

# MARSHALL PRECINCT STRUCTURE PLAN

STORMWATER MANAGEMENT STRATEGY
DECEMBER 2022

PREPARED FOR CITY OF GREATER GEELONG

This report has been prepared by the office of Spiire
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**Acknowledgements and Recognition**

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## TABLE OF ACRONYMS

| | |
|---|---|
| **Stormwater Management Strategy** | SWMS |
| **Precinct Structure Plan** | PSP |
| **Rail Projects Victoria** | RPV |
| **Major Roads Projects Victoria** | MRPV |
| **Corangamite Catchment Management Authority** | CCMA |
| **Main Outfall Sewer** | MOS |
| **North East Industrial Precinct** | NEIP |
| **Australian Rainfall and Runoff** | ARR |
| **Reinforced Concrete Box Culverts** | RCBC |
| **Reinforced Concrete Pipe** | RCP |
| **Future Urban Structure** | FUS |
| **Invert Level** | IL |
| **Normal Water Level** | NWL |
| **Extended Detention Depth** | EDD |
| **Every Year** | EY |
| **Annual Exceedance Probability** | AEP |
| **Developer Contribution Plan** | DCP |

# 1. INTRODUCTION

Spiire have been engaged by City of Greater Geelong Council (The City) to undertake a Stormwater Management Strategy (SWMS) for the Marshall Precinct Structure Plan (PSP). The SWMS is integral to the PSP and informs the Future Urban Structure (FUS) and Developer Contributions Plan (DCP).

This report presents the Marshall PSP SWMS which addresses the following key objectives:

- Management of flood flows using retarding basins.
- Water quality treatment using Water Sensitive Urban Design (WSUD).
- Conveyance of peak flows through the Precinct using pipes, road reserves and constructed waterways.
- Outfall drainage downstream of the Precinct through constructed waterways.

It is important to note that, as agreed with The City, volumetric reduction of stormwater has not been assessed or provided for Marshall PSP SWMS. Recycled Water will be provided by Barwon Water to Marshall Precinct (referred to hereinafter as "the Precinct") and the expectation is that this will be mandated for toilet flushing and garden tap supply. In the absence of any other large demands, such as sporting ovals within the Precinct, meaningful volumetric reduction of stormwater is considered unfeasible.

## 1.1 MARSHALL PSP LOCATION

The Marshall PSP forms part of the Armstrong Creek Growth Area, in the southeast of Geelong (refer Figure 1).

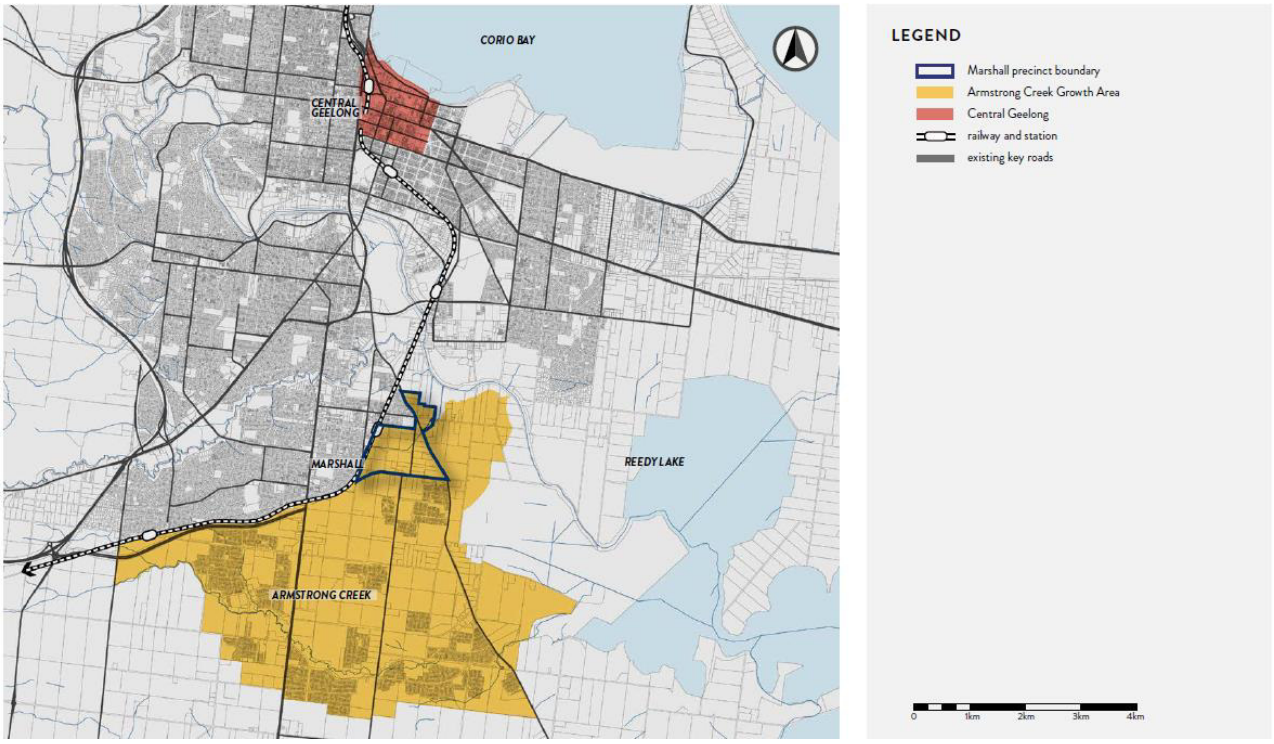



**Figure 1. Marshall Precinct location (City of Greater Geelong).**

Figure 2 presents the Armstrong Creek Precinct Plan. The Marshall Precinct is located in the northwest extent of the Growth Plan, bounded by the North East Industrial Precinct (NEIP) to the west and the Horseshoe Bend Precinct to the north.

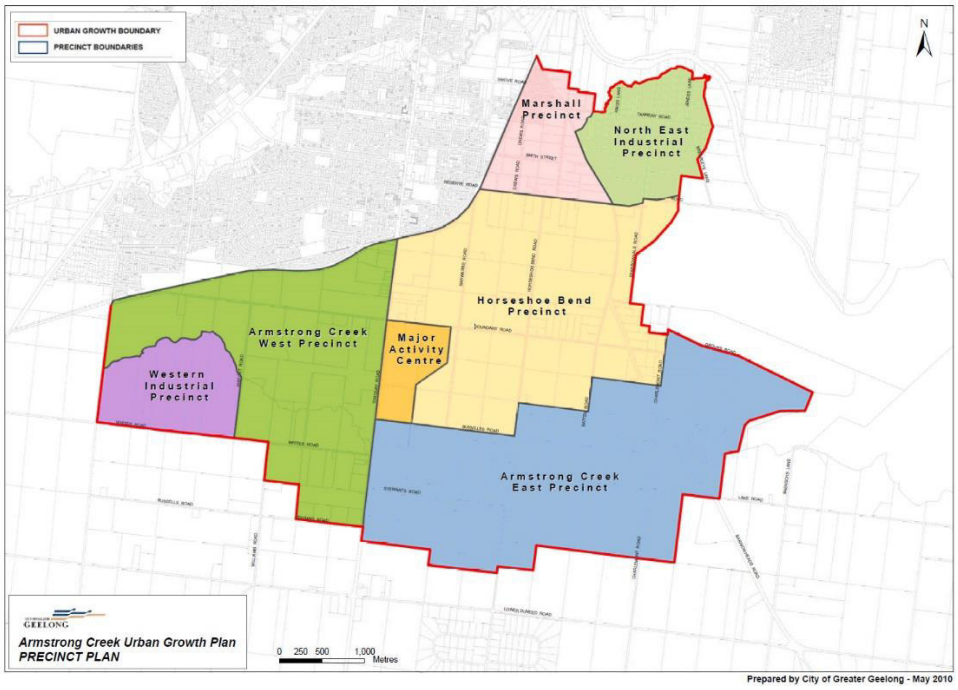



**Figure 2. Armstrong Creek Urban Growth Plan (City of Greater Geelong).**

Figure 3 presents Marshall Precinct in a local context.

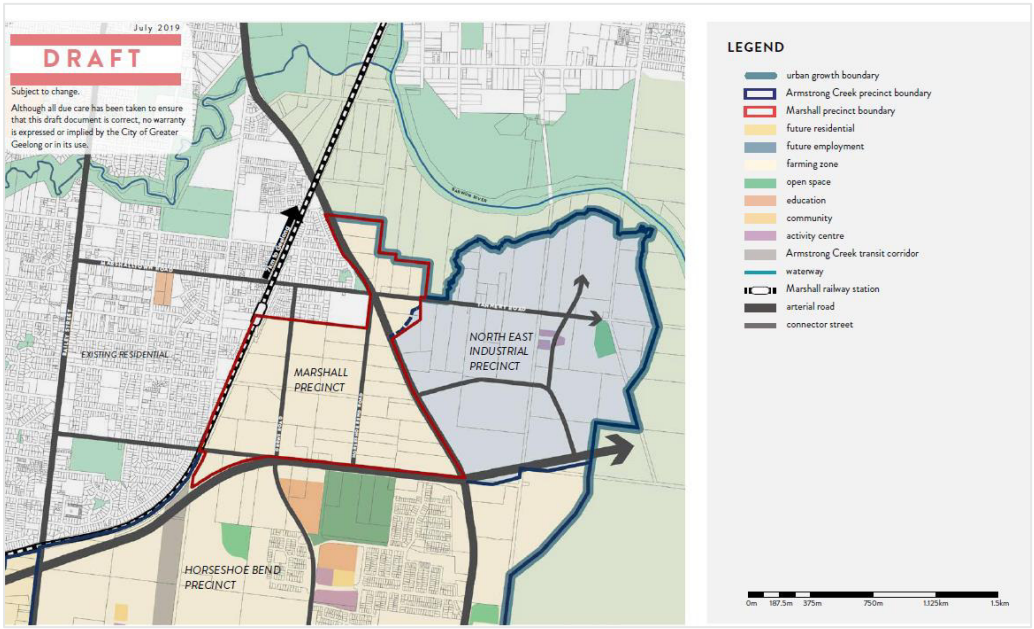



**Figure 3. Marshall Precinct local context (City of Greater Geelong)**

The Precinct will be predominantly residential in land use. Refer to Appendix 5 for the Future Urban Structure. As shown:

- Existing residential development (Grovedale) lies immediately to the west of the Precinct.
- The existing suburb of Marshall is located immediately to the north of the Precinct.
- The Horseshoe Bend Precinct lies to the south, including the Watermark and Charlemont Rise Estates. At the time of writing, both of these estates are at an advanced stage of development.
- Areas to the east of the Precinct currently have a mix of uses (open paddock, rural residential and commercial) although ultimately will form part of the future NEIP. Further east lies the Barwon River and its floodplain, to which both the Marshall and NEIP Precincts ultimately drain.

## 1.2 SCOPE OF WORK

The scope of work for this SWMS is as follows:

- Review all background information and studies as input to the SWMS.
- Engage with all relevant authorities and stakeholders to ensure the SWMS is suitably considered and informed.
- Undertake a site visit.
- Undertake hydrologic modelling and retarding basin sizing using RORB.
- Develop a WSUD treatment train using MUSIC.
- Develop a preliminary design and drawing set of the main SWMS assets to confirm the functionality of the system. Note this requirement was identified due to the high number of constraints and complexities within and around the Precinct, and also the flat local terrain.
- Prepare a SWMS report (this report).

# 2. EXISTING CONDITIONS AND SITE FEATURES

Roughly triangular in shape and covering an area of approximately 123ha, the Precinct is relatively flat across its internal catchments. This flat topography, combined with a number of existing constraints present across the Precinct creates a number of complexities from a stormwater management perspective.

Existing site conditions and significant features are described and discussed below.

## 2.1 EXISTING SURFACE WATER CATCHMENTS

There are 6 main surface water catchments associated with Marshall Precinct. These are shown in Figure 4, with details presented in Table 1, together with existing flow estimates, derived using RORB. Refer to Appendix 1 for detailed catchment assessment and hydrological (RORB) modelling.

The main waterway through the Precinct is unnamed, but for the purposes of this SWMS, is referred to as “Marshall Creek”.

**Table 1: Existing surface water catchment summary table**

| Catchment | Description | Area (ha) | 1% AEP peak flow ($m^3/s$) | 20% AEP peak flow ($m^3/s$) |
|---|---|---|---|---|
| External catchment southwest | Includes areas of southeast Grovedale and future Horseshoe Bend Precinct. Main flow path is Triffilos Drain, an open channel which drains to Marshall Precinct. | 152 | 8.1 | 2.5 |
| External catchment west | Includes catchment areas within Grovedale which flow through Smith Street retarding basin before entering Marshall Precinct. | 50 | 1.7 | 1.7 |
| Marshall catchment | Includes entire Marshall Precinct west of Barwon Heads Road. Marshall Creek is the Main flow path which conveys flows to the culvert crossing under Barwon Heads Road. | 86 | 11.7 | 3.8 |
| North west catchment | Catchments downstream/north of Barwon Heads Road, partially within the Barwon River 1% AEP floodplain. Includes northern portion of Marshall PSP. Drains to the Barwon River via an open channel. | 59 | 3.6 | 1.1 |

| Catchment | Description | Area (ha) | 1% AEP peak flow ($m^3/s$) | 20% AEP peak flow ($m^3/s$) |
|---|---|---|---|---|
| North east catchment | Downstream of Barwon Heads Road and includes a small portion of Marshall PSP. Partially within the Barwon River 1% AEP floodplain. Outlets to the Barwon River and represents total Marshall Creek catchment. | 58 | 12.6 | 4.1 |
| South eastern catchment | This catchment is separate from Marshall Creek and instead drains to the southeast corner of the Precinct. The outfall at this location is via culverts under Barwon Heads Road outlets to an open channel, which flows to the Barwon River. | 17 | 0.6 | 0.1 |

Figure 5 presents flood mapping predicting 1% AEP existing conditions flood depths and extents across the Precinct and surrounds. This mapping was prepared in a preliminary SWMS by Alluvium Consulting in 2019; refer to Section 3.2 for more details.

As shown, flooding across the southern and central part of the Precinct is shallow and broad. This is to be expected through this area which is relatively flat, with the absence of any substantial waterways or open channels. Further north and downstream, Marshall Creek becomes more defined and flood extents are more confined to this waterway corridor.

The flood envelope is broader and more extensive closer to the Barwon River, where the floodplain of this significant waterway is engaged. A Flood Overlay is associated with the Barwon River floodplain, and no development can occur within these extents.

Figure 6 presents the Precinct under existing conditions, with significant features detailed. These are described in more detail below.

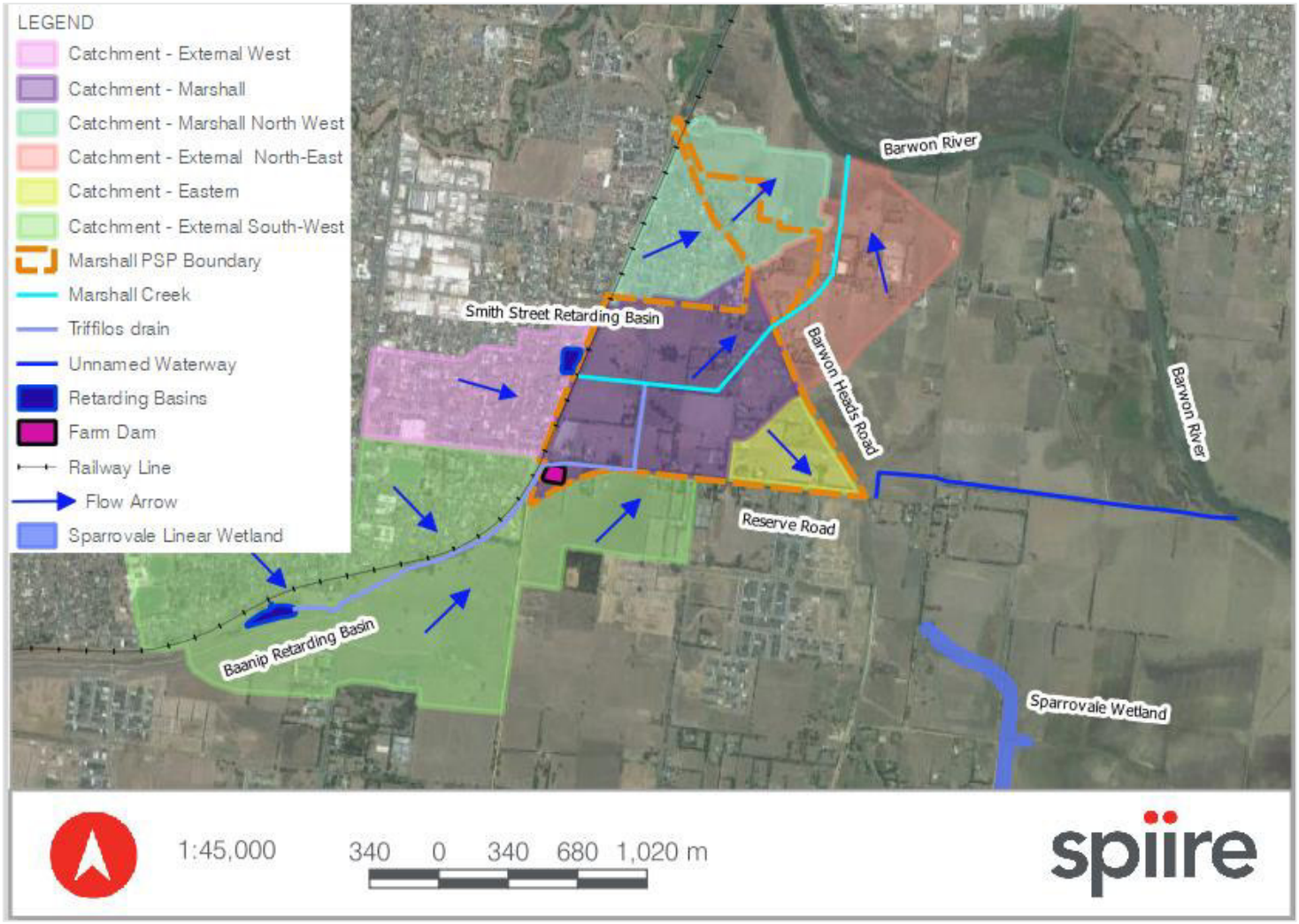



**Figure 4. Existing surface water catchments**

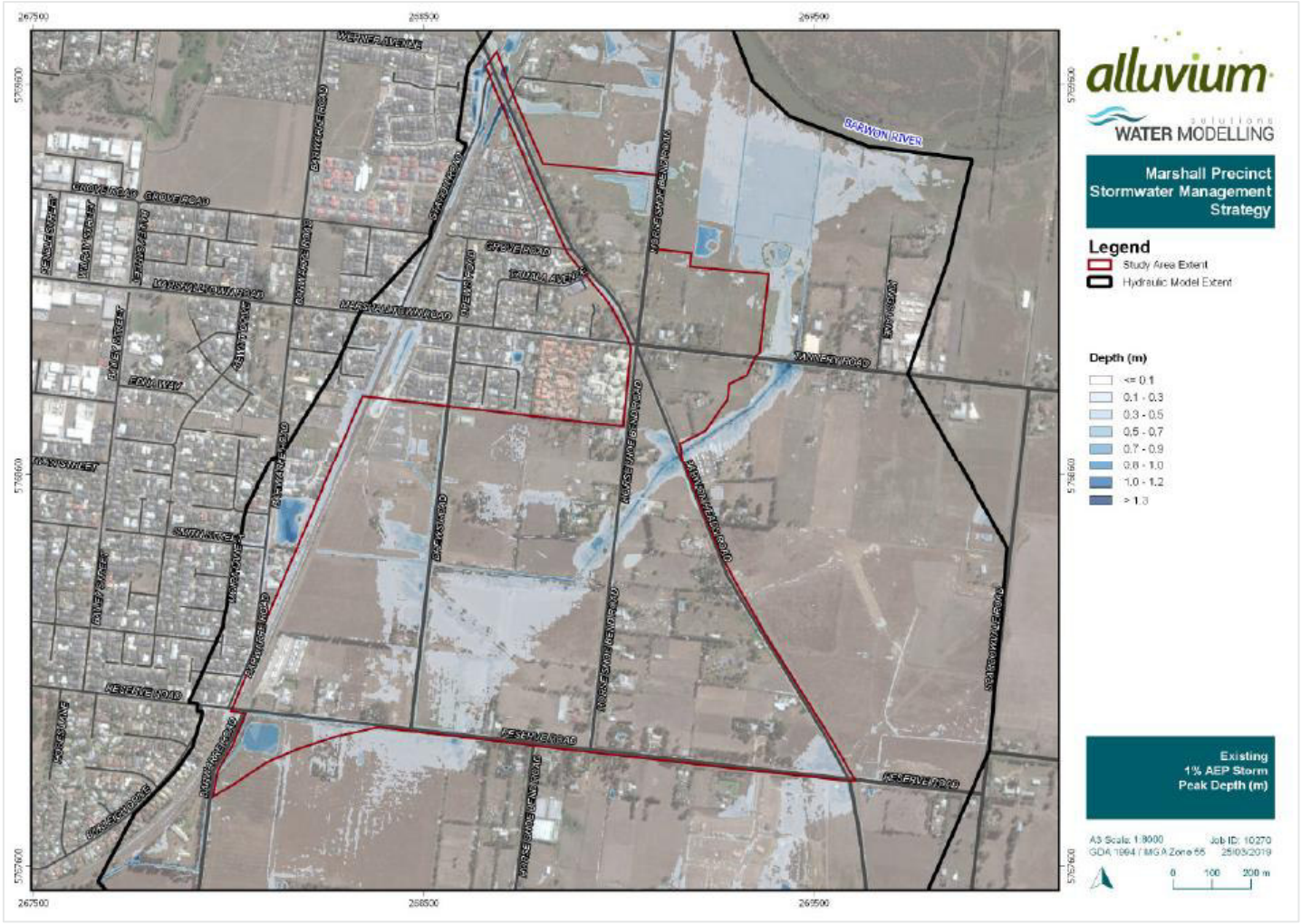



**Figure 5. Existing 1% AEP flood depths and extents (Alluvium, 2019)**

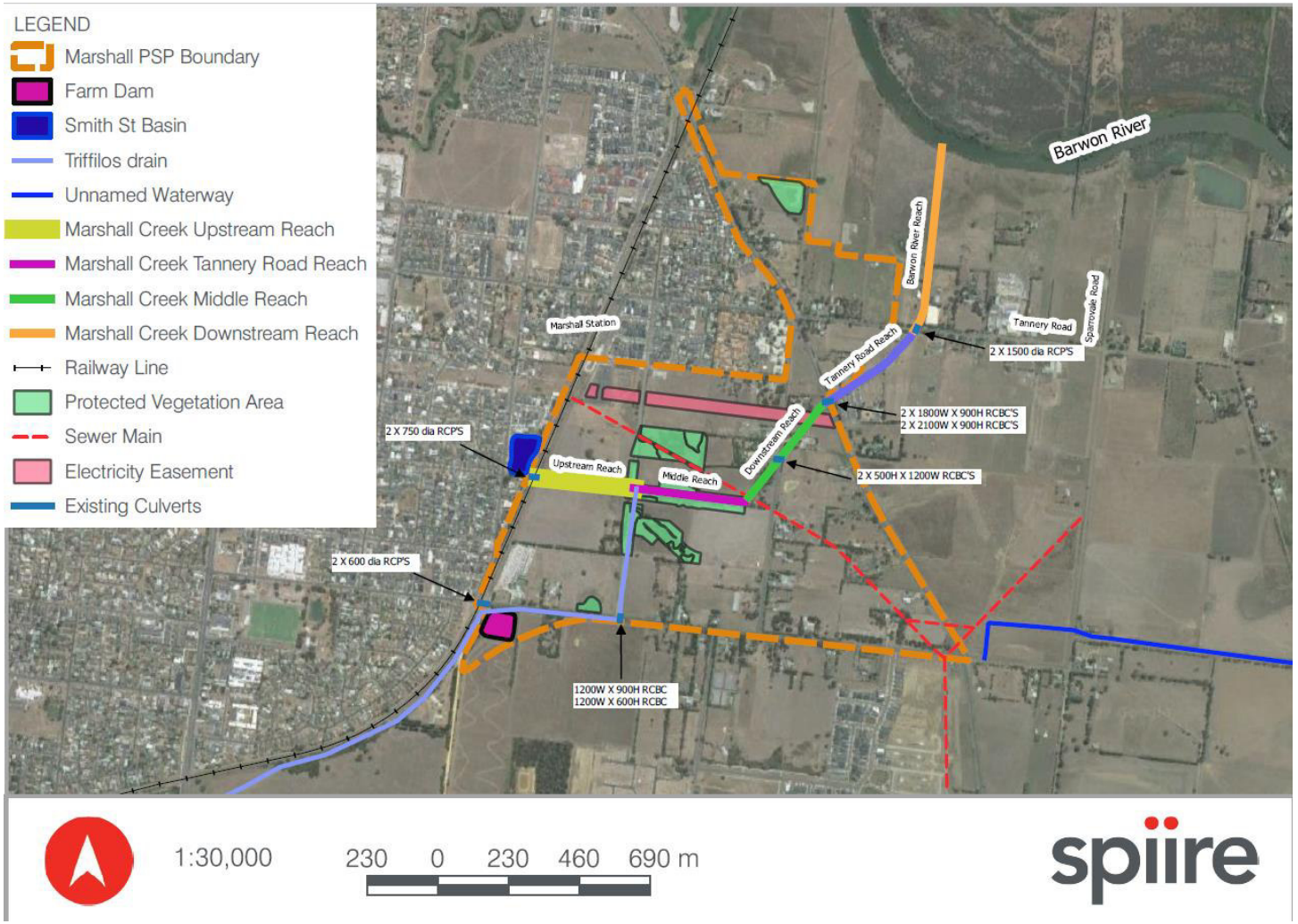



**Figure 6. Marshall Precinct existing conditions and features**

## 2.2 RAILWAY LINE

The Geelong to Warrnambool railway line forms the western boundary of the PSP, with Marshall station being located in the northeast corner of the Precinct. Duplication of this rail line is currently being designed by Rail Projects Victoria (RPV) which has stormwater drainage implications for the Precinct. Spiire have undertaken extensive engagement with RPV as part of SWMS preparation; this is discussed further in Section 4.2.

