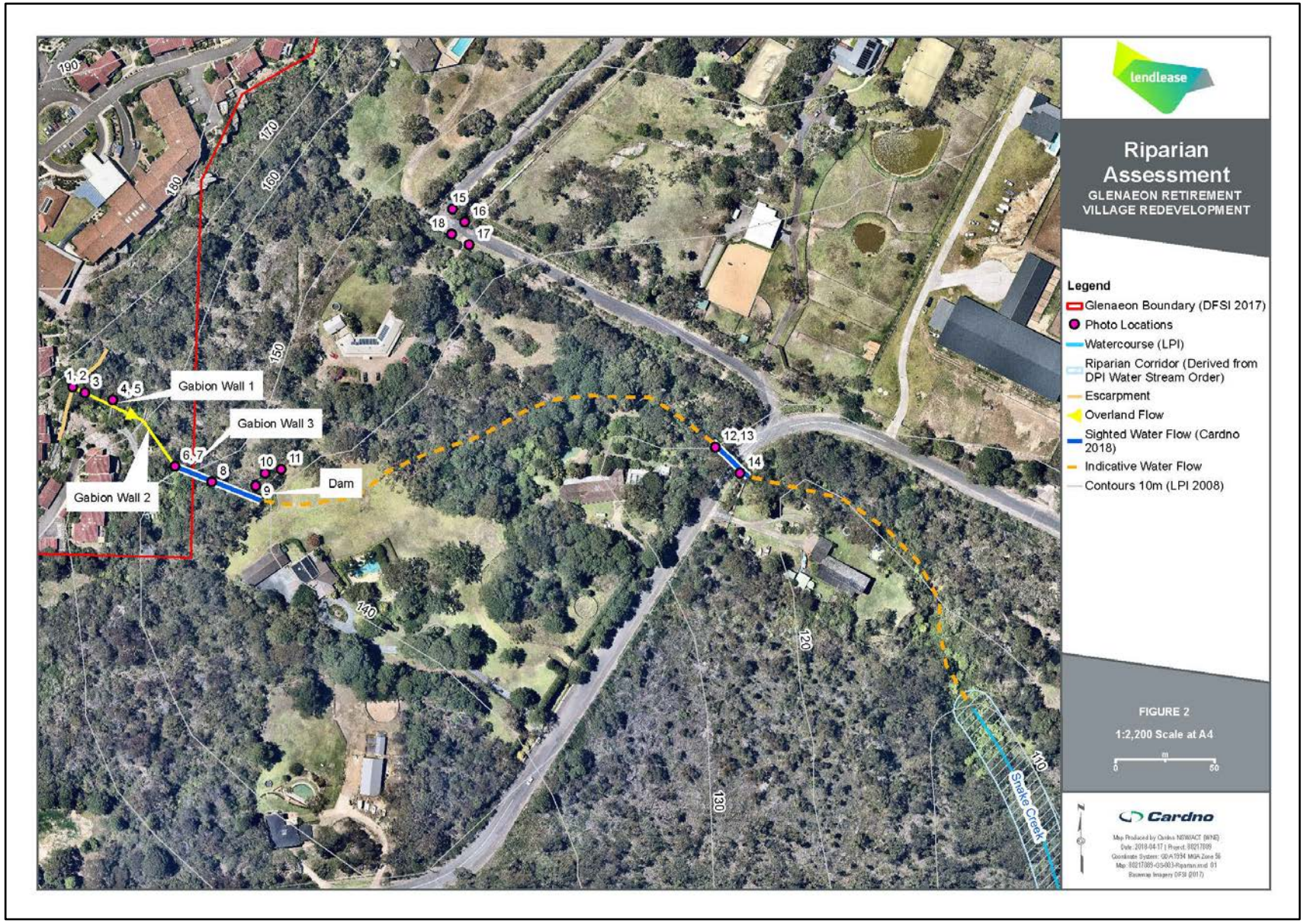
Cardno (2018) inspected the property boundaries to verify the drainage pathway to Snake Creek. A channel was identified in aerial photographs near the corner of Morgan Road and Hilversum Crescent. During the field investigation this was confirmed to be a stream of water that flowed east through a culvert under Morgan Road. It is likely this flow continues south east and joins with the head waters of Snake Creek as shown in Council's storm water mapping in **Figure 2-1**.

An additional review of historic photographs was undertaken using images from 1970, 1975, 1978 and 1982 in addition to the Nearmap images from 2010-2018. The image from 1975 predates a lot of the development on site and provides a clear image of any localised drainage. It clearly identifies riparian land from the north-east boundary of Lot 2, up to the corner of Morgan Road and Hilversum Crescent, and then to Snake Creek. Taller vegetation is evident following the north-south line of the rocky escarpment consistent with the existing vegetation to the east of the Glenaeon village. Clearing of properties east of Glenaeon had commenced by 1970 and there is some remnant vegetation retained between cleared areas running west towards Glenaeon. It is considered that the maximum extent of a defined channel historically extended from the corner of Morgan Road and Hilversum Crescent to close to the boundary of Lot 2 Hilversum Crescent and Lots 9 and 11 Morgan Road. Drainage from the escarpment to this point is via broad overland flow following contours through Lot 9 and Lot 2.