## 2.3 AUSNET TRANMISSION LINE EASEMENT

A 40m wide Ausnet transmission line easement runs approximately east – west through the northern portion of the Precinct. Downstream of Horseshoe Bend Road, Marshall Creek flows through this easement before being conveyed through culverts under Barwon Heads Road. Given Marshall Creek flows through the easement, this has implications for this SWMS. Engagement with Ausnet has been undertaken, to obtain 'In Principle' support for proposals as part of this SWMS. This is discussed in more detail in Section 6.7.3.

## 2.4 BARWON WATER MAIN OUTFALL SEWER

### 2.4.1 NORTHERN CROSSING

The Barwon Water Main Outfall Sewer (MOS) *Section 6* (1350mm dia) runs approximately northwest to southeast, through the centre of the Precinct. The MOS passes under Marshall Creek immediately to the west of Horseshoe Bend Road, as shown in Figure 7.

At this crossing of Marshall Creek by the existing MOS, the sewer invert is 4.85 m AHD (obvert ~6.20m AHD) compared with existing surface levels of about 8.5-9.0 m (Craigie, 2011). This equates to a cover depth of approximately 2.8m.

The upgraded culverts on Marshall Creek at Barwon Heads Road have an upstream invert level of 5.50m AHD, 0.65m higher than the MOS at the Marshall Creek crossing. Therefore, this sewer presents a critical hydraulic control for the Precinct.

Investigation into a Precinct stormwater system which adopts a pipe or waterway crossing above the MOS found that this will induce significant filling to upstream catchments (up to 2m). The resulting excessive extent and depth of this filling is considered to make the proposal to pass over the MOS unfeasible, from a development feasibility perspective. The preferred option is a siphon arrangement with pools either side, which will allow drainage to be lowered to more practical levels. A similar arrangment is in place on Armstrong Creek, as part of the Warralilly Estate, and is understood to be performing well.

This concept has been provided with In Principal support by Barwon Water and the Corangamite Catchment Management Authority (CCMA), who provided a number of requirements for the design of this structure. Some of these requirements have been incorparated to the proposed drainage system as part of this SWMS – the remaining requirements can be addressed at functional design. Refer Appendix 4 for details of Barwon Water and CCMA requirements.

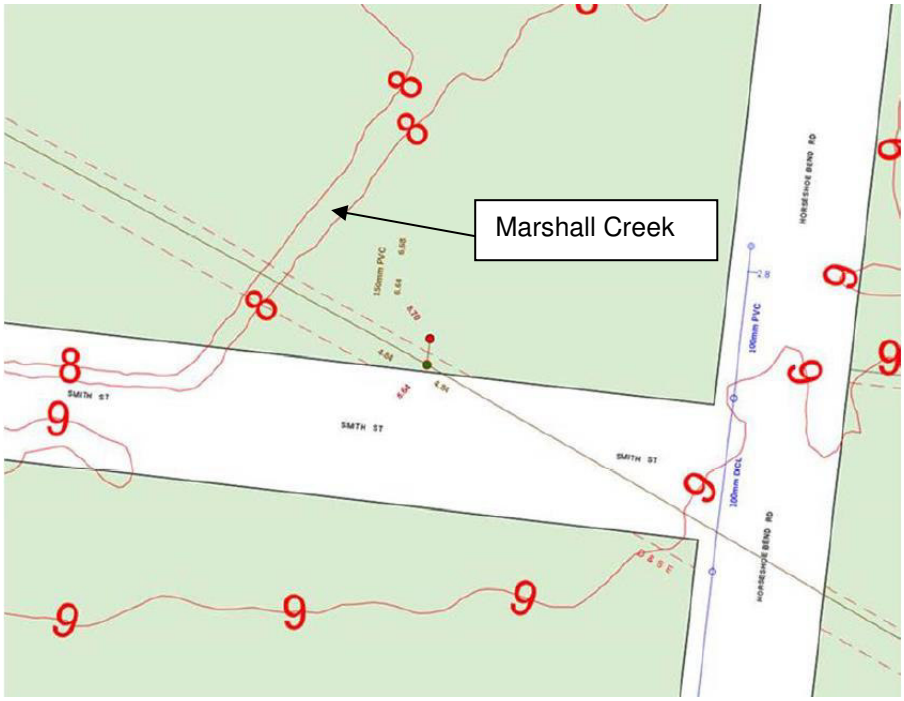



**Figure 7. Barwon Water MOS at Smith Street (Barwon Water)**

### 2.4.2 SOUTHERN CROSSING

In the south east corner of the Precinct, *Section 6* of the MOS extends down to a confluence with the 1500mm diameter *Southern Ovoid Replacement* sewer, immediately to the south of the Precinct boundary, with Reserve Road. Refer to Figure 8 for confluence location (red circle) relative to the Precinct (orange boundary).

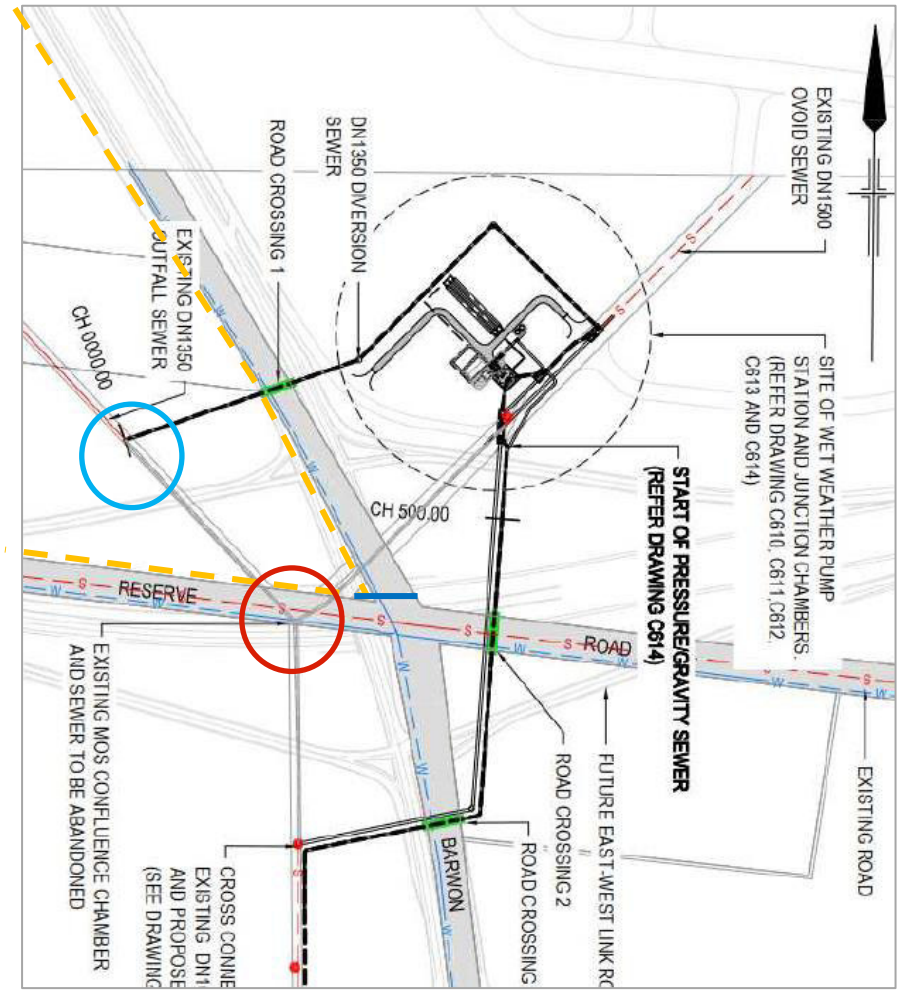



**Figure 8. Current concept for MOS relocation (GHD, 2011)**

This existing infrastructure is located within the south east catchment of the Precinct, adjacent to an existing storm water outfall under Barwon Heads Road (via culverts – indicated by blue line, Figure 8). The culvert outlets to an informal open channel which drains eastwards to the Barwon River. Figure 8 presents the MOS augmentation concept design (GHD 2011) which was prepared as part of planning for duplication of Barwon Heads Road and the Bellarine Link, a proposed highway connecting the Surf Coast Highway with the Bellarine Peninsula (refer Section 4.1 for details on the Bellarine Link). As shown in Figure 8:

- Diversions of the 1350mm diameter *Section 6* MOS and 1500mm diameter *Southern Void Replacement* are proposed, with the removal of the existing confluence.
- A wet weather pumping facility is proposed east of Barwon Heads Road.

Since the preparation of this concept in 2011, the planning of the Bellarine Link has advanced. Earlier this year, Barwon Water provided The City with the following advice:

- *Confirmation that the relocation of the Main Outfall Sewer is a long term project, and is not required by Barwon Water for many years (i.e. beyond 2030). The driver for this relocation in a shorter timeframe will be works directly over our sewer confluence, just south of Boundary Road.*

- *Based on the designs we have currently seen for the Barwon Heads Road duplication, the confluence is not impacted and therefore the sewer does not need to be moved for this project.*

- *A new Bellarine Link from the Surf Coast Highway to Barwon Heads Road is also unlikely to impact the confluence. It is more likely if and when the Bellarine Link continues east towards the Bellarine Highway. i.e. if a future grade separated interchange is proposed this would impact the confluence and require the relocation.*

- *Given these potentially long timeframes, it is desirable for the Marshall PSP to be able to progress independently of this relocation. That is:*

  - *It is recommended drainage assets be redesigned to take into account the existing alignment of the sewer.*

  - *The current and future alignment of the sewer be shown and some protections placed on this alignment.*

  - *Land use be based on the existing alignment.*

Therefore, proposed stormwater drainage assets within the south east catchment of Marshall Precinct must adhere to the above Barwon Water requirements.

Based on information provided in the GHD concept design, the proposed manhole on the MOS (blue circle in Figure 8) has an approximate IL of 4.4m. Allowing for the diameter of the sewer, and an existing surface of around 8.7m, sewer clearance in this location is approximately 3.0m. Due to steeper grades in the southeast catchment, there is more flexibility in the future drainage system, which should be able to cross over the MOS and into the future drainage reserve, without inducing fill upstream. Refer to Section 6.12 for more detail.

## 2.5 TRIFFILOS DRAIN

The open waterway known as Triffilos Drain is the main flow path through *External catchment south west* (refer Figure 4). Triffilos Drain accommodates flow from urban development north of Surf Coast Highway, and skirts the Rail Line, flowing northwards up to Barwarre Road/Reserve Road intersection. From here, the drain bypasses a large farm dam before entering the Marshall Precinct through culverts under Reserve Road. The open channel continues north along the eastern boundary of Drews Road before connecting to Marshall Creek, adjacent to Smith Street.

The existing urbanised external catchment draining to Triffilos Drain has no existing WSUD assets to provide formal treatment of urban runoff. A key element of this SWMS is the inclusion of a Council drainage reserve at the corner of Reserve Road and Barwarre Road, at the location of the existing farm dam (refer Figure 6). This will comprise a retarding basin (to control flood flows such that downstream conveyance can occur in a pipe rather than a waterway) co located with a sediment pond and wetland. This approach provides treatment for the upstream External South West catchment pollutants which would otherwise be conveyed to the Barwon River.

## 2.6 SMITH STREET RETARDING BASIN

The Smith Street retarding basin is located at the downstream end of *External Catchment West* (refer Figure 4), immediately upstream and to the west of the Railway Line. This basin is controlled by 2 x 750mm dia culverts which convey flows under the rail line into the upper reach of Marshall Creek, at the western boundary of Marshall Precinct.

## 2.7 MARSHALL CREEK

For the purposes of this SWMS, Marshall Creek has been split up into distinct sub reaches, which are described below. Refer to Figure 6 for Marshall Creek sub reach layout.

### 2.7.1 UPSTREAM REACH

While Marshall Creek is a Designated Waterway under the Water Act, the upstream reach (between the rail line and Drews Road) is little more than a shallow farm drain with no vegetation other than grass. Flows are conveyed under Drews Road via a 450mm dia culvert to the middle reach.

### 2.7.2 MIDDLE REACH

The middle reach of Marshall Creek follows Smith Street, to the north side. The waterway here is still of low capacity, but has high value vegetation on either bank, largely being mature gum trees (some Bellarine Yellow Gums). Refer to *Native Vegetation Mapping (draft)*, (Ecology and Heritage Partners, 2022) for details of native vegetation.

These trees are protected and will be retained, meaning there is no opportunity to increase the capacity of the channel as it is entirely within Tree Protection Zones of the adjacent trees. At the same time, it is important to maintain the flow regime through the middle reach, to protect the health of vegetation flanking the waterway. This has been identified as a requirement of this SWMS.

Downstream of Smith Street, the waterway flows into a farm dam. Downstream of the dam, the waterway flows under Horseshoe Bend Road via 2 x 1200 x 500 box culverts.

### 2.7.3 DOWNSTREAM REACH

The downstream reach of Marshall Creek extends from Horseshoe Bend Road to Barwon Heads Road. Here, the waterway extends through private property and the Ausnet Easement. Similar to the upstream reach, there is limited vegetation along its banks.

The creek flows out of Marshall Precinct through culverts under Barwon Head Road. These culverts are currently being constructed as part of the Barwon Head Road duplication project and represent the main outfall for the Precinct.

### 2.7.4 TANNERY ROAD REACH

Between Barwon Heads Road and Tannery Road, the Tannery Road reach begins to increase in capacity and becomes a more defined channel. This reach lies within the future NEIP but is considered as part of this SWMS as it forms the outfall for the Marshall Precinct as well as the NEIP. The waterway flows under Tannery Road through 2 x 1500mm dia culverts (refer Figure 6).

### 2.7.5 BARWON RIVER REACH

The Marshall Creek reach which extends from Tannery Road to the outfall to the Barwon River is a straight constructed channel. It is understood that this channel was originally constructed to improve drainage on adjacent properties, and has been increased in capacity over the years, including construction of bunding on the western bank.

It was noted during a site inspection that the bed of this channel is actually higher than adjacent areas to the west. During larger flow events, modelling has shown that Tannery

Road culvert capacity is exceeded, with overflows being conveyed through this low point in the landscape, adjacent to and west of the formal channel.

### 2.7.6 UPGRADE OF MARSHALL CREEK TO A CONSTRUCTED WATERWAY

Given that no volume reduction is proposed for the Precinct and considering the existing channel geometry and general lack of riparian vegetation, increased volumes from a developed Precinct will inevitably initiate the process of erosion through Marshall Creek. This will result in a long-term detrimental impact to the health of the waterway if not upgraded.

To address this issue, as part of this SWMS, Marshall Creek will be upgraded to a constructed waterway from the downstream reach (starting at Horseshoe Bend Road) to the confluence with the Barwon River. This will include providing a suitable waterway corridor, 1% AEP capacity and revegetation of the riparian corridor, to provide required resilience to increased stormwater volumes from the Precinct.

Refer to Section 6.7 for details of Marshall Creek upgrade proposals.

## 2.8 BARWON RIVER

At the confluence with Marshall Creek, the Barwon River is a substantial waterway, being in its lower reaches. The Barwon River floodplain adjacent to Marshall Precinct and Marshall Creek is broad and associated with a Flood Overlay. No future development can take place within the extents of this overlay.

## 2.9 EXISTING CULVERTS

Figure 6 on page 6 shows the various culverts across the Marshall Precinct and surrounds. The majority of these are retained as part of this SWMS – refer to Section 6 for details.

Table 2 and Table 3 present photographs of existing features and hydraulic structures, respectively.

**Table 2: Photographs of existing features**

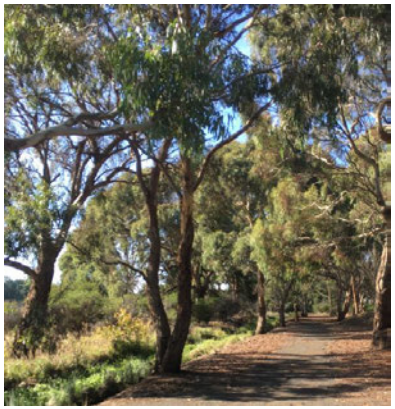
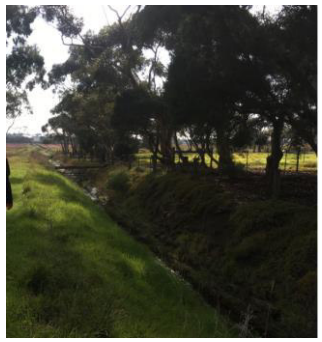
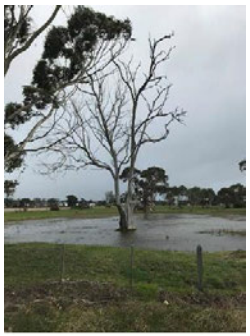
| Marshall Creek upstream reach looking upstream from Drews Road | Marshall Creek middle reach looking downstream to Smith Street. Note the mature gum trees. | Barwon River at the Marshall Creek confluence |
|---|---|---|
|  |  |  |
| **Marshall Creek downstream reach** | **Ponding looking west from Drews Road (Alluvium, 2019)** | **Marshall Creek downstream reach with electricity pylons in view (Craigie, 2012)** |
|  |  |  |

Table 3. Photographs of Existing hydraulic structures

| Barwon Heads Road culverts | Triffilos Drain culverts under Drews Road (looking south) | Tannery Road culverts |
|---|---|---|
|  |  |  |

# 3. BACKGROUND STUDIES

## 3.1 ARMSTRONG CREEK URBAN GROWTH AREA – MARSHALL PRECINCT STORMWATER MANAGEMENT STRATEGY V1 (DRAFT) (CRAIGIE, 25 JUNE 2012).

Neil Craigie developed a series of SWMS's on behalf of The City as part of planning for the Armstrong Creek Growth Area. A SWMS was developed for each of the 7 Precincts (as presented in Figure 2, page 7) including the Marshall Precinct.

While some elements of this SWMS are considered out of date due to subsequent changes to industry standards and guidelines, the SWMS series prepared by Craigie represents an overarching stormwater strategy for the Armstrong Creek Growth Area. This is critical given some of the Precincts share catchments and therefore their respective SWMS are interdependent.

One important element for the Marshall Precinct is the proposal to divert external catchments from the Marshall Precinct through the Horseshoe Bend Precinct, as presented in Figure 9, and as follows:

- A 76.3 ha existing catchment (shown in Figure 9 as the green catchment) flows as sheet flow northwards, across Reserve Road and into Marshall.

- Under the Craigie SWMS, it was identified that the future Bellarine Link highway (pink linear polygon in Figure 9) would form a barrier to this flow path. A retarding basin (Reserve Road basin) was proposed as part of the Horseshoe Bend Precinct (in the red polygon) which will receive developed flows from this catchment. From here, an outlet pipe is proposed to convey all flows up to the 1% AEP to Sparrovale Linear Wetland, to the east of Armstrong Creek Growth Area (indicative pipe alignment shown by blue arrow, Figure 9). Sparrovale – Nubijt yooree Wetlands wetland is discussed in more detail in Section 6.12.

  Since the preparation of the Craigie SWMS, significant development has occurred in the Horseshoe Bend Precinct. At the time of writing, the Reserve Road basin is at the detailed design stage and the principal of diverting the external catchment to Sparrovale – Nubijt yooree Wetlands is being adopted. Therefore, this external catchment diversion has been adopted for this SWMS and is a key part of the strategy.

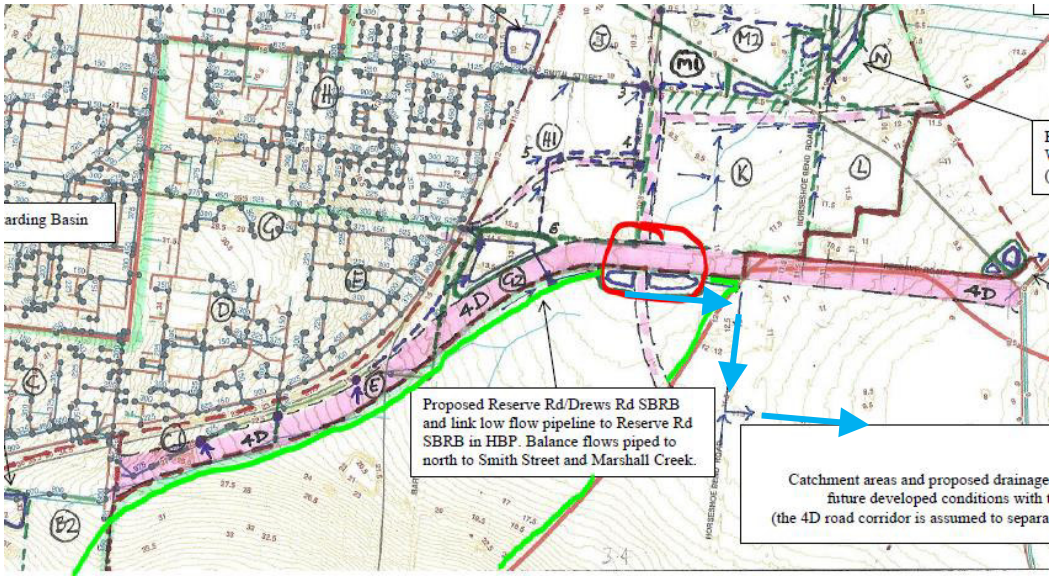



**Figure 9. Proposed external catchment diversion (Craigie, 2012)**

In general, the 2012 Craigie SWMS forms the basis for this SWMS, with updates provided to ensure consistency with current best practices.

## 3.2 MARSHALL PRECINCT STRUCTURE PLAN STORMWATER MANAGEMENT STRATEGY (ALLUVIUM, 2019)

Alluvium Consulting prepared this preliminary update to the Craigie SWMS in 2019. In summary:

- Hydrologic modelling was updated to current best practice methodologies (ARR 2019).
- Hydrodynamic modelling was undertaken across the Precinct and surrounding catchments, using TUFLOW. This was undertaken for existing and development conditions.
- A SWMS was prepared to consider water quality, water quantity and flow conveyance.

Since the Alluvium 2019 SWMS, new information from interfacing projects has become available. The City have also prepared a Future Urban Structure (FUS) for Marshall (refer Appendix 5). Based on this new information, Spiire have progressed the SWMS (this report), using the Alluvium hydrologic and TUFLOW modelling as key inputs to the project. Note that this SWMS supersedes the Alluvium 2019 SWMS.

## 3.3 MARSHALL EMPLOYMENT PRECINCT: ABORIGINAL HERITAGE AND POST CONTACT ARCHAEOLOGICAL ASSESSMENT (TERRA CULTURE, 2013)

This study was undertaken to assess likely cultural heritage requirements within the Marshall Precinct. The report states “in the absence of any registered Aboriginal heritage places or named waterways there are no mapped areas of sensitivity within the Marshall Employment Precinct”.

The report makes the following recommendations in relation to further cultural heritage assessments:

- Assessments of Aboriginal cultural heritage are recommended for future development activities on all properties within the Marshall Employment Precinct. These assessments will ensure compliance with the *Aboriginal Heritage Act* 2006 and the *Aboriginal Heritage Regulations* 2007.

- The requirement for a CHMP for any property or group of properties within the Marshall Employment Precinct can be determined through a due diligence assessment from a cultural heritage advisor (CHA) which, among other things, would consider the cultural heritage sensitivity of the parcel of land and the type of activity and its potential impact on Aboriginal cultural heritage.

- Any individual property owner or group of property owners should seek advice from a CHA on how best to define activity areas for the purposes of undertaking a CHMP.

- Even if a mandatory CHMP is not required a sponsor (land owner or developer) should consider undertaking a voluntary CHMP to ensure compliance with the Act.

- Assessments of post-contact archaeological heritage are recommended for future development activities on all properties within the Marshall Employment Precinct. These assessments will ensure compliance with the *Heritage Act* 2005.

- Assessments should take the form of stand alone reports, written and presented to HV standards.

These recommendations should be considered at the planning stage for any future development within Marshall Precinct, including future outfalls downstream of the Precinct area.

## 3.4 FAUNA SURVEYS, MARSHALL PRECINCT PLAN AREA, MARSHALL (ECOLINK, 2022)

This study provided a fauna habitat assessment for the Precinct area. A number of species were identified, most notable, Latham's Snipe, a ground foraging wetland bird (refer Figure 10 for photograph example). While Growling Grass Frog are known to be present within surrounding areas to Marshall, and "suitable habitat" was identified within the Marshall Precinct, no Growling Grass Frogs were observed during a survey.



**Figure 10. Latham's Snipe (Ecolink, 2022)**

The following recommendations are provided in the Ecolink report with particular relevance to this SWMS:

- *Create appropriate hydrology for retaining wetlands within the landscape and improving habitats for native wildlife such as Growling Grass Frogs and Latham's Snipe.*
- *The creation of wetlands and biobasins which are constructed early in the development process to ensure flows are managed and treated appropriately prior to discharge throughout the entire life of the development of the Marshall PSP.*
- *Improve habitats for Growling Grass Frog, Latham's Snipe, fish and other wildlife by:*
  - *Developing hydrological regimes that maintain fauna habitats (e.g. supporting aquatic vegetation, semi-aquatic vegetation, as well as terrestrial vegetation), allow native fish passage, and provide a suitable hydrological regime to manage pest animals. This can include periods of drying to kill predatory exotic fish such as Eastern Gambusia.*
  - *Designing wetlands (and possibly water treatment facilities such as the retarding basins/biobasins) to be connected through a series of ponds, and to incorporate desirable and varied water depths and habitat variability (including swales which may be preferred by Latham's Snipe).*

A clear requirement for fauna present within the existing Marshall Precinct area is provision of water bodies and wetlands, with varied depth and appropriate vegetation. This will be provided through WSUD assets such as sediment basins, constructed wetlands and constructed waterways, with in channel pools.

Given the fragmented nature of the Precinct, which by necessity will ultimately contain a series of culverts and other fish barriers, fish passage will likely be a challenge. To cater for Growling Grass Frog passage of hydraulic structures, designs will be consistent with *Growling Grass Frog Crossing Design Standards* (DELWP, 2017).

## 3.5 MARSHALL PRECINCT STRUCTURE PLAN NATIVE VEGETATION PRECINCT PLAN (ECOLOGY AND HERITAGE PARTNERS, 2022)

A critical existing feature of the Marshall Precinct is the Native Vegetation. Ecology and Heritage Partners have recently updated the vegetation mapping (due to significant recent recruitment of vegetation), as presented in Figure 11. Native vegetation in the Precinct can be summarised as follows:

- There are a number of Native Vegetation community zones which will be retained.
- Some Native Vegetation will be removed, where necessary, to accommodate the future Precinct.
- A number of Scattered Trees are present across the Precinct. The majority will be retained, although some have been identified for removal.

This Native Vegetation forms a major consideration for the SWMS, as it is critical this retained vegetation is not impacted. The Native Vegetation mapping directly informs the FUS, presented in Section 5.

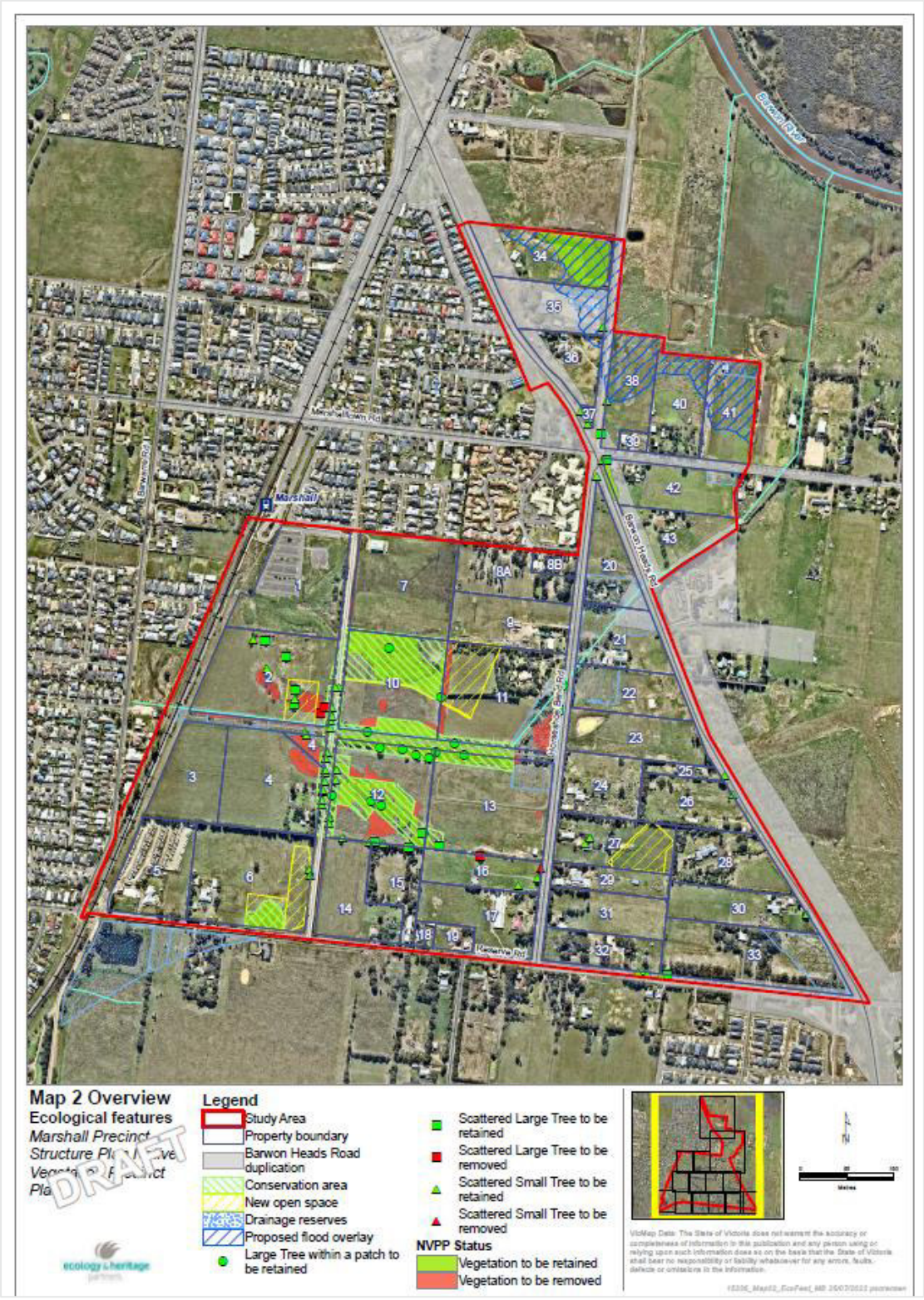



**Figure 11. Marshall Precinct Native Vegetation Plan (Ecology and Heritage Partners, 2022)**

# 4. INTERFACING MAJOR INFRASTRUCTURE PROJECTS

The Marshall Precinct is roughly triangular in shape and bounded by three key transport infrastructure projects: the Geelong to Warrnambool rail line to the west, Barwon Heads Road to the east and Reserve Road to the south. At the time of this SWMS preparation, major upgrade projects for each one of these transport links were underway.

Each one of these projects have significant implications for stormwater drainage within the Marshall Precinct. This is discussed further in the following section.

## 4.1 THE BELLARINE LINK

The Bellarine Link is a proposed extension of the Geelong Ring Road, which may ultimately connect Surf Coast Highway to the Portarlington Highway. Figure 12 presents the Geelong Ring Road Extension Study Area (Vic Roads, 2017), with the Marshall Precinct indicated in orange.

Bellarine Link Stage 1 extends from Surf Coast Highway in the southwest to Barwon Heads Road at the southeast corner of the Precinct and will replace Reserve Road. At the time of writing, Stage 1 is currently at the Business Case stage; Spiire have undertaken engagement with MRPV and their consultants, to ensure alignment between the Bellarine Link at Marshall Precinct SWMS.

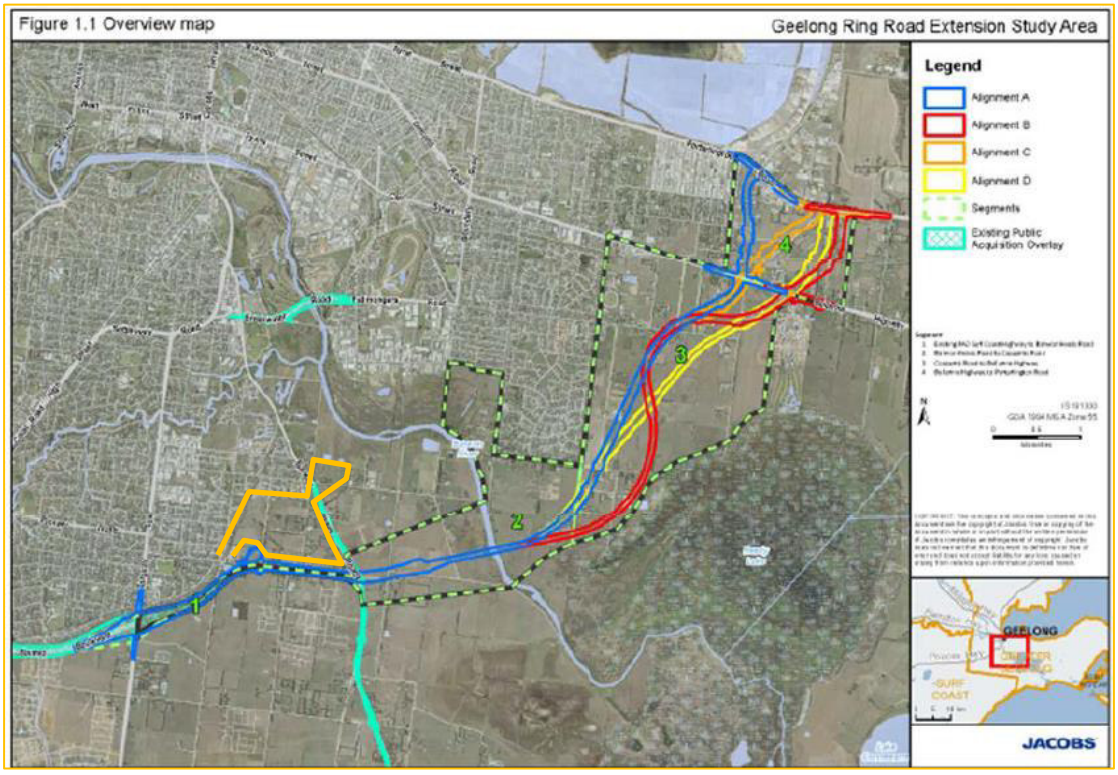



**Figure 12. Geelong Ring Road Extension (adapted from VicRoads, 2017)**

MRPV provided Spiire with a concept design of the Bellarine Link stage 1, including stormwater drainage. This is shown as Figure 13, with the following relevant aspects for Marshall Precinct as follows:

- The Bellarine Link will form a barrier to the broad flood flows which occurs through the catchments to the south of Marshall Precinct. Consistent with the overarching Craigie SWMS, these southern catchments will be diverted to Sparrovale – Nubijt yooree Wetlands to the east – refer to Appendix 1 for existing and developed catchment assumptions for Marshall Precinct.

- The eastern section of Bellarine Link Stage 1 drains towards the corner of Reserve Road and Barwon Heads Road. Drainage in this area falls to the south east corner of the Marshall Precinct (yellow circle in Figure 13), before passing under Barwon Heads Road via a culvert. Given a drainage basin (WLRB2) for the south east catchment of the Marshall Precinct will be required in this location, this SWMS will seek to provide retardation for both Marshall and the eastern catchment of Bellarine Link Stage 1 using WLRB2.

  MRPV have confirmed water quality treatment for Bellarine Link is provided within the Bellarine Link reserve area, no additional water quality assets are required in the Marshall Precinct.

- The south west external catchment which drains to Triffilos Drain is located on the northern side of the Bellarine Link and will still flow through the Marshall Precinct in the ultimate condition.

  As described earlier in this report, the existing farm dam (red circle, Figure 13) will be replaced by a sediment pond and wetland, co located with a retarding basin (WLRB3). This will become a Council owned and maintained asset. It is understood that the Bellarine Link project may seek to include additional storage within this future facility for retardation purposes. If additional storage is required within this future basin, it will be the role of MRPV to demonstrate that the ultimate Council basin presented as part of this SWMS can operate as per design intent, with no detrimental impacts to surrounding areas.

- A retardation basin is proposed to straddle the southern intersection of Drews Road, as shown in the blue circle, Figure 13. It is noted the MRPV allowed in the concept design to allow low flows to discharge from this basin to the Marshall Precinct, on the basis that these flows are restricted to existing conditions. Given that the RORB modelling undertaken for Marshall (refer Appendix 1) includes Bellarine Link catchments under existing conditions (i.e. grassed paddock), the proposal of low flows from Bellarine Link is appropriate.

  A critical design consideration for the proposed Bellarine Link retarding basins (within blue circle, Figure 13) is an ancillary flow path. As this is located at the low point in the landscape, it is expected that the ancillary flow path will occur over Bellarine Link, up Drews Road and into Marshall Creek (refer plans in Appendix 3 for details). The design of Bellarine Link must ensure the future retarding basins can discharge to this ancillary flow path.

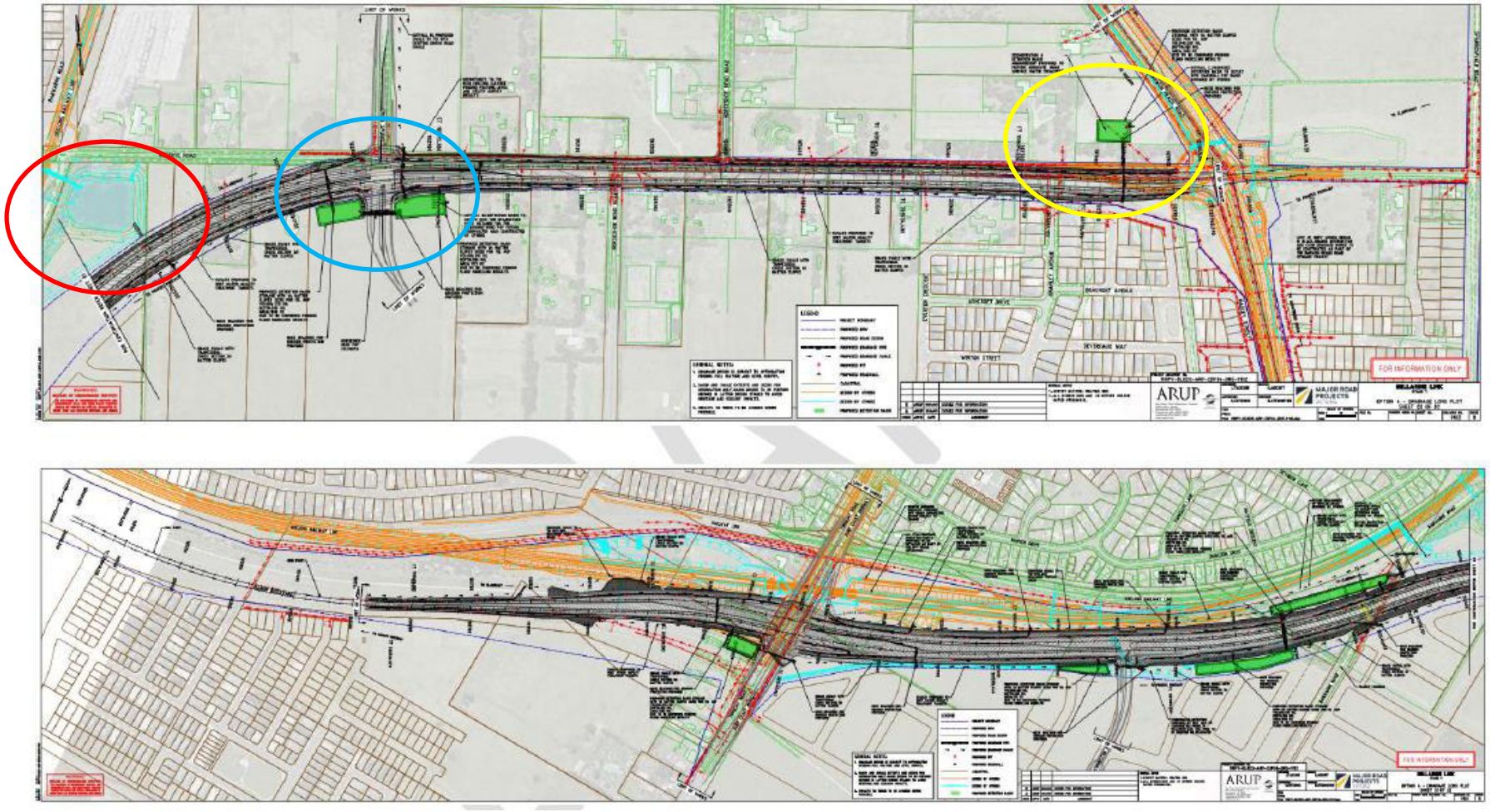



**Figure 13. Bellarine Link Stage 1 concept design (Arup, 2022)**

## 4.2 SOUTH GEELONG TO WAURN PONDS RAIL DUPLICATION

At the time of writing, RPV are undertaking design of the South Geelong to Waurn Ponds rail duplication. During the development of this SWMS, substantial engagement with RPV was undertaken to ensure general alignment between the Marshall SWMS and the RPV drainage strategies.

During a number of meetings held in 2021, RPV previously advised that as the rail project will reduce floodplain storage in areas south of Marshall Precinct, compensatory storage may be required throughout the project corridor to manage detrimental impacts. To provide some of this compensatory storage, RPV and their consultants were considering the use of the existing basin in the southeast corner of the Precinct (red circle, Figure 13). The City advised that this existing basin will be demolished to make way for a future Council wetland/retarding basin (WLRB03).

At the time of writing, RPV have now advised that through refined modelling and assessment, the rail project will likely not require WLRB03 to control flooding (refer Appendix 4 for RPV memo). This is a good outcome and simplifies the requirements and design of WLRB03.

In the event that RPV do seek additional storage within this future basin, it will be the role of RPV to demonstrate that the ultimate WLRB03 presented as part of this SWMS can operate as per design intent, with no detrimental impacts to surrounding areas.

## 4.3 BARWON HEADS ROAD DUPLICATION PROJECT

The Barwon Heads Road duplication project will increase the lanes within the roadway from two to four. This project is crucial to Marshall as proposed infrastructure upgrades on both Marshall Creek and the southeast catchment will form ultimate hydraulic controls to the Precinct.

Unlike the Bellarine Link and railway projects, the Barwon Heads Road project is at an advanced stage and construction is taking place at the time of writing.

Figure 14 shows the detailed design of the Marshall Creek culvert upgrade on Barwon Heads Road (Beca, 2022). As shown, these comprise 2 x 1800 x 900 RCBC's and 2 x 2100 x 900 RCBC's. The upstream design IL of these culverts is 5.50 m AHD, forming the outlet and level control for the Marshall Precinct on Marshall Creek.

Figure 15 presents the detailed design of the Barwon Heads Road upgrade at the south east catchment (Beca, 2022). As shown, the design includes an inlet headwall which connects to 2 x 600 dia pipes under Barwon Heads Road. These pipes then discharge to a small detention basin serving Barwon Heads Road, before outfalling to the shallow outfall channel which flows east to the Barwon (refer SWMS plans in Appendix 3 for details).

On review of this design, it has been determined that the design levels of the 2 x 600 diameter pipes are too high to service a future basin in Marshall Precinct south east catchment. Therefore, a new drainage pipe will need to be bored under Barwon Heads Road. This is discussed futher in Section 6.12.

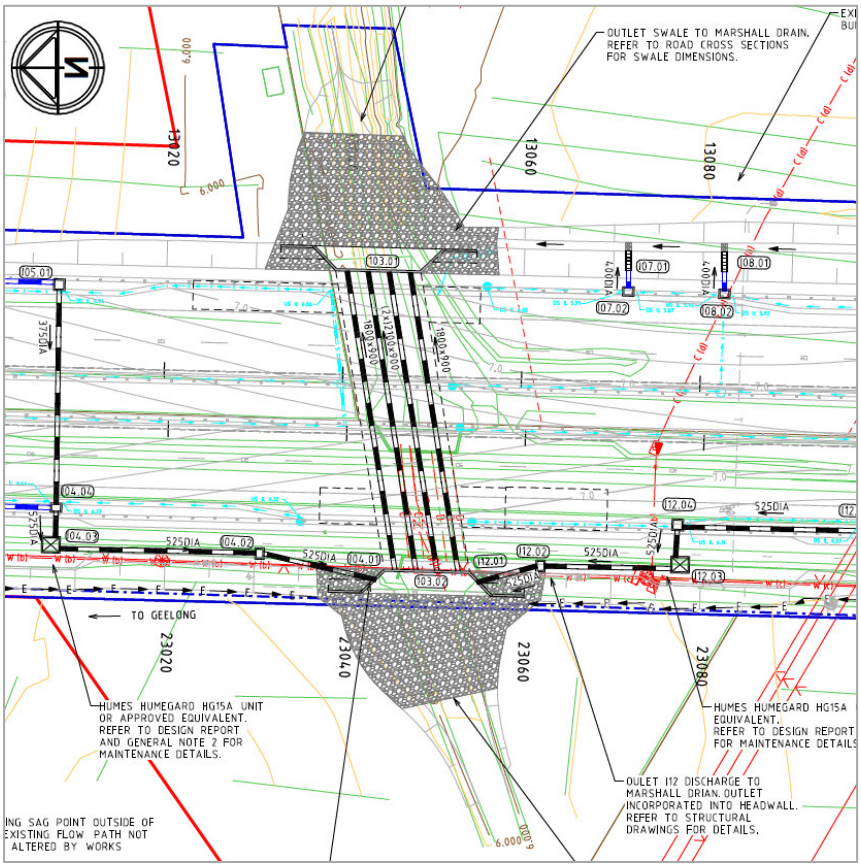



**Figure 14. Detailed design of Marshall Creek culvert upgrade (Beca, 2022)**

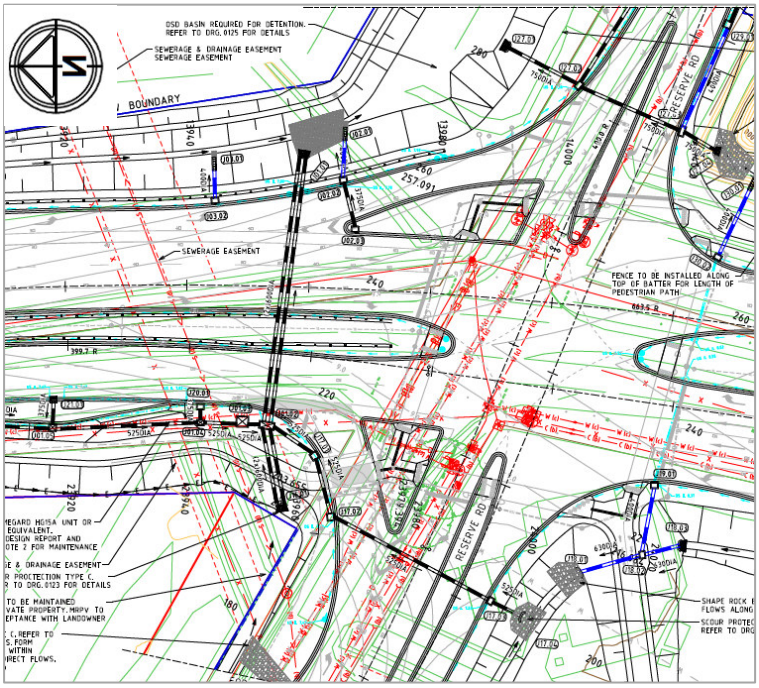



**Figure 15. Detailed design of culvert upgrade at southeast corner of Precinct (adapted from Beca, 2022)**

## 4.4 NORTH EAST INDUSTRIAL PRECINCT (NEIP)

The NEIP PSP was prepared by The City in 2010, with the FUS presented in Figure 16. To support this PSP, a SWMS was undertaken in 2009 by Water Technology – refer Figure 17 for SWMS layout. In summary:

- There are two main drainage outfalls from the NEIP, one to the north (circled in yellow, Figure 17) and one to the south (circled in red, Figure 17).
- The outfall to the north is Marshall Creek, extending from Barwon Heads Road (note the indicative culverts in orange, Figure 17) down to the Barwon River confluence. Hence, this outfall is shared with the Marshall Precinct, and given the NEIP SWMS is out of date (swales and retarding basin) and no longer considered best practice, the nature of the reaches of Marshall Creek downstream of Barwon Heads Road will be updated as part of this SWMS.
- The outfall to the south (circled in red, Figure 17) is downstream of the Marshall south east catchment outfall (refer indicative future basin and outfall pipe, Figure 17) and also the small Barwon Heads Road detention basin (indicated in orange, Figure 17). Hence, this outfall will be shared by Marshall Precinct, NEIP Precinct and also some Barwon Heads Road catchment. Similar to the northern outfall, the Water Technology SWMS uses open swales and retarding basins. This SWMS will revise the nature of this outfall and supersede the Water Technology SWMS in this regard.
- Figure 17 also shows a concept for Bellarine Link Stage 2, which extends eastwards across the Barwon River. At the time of writing, MRPV were not in a position to provide updated designs, and the likelihood of Stage 2 taking place was unclear. For the purposes of this SWMS, and indicative Stage 2 extents has been shown on the plans (based on previous VicRoads designs) to provide some allowance for this future project.