The results of the review of information indicated that the proposed development does not sit on a watercourse or riparian vegetation. The current and historical evidence indicates, however, that the headwaters of Snake Creek (i.e. a first order stream) and remnants of riparian vegetation occur to the east of Lot 100 but not within it. Within Lot 100, the sediment basins and the general flow pathways towards the site boundary are not a watercourse of ecological value and there is no associated riparian corridor. The available evidence indicates that Cardno's (2018) assessment that the subject land did not meet the definition of riparian land is correct.

Figure 2-1 Council 'Indicative' mapping of stormwater, waterways and riparian lands

Figure 2-2 Riparian Assessment, (Cardno, 2018)



2.3 Proposed Works

2.3.1 Option A – Approved proposal

LendLease's initial proposal to construct Building D was not supported by Council, although Council did support the proposed modified stormwater drainage system. The approved stormwater drainage system (Option A) would include the retention of the three existing sediment basins (two within the proposed Building D footprint, and one on the property boundary) and the construction of two detention ponds. Under the proposal, approximately 48m of flow path downstream of the current sediment basins would be removed leaving no natural flow paths. Channels would be constructed to allow stormwater to flow through the sediment basins and detention ponds to the property boundary. Drawings of the existing sediment ponds, and the proposed design are found in **Appendix B**.

This option represents an improvement to the existing drainage system that provides limited riparian ecological value, augmenting it with a more ecologically sensitive design that would improve downstream water quality. However the approved design would leave no natural flow path for stormwater, removing approximately 48m of existing flow path. Instead the flow path would terminate in the uppermost existing sediment basin. The construction of the ponds would represent a disturbance footprint of approximately 740m^2, in addition to the existing sediment basins' area of approximately 420m^2. This option would result in a total disturbance footprint of 1,160m^2. The two new ponds would provide an ecologically sensitive design for the project's stormwater management and would include plantings of native flora to create a riparian-like setting surrounding the sediment basins and detention ponds.

2.3.2 Option B – Revised proposal

Following referrals from Council (Warringah Council, 2018b, 2018a), LendLease is proposing a new stormwater management solution that would maximise ecological outcomes. Under the proposed redesign, an onsite stormwater detention system (OSD) would be constructed beneath the entry exit driveway of the approved podium parking facility for Buildings A B and C , and would be designed to meet the requirements of the former "*Warringah Council On Site Detention Technical Specification*" (Warringah Council, 2012).

Stormwater, treated on site beneath Building A, would be channelled toward Building D, and then to the property boundary along a rehabilitated channel flow path, shown in **Appendix C**. The existing sediment basins, which are currently abandoned infrastructure, would be removed for construction of Building D. The rehabilitated flow path would be maintained in accordance with ecological principles in mind so that bed and banks and a pool/riffle sequence would be consistent with the expected flow volumes for the site. Maintenance of the land would involve planting of appropriate local species to enhance the ecological values of the land and flow path and create a corridor that would be consistent with high quality corridors in the region. The distance of this maintained and improved flow path would be approximately 40m, a substantial improvement to the approved design with no form of flow path remaining on site. The total area of disturbance would be limited to the footprint of the existing sediment basins, which are to be replaced with Building D, or approximately 540m^2, saving 740m^2 of bushland area by relocating the detention ponds of Option A. Thus, Option B would result in an increase in ecological values consistent with Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land* , as well as their *Water Management Policy, Section 8.1 – Stormwater Quality* (Warringah Council, 2017). Flow quantity would remain the same, as it would primarily receive the same piped stormwater flow as the existing land use. However, with the updated stormwater and sediment retention plan, water quality would be enhanced. Hence, there would also be benefits to downstream areas of Snake Creek.

2.4 Options Comparison

Table 2-1 provides a summary comparison of the existing environment with the approved and proposed options.

Table 2-1 Comparison of existing treatment options against existing and proposed options

Existing System	Option A (Approved)	Option B
▪ Footprint: 640m^2 ▪ Three sediment basins with embankment wall formed by gabion baskets ▪ No riparian zone	▪ Disturbance Footprint: 1,160m^2 ▪ Excavation along overland flow path ▪ Construction of two new retention ponds downstream of existing sediment basins ▪ Gross Pollutant Trap and Jellyfish Unit installed at incoming pipes	▪ Disturbance Footprint: 760m^2 ▪ Reduced excavation along overland flow path ▪ OSD located under approved Building A with stormwater treatment filters for removal of nutrients.

Existing System	Option A (Approved)	Option B
▪ Coarse sediment retention ▪ End of line treatment	▪ End of line treatment	▪ Stormwater channeled to Building D, outflow into landscaped flow path ▪ Source treated stormwater ▪ Gross Pollutant Trap (GPT) installed at outlet of trunk drainage for course sediments and litter removal ▪ Retention of bottom sediment basin

3 Potential Impacts

Table 3-1 compares impacts under existing conditions, with potential impacts that would result from the approved, and the proposed development.

Table 3-1 Existing conditions, and potential impacts of each development option

Aspect	Existing Condition	Potential Impacts, Option A (Approved)	Potential Impacts, Option B (Proposed)
Water Quality	The water quality of the existing site would be affected by the ongoing activities associated with the adjacent residential premises. This may include the use and disposal of stormwater and wastewater, maintenance of landscaped areas, and the presence of vehicles onsite. The existing sediment basins provide physical filtration of coarse sediment and litter, but no treatment for other pollutants.	Construction ▪ Mobilisation of sediment due to clearing and removal of existing vegetation and construction of detention ponds Operation ▪ Settlement in sediment basins of coarse sediments and suspended solids from paved areas ▪ Litter and hydrocarbons from onsite vehicles	Construction ▪ Mobilisation of sediment due to clearing and removal of existing vegetation and sediment ponds Operation ▪ Improved stormwater quality prior to discharge to the drainage network
Geomorphology	The existing drainage network is characterised by the presence of large gabion sediment basins located within the footprint of the proposed Building D and downstream at the site boundary. The southern embankment of the upper two basins is primarily comprised of fill from previous construction of South Avenue. It comprises a constructed landscape for the purposes of stormwater management and does not resemble a natural landscape feature. There are no features such as a defined channel with bed and banks that comprise a watercourse or vegetation that meets the features of a riparian corridor	Construction ▪ Disturbance Footprint: 740m^2 ▪ Total Footprint: 1,160m^2 ▪ Removal of 48m of existing flow path Operation ▪ 32m flow path upstream of constructed ponds ▪ Discontinuous flow path ▪ Moderated flow volumes to downstream 1st order stream and riparian zone	Construction ▪ Disturbance Footprint: 760m^2 ▪ Total Footprint: 795m^2 ▪ Removal of 40m of existing flow path Operation ▪ 40m natural flow path created ▪ Flow path connected to downstream 1st order stream (outside of property) ▪ Moderated flow volumes to downstream 1st order stream and riparian zone
Stormwater Management	The existing stormwater drainage network discharges to the existing sediment basins at the end of South Avenue. The basins have an embankment wall made with gabion baskets. Each basin has a storage volume of approximately 200m^3 and the existing dams are covered with overgrown vegetation. Based on the construction details, the basins are likely being used for coarse sediment retention as the porous materials at the embankment	Construction ▪ Stormwater runoff from the development to be compliant with PL 850 (Warringah Council, 2017) Operation ▪ End of line treatment of pollutants through installation of Gross Pollutant Trap (GPT) and Jellyfish Trap	Construction (Outside of property) ▪ Stormwater runoff from the development to be compliant with PL 850 (Warringah Council, 2017) Operation ▪ OSD providing source treatment of sediments and contaminants ▪ Reduced drainage pits and size of maintenance pads near overland flow path ▪ Reduced impact on drainage network in South Avenue

Aspect	Existing Condition	Potential Impacts, Option A (Approved)	Potential Impacts, Option B (Proposed)
	wall would be too coarse to retain suspended solids and fine sediments.		▪ Improved pollutant retention efficiency through installation of Gross Pollutant Trap (GPT) and stormwater treatment filters.
Ecology	There are no natural waterways present on site, and no areas within the site meet the definition of riparian land. The existing stormwater sediment basin is located within the area mapped by Council as 'indicative' riparian land. The vegetation within this area is dominated by weeds. Currently no area of the site is mapped as having important Biodiversity Value. There are no threatened flora species or endangered ecological communities and the area offers no value to threatened or non-threatened native fauna. Adjacent bushland is subject to general hazard reduction burning, and the value of the vegetation is low (Ethos Urban Pty Ltd, 2018).	<u>Construction</u> ▪ Prescribed impact due to clearance of native vegetation (low value vegetation) <u>Operation</u> ▪ Loss of 7 trees of significance ▪ Replacement of exotic trees with natives complimentary to riparian zone ▪ Disconnected habitats between land above sediment ponds and downstream riparian zones	<u>Construction</u> ▪ Prescribed impact due to clearance of native vegetation (low value vegetation) <u>Operation</u> ▪ Loss of 5 trees of significance (For construction of Building D) ▪ Retain 7 trees of significance as a consequence of the removal of the approved stormwater ponds. ▪ Rehabilitation of the area covered by approved detention ponds ▪ Retains more existing bushland and natural ground, of benefit to the ecological processes that sustain the vegetation, including plant-soil interactions and soil seedbanks ▪ Existing aquatic habitat within bottom sedimentation pond will be retained and improved ▪ Consolidation of retained and regenerated bushland improving fauna habitat connections to the riparian lands associated with Snake Creek to the east of the site ▪ Connected rehabilitated and new parts of greater value to less mobile fauna and those species unlikely to use or cross the detention basin system. Natural rehabilitated systems provide less hostile habitat for more species than engineered systems. ▪ Created habitat would provide foraging area for threatened and non-threatened native fauna
Landscape	Constructed landscape for the purposes of stormwater management which does not resemble a natural landscape feature. Predominantly landscaped lawns with no stream flow, defined channel or riparian zone.	▪ Proposed revegetation of footprint of former upper sediment ponds ▪ Does not allow for amenity and use of area	▪ Bottom sedimentation pond retained, weeds removed, and surrounding lands regenerated; opening of the canopy improving the aquatic habitat and allow for planting of native riparian vegetation ▪ Regeneration of surrounding bushland, opening canopy

4 Compliance Assessment / Comparison

The *Warringah Local Environmental Plan 2000* (LEP) was replaced in 2011 with the Warringah LEP 2011. Certain parts of the LGA have been 'deferred' and are not covered by the LEP 2011. The proposed site is located within an area identified as a 'deferred matter' and the Warringah Local Environmental Plan (LEP) 2000 applies. As such, the *Warringah Development Control Plan 2011* (DCP) does not apply to the proposed site, and the LEP 2000 is to be read in conjunction with the Warringah DCP 2000 to assess planning and development applications within the previous Warringah section of the Northern Beaches LGA (McTackett & Ashby, 2018).