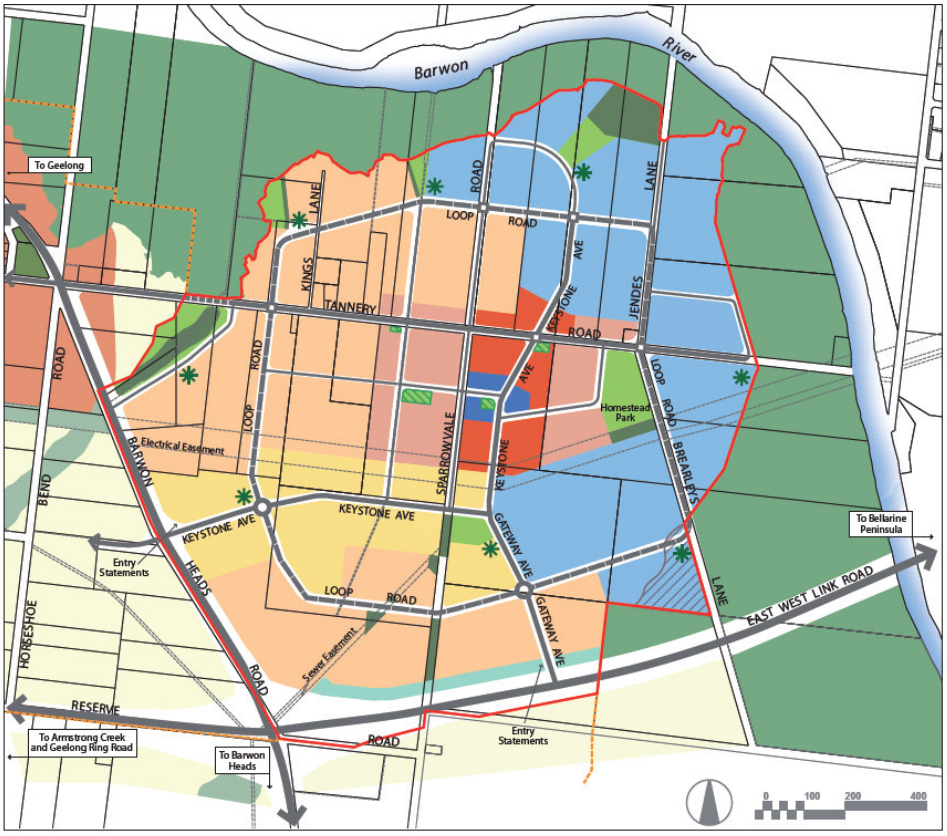



**Figure 16. The NEIP Future Urban Structure (City of Greater Geelong, 2010)**

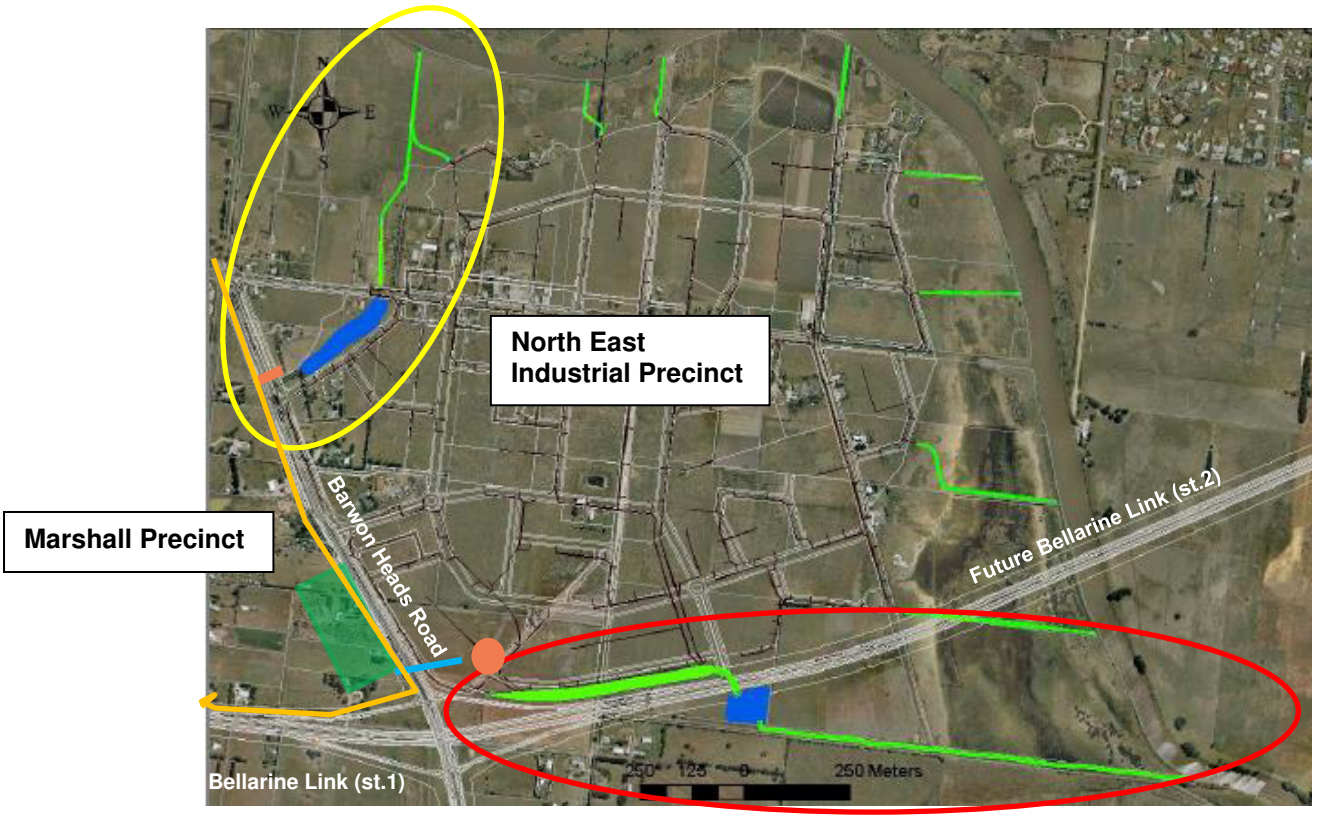



**Figure 17. NEIP SWMS layout (adapted from Water Technology, 2009)**

# 5. DRAFT MARSHALL PSP FUTURE URBAN STRUCTURE

The FUS for Marshall Precinct has been prepared by The City and is presented in Figure 18. The FUS forms the basis for this SWMS, with notable features as follows:

- Drainage reserves have been allowed for at the logical locations of the Precinct, informed by a draft Spiire SWMS.
- Significant Conservation Areas are included, defined by Native Vegetation to be retained/protected. Scattered trees are also identified in the FUS.
- A Station Precinct is located immediately south of Marshall Station. A Transport Hub is centred around Marshall Station.
- Smith Street is no longer shown as road reserve, being entirely covered by Native Vegetation. This will become the “Greenway”, a high amenity shared user path, adjacent to Marshall Creek.
- Medium Density Residential is allocated to areas west of Horseshoe Bend Road; areas to the east of Horseshoe Bend Road are designated Standard Residential.
- The Commercial/Bulky Good Precinct is located to the north of Barwon Heads Road.

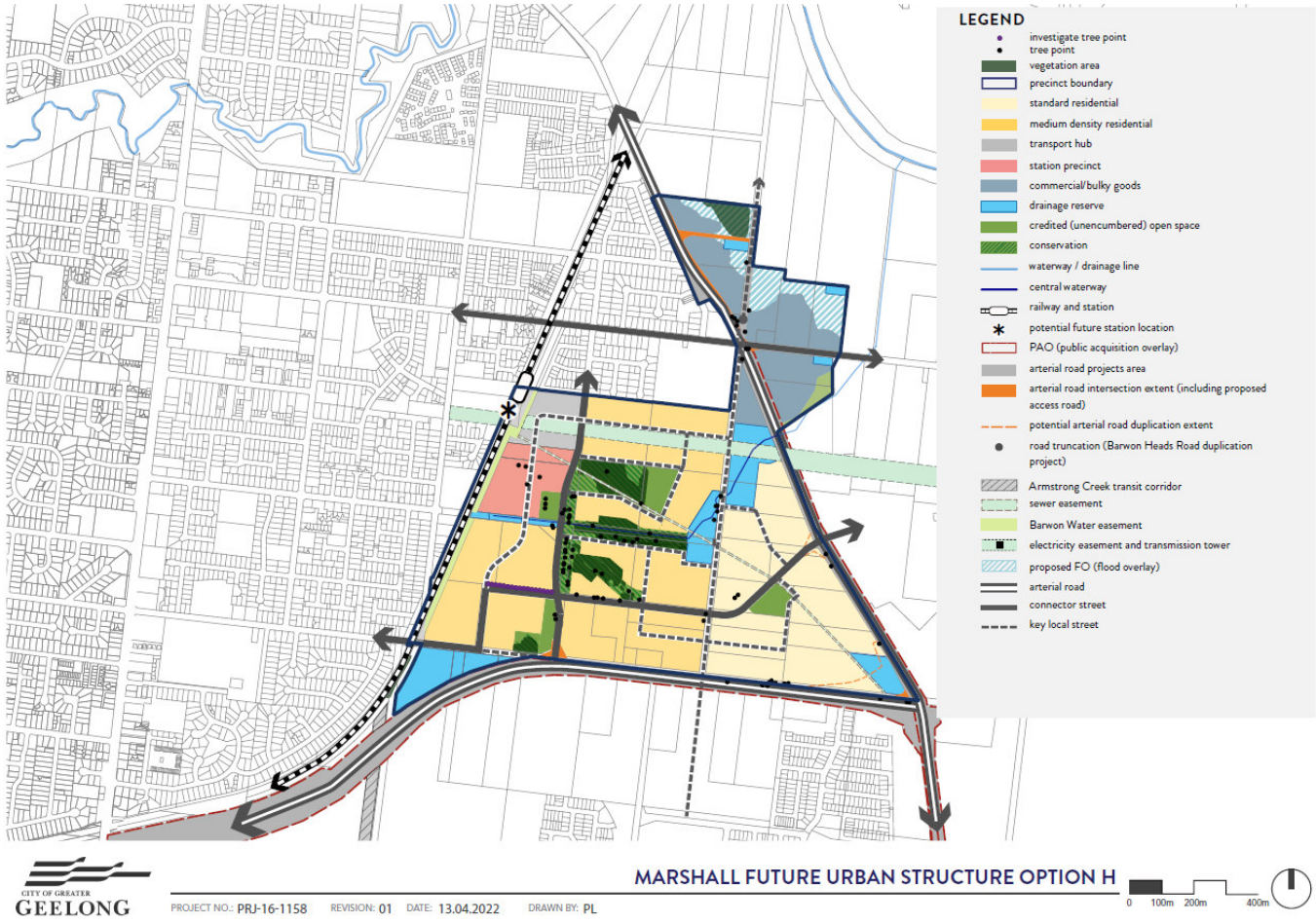



**Figure 18. Marshall Future Urban Structure (City of Greater Geelong)**

# 6. STORMWATER MANAGEMENT STRATEGY

## 6.1 PRELIMINARY DESIGN

The SWMS presented here has by necessity been considered in some detail, due to the high number of constraints and interfacing projects. To supplement the strategy, a preliminary design for each significant SWMS element has been undertaken, to ensure the requirements for each asset is understood, and to suitably inform the DCP. It is important to note that these designs are intended as a guide only, and while they form the basis for future design as part of developer works, are subject to progression and modification through the design process.

The preliminary design plans are presented in Appendix 3.

## 6.2 MANAGEMENT OF FLOOD FLOWS

The SWMS provides for management of flood flows through retarding basins and appropriate flow conveyance using pipes, roads and waterways. No consideration of floodplain storage has been given on the basis that the SWMS ensures no detrimental impacts to downstream properties (refer Appendix 4 for Meeting minutes (14th April 2021) confirming this with CCMA).

## 6.3 DEVELOPED CATCHMENTS AND SWMS LAYOUT

The Marshall PSP SWMS developed catchments are presented in Figure 19 and the plans in Appendix 3. As shown, this includes the diversion of Horseshoe Bend Precinct catchments to Sparrovale Linear Wetland.

The Marshall PSP SWMS is presented in Figure 20. This comprises the following:

- The upgrade of Marshall Creek to a constructed waterway down to the confluence with Barwon River.
- A siphon arrangement to pass flows under the MOS to mitigate excessive filling across the Precinct.
- WLRB03 at the southwest (upstream) corner of the Precinct. This includes a sediment pond, constructed wetland and retarding basin.
- WL01, a constructed wetland and associated sediment pond at the downstream end of the Precinct, between Horseshoe Bend Road and Barwon Heads Road.
- Three additional standalone sediment ponds, to provide primary treatment of stormwater before discharge to waterways. SB1 is located immediately upstream of the siphon and SB02 is located immediately upstream of Barwon Heads Road.
- Three sediment ponds co located with retarding basins are located north of Barwon Heads Road, to service the Commercial/Bulky Goods Precinct.
- A main drain (Main Drain South) to convey flows from WLRB03 to the siphon.
- Another main drain (Main Drain North) to convey excess flows around the middle reach of Marshall Creek (which has low capacity and cannot be altered) to the siphon.
- WLRB02 which serves the southeast catchment of the Precinct. This includes a sediment pond, wetland and retarding basin.

- An outfall arrangement from WLRB02 to Sparrovale Linear Wetland, which comprises a piped outfall transitioning to an open waterway.

The preliminary design of the main SWMS assets is provided in Appendix 3.

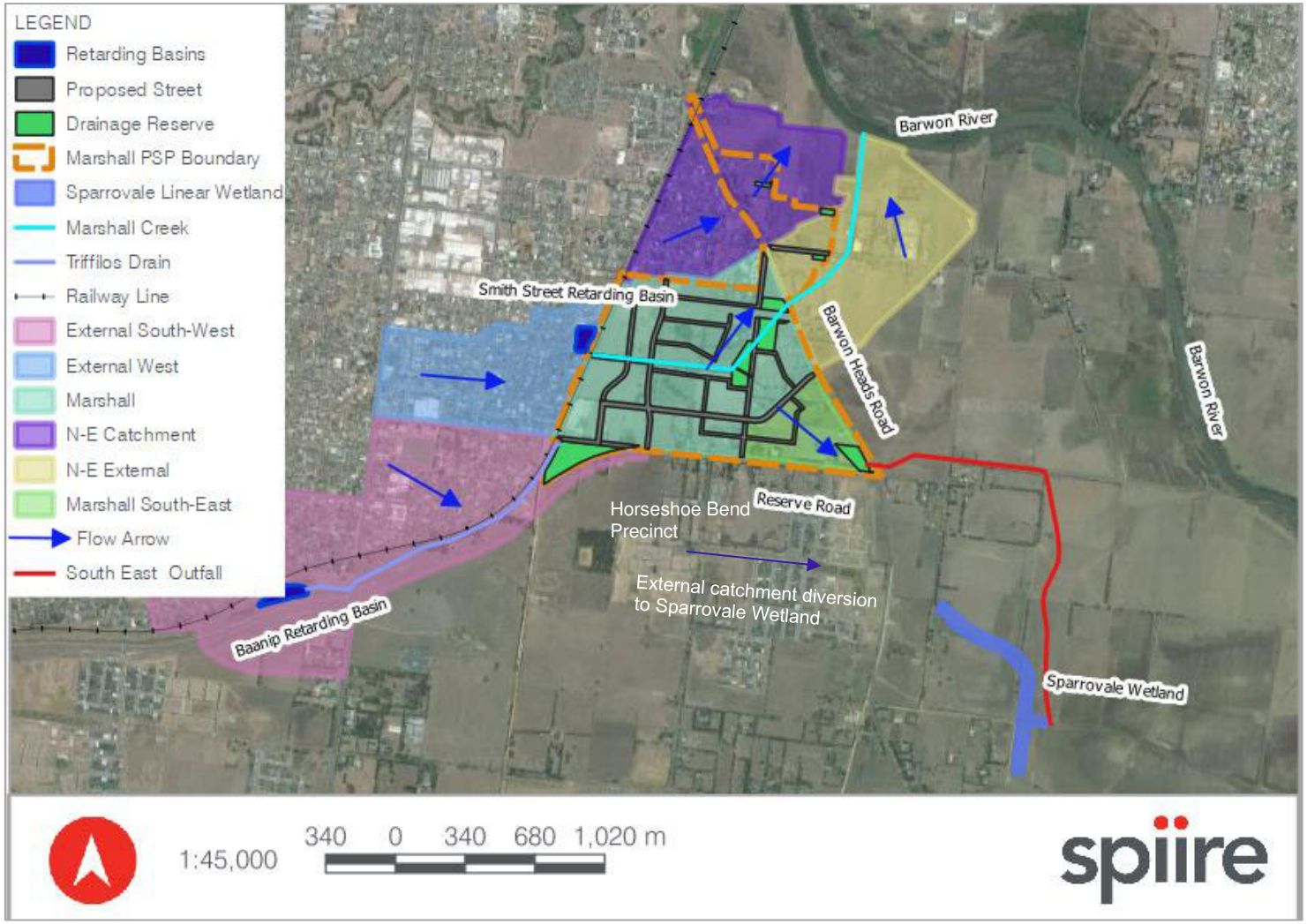



**Figure 19. Developed catchments**

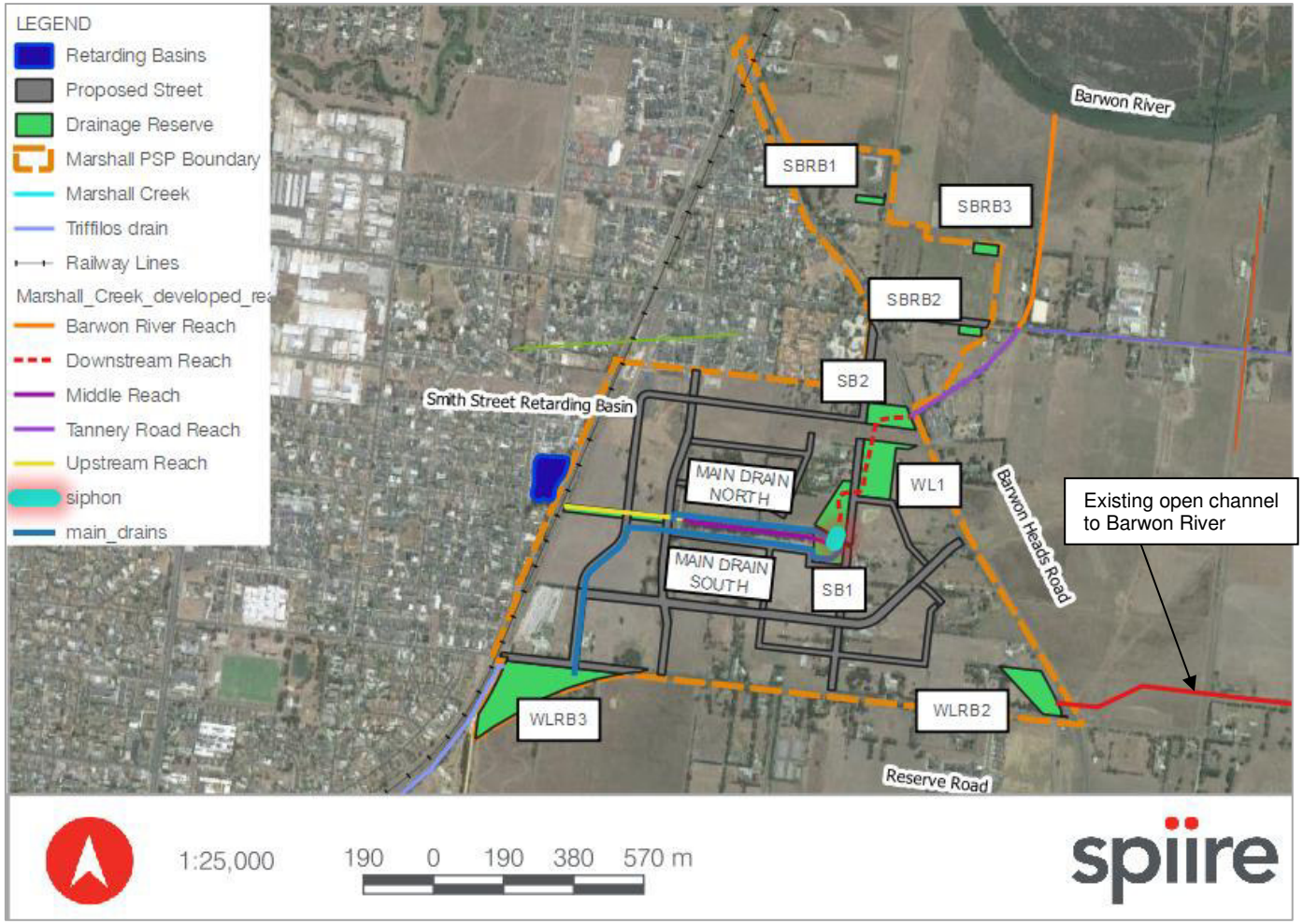



**Figure 20. Marshall PSP SWMS layout**

## 6.4 RORB MODELLING

### 6.4.1 RETARDING BASIN DESIGN

Hydrological modelling has been undertaken using RORB. This provides design flow estimates through the system and was used to analyse and size retarding basins. Refer to Appendix 1 for details of RORB model build and assumptions and full results. A summary of the RORB modelling results at key locations is provided in Table 4. This demonstrates that the proposed SWMS appropriately controls flood flows at the main catchment outlets (Marshall Creek at Barwon Heads Road and WLRB2 outlet).

Note that the retarding basins on smaller catchments north of Barwon Heads Road (SBRB1, SBRB2 and SBRB3) have been sized used methods other than RORB; refer to Section 54 for details.

**Table 4: RORB modelling peak flow results summary**

| Location | 1% AEP developed design flow ($m^3/s$) | 1% AEP existing flow ($m^3/s$) | 20% AEP developed design flow ($m^3/s$) | 20% AEP existing design flow ($m^3/s$) |
|---|---|---|---|---|
| WLRB3 outlet | 2.6 | 7.1 | 1.8 | 2.3 |
| MOS siphon | 6.9 | 10.9- | 3.2 | 3.6 |
| Marshall Creek - Barwon Heads Road culverts | 8.9 | 11.7 | 3.6 | 3.8 |
| Marshall Creek – confluence with Barwon River | 10.9 | 12.6 | 4.0 | 4.1 |
| WLRB2 outlet | 0.6 | 0.6 | 0.3* | 0.1 |

*Note that the outlet control for WLRB2 will need to be refined at the development design stage, to provide retardation of the 20% AEP as well as the 1% AEP event.

Table 5 presents a summary of RORB modelling for the two proposed retarding basins.

**Table 5: RORB modelling retarding basin summary**

| Basin | 1% AEP peak inflow ($m^3/s$) | 1% AEP peak outflow ($m^3/s$) | 1% AEP peak storage ($m^3$) | 1% AEP peak level (m AHD) |
|---|---|---|---|---|
| WLRB02 | 3.3 | 0.6 | 4,270 | 7.5 |
| WLRB03 | 6.6 | 2.6 | 13,800 | 11 |

For full details of RORB analysis, refer Appendix 1.

## 6.5 MUSIC MODELLING RESULTS

The WSUD treatment train was analysed using MUSIC. Note that sediment pond and wetland concept design has been undertaken consistent with *WSUD Engineering Procedures* (Melbourne Water, 2005) and *Constructed Wetlands Design Manual* (Melbourne Water, 2020).

For details for MUSIC modelling assumptions and full analysis (including bypass assumptions and inundation analysis), refer to Appendix 2. A summary of the treatment train MUSIC modelling results is provided in Table 6.

Note that there are some instances where reduction exceeds 100%. These reductions take into account incoming high pollutant loads from external catchments which have no formal water quality treatment measures in place. Therefore, when comparing the pollutants removed to the pollutants generated by Marshall Precinct, reductions are high. For full details of the MUSIC analysis, refer to Appendix 2.

The results in Table 6 demonstrate that the proposed treatment train will meet and exceed Best Practice targets (EPA, 2021).

**Table 6: MUSIC modelling results summary**

| Location | Marshall PSP – Marshall Creek catchment (% reduction) | Marshall PSP – WLRB2 catchment (% reduction) | Performance objective (% reduction) * |
|---|---|---|---|
| Flow (ML/yr) | 5% | 8% | n/a |
| Total Suspended Solids (kg/yr) | 156%** | 83% | 80% |
| Total Phosphorus (kg/yr) | 117%** | 70% | 45% |
| Total Nitrogen (kg/yr) | 56% | 46% | 45% |
| Gross Pollutants (kg/yr) | 268%** | 99% | 70% |

**as defined in table 1, Urban stormwater management guidance (EPA, 2021)*

## 6.6 WLRB03

WLRB03 is presented in Figure 21 and has been designed to provide the following:

- Formalisation of Triffilos Drain into a high flow bypass channel.
- A 1,500 $m^2$ sediment pond with an Extended Detention Depth (EDD) of 0.35m, which treats low flows (up to 0.6$m^3$/s) from Triffilos Drain. Note this has a clean out frequency of 3 years.
- A 2,500 $m^2$ constructed wetland, with EDD of 0.35m. Given the large external catchment and associated volumes, it was necessary to bypass low flows (up to 50l/s) from the

sediment pond via pipe back to the high flow bypass channel, before reaching the wetland. This was necessary to prevent excessive inundation depths and durations in the wetland, which would be detrimental to macrophyte plant health. This was assessed using Melbourne Water's online *Wetland Analysis Tool* to confirm appropriate bypass rates, residence time and water depth relative to plant heights (refer Appendix 1 for details).

- A 1,650mm dia outlet pipe (Main Drain South), which controls the retarding basin and conveys all flows up to the 1% AEP down to the siphon crossing of the MOS. Note the intent of this retardation is to reduce flows to allow conveyance through the 1,650dia pipe, rather than a waterway.

  Also note that the 1,650mm dia outfall pipe will cross existing water and Telstra services, which have not been proven. It is possible that these services may require relocation to accommodate the future proposed drainage pipe.

- Retardation storage above the wetland of 13,800m$^3$. Peak 1% AEP level is 11.0m, which gives 200mm freeboard to the existing Reserve Road. The Bellarine Link design will need to ensure sufficient freeboard for the ultimate road design.

- An ancillary flow path from WLRB3 must also be allowed for as part of the Bellarine Link design. It is anticipated that the Bellarine Link will grade east from WLRB3 down to the low point at the future Bellarine Link retarding basins at Drews Road (refer preliminary design plans in Appendix 3). The Bellarine Link ultimate design must ensure this ancillary flow path can be accommodated and is appropriate.

For full details of the preliminary design of WLRB03, refer to Appendix 3.

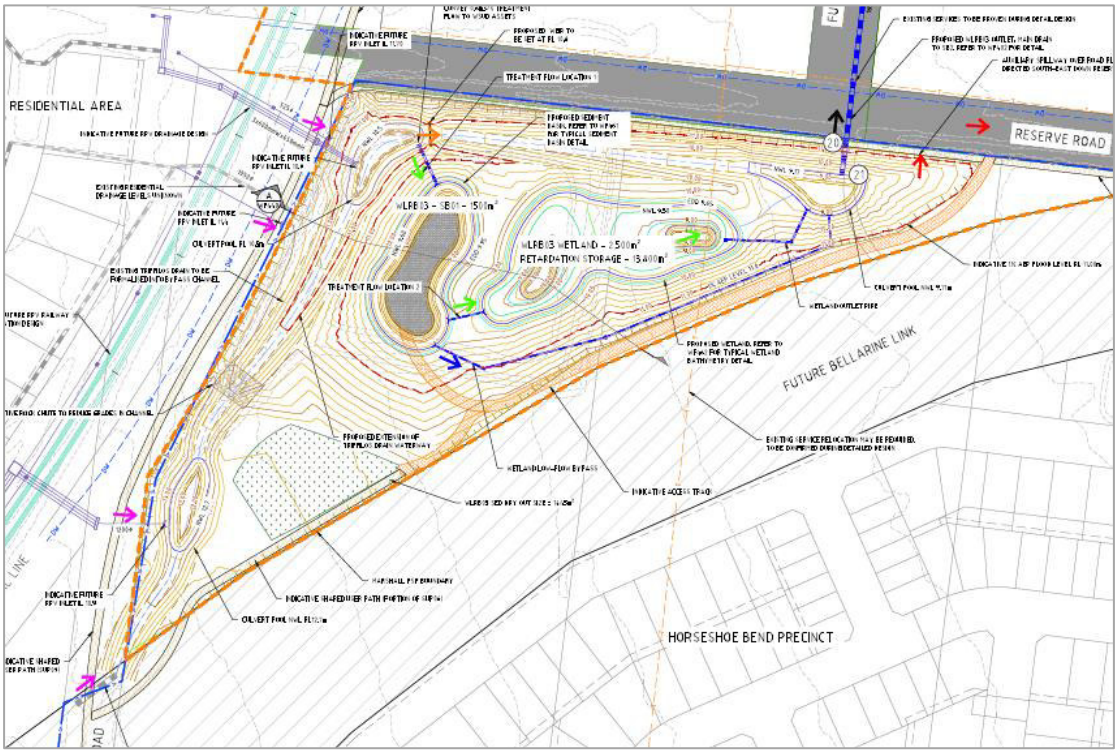



**Figure 21. WLRB03 preliminary design**

## 6.7 MARSHALL CREEK

Marshall Creek is the main conveyance corridor through the Marshall catchments. The condition, capacity and vegetation cover along the various reaches of Marshall Creek varies but is generally considered to have limited geomorphic value with limited vegetation cover. This is with the exception of the middle reach of Marshall Creek (refer to Section 2.7 for description of Marshall Creek under existing conditions), which is flanked by mature Native Vegetation, including Bellarine Yellow Gums and will therefore be protected.