Of relevance to this assessment report are the following clauses:

- Clause 56 – Retaining distinctive environmental features on sites;
- Clause 58 – Protection of existing flora;
- Clause 60 – Watercourses and aquatic habitat; and
- Clause 76 – Management of Stormwater.

Table 4-1 outlines the requirements of these clauses, and how Option B will achieve compliance to them.

Table 4-1 Requirements of relevant clauses with Warringah LEP 2000, and Project response

Specific Clause Requirements	Response
Clause 56 – Retaining distinctive environmental features on sites	
Development is to be designed to retain and complement any distinctive environmental features of its site and on adjoining and nearby land. In particular, development is to be designed to incorporate or be sympathetic to environmental features such as rock outcrops, remnant bushland and watercourses.	The proposed development of Building D will be constructed at least 60m from the small rock overhangs with most potential to provide temporary night resting places for a number of microbats, and within 12m of other rocky features. The two existing sediment basins within the footprint of Building D will be removed. The downslope basin will be retained. Part of the remnant bushland will be cleared for Building D. However, this loss is small in scale, and most of the remnant bushland that occurs on the Glenaeon Retirement Village will remain. The nature of the site will remain essentially unchanged, with important environmental features retained, replaced, or only minimally reduced.
Clause 58 – Protection of existing flora	
Development is to be sited and designed to minimise the impact on remnant indigenous flora, including canopy trees and understorey vegetation, and on remnant native ground cover species.	The proposal seeks to replace exotic landscaped plantings with native plantings that will improve the site's ecological relationship with its surrounds. In accordance with good environmental practice, the loss of native vegetation and flora habitats has been minimised. The location, orientation, extent, and stormwater design of Building D has been subject to a number of revisions in order to minimise its environmental impact. The site supports some natural areas within and alongside the area nominated for the construction of Building D The proposed loss of vegetation is small (approximately 0.16 hectare) and consists of canopy trees and shrubby/grassy understorey that is already regularly fuel-reduced for bushfire hazard control. The proposal will retain the majority of native vegetation on site.
Clause 60 – Watercourses and aquatic habitat	
Development is to be sited and designed to maintain and enhance natural watercourses and aquatic habitat. Note. Development within 40m of a watercourse requires a permit pursuant to the *Rivers and Foreshores Improvement Act 1948*, from the Department of Land and Water Conservation.	*Note: no mapping of watercourses and aquatic habitat under the WLEP 2000 was identified during desktop analysis, however mapping of Waterways and Riparian Lands as per the WLEP 2011 identified the proposed site as Riparian Lands. In the absence of mapping for the WLEP 2000, it is assumed that mapping for the WLEP*

Specific Clause Requirements	Response
	2011 is reflective of previous Watercourse and Aquatic habitats nominated under the WLEP 2000. The site has been confirmed as not containing riparian land and no permit is required for a Controlled action under the Water Act (NB these provisions replaced the *Rivers and Foreshores Improvement Act 1948*). As identified by Cardno (2018), the headwaters of Snake Creek are located 500m downstream and south east of the site. Notwithstanding this, the development seeks to create a natural flow path on site and improve the overall water quality of any downstream flow from the site through new stormwater management systems. Refer to **Section 2.3** and **Section 3** of this report for more details.
Clause 76 – Management of Stormwater	
Stormwater runoff from development is to discharge to a Council drainage system approved by the Council for the purpose and is to have minimal impact on any receiving stormwater infrastructure, watercourse, stream, lagoon, lake, waterway or the like. Water quality control measures are to be provided in accordance with the *Northern Beaches Stormwater Management Plan*. Stormwater runoff is to be controlled using on-site stormwater detention in accordance with the Council's "On-site Stormwater Detention Technical Specification". Stormwater detention systems are to be visually unobtrusive and integrated with site landscaping.	Stormwater management plans have been prepared by Cardno and Wood & Grieve Engineers to appropriately manage stormwater runoff and the quality of stormwater discharge. The plans have been designed in accordance with the Northern Beaches Council's *Water Management Policy* and *NSW MUSIC Modelling Guidelines*, 2015. Incorporating the stormwater treatment system into the building footprint provides for approximately 48m of land suitable for establishment of natural flow pathsthat reflect the values of a natural upper catchment as well as directly connecting into the downstream riparian land.

5 Mitigation Measures

The following measures are proposed to be implemented as part of design, construction, and operation of Building D. These measures have been developed to meet the performance criteria set out in Section 8.1.5 of the *Creek Management Study* (Warringah Council, 2004), and the *Waterways Impact Statement Guidelines* (Warringah Council, 2011).

Table 5-1 Mitigation measures for meeting required outcomes

Outcomes and Performance Criteria	Measures
Outcome 1: Protecting native species and communities	
Maintain natural habitats	▪ Retain 7 trees of significance ▪ Retain and rehabilitate existing bushland and natural ground
Provide fauna movement routes	▪ Rehabilitate and connect parts of value to fauna ▪ Continuous flow path connecting upper stormwater flows to downstream (off site) aquatic habitats and riparian land in accordance with Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Prevent unnatural erosion or sediment deposition	▪ Erosion and Sediment Control Plan implemented before and during construction until site is stabilized, in accordance with Landcom's 'Blue Book' ▪ OSD and stormwater treatment filters providing source treatment of sediments and contaminants ▪ Reduced impact on drainage network in South Avenue ▪ Installation of Gross Pollutant Trap (GPT)
Maintain acceptable water quality	▪ Stormwater treatment measures are designed to ensure stormwater management would meet the principals of neutral or beneficial effect ▪ OSD and stormwater treatment filters providing source treatment of sediments and contaminants ▪ Stormwater quality runoff from the development to be compliant with PL 850 (Warringah Council, 2017)
Maintain connectivity between waterways and floodplains	▪ Proposed development will maintain the natural drainage into Snake Gully in accordance with Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Outcome 2: Prevent loss of natural diversity through protecting waterway and riparian vegetation (including non-native vegetation)	
Avoid introducing plants or animals which may displace natural species	▪ Exclusion fencing during construction to prevent introduction of plants or animals to site ▪ Ongoing bush regeneration including weed control
No increase in nutrient loads to riparian soils and waterways	▪ Stormwater treatment measures are designed to ensure stormwater management would meet the principals of neutral or beneficial effect to comply with Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Avoid displacing species by habitat changes	▪ Replace exotic and ornamental landscaping with extensive native (replacement plantings ▪ Plant species to be used in revegetation are to suit the site characteristics; are native to the area and vegetation community that is being enhanced; belong together naturally; and have been grown from local seeds
Protect natural areas from contamination	▪ Bush regeneration undertaken by qualified contractors ▪ Natural areas are downslope of OSD system
Prevent the loss of any rare or threatened natural features	▪ The site does not contain any threatened flora species or endangered ecological communities or other important features

Outcomes and Performance Criteria	Measures
Protect downstream protected areas, such as National Parks	▪ Erosion and Sediment Control Plan implemented before and during construction until site is stabilized, in accordance with Landcom's 'Blue Book' ▪ OSD and stormwater treatment filters providing source treatment of sediments and contaminants prior to discharge into natural system ▪ Stormwater quality runoff from the development to be compliant with PL 850 (Warringah Council, 2017) ▪ Stormwater treatment measures are designed to ensure stormwater management would meet the principals of neutral or beneficial effect as outlined in Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Outcome 3: Minimise damage to public and private property by waterway processes through maintaining the relative stability of the bed and banks	
Avoid increases in peak channel flows and sediment exports for events smaller than 2-year Average Recurrence Interval (ARI)	▪ OSD system is being proposed for the site; there will be no increase peak flows in any flood events
Avoid local erosion at stormwater outlets	▪ Sedimentation fences installed during construction ▪ Stormwater drainage inlet protection
Avoid export of weeds from private properties into waterways	▪ Collected stormwater will pass through OSD and stormwater treatment filters system before discharge into natural systems ▪ Ongoing weed management will be done as facility management
Channel banks are not over steepened	▪ There are no formed channels on site and none proposed that would be over steepened ▪
Channel banks are stable	▪ There are no formed channels on site ▪ The proposed design includes planting with suitable native vegetation to create a natural and stable flow path to comply with Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Outcome 4: Preserve natural ecological processes	
Streamflow and water quality are natural	▪ Stormwater treatment measures are designed to ensure stormwater management would meet the principals of neutral or beneficial effect as outlined in Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land* ▪ Stormwater quality runoff from the development to be compliant with PL 850 (Warringah Council, 2017) ▪ Moderated flow volumes to site and downstream waterways
Aquatic and riparian vegetation are undisturbed and unmodified	▪ There are no formed channels on the site and no aquatic or riparian vegetation present ▪ Vegetation will be enhanced through weed management and the planting of appropriate local indigenous species, improving ecological values as per Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Aquatic and riparian fauna habitat and movement corridors are maintained	▪ Retain and rehabilitate existing bushland and natural ground ▪ Rehabilitate and connect parts of value to fauna ▪ Continuous flow path proposed that would connect upper stormwater flows to downstream off site riparian land and habitats to meet objectives of Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*
Outcome 5: Create opportunities for public access and recreation in waterway corridors	
Provide public access along creek corridors where appropriate	▪ Works are proposed to be carried out on private property; public access is not intended. ▪ The revegetated land will provide improved visual amenity to private residents and visitors

6 Conclusion

This WIS considered the potential impacts of the proposed development on ecology and aquatic biodiversity, water quality and waterway hydrology and compared the outcomes of two proposed options against existing conditions. The WIS found the site of the proposed development at 207 Forest Way, Belrose had no value as aquatic or riparian habitat, consistent with the 2018 assessment carried out by Cardno. The site, however, is located approximately 500m west and upstream of the observed headwaters of Snake Creek, a sub-catchment of the Narrabeen Lagoon Catchment, where there is aquatic and riparian habitat.

The proposed development would change the land use in the area of the existing constructed sedimentation ponds, to a more water sensitive and ecologically valuable outcome. The proposed development footprint would not extend beyond the area of the existing sedimentation ponds.