It is proposed to formalise Marshall Creek into a constructed waterway, set within a waterway corridor. This requirement has been identified through engagement with The City and CCMA and will provide increased resilience to the waterway to withstand increased stormwater volumes as a result of a developed Precinct. An assessment has been undertaken using the *Waterway Corridors* guidelines (Melbourne Water, 2013), as follows:

- Develop a concept cross section with sufficient capacity to convey the 1% AEP flow.
- Use Manning's equation to estimate the hydraulic width for each reach of Marshall Creek, based on the concept cross section and peak design flow estimate.
- Apply the calculated hydraulic width for each reach to Table 7 for calculating constructed waterway widths.

**Table 7: Determining waterway corridor widths for constructed waterways (Melbourne Water, 2013)**

Table 3. Sliding scale for calculating constructed waterway corridor widths – assumes active edges (roads) that allow vehicle access along entire corridor length, on both sides of the corridor.

| HYDRAULIC WIDTH (M) | CRZ WIDTH (M) | VB WIDTH (M) | CORRIDOR WIDTH (M) |
|---|---|---|---|
| 5 | 20 | 10 | 30 |
| 10 | 20 | 10 | 30 |
| 15 | 25 | 15 | 40 |
| 20 | 25 | 15 | 40 |
| 25 | 30 | 15 | 45 |
| 30 | 30 | 15 | 45 |
| 35 | 30 | 15 | 45 |
| 40 | 30 | 20 | 50 |
| 45 | 35 | 20 | 55 |
| 50 | 35 | 20 | 55 |
| 55 | 40 | 20 | 60 |
| 60 | 40 | 20 | 60 |
| 65 | 40 | 25 | 65 |
| 70 | 45 | 25 | 70 |

Table 4. Sliding scale for calculating constructed waterway corridor widths – addition of shared trail/maintenance track either side of channel (within vegetated buffer)

| HYDRAULIC WIDTH (M) | CRZ WIDTH (M) | VB WIDTH (M) | CORRIDOR WIDTH (M) |
|---|---|---|---|
| 5 | 20 | 20 | 40 |
| 10 | 20 | 20 | 40 |
| 15 | 20 | 25 | 45 |
| 20 | 25 | 25 | 50 |
| 25 | 30 | 25 | 55 |
| 30 | 30 | 25 | 55 |
| 35 | 30 | 25 | 55 |
| 40 | 35 | 25 | 60 |
| 45 | 35 | 25 | 60 |
| 50 | 35 | 25 | 60 |
| 55 | 40 | 25 | 65 |
| 60 | 40 | 25 | 65 |
| 65 | 40 | 25 | 65 |
| 70 | 45 | 25 | 70 |

The waterway corridor analysis and estimated width for each reach is presented in Table 8.

**Table 8: Constructed waterway corridor assessment for Marshall Creek**

| Reach | Description | 1% AEP design flow | Estimated hydraulic width (m) | Active edges? | Waterway corridor width (m) |
|---|---|---|---|---|---|
| Upstream | From the rail line to Drews Road | 1.7 | 11.3m | Yes | 30m |
| Middle | From Drews Road to SB2 | 0.4* | na | na | Varies based on Native Vegetation zone |
| Downstream | From the siphon outlet pool to the Barwon Heads Road culverts | 7.8 – 9.6 | 30m | Yes | 45m |
| Tannery Road | From Barwon Heads Road to Tannery Road | 10.2 | 25m | Yes | 45m |
| Barwon River | From Tannery Road to Barwon River | 10.9 | 25m | No | 55m |

*estimated capacity of low flow channel

A more detailed description of each reach is provided in the following section. Refer to the design plans in Appendix 3 for further detail.

### 6.7.1 UPSTREAM REACH

The upstream reach is currently a straight shallow channel under existing conditions, with inflows being restricted by the capacity of the 2 x 750 mm culverts from Smith Street retarding basin (estimated as 1.7$m^3$/s, based on RORB modelling). The downstream IL of these culverts (10.0) sets the upstream invert of the channel. The downstream end of this reach ties into the existing channel adjacent to Smith Street (refer middle reach description below) at IL 8.9.

Given the upstream and downstream level controls of the upstream reach, the channel is relatively shallow, with the following concept design assumptions:

- Longitudinal grade = 1 in 425, base width = 3m, bank slope = 1 in 6 and total depth = approximately 0.8m.

New 2.7m wide x 0.6m high box culverts will be required under a realigned Drews Road, as shown on the design plans.

### 6.7.2 MIDDLE REACH

The middle reach commences downstream of Drews Road. Given there is a Native Vegetation community which lies adjacent to this reach, it is considered important to maintain some flows down this channel; by diverting all flows, it is possible that the health of these trees will diminish. Conversely, as it is proposed to provide a shared path alongside this channel, it is important to limit flows rates to the capacity of the channel to ensure flood immunity to the shared path.

Figure 22 shows the low flow diversion pit concept to the middle reach of Marshall Creek. The intent of this structure is to divert low flows to the middle reach via a pipe (sized to the minimum capacity of the middle reach). Once the low flow pipe reaches capacity, a bypass pipe (Main Drain North) becomes engaged to divert all excess flows up to the 1% AEP around the middle reach to the downstream siphon. Note that the catchment upstream of the proposed diversion pit is fully developed (contributing to Smith Street retarding basin). Therefore, the flow regime to this pit will not change as development progresses from existing conditions to ultimate conditions.

As Main Drain North collects the 20% AEP drainage from local catchments within the Marshall Precinct, flows up to the 1 EY are directed from Main Drain North to SB1 for treatment. It is important to note that while the main drains are shown on the design plans are being partially located in Native Vegetation areas, these will ultimately be located in future road reserves.

On review of the middle reach minimum channel capacity, this is estimated to be approximately 0.4$m^3$/s. However, as this is based on LiDAR, this is considered a preliminary estimate only. Channel capacity and allowable low flow rate will need to be reviewed based on updated feature and level survey.

The downstream end of the middle reach will be realigned into SB1, at the upstream end of the siphon, as shown in Figure 23. Also note the 1EY diversion from the Main Drain North to SB2. The siphon is discussed in Section 6.8.

Given the native vegetation constraints of the middle reach, future design associated with this reach will be sensitive to this vegetation.

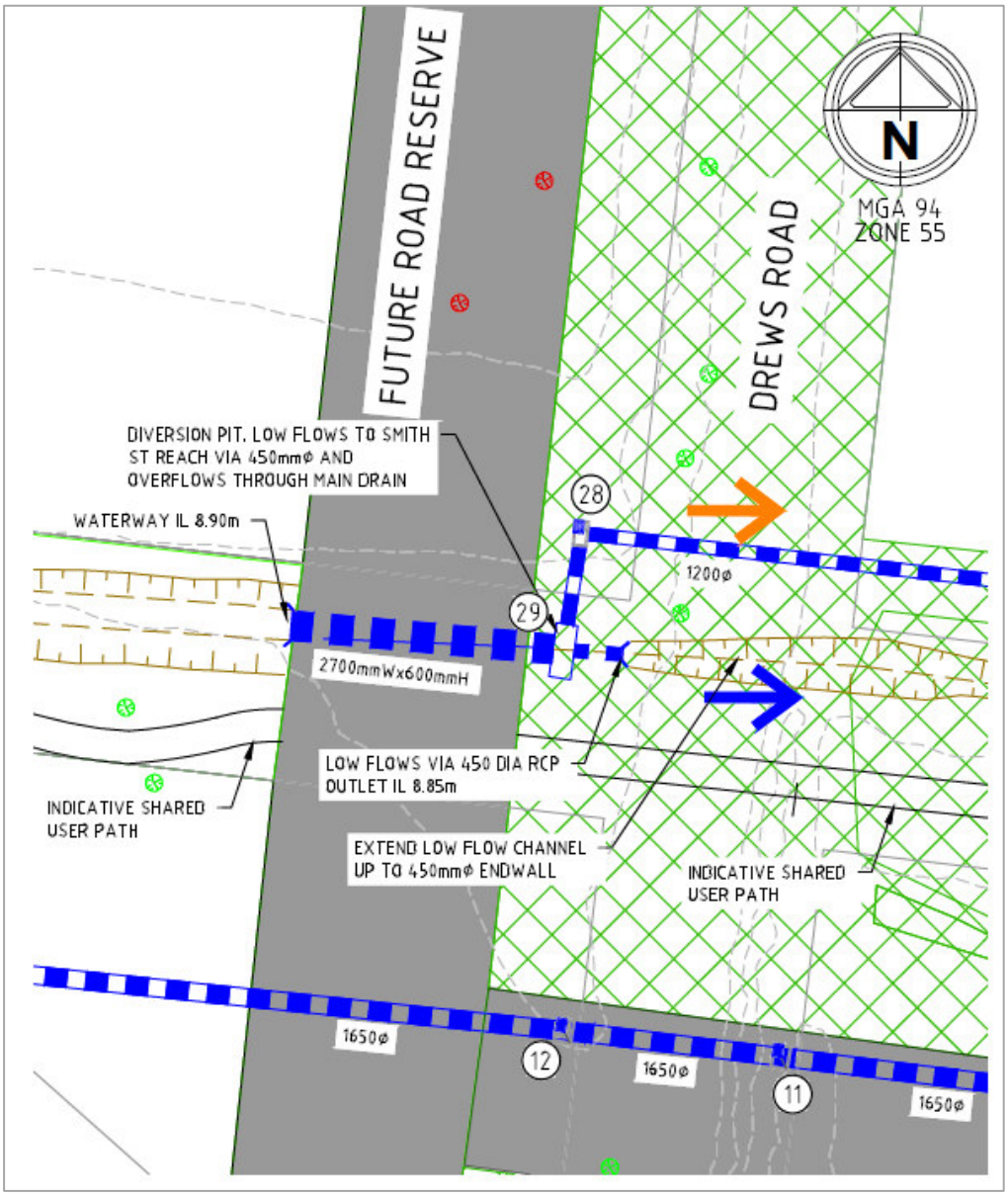



**Figure 22. low flow diversion concept to middle reach of Marshall Creek**

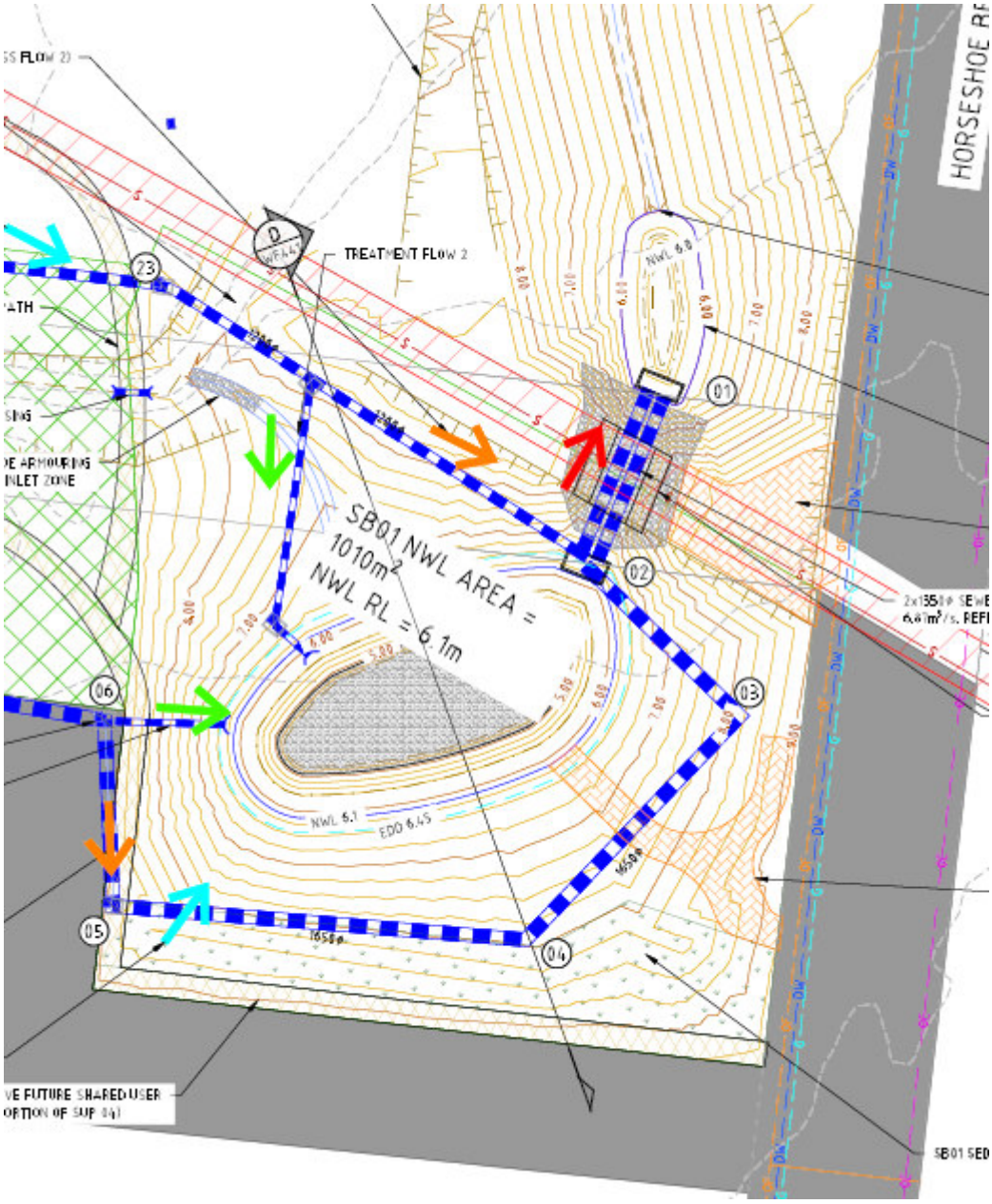



**Figure 23. Downstream end of the middle reach**

### 6.7.3 DOWNSTREAM REACH AND WL01

The downstream reach of Marshall Creek extends from the outlet pool of the siphon down to the outlet culverts under Barwon Heads Road. Through this reach, there are a number of notable design features, as follows:

- The waterway channel upstream of Horseshoe Bend Road has a base width of 2m, bank grade of 1 in 8 and is generally around 2m deep.

- As shown in Figure 24, new 4 x 1200 RCP culverts are required under Horseshoe Bend Road, given the existing 2 x 1200W x 500H RCBC are of insufficient capacity and are too high (upstream IL 7.5 m). Due to requirement to protect the existing tree to be retained adjacent to the existing culverts (refer plans in Appendix 3), the new culverts are proposed 10m south of the existing culverts, with an upstream IL of 5.8m. Culvert pools are proposed at either end.

- Given the native vegetation constraints of the downstream reach, future design associated with this reach will be sensitive to this vegetation.

- Note that existing gas and optic fibre services are located in Horseshoe Bend Road, which have not been proven. These may require relocation to accommodate the future proposed culvert.

- A 4,100m$^2$ constructed wetland (WL01) is positioned offline to the downstream reach and provides treatment to flows from Marshall Creek and also local catchments to the south. NWL is 5.9m.

- Analysis for WL01 was undertaken using MUSIC and Melbourne Water's online *Wetland Analysis Tool.* This showed that treating flows up to the 4 EY for the entire upstream Marshall Creek catchment created excessive inundation depths and durations within WL1. These conditions are detrimental to macrophyte plant health over time and therefore a low flow bypass, as well as a high flow bypass, is required for WL01. As follows:

  - Provide a 450mm dia outlet pipe and headwall with the invert set at the culvert outlet pool NWL (5.8m). At 1 in 200 grade, this has a capacity of 0.2m$^3$/s, which is the low flow bypass around WL1.

  - Construct 3 x 450mm dia pipes with the invert set at 6.25m, the obvert of the 450mm dia low flow pipe. This allows treatment inflows to WL01 to commence at the point at which the low flow pipe capacity is reached. The peak treatment flows through the wetland will be 0.5m$^3$/s.

  - Set a weir along the downstream boundary of the culvert outlet pool, with the crest set to RL 6.7m, the obvert of the inlet pipes to the wetland. This weir controls the high flow bypass around WL1.

  - A 12m long 1.2m high rock chute will be required from the pool weir to the base of the downstream reach.

- The reach downstream of Horseshoe Bend Road has a longitudinal grade of 1 in 1,000m, base width of 3m and bank grade of 1 in 6. General channel depth is approximately 1.1m. This extends down to the Barwon Heads Road culverts outlet pool.

- Through engagement with Ausnet, the small section of waterway through the Ausnet Easement was reduced to have a top width of 20m. This is an Ausnet requirement, to ensure access for future upgrades which are anticipated by Ausnet and advised to inform the SWMS.

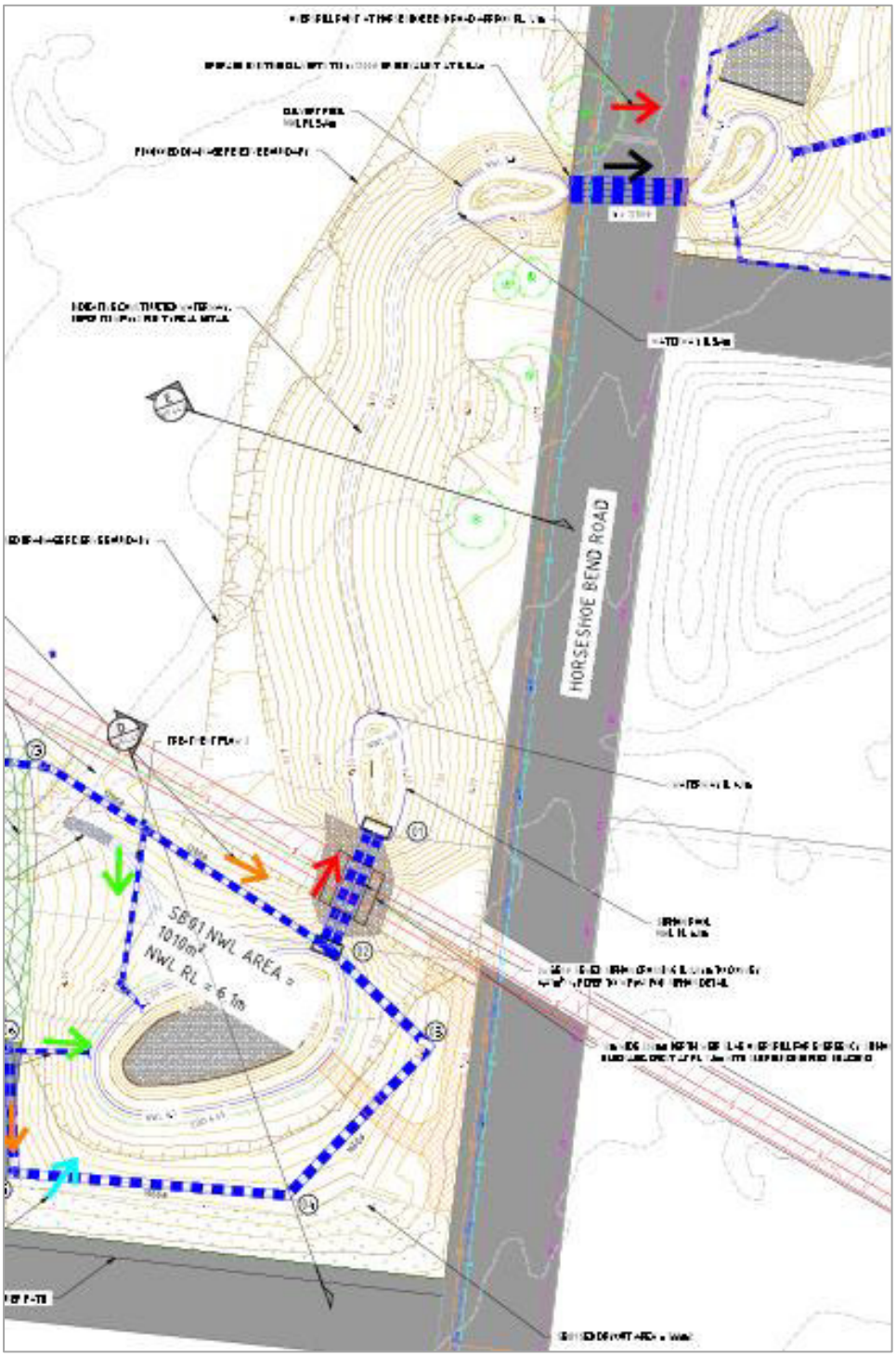



**Figure 24. Downstream reach - upstream of Horseshoe Bend Road**

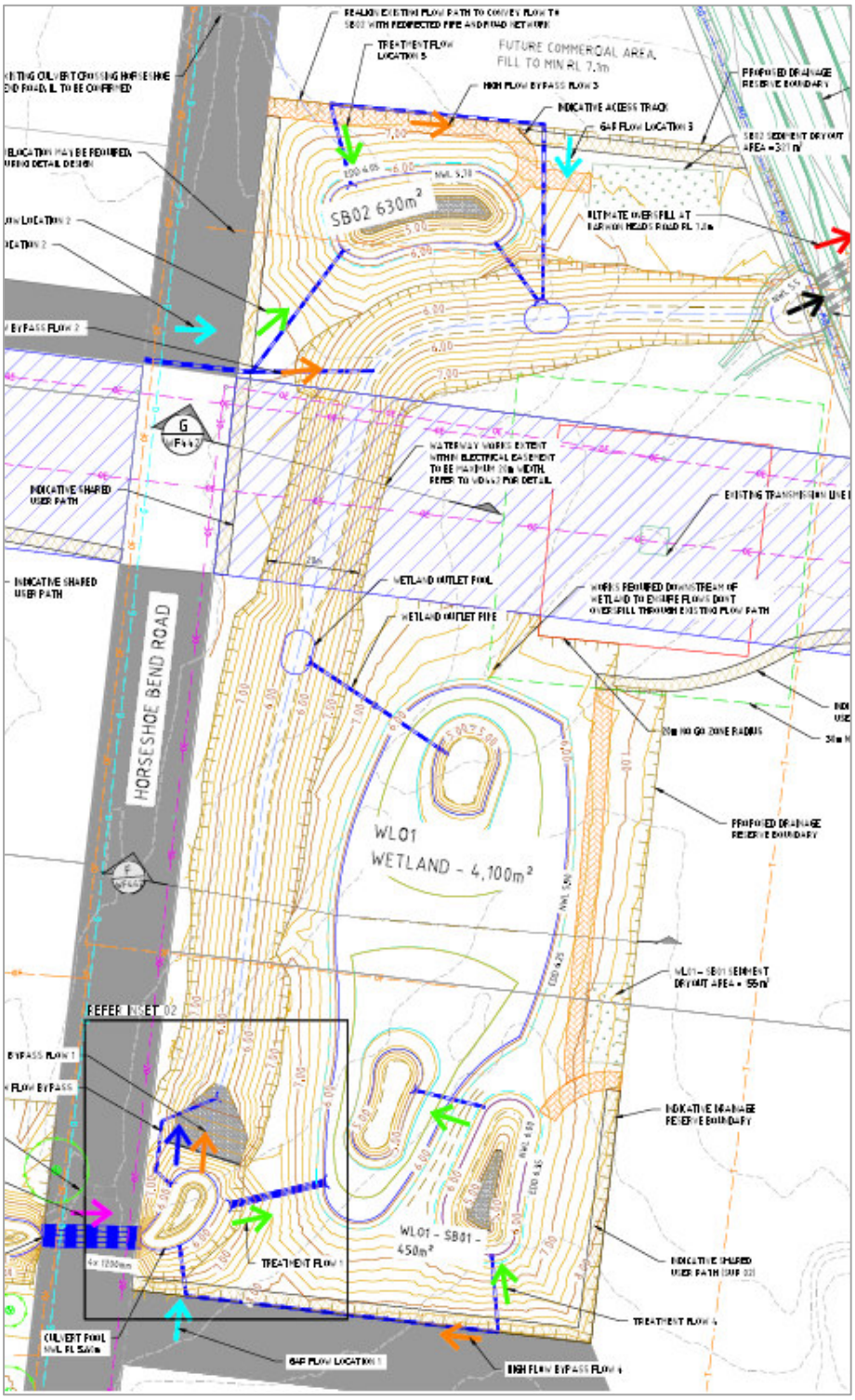



**Figure 25. Downstream reach - downstream of Horseshoe Bend Road**

### 6.7.4 MARSHALL CREEK OUTLET THROUGH BARWON HEADS ROAD CULVERTS

The outlet of Marshall Creek at the downstream end of the Marshall Precinct is located at Barwon Heads Road, via 2 x 1800 x 900 RCBC's and 2 x 2100 x 900 RCBC's.

Through RORB analysis, it has been determined that no 'end of line' retarding basin is required upstream of Barwon Heads Road. A combination of retardation at WLRB3 and the diversion of external catchments (as part of the Horseshoe Bend Precinct) suffice to ensure developed peak flows do not exceed existing conditions. Refer to Section 6.4 for more details.