The preferred option (Option B) would provide for improved water quality at the site and downstream, a natural flow path, potential for good quality native vegetation within the site, and connection of site stormwater flow paths and habitat with downstream areas. These improvements would have flow on benefits to threatened and other native fauna by providing new areas of quality habitat, corridors and foraging habitat, meeting the objectives of Warringah Council Policy No. PL740 *Protection of Waterways and Riparian Land*.

The proposed site for Building D does not meet the definition of riparian land, as found by the review of information completed in preparation of this report, as well as the previous assessment completed by Cardno (2018), however the environmental management of the proposed works under Option B has carefully considered mitigation measures which would contribute to meeting the following outcomes for riparian land downstream of the site:

- Outcome 1: Protecting native species and communities;
- Outcome 2: Prevent loss of natural diversity through protecting waterway and riparian vegetation (including non-native vegetation);
- Outcome 3: Minimise damage to public and private property by waterway processes through maintaining the relative stability of the bed and banks;
- Outcome 4: Preserve natural ecological processes

7 References

Cardno. (2018). *Riparian Assessment*.

Ethos Urban Pty Ltd. (2018). Statement of Environmental Effects Integrated DA - Seniors Housing Glenaeon Renewal. *Submitted to Northern Beaches Council On Behalf of Lendlease - Retirement Living*.

McTackett, A., & Ashby, E. (2018). Biodiversity Impact Assessment Report (Local and Commonwealth Matters) Glenaeon Renewal Precincts 199 and 207 Forest Way Northern Beaches LGA. *Unpublished Report*. Keystone Ecological.

Warringah Council. (2000). Warringah Council Policy (No . PL 740): Waterways and Riparian Land Policy. *Policy*, 1–8.

Warringah Council. (2004). *Creek Management Study* (Montgomery Watson Harza, Ed.).

Warringah Council. (2011). *Waterways Impact Statement Guidelines: Guidelins for Preparing a Waterways Impact Statement* (pp. 1–7). pp. 1–7.

Warringah Council. (2012). *On-site Stormwater Detention Technical Specification*.

Warringah Council. (2017). *PL 850 Water Water Management Policy (version 3)* (pp. 1–24). pp. 1–24.

Warringah Council. (2018a). *Natural Environment Referral Response - Riparian* (pp. 1–2). pp. 1–2.

Warringah Council. (2018b). *Water Management Referral Response*.

APPENDIX

A

EXISTING SITE CONDITIONS

Existing Condition & Asset Protection Zone

Image Explanation: This image shows the site in its existing condition. The trees highlighted are those that would be specifically removed for purposes of creating an APZ for the village today. They were selected for removal by the combined review of the Bushfire, Ecology and Arboreal consultants to select those trees which collectively would have the least overall ecological impact. Trees highlighted (both unstable and other) were selected for the Asset Protection Zone (APZ).

It should be noted that an APZ requires reduction to 15% canopy cover with some flexibility due to risk of fire and environmental considerations. Thus a number of the trees removed to make way for development (on the next page) would continue to need to come out in in the SW quadrant of the site to assure a valid APZ is achieved.

Sedimentation Pond
Area: 444m2 approx

Water Channel
Length: 32m approx.

Water Channel Length:
48m approx.

Sedimentation Pond
Area: 207m2 approx

Tree Legend:

- Trees to be retained
- Trees to be retained with branch pruning (refer to sheet 21)
- Other trees to be retained not specifically considered in this report
- Trees that are structurally Unstable and proposed to be removed for the APZ
- Trees to be moved for the purposes of bushfire asset protection for the APZ
- Gabions
- Flow Path

This plan is based upon:

Plan Showing Tree Survey & Levels Glenaeon Village, 199 Forest Way Belrose Dwg. No. T11828704001, Dated 23/05/2018 (Cardno, Rockdale, NSW).

General Arrangement Plan, Dwg No. 256773_CDA_BA_000_1031, Rev. 7, Dated 05/03/2019, (Cardno, Rockdale, NSW).

The tree canopy spreads on this plan have been adjusted from those on the survey to better reflect the actual canopy spreads however they remain as indicative graphics.

PRE DA MEETING

NOT FOR CONSTRUCTION

lendlease

Scale
1 : 700 @ A3

Lendlease Retirement Living

Project
Glenaeon Retirement Village

Drawing Title
Existing Condition & Asset Protection Zone

Rev	Revision Description	Date
01	DRAFT ISSUE FOR COMMENT	13.08.2019

Drawing Number
A0001

Date 13.08.2019

Revision
01

APPENDIX

B

OPTION A DRAWINGS

Submitted DA Proposal

Image Explanation: This image shows the full proposal submitted for DA approval. The additional orange coloured trees are those that require removal due to the direct impact of development. Of focus are the trees around building D and the adjacent stormwater ponds (that development marked in black).

Tree Legend:

- Trees to be retained
- Trees to be retained with branch pruning (refer to sheet 21)
- Other trees to be retained not specifically considered in this report
- Trees that are structurally Unstable and proposed to be removed for the APZ
- Trees to be moved for the purposes of bushfire asset protection for the APZ
- Trees to be removed due to the direct impact of development.
- Gabions
- Flow Path

This plan is based upon:

Plan Showing Tree Survey & Levels Glenaeon Village, 199 Forest Way Belrose Dwg. No. T11828704001, Dated 23/05/2018 (Cardno, Rockdale, NSW).

General Arrangement Plan, Dwg No. 256773_CDA_BA_000_1031, Rev. 7, Dated 05/03/2019, (Cardno, Rockdale, NSW).