### 6.7.5 TANNERY ROAD REACH

This reach commences at the outlet of the Barwon Heads Road culverts, with an outlet pool (NWL 5.3m) at this location. The channel follows the current alignment and extends down to the existing Tannery Road culverts (2 x 1500 dia) at IL 4.0m, with the following geometry:

- Longitudinal grade = 1 in 530, base width 3m and low flow bank slopes at 1 in 3.

Note there is a Telstra communications conduit which crosses the future waterway and may require relocating.

### 6.7.6 BARWON RIVER REACH

The Barwon River reach extends from the Tannery Road culverts down to the Barwon River. Rather than following the current alignment (which has low capacity), the proposed alignment extends to the east of property 31 – 39 Tannery Road and west of the NEIP PSP boundary. This is to ensure no impact to the 31 – 39 Tannery Road property. The Barwon River reach has the following geometry:

- Longitudinal grade = varies between 1 in 150 to 1 in 250, base width 3m and low flow batter slopes 1 in 3.

Allowance for a rock chute/rock scour pad is also required at the confluence to the Barwon River, to manage transition of flows and associated erosion risk. Note that design considerations such as RL of tie in to the bank of Barwon River and angle of tie in will be subject to engagement with and approvals from the CCMA.

Also note that consideration should be given at the design stage to the extent of backwater ponding in the Barwon River reach, formed by the confluence with the Barwon River.

### 6.7.7 CONSTRUCTED WATERWAY DESIGN LIMITATIONS

It is important to note that the waterway concept has not been assessed against the *Constructed Waterway Design Manual* (Melbourne Water, 2019) as this was beyond the scope of the SWMS. Rather, attention has been given to ensure appropriate capacity and corridor widths. The *Constructed Waterway Design Manual* should be adopted at the design phase of the waterway.

## 6.8 SIPHON UNDER BARWON WATER MAIN OUTFALL SEWER

As discussed in preceding sections of this report, the requirement for a siphon crossing of Marshall Creek under the Barwon Water MOS was identified. This will negate excessive filling, which would otherwise be induced by a Marshall Creek crossing over the top of the MOS.

Based on requirements provided by Barwon Water (refer Appendix 4), a preliminary design has been prepared as shown in Figure 26 and Figure 27, and as follows:

- A sediment pond (SB01) lies immediately upstream of the siphon and is controlled by the upstream siphon pit.
- The upstream siphon pit serves a number of purposes: to control SB01, to act as an inlet to gap flows which are conveyed through SB2 and to connect the North Main Drain and South Main Drain to the siphon.
- From the upstream siphon pit, 2 x 1350 dia RCP's pass under the MOS, to a surcharge chamber within an outlet pool.
- Existing 1350mm diameter MOS invert is approximately 4.85m, with the obvert at 6.20m (Craigie, 2011) (this should be proven to confirm). An allowance of 1m vertical clearance between the 1350 dia siphon pipes and overlying MOS has been provided. The actual minimum clearance will be informed by future geotechnical assessment and design, together with a Barwon Water Activity Method Statement.
- A concrete weir is provided above the MOS, to cater for larger design flows, and to provide emergency overflow in the event of a blockage.
- The 1% AEP developed flow at the siphon is 6.9m$^3$/s. This design flow has been used to calculate hydraulic losses through the siphon arrangement, resulting in a 1% AEP headwater at the siphon of 8.4m AHD. Freeboard to surrounding lots will need to be provided above this level.
- The hydraulic calculations undertaken for the siphon as part of this SWMS will be refined through the design process. For these purposes of this SWMS, it has been assumed that all flows up to the 1% AEP are conveyed through the siphon when in reality, a portion of this will flow over the concrete weir. Refinement of these calculations will likely see a lowering of HGL's through the siphon. Given this is a conservative approach for the SWMS, it is considered appropriate.
- By refining the hydraulic calculations through the siphon and lowering HGL's, it may be possible to reduce the size of the Main Drain North and Main Drain South, which are tailwater controlled by the siphon. This will be addressed through design development.
- Given the critical nature of the MOS, the design of the siphon and spillway will be subject to Barwon Water approvals.

Refer to the preliminary design plans in Appendix 3 for more details of the proposed siphon.

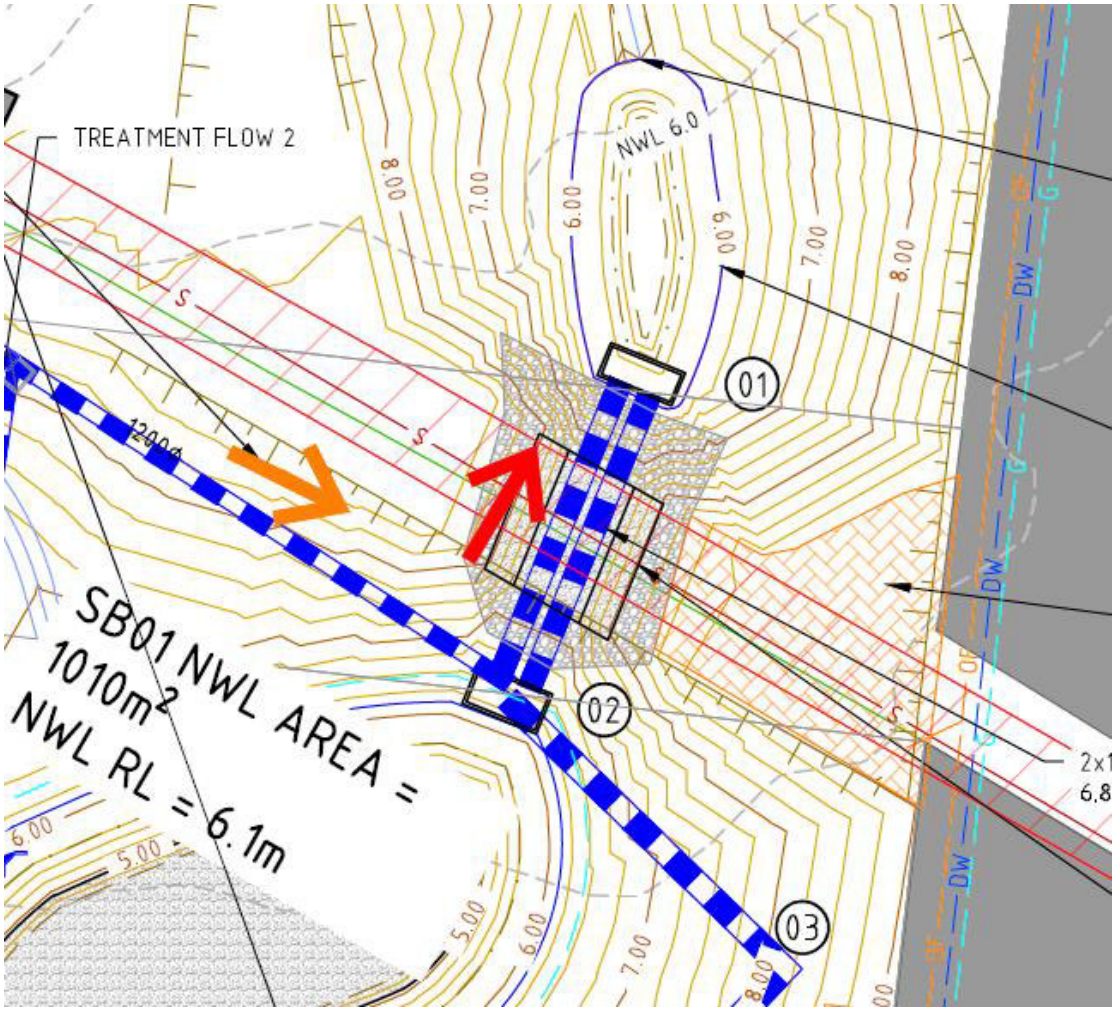



**Figure 26. Plan view of MOS siphon**

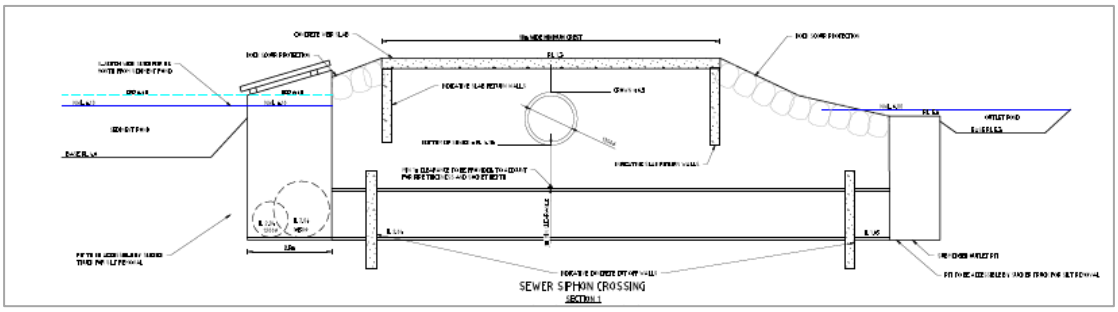



**Figure 27. Proposed siphon arrangement under MOS sewer**

## 6.9 MAIN DRAINS

As described above, two main drains are proposed, as follows:

- Main Drain South, a 1,650mm dia RCP at 1 in 320 which conveys 1% AEP flows from WLRB03 to the MOS siphon. This will also form the drainage connection point for the internal Marshall catchments in the south of the Precinct, and thus treatment flows (up to 1 EY) from the Main Drain South are diverted into SB1.

The 1,650mm dia outfall pipe will cross existing water and Telstra services, which have not been proven. It is possible that these services may require relocation to accommodate the future proposed drainage pipe.

Note that the long section of Main Drain South, provided in Appendix 3

preliminary design plans.

- Main Drain North, a 1,200mm dia RCP at 1 in 300 which conveys 1% AEP flows from the diversion pit at the upstream end of the middle reach of Marshall Creek, to the MOS siphon. This drain forms the connection point for the internal Marshall catchments in the north of the Precinct, and treatment flows (up to 1 EY) from the Main Drain North are diverted into SB2.

## 6.10 STAND ALONE SEDIMENT PONDS

There are two standalone sediment ponds as part of the SWMS, required to provide primary treatment prior to discharge to Marshall Creek, and as follows:

- SB01 is 1,010m$^2$ and located immediately upstream of the siphon. EDD provided is 0.35m and clean out frequency is 3 years.
- SB02 is 630m$^2$ and located immediately upstream of Barwon Heads Road. EDD provided is 0.35m and clean out frequency is 5 years.

## 6.11 COMMERCIAL/BULKY GOODS AREA CATCHMENTS

This area of the Marshall Precinct is located to the north of Barwon Heads Road, as presented in Figure 28. As shown, part of this area of Marshall is within the Flood Overlay associated with Barwon River.

Figure 29 presents the locations of three proposed drainage reserves within the Commercial/Bulky Goods Area. As shown, this area is fragmented from a drainage perspective, and the consolidation into one basin is not possible. Given the relatively small size of each catchment, three separate sediment ponds only are proposed, co located within 1% AEP retarding basins. While the sediment ponds do not meet BPEM for these individual catchments, the overall Marshall Precinct treatment train overtreats for water quality so this is appropriate.

The Swinburne Tech method was adopted to conceptually size the retarding basins for SBRB01, SBRB02 and SBRB03. No tailwater analysis from the Barwon River was considered for the SWMS; this should be provided during the design process.

SBRB02 is proposed to outfall to an existing small open channel which flows directly north to the Barwon River (it is not possible to discharge to Marshall Creek due to existing levels). This may be subject to a drainage easement in favour of The City.

SBRB03 is located immediately to the south of Tannery Road, on the PSP boundary. As shown in Figure 29, there is an area of land between the Marshall PSP boundary and the proposed waterway corridor, which was set aside as part of the NEIP PSP for drainage purposes, being a proposed basin. Through the development of this SWMS, the City advised that the online drainage asset servicing the NEIP was no longer acceptable and required all stormwater infrastructure to be offline. Hence, Marshall Creek through this area (Barwon Heads Road to Tannery Road) has been designed as a waterway only.

It is acknowledged that through the removal of the online basin proposed in the NEIP, the associated drainage catchment area of the NEIP is no longer sufficiently serviced. It is understood that the NEIP SWMS is planned to be revised at some point in the future, and it is recommended that the waterway/drainage design alignment is revisited at this time to ensure that an additional offline asset can be introduced to suitably service the NEIP and not reduce the developable area of the applicable catchment. For example, it is foreseen that the area originally marked as encumbered open space within the NEIP PSP is no longer required, this area is marked as 'Zone between Waterway and PSP' within figure 29, therefore potentially allowing for the realignment of the waterway to encumber this area, opening up additional area between the realigned waterway and the future road for an offline drainage asset.

Refer to Appendix 2 for MUSIC modelling and Appendix 3 for preliminary design.

**Table 9: Commercial/Bulky Goods basin information**

| Basin | Catchment Area (ha) | Sediment basin size ($m^2$) (EDD 0.35m) | NWL (m AHD) | 1% AEP Retarding basin volume | Outfall details |
|---|---|---|---|---|---|
| SBRB 01 | 2.97 | 390 | 2.1 | 725 | Outfall to existing swale drain on Horseshoe Bend Road |
| SBRB 02 | 5.35 | 390 | 2.0 | 970 | Piped outfall to existing open channel downstream of Tannery Road. Note this may subject to a drainage easement in favour of The City. |
| SBRB 03 | 3.56 | 390 | 4.6 | 890 | Piped outfall to Marshall Creek upstream of Tannery Road |

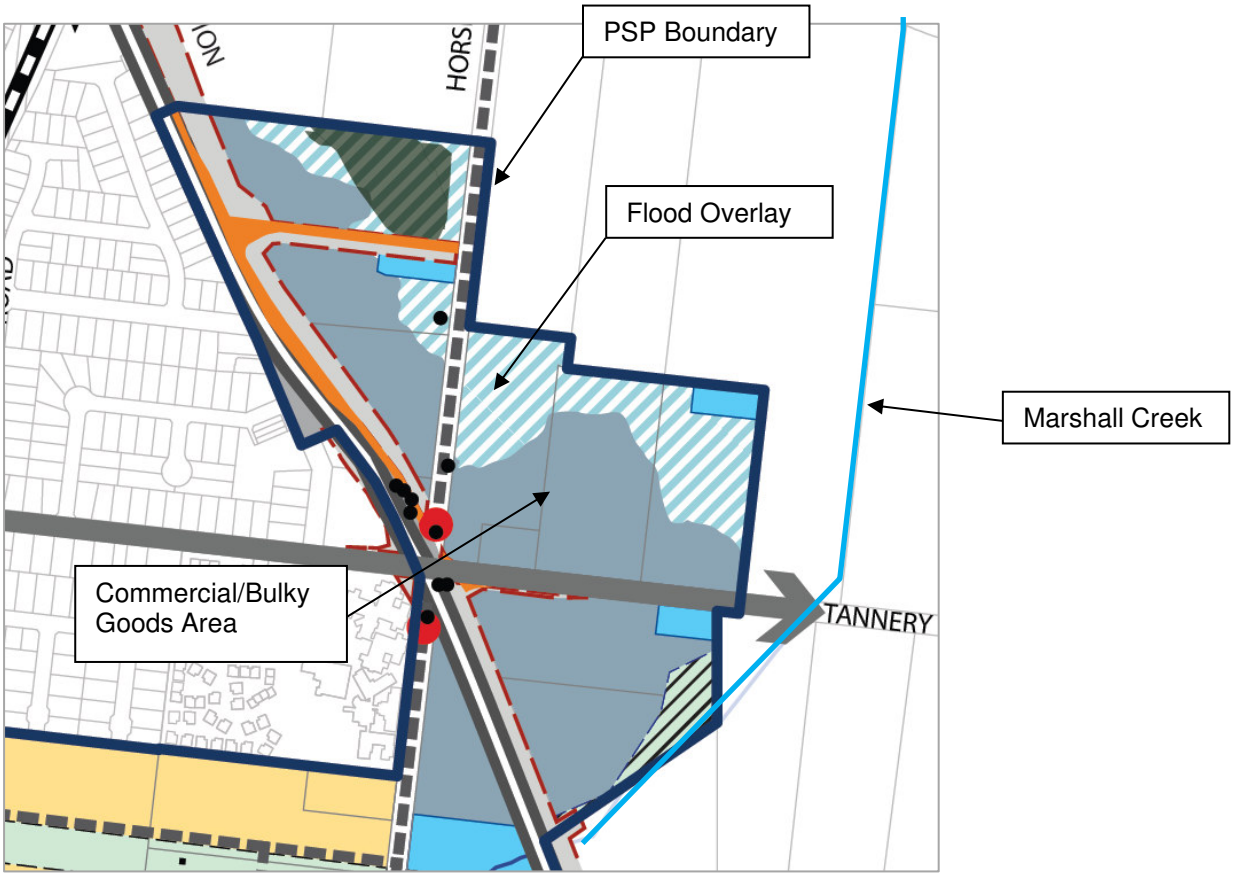



**Figure 28. Commercial/Bulky Goods Area (adapted from City of Greater Geelong, 2022)**

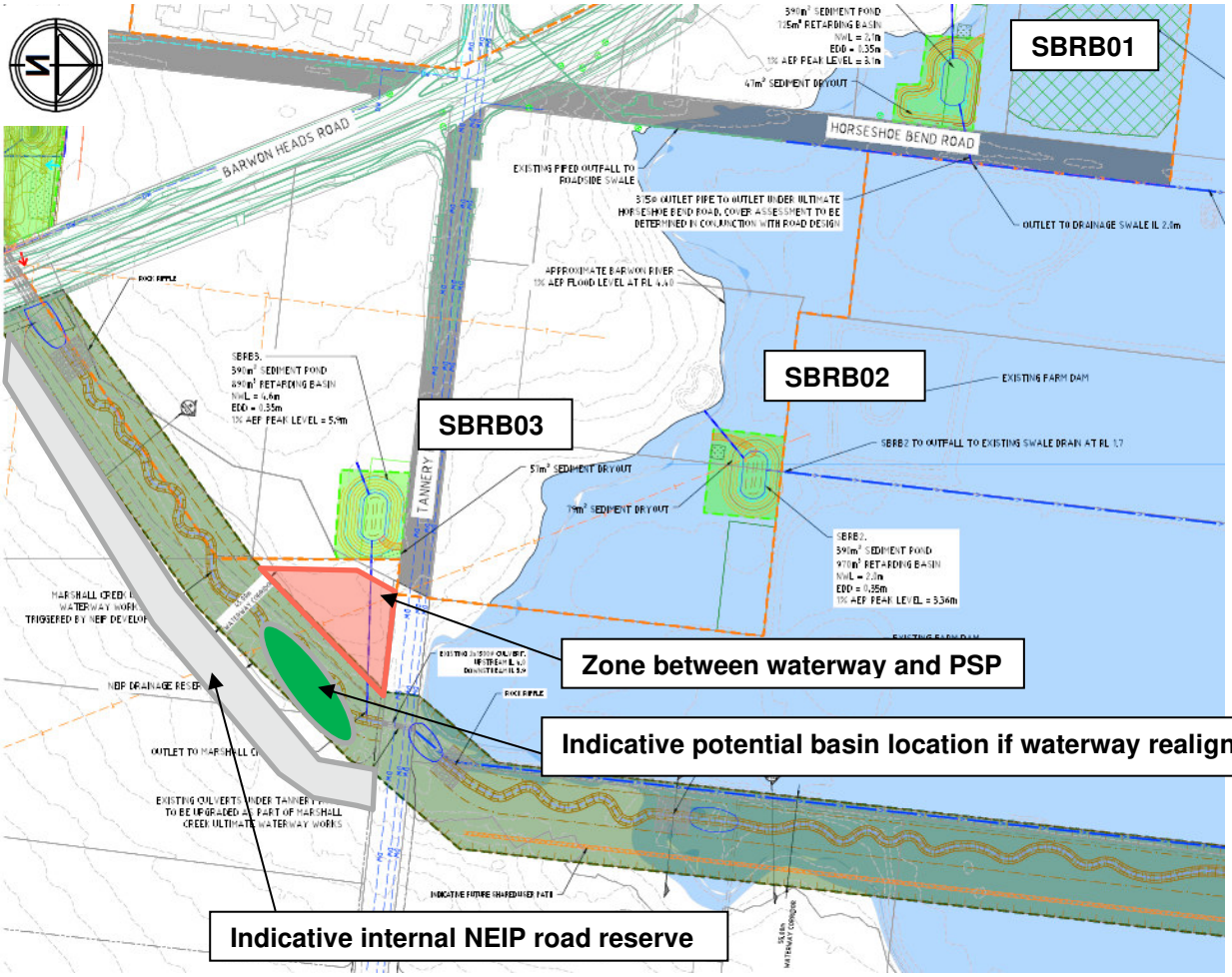



**Figure 29. Commercial/Bulky Goods Area – catchments and basins**

## 6.12 WLRB02

WLRB02 is the proposed end of line basin for the 17.1ha south east catchment, which outfalls to the south east corner of the Precinct. Under existing conditions, a culvert drains the low point from the south east corner of the Reserve Road/Barwon Heads Road intersection, to the eastern side of Barwon Heads Road and then to a shallow farm drain. This ultimately drains to the Barwon River, approximately 1.9 km to the east of the Precinct. Refer to Section 2 for full description of existing conditions.

Following engagement with The City, the most appropriate ultimate drainage outfall alignment was determined to be to immediately downstream of Sparrovale Linear Wetland, approximately 1,500m to the southeast of the Precinct.

The WLRB2 location and proposed outfall alignment to Sparrovale Linear Wetland are presented in Figure 30; Figure 31 presents the WLRB2 layout. Refer to Section 4.4 for background details of the NEIP and how the NEIP outfall interfaces with the WLRB2 catchment. The intent is that this outfall will also provide outfall for the local Barwon Heads Road's catchment which outfalls to the shallow farm drain in this vicinity. After engagement with The City, this outfall will also serve the NEIP catchments which fall southwards to Reserve Road.

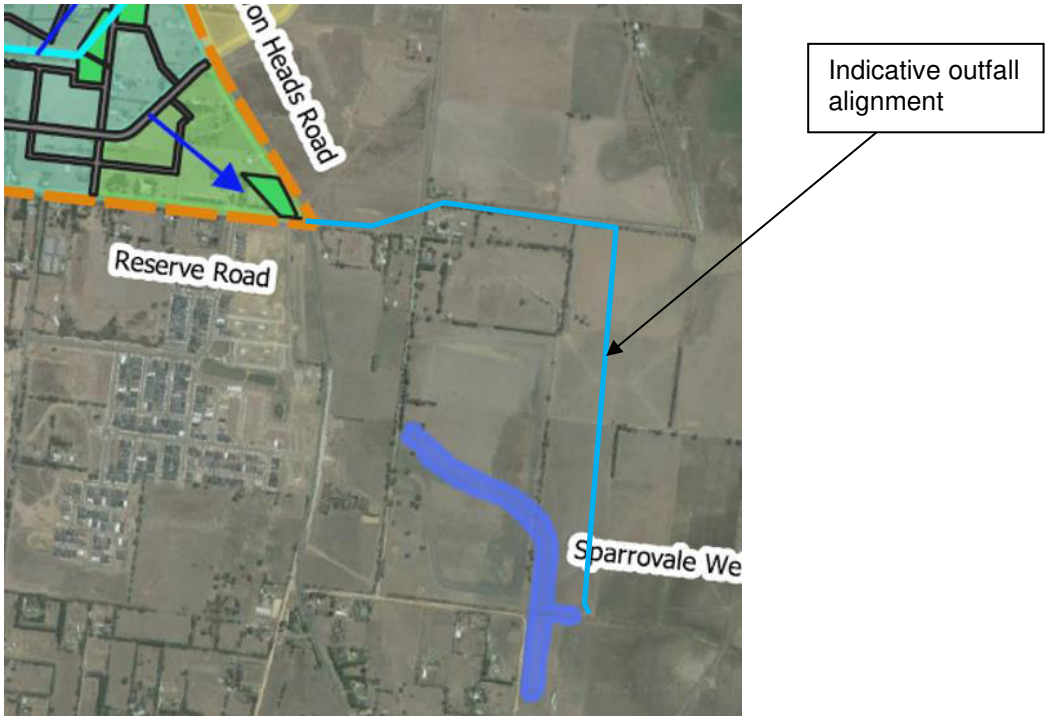



**Figure 30. Proposed outfall alignment to Sparrovale Linear Wetland**

It should also be noted that 2.9ha of the future Bellarine Link catchment has been allowed for in the retarding basins calculations and resultant storage (refer Section 4.1 for details). Refer to Appendix 1 for catchment and RORB modelling details.

A preliminary design for WLRB2 and the outfall is presented in the plans (Appendix 3).