The tree canopy spreads on this plan have been adjusted from those on the survey to better reflect the actual canopy spreads however they remain as indicative graphics.

PRE DA MEETING

NOT FOR CONSTRUCTION

lendlease

Scale
1 : 700 @ A3

Lendlease Retirement Living

Project

Glenaeon Retirement Village

Drawing Title

Submitted DA Proposal

Rev	Revision Description	Date
01	DRAFT ISSUE FOR COMMENT	13.08.2019

Drawing Number
A0002

Date 13.08.2019

Revision
01

Approved DA Proposal

Image Explanation: This image shows the portion of the DA approved by the NSPP. The NSPP approval excluded the approval for Building D but approved the balance of the project including the APZ and the new stormwater ponds.

Note that all that is to occur over the existing sedimentation ponds that are now without a stormwater source is “to be maintained with native vegetation.”

Tree Legend:

- Trees to be retained
- Trees to be retained with branch pruning (refer to sheet 21)
- Other trees to be retained not specifically considered in this report
- Trees that are structurally Unstable and proposed to be removed for the APZ
- Trees to be moved for the purposes of bushfire asset protection for the APZ
- Trees to be removed due to the direct impact of development.
- Gabions
- Flow Path

This plan is based upon:

Plan Showing Tree Survey & Levels Glenaeon Village, 199 Forest Way Belrose Dwg. No. T11828704001, Dated 23/05/2018 (Cardno, Rockdale, NSW).

General Arrangement Plan, Dwg No. 256773_CDA_BA_000_1031, Rev. 7, Dated 05/03/2019, (Cardno, Rockdale, NSW).

The tree canopy spreads on this plan have been adjusted from those on the survey to better reflect the actual canopy spreads however they remain as indicative graphics.