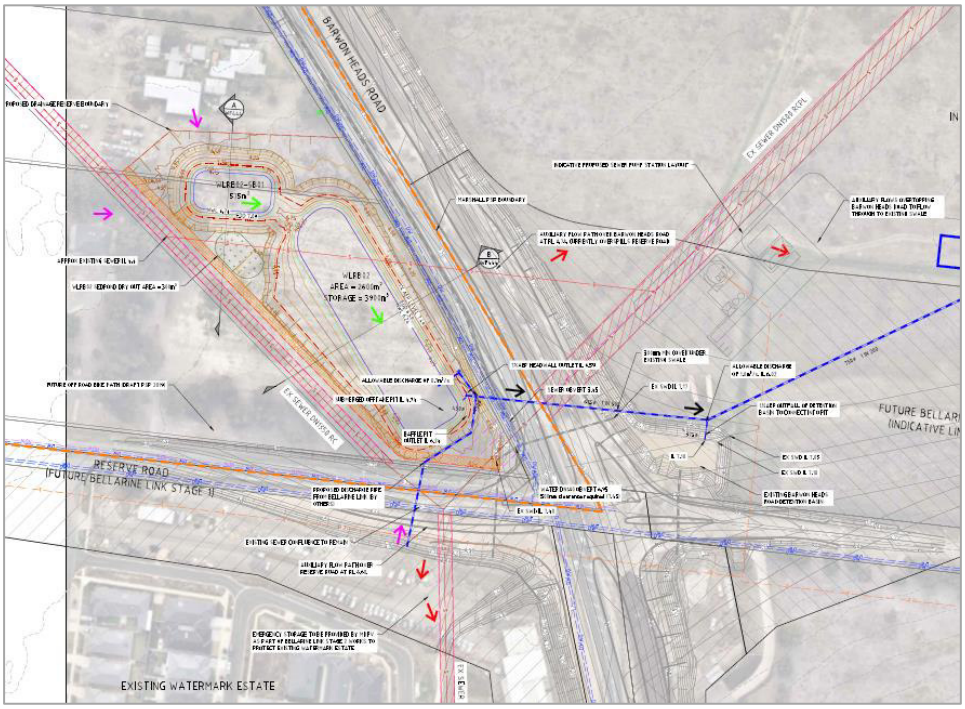



**Figure 31. WLRB02 layout**

The key stormwater drainage considerations and allowances for WLRB2 are as follows:

- Provision of a 575 $m^2$ sediment pond with an Extended Detention Depth (EDD) of 0.35m. Note this has a clean out frequency of 5 years.
- A 2,600$m^2$ constructed wetland, with EDD of 0.35m. Note that given the small size of contributing catchment, analysis found that velocities up to the 1% AEP remain suitably low, and no high flow bypass is required.
- A 10m minimum offset from the centreline of the MOS to the top of batter (refer Barwon Water requirements, Appendix 4).
- The proposed realignment of the MOS from the future pumping station to *Section 6* of the MOS will need to be moved northwards to accommodate WLRB2, as shown on the preliminary design plans (Appendix 3). Discussions with Barwon Water confirmed that there is some flexibility in this section of design of MOS upgrade (GHD 2001) and it is understood that this is acceptable.
- A 675mm dia outlet pipe which controls the retarding basin and conveys all flows up to the 1% AEP from WLRB2. Refer to Table 10 for WLRB2 retarding basin details.

**Table 10: WLRB2 retarding basin details**

| Existing 20% AEP peak flow ($m^3/s$) | Developed 20% AEP peak flow ($m^3/s$) | Existing 1% AEP peak flow ($m^3/s$) | Developed 1% AEP peak flow ($m^3/s$) | Peak 1% AEP flood level (m AHD) | Peak 1% AEP flood storage ($m^3$) |
|---|---|---|---|---|---|
| 0.1 | 0.3* | 0.6 | 0.5 | 7.7 | 5,571 |

*Note that the outlet control for WLRB2 will need to be refined at the development design stage, to provide retardation of the 20% AEP as well as the 1% AEP event.

- On review of the Barwon Heads Road upgrade detailed design (provided to Spiire by MRPV), there will be two emergency spillways and ancillary flow paths from WLRB2, as follows, and as detailed in Table 11:
  - The first spill point (point at which flows spill from the drainage reserve to the road reserve) to Barwon Heads Road on the eastern boundary of WLRB2 is 8.53m. In an extreme event, flows will continue to back up until the crest of Barwon Heads Road is reached at 8.78m.
  - The second spill point is to Reserve Road to the south of WLRB2, at 7.8m. Extreme event flows will continue to back up to the crest of Reserve Road at 8.60m. From here, it appears that flows will be conveyed southwards towards the Watermark Estate. Spiire were not provided with design information for the ultimate Bellarine Link/Barwon Heads Road intersection immediately adjacent to Watermark, however, it appears that a trapped low point has been created here. (prior to the Barwon Heads Road upgrade, flows overtopped Barwon Heads Road and were then conveyed eastwards towards Barwon River). It is recommended that MRPV review this situation to ensure that spillway flood flows from WLRB2 are not directed to lots within the Watermark Estate
  - Minimum Finished Floor Levels to lots surrounding WLRB2 will be 8.60.

Table 11. WLRB2 Ancillary flow paths and spillway levels

| Spill point to Barwon Heads Road (m AHD) | Crest of Barwon Heads Road (m AHD) | Spill point to Reserve Road (m AHD) | Crest of Reserve Road (m AHD) |
|---|---|---|---|
| 8.53 | 8.78 | 7.80 | 8.60 |

- Bellarine Link Stage 2 is indicatively shown on the preliminary design plans (Appendix 3). While MRPV were unable to provide updated concept designs for this project, it was confirmed that Bellarine Link Stage 2 is a possibility at some point in the future.

## 6.13 WLRB02 OUTFALL TO SPARROVALE – NUBIJT YOOREE WETLANDS

The WLRB02 outfall pipe extends along the northern side of an unnamed road before being conveyed to the south side via proposed culverts. Given the flat topography from this point down to Sparrovale Linear Wetland, a waterway will convey flows to a location immediately downstream of Sparrovale Linear Wetland. Details of the waterway are shown on the preliminary design plans (Appendix 3) and as follows:

- Estimated 1% AEP design flow = 2.5m$^3$/s. Note that as hydrological modelling of the NEIP was outside the scope of this SWMS, a simple summation of peak flows from WLRB2, Barwon Heads Road and the NEIP (based on the previous Water Technology SWMS) was adopted to guide design. This will need to be revisited as part of the future NEIP SWMS update.
- Base width = 3m
- Bank grades = 1 in 3
- Longitudinal grades of channel = 1 in 200, connected by a series of in channel pools.
- Number of in channel pools = 6. Note that the adoption of pools in the waterway is required to manage the flat grades.
- Tie in point at RL 0.5m, immediately downstream of Sparrovale Linear Wetland.

It should be noted that an allowance for fill embankments has been made to some areas in the waterway design, where due to flat grades, a waterway in cut is not possible. These fill embankments can have relatively flat batters, and be designed to integrate with the landscape, if designed appropriately.

It should also be noted that due to flat topography, the concept waterway to Sparrovale Linear Wetland does not have full 1% AEP capacity. Ultimate design will need to consider where flows break out with provision of floodplain. Providing infrequent wetting of localised areas adjacent to the waterway may be considered as a benefit from an environmental perspective, in the context of Sparrovale – Nubijt yooree Wetlands. This should be discussed with The City Environment Team as the design phase.

Collaboration with The City (in particular the Environment Department) will be required during the design development for the outfall waterway, given the waterway will extend through the Sparrovale – Nubijt yooree Wetlands area. Figure 32 shows an extract from the Sparrovale – Nubijt Yooree Wetlands Master Plan and indicates the WLRB2 pipe alignment (blue) and

waterway alignment (red). The Master Plan shows that Future land use of areas where the waterway will extend through are “Floodplain revegetation area” and “future open space”. Therefore, it is critical that the future waterway integrates appropriately with the Sparrovale – Nubijt yooree Wetlands Master Plan, with the following requirements met:

- No impact to biodiversity values within Sparrovale – Nubijt yooree Wetlands by either construction impacts or detrimental impacts through changes to the flow regime.
- No impact to hard assets (such as access tracks) within the Sparrovale – Nubijt yooree Wetlands area
- Design of waterway to consider a more meandering alignment, with particular focus on the pools/ponds, to the satisfaction of The City.

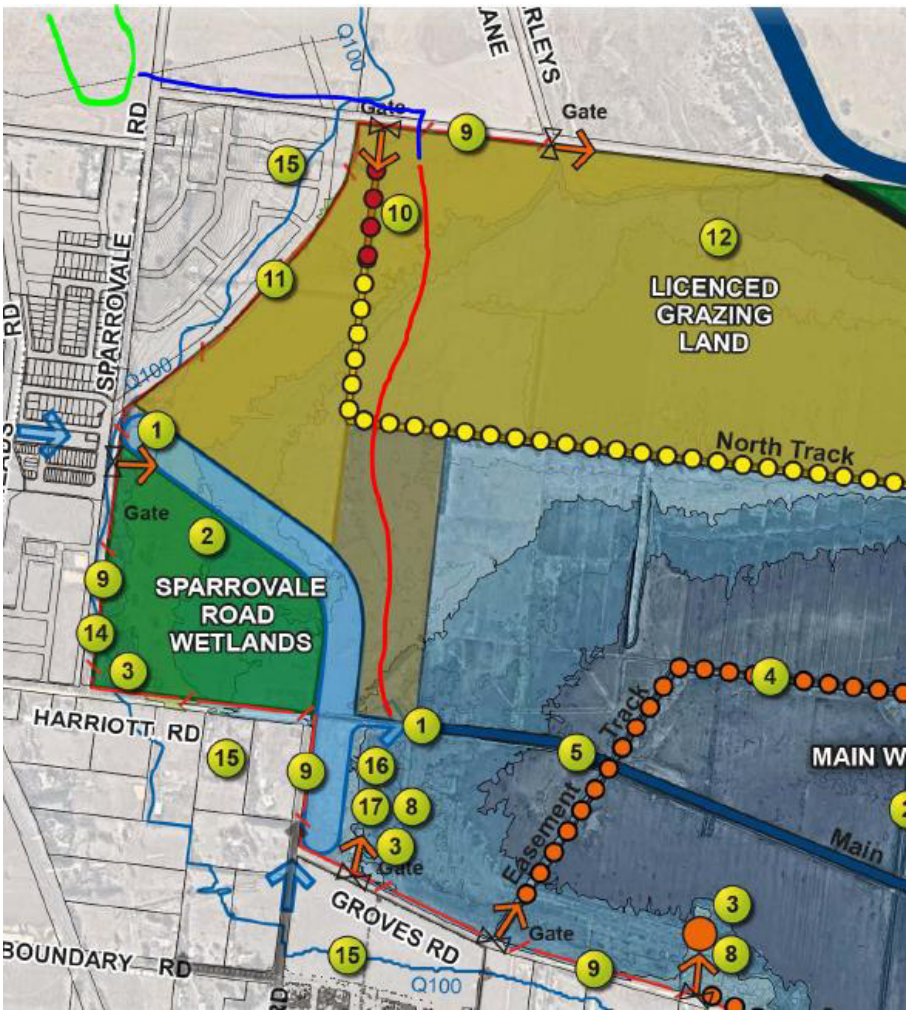



**Figure 32. Sparrovale – Nubijt yooree Wetlands Master Plan (adapted from City of Greater Geelong)**

## 6.14 TUFLOW MODELLING RESULTS

To validate the SWMS from a hydraulic perspective, TUFLOW modelling was undertaken for the 1% AEP event. Note that this modelling is not intended to provide a flood impact assessment for the Precinct, rather as a tool to test that the proposed hydraulic structures and storages are appropriate.

For full details of the TUFLOW model build, assumptions, and all mapping, refer to Appendix 1.

### 6.14.1 MARSHALL CREEK CATCHMENT

The developed Marshall Creek catchment was modelled from the MOS down to Barwon River. The 1% AEP depths and extents are presented in Figure 33, with an afflux map presented in Figure 34. As shown, this demonstrates that no detrimental impacts downstream of the Precinct will occur.

Modelling of the MOS siphon predicts an upstream peak 1% AEP flood level of 7.8m AHD, compared with 8.4m AHD determined by head loss calculations (refer to Section 6.8 for details). This suggests that 8.4m AHD is conservative and therefore further hydraulic assessment through the future design process is recommended to refine siphon head loss estimates and associated flood levels.

Refer to Appendix 1 for details of TUFLOW modelling methodology.

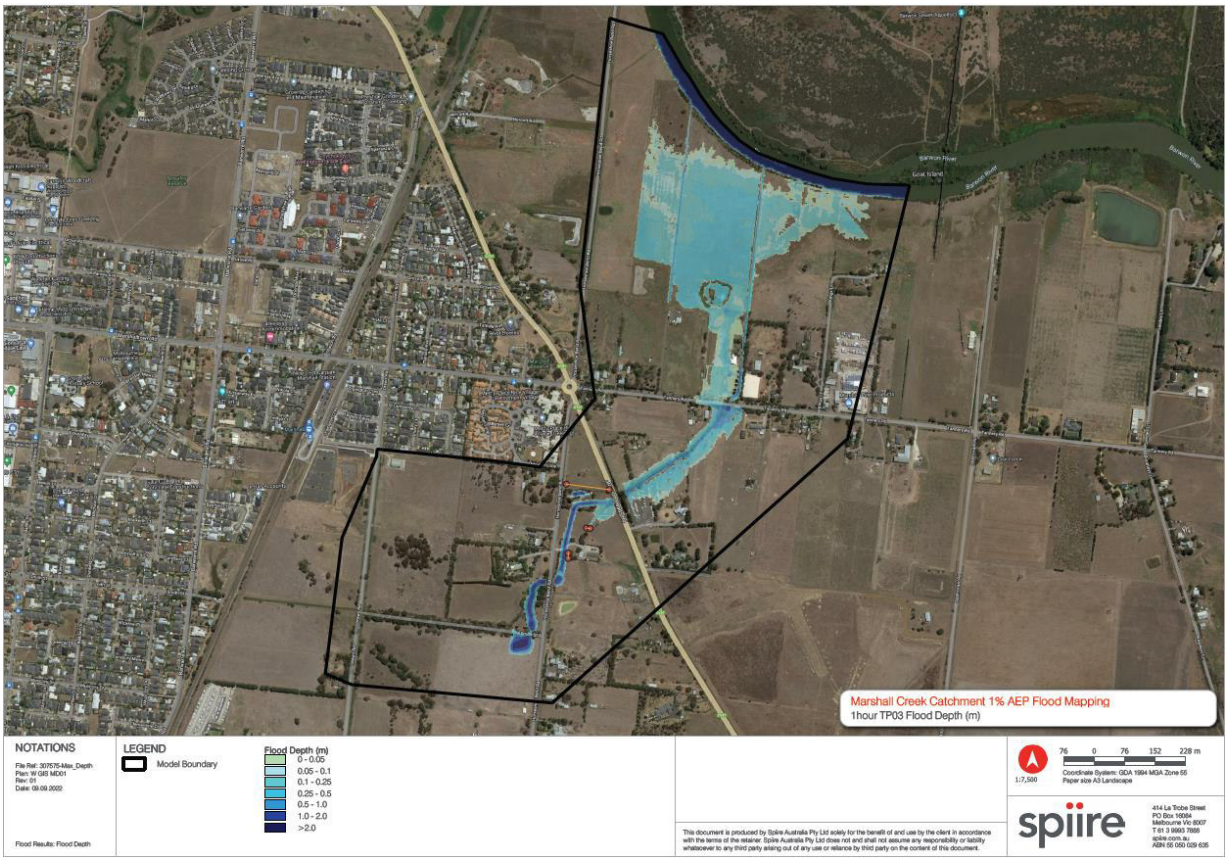



**Figure 33. Developed case 1% AEP depths and extents on Marshall Creek**

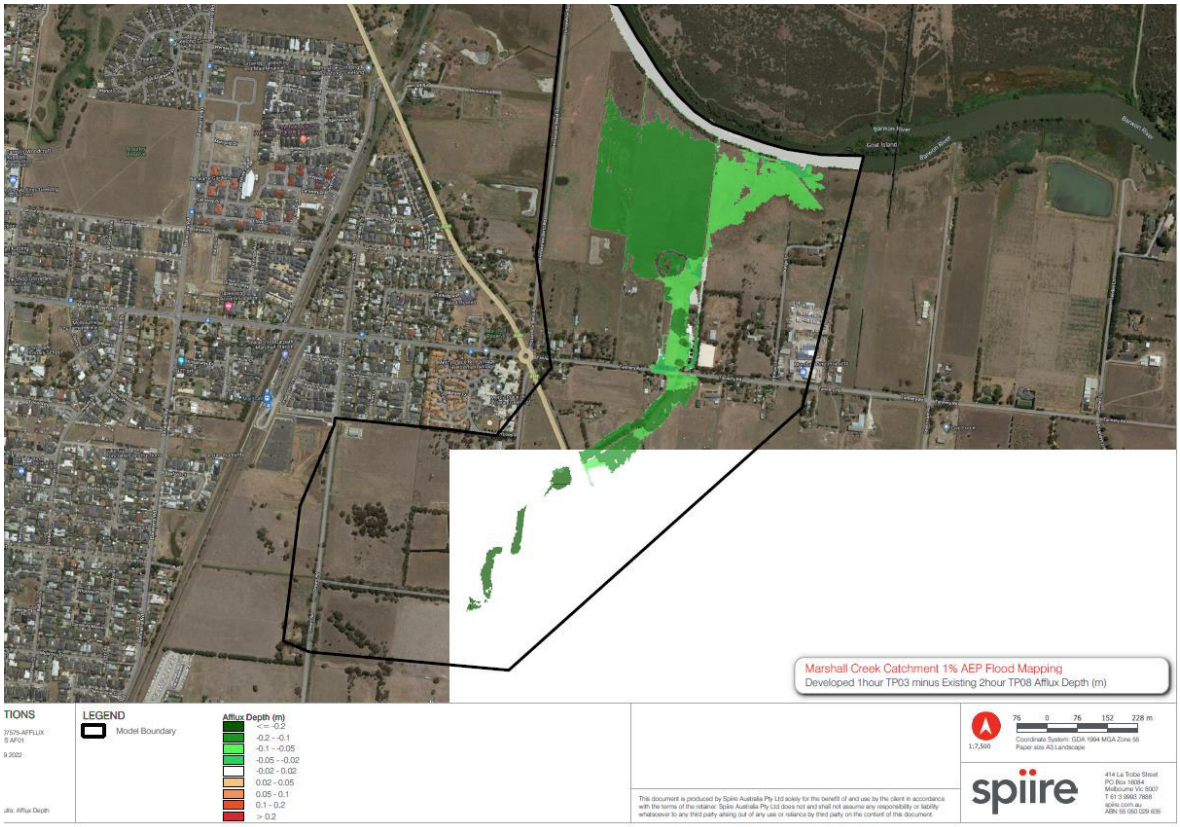



**Figure 34. Afflux mapping: 1% AEP on Marshall Creek**

### 6.14.2 SOUTH EAST CATCHMENT

TUFLOW modelling was undertaken to validate hydraulics of WLRB02, which was initially sized using RORB. The piped outfall from WLRB02 has been conceptually designed to include connection of the local Barwon Heads Road catchment, before discharging to the future outfall waterway down to the Sparrovale – Nubijt yooree Wetlands area. This pipe has also been modelled to validate hydraulics.

Figure 35 presents 1% AEP maximum depth and extents results from TUFLOW modelling. As shown, flows are contained within the basin, with 1% AEP peak levels presented in Table 10, page 59.

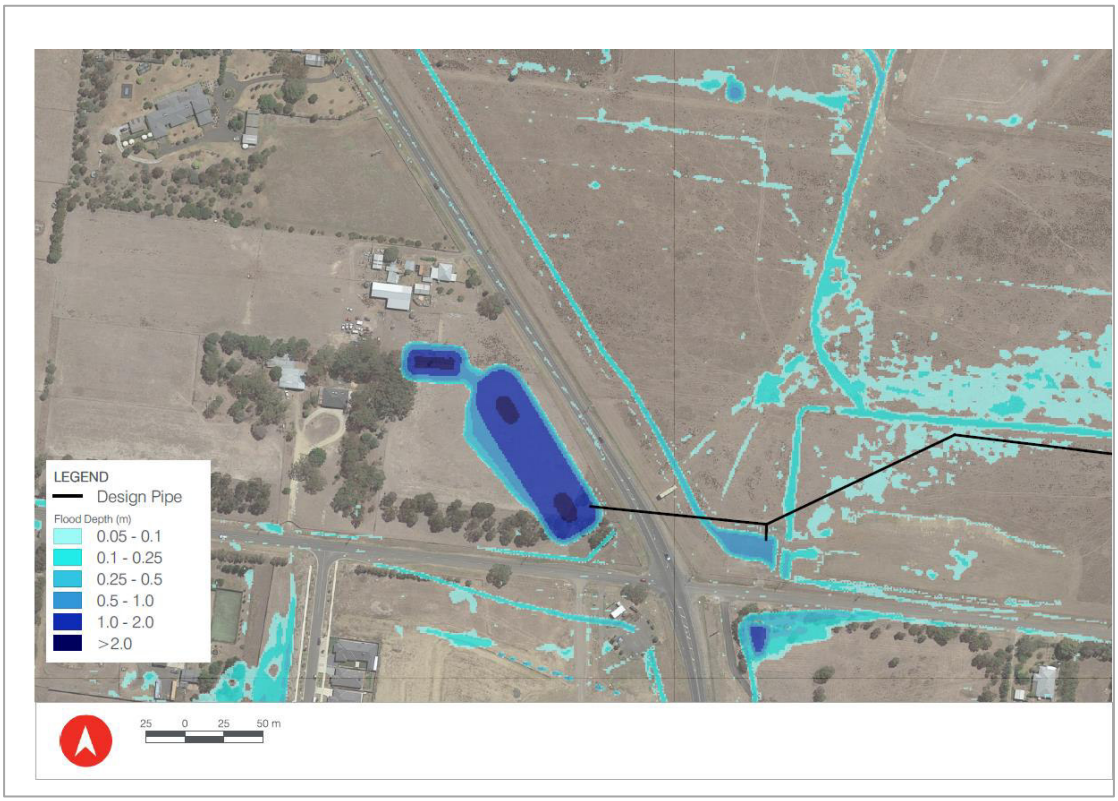



**Figure 35. Developed case 1% AEP depths and extents on South East Catchment**

## 6.15 PROTECTED NATIVE VEGETATION ZONES

As discussed in Section 3.5, there are a number of areas within the Precinct which contain Native Vegetation to be protected.

Through engagement with The City Environment Department regarding this vegetation, the following advice was provided to Spiire:

- *Environment has noted Gilgai in the area, it is important to protect these areas where possible/where vegetation is going to be retained to assist with long term survival and recruitment of native vegetation*
- *Consideration for the protection or replacement of natural flows in areas, especially where there are Red Gums which require periods of inundation for recruitment/natural regeneration.*

To ensure the above requirements are met to maintain the long-term health of this native vegetation, allowance for water supply (post development) to these areas has been considered in this SWMS.

Figure 36 presents an analysis of local catchments which contribute to different native vegetation zones in the Precinct. Trees to be retained are shown as green circles, vegetation to be retained is shown as pink polygons and local catchments are shown as purple polygons.




**Figure 36. Local catchments contributing to Native Vegetation areas (Spiire)**

To estimate how much run off volume is received by each Native Vegetation zone, a MUSIC analysis was undertaken (using the model detailed in Appendix 2). The local contributing catchment to each vegetation zone was estimated and set up in MUSIC using a fraction impervious value of 0.1. The Mean Annual Volume for each area was then estimated by MUSIC, as presented in Table 12.

**Table 12: Native Vegetation zones catchment information**

| Vegetation Zone | Local catchment area (ha) | Mean annual volume (ML) |
|---|---|---|
| Veg Area West* | 13.6 | 11.7 |
| Veg Area South West | 1.8 | 1.6 |
| Veg Area South East* | 8.5 | 7.3 |
| Veg Area North | 4.1 | 3.5 |
| Veg Area East** | na | na |

*it is recognised that the vegetation which flanks Drews Road may receive some flow from the opens channel, which will ultimately be replaced by the Main Drain South. For simplicity, this analysis has focused on flows from local catchments only.

**Maintenance of low flows through Marshall Creek middle reach will provide continued water supply.

In order to maintain the long-term health of this vegetation, the future developments should seek to provide similar mean annual volumes for each area, or as close as possible, to the satisfaction of The City. As a guide, the following measures may be employed to achieve this:

- Passive irrigation to vegetation areas from impervious surfaces such as roads and footpaths.
- Kerb cuts to convey flows from road ways to vegetation areas.
- One-way cross fall on roads to increase catchment to vegetation areas.
- Swale drains to convey local flows into vegetation areas, with appropriate drainage to convey overflows to the piped drainage system.
- Other WSUD technologies such as leaky tanks and wicking beds should be encouraged when assessing options at the development planning stage.

This will be undertaken in consultation with a suitably qualified Ecologist and to the satisfaction of The City.

# 7. STAGING AND IMPLEMENTATION

Consideration of staging of the main drainage infrastructure has been given, to determine when different parts of the Precinct can be developed.

The following section provides a suggested sequence of staging, with associated triggers for drainage infrastructure. It should be noted, however, that this staging is not definitive, and is subject to review and further assessment. A different sequence to that presented below may be appropriate, subject to approval by The City.

Refer to the Staging and Implementation Plan in Appendix 6 for more details.

**Table 13: Staging and Implementation Plan sequence**

| Catchment Delivery Area | Asset Delivery Trigger | Description | DCP Included ? | Comments |
|---|---|---|---|---|
| Catchment A | SB02 - DR04 | Sedimentation Basin & connection to BHRD culvert | Yes | |
| | WW03 - DR02 (Part) | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection. |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment B | SB02 - DR04 | Sedimentation Basin & connnection to BHRD culvert | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | WW05 Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment C | SB01 - DR03 | Sedimentation Basin & connnection to Waterway | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | | Permit SWMS to confirm extents required for flood protection |

| Catchment Delivery Area | Asset Delivery Trigger | Description | DCP Included ? | Comments |
|---|---|---|---|---|
| | WW02 - DR09 (Part) | Major U/G SW & waterway/path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW01 – DR08 | Outfall and environmental flow. Waterway enhance and path. | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment D | SB01 - DR03 | Sedimentation Basin & connnection to Waterway | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW02 - DR09 | Major U/G SW & waterway/path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW01 - DR08 | Outfall & enviro flow. Waterway enhance and path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WLRB03 - DR12 | Wetland/Retarding basin & Main Drain South Outfall | Yes | |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment E | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |

| Catchment Delivery Area | Asset Delivery Trigger | Description | DCP Included ? | Comments |
|---|---|---|---|---|
| | WL01 - DR13 | Wetland treatment | Yes | |
| | SBWL01 - DR14 | Sedimentation Basin & connection to WL01 | Yes | |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment F | SB02 - DR04 | Sedimentation Basin & connnection to BHRD culvert | Yes | |
| | WW03 - DR02 (Part) | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway outfall control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment). |
| Catchment G | SBRB01 - DR05 | Sedimentation / Retarding Basin and outflow | Yes | |
| Catchment H | SBRB02 - DR06 | Sedimentation / Retarding Basin and outflow | Yes | |
| Catchment J | SBRB03 - DR07 | Sedimentation / Retarding Basin and outflow | Yes | |
| SE Catchment K | WLRB02 - DR01 | Wetland Retarding basin and outfall pipe | Yes | |
| | WW06 - DR14 | Waterway outfall control | Yes | Triggered upon the first subdivision within the catchment to the satisfaction of the responsible authority |

## 7.1 IMPLEMENTION OF MARSHALL CREEK REACHES WW04 AND WW05

To provide more resilience to negate erosion which would otherwise occur due to increased volumetric flow from development and to prevent detrimental impacts to the waterways, WW04 and WW05 are ultimately required to be formalised into constructed waterways by both the Marshall and NEIP PSP's (Refer Sections 2.7.6 and 6.7 for further details of waterway upgrade requirements) Catchment areas discharging to these waterways are split with Marshall contributing 71.4% and the NEIP contributing 21.6%.Refer to Table 14 below, which details the contributing catchments for Marshall (refer catchment plan in Appendix 3) and for NEIP (refer sub catchments 6 and 7 in Figure 37 below, extracted from NEIP SWMS report. These areas of these catchments combined is 33.24ha).