NOT FOR CONSTRUCTION

PRE DA MEETING

lendlease

Scale
1 : 700 @ A3

Lendlease Retirement Living

Project
Glenaeon Retirement Village

Drawing Title
Approved DA Design

Rev	Revision Description	Date
01	DRAFT ISSUE FOR COMMENT	13.08.2019

Drawing Number
A0003

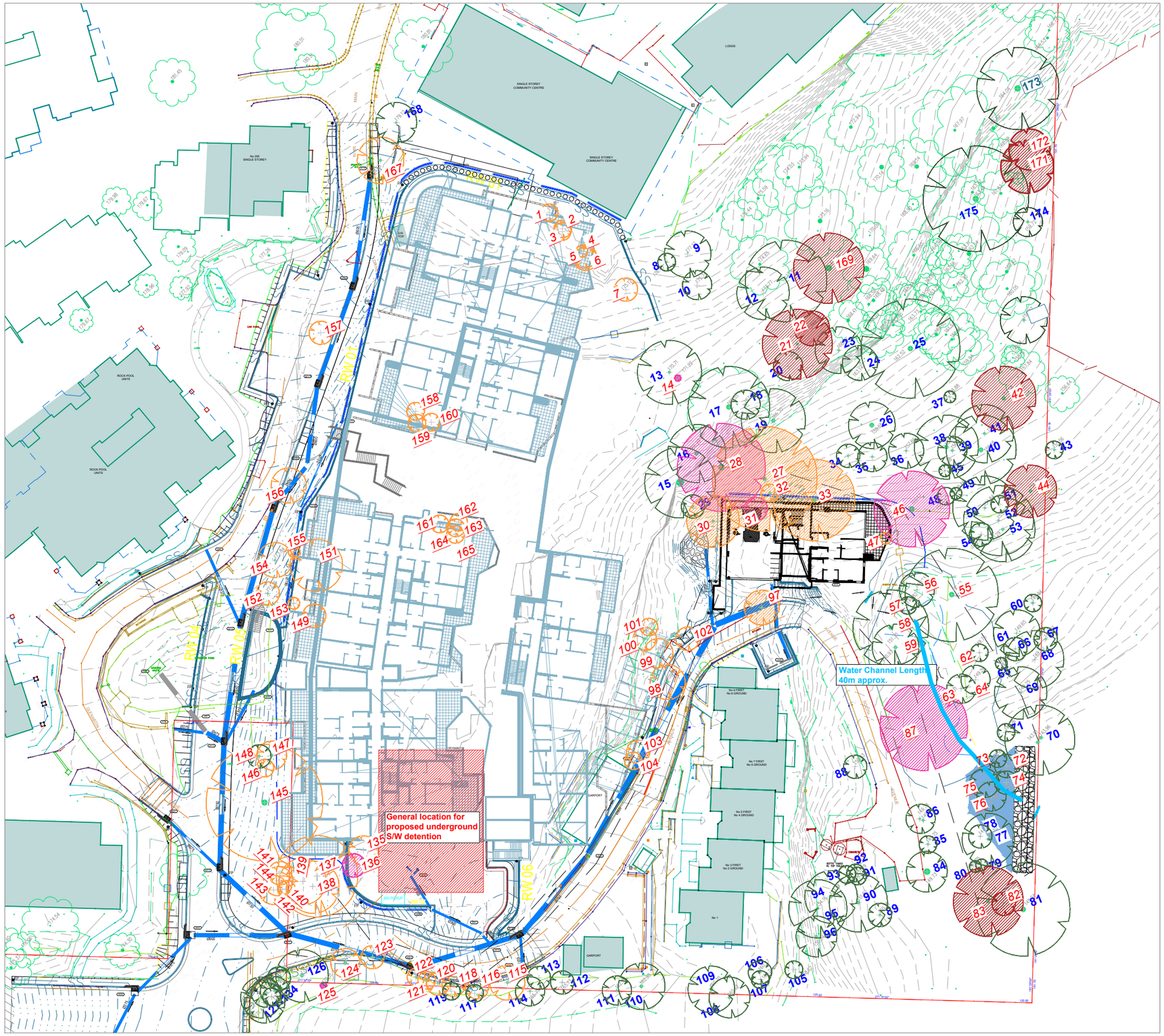
Date 13.08.2019

Revision
01

APPENDIX

C

OPTION B DRAWINGS



New Proposal

Image Explanation: This image shows Lendlease Retirement Livings new proposal. It would allow the construction of Building D to go forward while relocating the detention associated with the 2 approved stormwater ponds into an underground tank/s located below the entry and the project's main underground garage. It results in the same to improved stormwater and water quality outcomes as the approved design.

Tree Legend:

- Trees to be retained
- Trees to be retained with branch pruning (refer to sheet 21)
- Other trees to be retained not specifically considered in this report
- Trees that are structurally Unstable and proposed to be removed for the APZ
- Trees to be moved for the purposes of bushfire asset protection for the APZ
- Trees to be removed due to the direct impact of development.
- Gabions
- Flow Path

This plan is based upon:

Plan Showing Tree Survey & Levels Glenaeon Village, 199 Forest Way Belrose Dwg. No. T11828704001, Dated 23/05/2018 (Cardno, Rockdale, NSW).

General Arrangement Plan, Dwg No. 256773_CDA_BA_000_1031, Rev. 7, Dated 05/03/2019, (Cardno, Rockdale, NSW).

The tree canopy spreads on this plan have been adjusted from those on the survey to better reflect the actual canopy spreads however they remain as indicative graphics.

PRE DA MEETING

NOT FOR CONSTRUCTION

lendlease

Scale
1 : 700 @ A3

Lendlease Retirement Living

Project
Glenaeon Retirement Village

Drawing Title
New Proposal

Rev	Revision Description	Date
01	DRAFT ISSUE FOR COMMENT	13.08.2019

Drawing Number
A0004

Date 13.08.2019

Revision
01

APPENDIX

D

SNAKE CREEK ECOLOGICAL VALUE ANALYSIS

Snake Creek – Cnr Morgan Rd and Hilversum Cr

Reach Number	Current Condition and Processes	Environmental Values (generally ecological)	Environmental Issues or Risks	Value Indicator	Environmental Management Strategy
6.1.3.3	• Irregular shaped, sand dominated channel 2-5min width, 1-2m in depth. Transition from Steep headwater to Partly confined, bedrock controlled reach with discontinuous floodplain. • Channel characterised by pool-riffle sequences (5m), cascades, high waterfalls, plunge pools, sand and gravel bars (~1-2m length), erosional benches. • Pockets of floodplain show scour features indicating channel floodplain connectivity is functional. Accumulations of sediment form pseudo levee • Channel at this site goes through transition from steep headwater to partly confined with alternating floodplain pockets. The transition point between these river styles is a large waterfall. • Downstream of the waterfall the valley opens up and becomes moderately sinuous. The creek meanders within this broad valley floor (>100m). • The channel within this reach is narrow and shallow, and is kept stable by the infestation of weeds. • The reach upstream of the waterfall has a bad odour	• Input of large amounts of sand and gravel from upstream construction and land clearing are depositing sediment bars in channel. • Upstream of the waterfall channel suffers bank erosion and bed aggradation. • Water quality is poor, resulting in the dieback of angophoras and the proliferation of weeds. • GPT and small retention basin .prevent fish passage • Some areas of natural catchment land-use, small farms also making up large part of catchment. • Good connectivity, species richness and composition of natural vegetation on floodplain and in riparian zone upstream of waterfall • Good representation of native vegetation of local creeks upstream of waterfall, but showing signs of degradation. • Good native species richness and abundance upstream of waterfall • Crayfish in creek (upstream of road) Good connectivity of vegetation for dispersal of terrestrial species especially upstream of road (limited corridor on downstream side) • Good refuge for native fauna on upstream side, limited refuge downstream of road due to exposure to road and adjoining farm	• Naturalness, representativeness and diversity threatened by deteriorating water quality due to runoff from farms, import of weed propagules and consequent intensification of weed invasion. Dieback of some trees further downstream. Mown lawn of adjacent house is fairly close to stream. Fill for road on north-east side • Native stream fauna such as crayfish strongly affected by water quality, particularly downstream. • Habitat for native fauna threatened particularly downstream of road, due to its narrow width, high edge to area ratio and consequently high vulnerability to weed	Naturalness: 2 Representativeness: 2 Diversity: 3 Rarity: 2 Special Features: 2 **Overall Ecological Value: 2.2**	• Source of effluent entering the channel needs to be discovered and controlled. • Sediment runoff from construction and agriculture upstream needs to be controlled • Weed removal and bank stabilisation is required both at this site and upstream

Ecological Value Indicator:
4=Very High; 3=High; 2=Moderate; 1=Low