Due to the existing waterways currently in operation being suitable as an outfall for early development of the Marshall PSP, a practical trigger of 50% development of the contributing catchments to WW04 and WW05 within the Marshall PSP is acceptable to ensure these assets have connection to this PSP. Table 14 outlines the calculation for the 57ha (50%) trigger for WW04 and WW05 to be constructed.

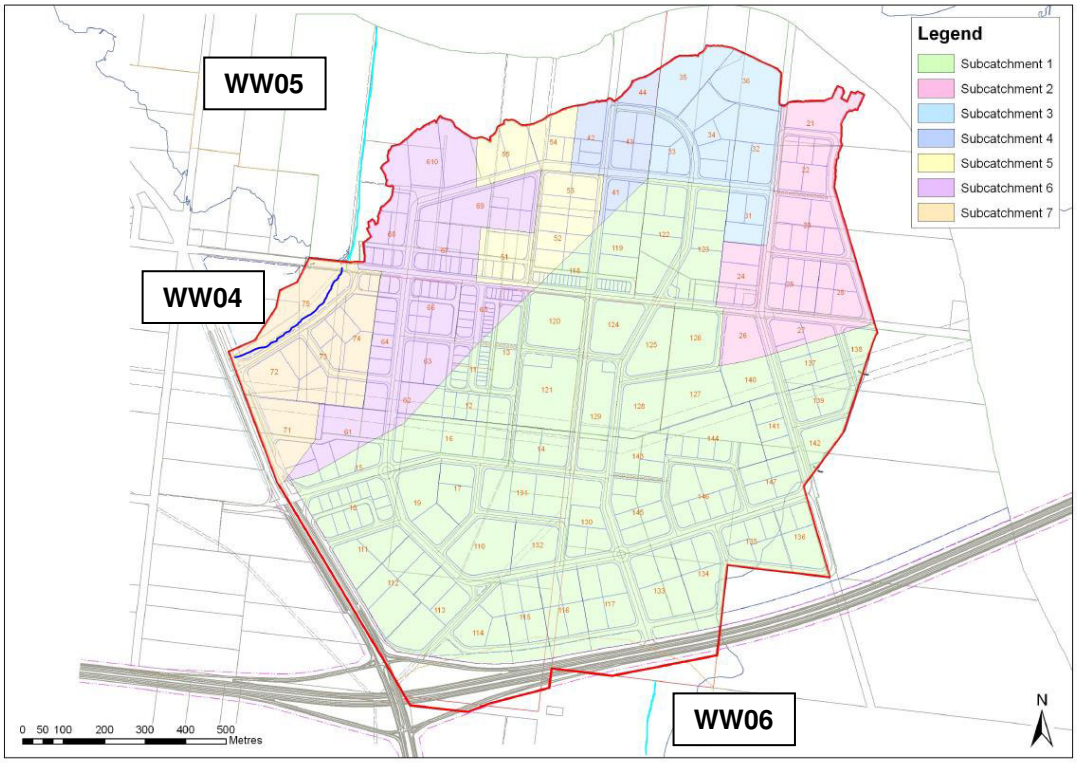



**Figure 37. sub catchments contributing to Marshall Creek (adapted from NEIP SWMS (Water Technology, 2019))**

**Table 14: Contributing catchments and trigger for WW04/WW05**

| Catchment Identifier | Area (ha) | WW04/WW05 Outfall |
|---|---|---|
| A | 10.97 | Yes |
| B | 8.06 | Yes |
| C | 10.81 | Yes |
| D | 35.82 | Yes |
| E | 9.69 | Yes |
| F | 1.51 | Yes |
| J | 3.56 | Yes |
| Marshall Total (71.4%) | 80.42 | Yes |
| NEIP (21.6%) | 33.24 | Yes |
| Total (NEIP + Marshall) | 113.66 | |
| 50% Total catchment | **57.0** | |

## 7.2 IMPLEMENTATION OF PROPOSED WATERWAY TO SPARROVALE – NUBIJT YOOREE WETLANDS (WW06)

An outfall pipe will convey flows from WLRB02 outfall to the upstream point of a future constructed waterway which extends down to Sparrovale – Nubijt yooree wetlands (refer design plans in Appendix 3 for details). The NEIP sub catchments draining south (refer subcatchment 1 in Figure 37 ) will also be directed to this waterway.

Table 15 presents the catchment split between Marshall and NEIP Precincts draining to this future waterway, with the Marshall SE Catchment K and NEIP catchment contributing 15% and 85% respectively.

**Table 15: Contributing catchments for WW06**

| Catchment Identifier | Area (ha) | WW06 Outfall |
|---|---|---|
| SE Catchment K (15%) | 17.10 | Yes |
| NEIP (85%) | 96.89 | Yes |
| Total | 113.99 | |

## 7.3 DRAINAGE RESERVE AREAS

Drainage reserve areas are presented in Table 16. Note that these are subject to detailed design.

**Table 16: Drainage Reserve Areas**

| Item | Area (ha) |
|---|---|
| WLRB03 | 2.90 |
| WW01 – Upstream Reach | 0.824 |
| WW02 – Middle Reach | 1.16 |
| SB01 | 0.61 |
| WW03 – D/S Reach (upstream of horseshoe bend road) | 0.87 |
| WW03 – D/S Reach (downstream of horseshoe bend rd, upstream of barwon heads rd) | 1.43 |
| WL01 | 0.94 |
| SBWL01 | 0.23 |
| SB02 | 0.36 |
| WW04 Tannery Road Reach | 1.55 |
| WW05 Barwon River Reach | 3.25 |
| SBRB01 | 0.24 |
| SBRB02 | 0.23 |
| SBRB03 | 0.22 |
| WLRB02 | 1.22 |

# 8. RISKS AND LIMITATIONS

This section provides a consolidated list of risks and limitation of particular note to the SMWS. As follows:

1. There are two locations where future drainage will cross existing services: the Main Drain South at Reserve Road (water and Telstra services), and the proposed culverts on Horseshoe Bend Road (gas and fibre optic). No services proving has been undertaken at either location and hence it is possible relocation of services may be required to accommodate future drainage.

2. The Swinburne Tech method was adopted to conceptually size the retarding basins for SBRB01, SBRB02 and SBRB03. No tailwater analysis from the Barwon River was considered for the SWMS; this should be provided during the design process, and sizing may change as a consequence. Consideration should also be given to confirmation of the suitability/capacity of proposed outfalls to existing open drains to Barwon River, upgrade as necessary to the satisfaction of the City.

3. The southern ancillary flow path from WLRB02 which flows south over Reserve Road/Bellarine Link may be a trapped low point adjacent to the Watermark Estate. It is recommended that MRPV review this situation to ensure that spillway flood flows from WLRB2 are not directed to lots within the Watermark Estate.

4. Design flows to Sparrovale Linear Wetland were estimated by a summation of design flows from WLRB02, Barwon Heads Road duplication project and the NEIP SWMS. By aligning the peaks, this is considered a conservative estimate but preliminary only. Design flows should be revised as part of the future NEIP SWMS update.

5. It is understood that the Bellarine Link project may seek to include additional storage within WLRB03 for retardation purposes. If additional storage is required within this future basin, it will be the role of MRPV to demonstrate that the ultimate Council basin presented as part of this SWMS can operate as per design intent, with no detrimental impacts to surrounding areas.

6. It is understood through correspondence with RPV that the South Geelong to Waurn Ponds rail duplication project does not require additional storage in WLRB03 as part of that project. However, should it be determined that additional storage is required in WLRB03 by that project, it will be the role of RPV to demonstrate that WLRB03 can accommodate additional volume, with no detrimental impact to the Marshall Precinct, or surrounding areas.

7. The proposed realignment of the MOS from the future pumping station to *Section 6* of the MOS will need to be moved northwards to accommodate WLRB2, as shown on the preliminary design plans (Appendix 3). Discussions with Barwon Water confirmed that there is some flexibility in this section of design of MOS upgrade (GHD 2001) and it is understood that this is acceptable.

8. The downstream reach of Marshall Creek is located between two Native Vegetation Precinct Plans (for Marshall and NEIP PSP's). The biodiversity values through this reach will need to be defined to allow biodiversity impact to be understood, to the satisfaction of The City.

9. Biodiversity impacts from the outfall waterway to Sparrovale – Nubijt yooree Wetlands need to be addressed at the design phase. While this area is currently devoid of native vegetation, this may improve over time and hence biodiversity values need to be mapped in the future.

10. Hydraulic assessment using head loss calculations for the MOS siphon predicts an upstream peak 1% AEP flood level of 8.4m AHD. This level has subsequently been used as a tail water for Main Drain South. A validation run in TUFLOW predicts a peak 1% AEP level upstream of the siphon of 7.8m AHD, which suggests that 8.4m AHD is conservative. Further hydraulic assessment through the future design process is recommended to refine siphon head loss estimates and associated flood levels.

# 9. SUMMARY AND RECOMMENDATIONS

The Marshall Precinct SWMS has been prepared to identify a system which manages both stormwater water quality and stormwater quantity, including conveyance of flows through, and downstream of the Precinct area. A preliminary design of the main drainage infrastructure has been prepared to accompany the SWMS, and to inform the DCP.

The SWMS allows for the following:

- WLRB03 at the southwest corner of the Precinct and comprising a 1,500m$^2$ sediment pond, 2,500m$^2$ wetland and 13,800m$^3$ retarding basin. Triffilos Drain is formalised into a high flow bypass channel around WLRB03. An allowance for a low flow bypass around the wetland is also provided, to manage excessive inundation depths and durations.

- WLRB02 at the southeast corner of the Precinct. This comprises a 575m$^2$ sediment pond, 2,600m$^2$ wetland and 4,270m$^3$ retarding basin. An allowance has been made for a subarea of future Bellarine Link catchment to contribute to WLRB02, with additional retardation storage provided for this catchment.

- WL01 which sits offline to Marshall Creek at the downstream end of the Precinct. This comprises a 450m$^2$ sediment pond and 4,100m$^2$ wetland. Flow flows from Marshall will be allowed to by pass the wetland to manage excessive inundation depths and durations.

- Two standalone sediment basins: SB01 at the outlet of Main Drain North and Main Drain South (1,010m$^2$) and SB02, serving a local catchment offline to Marshall Creek downstream reach (630m$^2$).

- Three sediment pond/retarding basin combinations serving the Commercial/Bulky Goods area to the north of Barwon Heads Road: SBRB1 (390m$^2$ sediment pond, 725m$^3$ retarding basin), SBRB2 (390m$^2$ sediment pond, 970m$^3$ retarding basin) and SBRB3 (390m$^2$ sediment pond, 890m$^3$ retarding basin).

- Formalisation of Marshall Creek into a constructed waterway, from the Rail Line in the west of the Precinct down to the confluence with Barwon River. Upgrade of Marshall Creek downstream of Barwon Heads Road is a DCP item which will be shared with the NEIP.

- Protection of the middle reach of Marshall Creek, which is flanked by high value Native Vegetation (including Bellarine Yellow Gums) to be retained. The flow regime through this reach will be maintained to protect the long term health of this vegetation community.

- Creation of an outfall from WLRB02 at the southeast corner of the Precinct which outlets to Sparrovale – Nubijt yooree Wetlands, immediately downstream of Sparrovale Linear Wetland. This comprises a piped outfall, which will serve some Barwon Heads Road catchment and also the future NEIP. The pipe transitions to a waterway which, due to very flat topography, will require some filling to form a channel. As the waterway extends through Sparrovale – Nubijt yooree Wetlands area, the ultimate design will require collaboration with various City departments, to ensure integration with the S Sparrovale – Nubijt Yooree Wetlands Masterplan.

- Two 1350 dia pipes with upstream and downstream pits to form a siphon under the MOS. This measure is required to prevent excessive filling across much of the Precinct. Design of this structure will be subject to engagement and approvals by Barwon Water, CCMA and The City.

- Main Drain South, a 1,650mm dia RCP from WLRB03 to the siphon. Note that the long section in Appendix 3 indicates that to provide sufficient cover over this pipe, some filling will be required. However, it is expected that this filling can be removed or reduced by changing the pipe to two smaller pipes, together with refined hydraulic analysis of the siphon (which should bring down HGL's, reduce tailwater and increase pipe capacity).

- Main Drain North, a 1,200 dia RCP from Marshall Creek upstream reach to the siphon.

As part of SWMS preparation, extensive engagement has been undertaken with Barwon Water, CCMA, MRPV, RPV, and City of Greater Geelong.

# 10. REFERENCES


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# APPENDIX 1

# HYDROLOGY AND HYDRAULICS METHODOLOGY

# 1. BACKGROUND

As a part of the Marshall Precinct Stormwater Management Strategy (SWMS) a hydrologic and hydraulic analysis of the Marshall Creek catchment has been completed (Section 2.2and 3.3 respectively) to inform the following:

- The assessment and sizing of stormwater detention assets for the 1% AEP and 20% AEP storm events
- Validation of the proposed hydraulic infrastructure
- A flood impact assessment for Marshall Creek downstream of Barwon Heads Road for the 1% AEP storm event.

A hydrologic and hydraulic analysis of the South Eastern Catchment has been complete (Section 2.3 and 3.4 respectively) to inform the following:

- The assessment and sizing of stormwater detention assets for the 1% AEP and 20% AEP storm events
- Validation of the proposed hydraulic infrastructure

## 1.1 PREVIOUS STUDIES

The following previous studies have been completed for the Marshall Creek catchment:

- Armstrong Creek Urban Growth Area – Marshall Precinct – Stormwater Management Strategy (SWMS) – Draft V2 (Cragie, 2017)
- Draft Marshall Precinct Structure Plan (PSP) – Stormwater Management Strategy (SWMS) (Alluvium and Water Modelling Solutions, 2019)
- Barwon Heads Road Duplication WP3 Marshalltown Road to Reserve Road – Design Report (BECA, 2021)

# 2. HYDROLOGY

Two RORB models have been created for the existing and developed conditions to inform the SWMS for the Marshall PSP. The RORB models have been created for the estimation of the 1% and 20% Annual Exceedance Probability (AEP) flows. The model inputs and parameters are described below.

## 2.1 INPUTS

The following inputs where used to develop the RORB models:

- 1 metre LIDAR captured in 2017 (vertical accuracy unknown) – provided by Water Technology April 2020
- 0.5 metre contours – provided by City of Greater Geelong April 2021
- Underground drainage alignments – provided by City of Greater Geelong April 2021
- Armstrong Creek Urban Growth Area – Marshall Precinct – Stormwater Management Strategy (SWMS) (Cragie, 2017)
- Bureau of Meteorology Intensity-Frequency-Duration data (Bureau of Meteorology , 2021) – accessed June 2021
- Australian Rainfall and Runoff 2019 Data Hub [redacted], (Editors), 2019) – accessed June 2021.
- AM STA 6200 Flood Mapping Projects Specification (Melbourne Water, 2020)
- Marshall Precinct Structure Plan, First Draft 2019, City of Greater Geelong (City of Greater Geelong, 2019)
- Most recent draft of the Marshall Precinct Structure Plan received 31/05/2022 (currently not publicly available).
- Publicly available planning scheme information (Department of Environment, Land, Water and Planning, 2021).
- Barwon Heads Road Duplication WP3 Marshalltown Road to Reserve Road (BECA, 2021)
- Bellarine Link Preliminary Drainage Strategy (MRPV-BLKDS-ARP-CDP04-DRG-9101 – Bellarine Link Prelim Draft Drainage Strategy Sheet 1, Received 28/03/2022)

## 2.2 MARSHALL CREEK CATCHMENT

### 2.2.1 EXISTING CONDITIONS

#### 2.2.1.1 Sub-Catchments and Reaches

The RORB sub-catchments have been delineated using available LIDAR data, contour data, and underground drainage alignment data (see Section 2.1).

Reach types have been adopted based on a visual assessment of aerial imagery and available drainage alignment data. The existing conditions RORB model has been created for the estimation of 1% flows. Reach types have been selected accordingly. The existing conditions RORB model layout is shown in Figure 1.

The existing conditions RORB models includes two catchments that are defined by interstation areas:

- Marshall Creek catchment (sub-catchments A to AH)
- Drainage catchment for the urban area and farmland areas to the north of Marshall Creek (sub-catchments AI to AO) – referred to as Marshall North within this report.

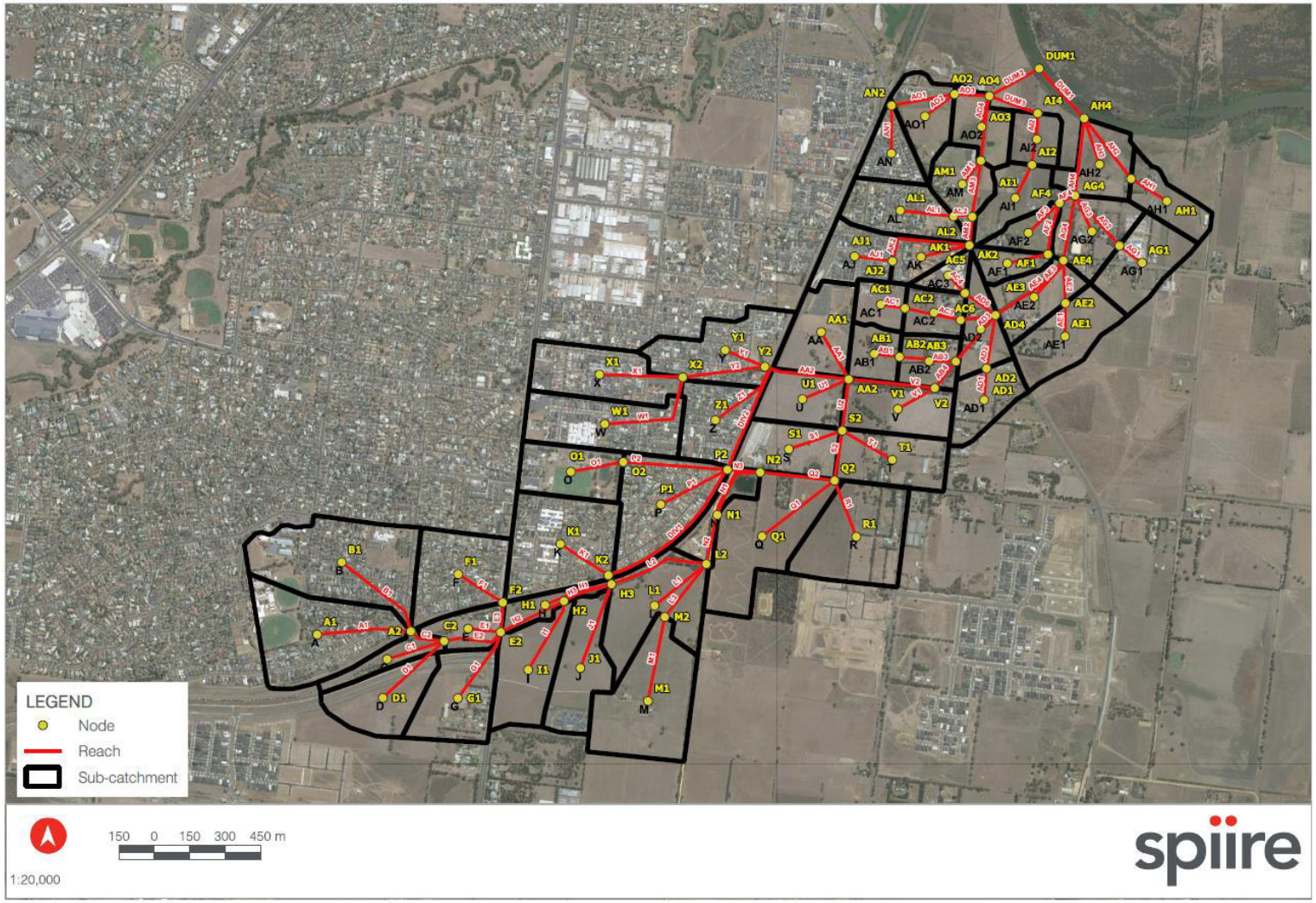



**Figure 1: Existing conditions RORB model layout**

#### 2.2.1.2 Rainfall Depths

Rainfall depths have been adopted from information available via the Bureau of Meteorology (Bureau of Meteorology , 2021). Rainfall depths have been adopted from the centroid of the overall RORB catchment inclusive of Marshall Creek and Marshall North. Rainfall depths for the 1% Annual Exceedance Probability (AEP) are shown in Table 1.

**Table 1: Rainfall depths (at -38.205207, 144.350866)**

| Duration | Annual Exceedance Probability | | | | |
|---|---|---|---|---|---|
| | 50% | 20% | 10% | 5% | 2% |
| 10 min | 6.04 | 8.8 | 10.8 | 12.9 | 15.9 |
| 15 min | 7.31 | 10.7 | 13.2 | 15.8 | 19.5 |
| 20 min | 8.25 | 12.1 | 14.9 | 17.9 | 22.1 |
| 25 min | 9.01 | 13.2 | 16.3 | 19.5 | 24 |
| 30 min | 9.64 | 14.1 | 17.4 | 20.8 | 25.6 |
| 45 min | 11.2 | 16.3 | 20 | 23.8 | 29.1 |
| 1 hour | 12.4 | 17.9 | 21.9 | 26 | 31.6 |
| 1.5 hour | 14.3 | 20.4 | 24.8 | 29.3 | 35.4 |
| 2 hour | 15.9 | 22.5 | 27.1 | 31.9 | 38.3 |
| 3 hour | 18.7 | 25.8 | 31 | 36.2 | 43.3 |
| 4.5 hour | 22 | 30 | 35.6 | 41.4 | 49.4 |
| 6 hour | 24.9 | 33.4 | 39.6 | 45.8 | 54.8 |
| 9 hour | 29.5 | 39.2 | 46.2 | 53.4 | 63.9 |
| 12 hour | 33.1 | 44 | 51.8 | 59.9 | 71.8 |
| 18 hour | 38.7 | 51.6 | 60.9 | 70.5 | 84.7 |
| 24 hour | 42.8 | 57.6 | 68.2 | 79 | 95.2 |
| 30 hour | 46 | 62.4 | 74.1 | 86.1 | 104 |
| 36 hour | 48.5 | 66.3 | 79.1 | 92.1 | 111 |
| 48 hour | 52.2 | 72.4 | 86.9 | 102 | 122 |
| 72 hour | 56.8 | 80.1 | 96.9 | 114 | 137 |

#### 2.2.1.3 Losses

An initial and continuing loss has been adopted from the Australian Rainfall and Runoff 2019 Data Hub (Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019). The following losses have been applied to pervious areas:

- Initial Loss (IL) = 17 mm
- Continuing Loss (CL) = 3 mm

The initial and continuing losses adopted for effective impervious area and indirectly connected area has been based on guidance from AM STA 6200 Flood Mapping Projects Specification (Melbourne Water, 2020):

- Effective impervious area: IL = 1 mm, CL = 0 mm (recommended values)
- Indirectly connected area: IL = 11.9 mm, CL = 2.5 mm (recommended values)
  - IL for Indirectly connected area was adopted as 70% of the recommended rural IL.

#### 2.2.1.4 Pre-Burst Depths

Median pre-burst depths were adopted from the Australian Rainfall and Runoff 2019 Data Hub (Ball J, Babister M, Nathan R, Weeks W, Weinmann E, Retallick M, Testoni I, (Editors), 2019). The initial loss was adjusted to account for pre-burst for each storm duration. For durations where a median pre-burst depth was not available a depth was interpolated from the previously shorter and next longer durations. For all durations less than 60 minutes the median pre-burst depth for the 60-minute duration was adopted. The median-pre-burst depths and corresponding adjusted initial losses are shown in Table 2.

**Table 2: 1% AEP median pre-burst depths and adjusted initial losses**

| Duration (hrs) | Median pre burst depth (mm) | Adjusted initial loss (mm) |
|---|---|---|
| 1 | 3.3 | 13.7 |
| 1.5 | 2 | 15 |
| 2 | 2.3 | 14.7 |
| 3 | 1.8 | 15.2 |
| 4.5 | 2.2 | 14.8 |
| 6 | 2.6 | 14.4 |
| 9 | 1.65 | 15.35 |
| 12 | 0.7 | 16.3 |
| 18 | 1.5 | 15.5 |
| 24 | 0.4 | 16.6 |
| 30 | 0.2 | 16.8 |
| 36 | 0 | 17 |
| 48 | 0 | 17 |
| 72 | 0 | 17 |

#### 2.2.1.5 Temporal Patterns

Temporal patterns were adopted from the Australian Rainfall and Runoff 2019 Data Hub [redacted], (Editors), 2019). The catchment is located in the Southern Slopes Mainland temporal pattern region.

#### 2.2.1.6 Areal Reduction Factors

Areal reduction factors (ARF) were adopted from the Australian Rainfall and Runoff 2019 Data Hub ([redacted] (Editors), 2019). ARF parameters were adopted for the Southern Temperate zone. The parameters adopted in RORB are shown in Table 3.

**Table 3: ARF factors**

| | |
|---|---|
| a | 0.158 |
| b | 0.276 |
| c | 0.372 |
| d | 0.315 |
| e | 0.000141 |
| f | 0.41 |
| g | 0.15 |
| h | 0.01 |
| i | -0.0027 |

#### 2.2.1.7 Impervious Fractions

The impervious fraction for each sub-catchment has been calculated using the following methodology:

- Land use has been defined for each sub-catchment using publicly available planning scheme information (Department of Environment, Land, Water and Planning, 2021)
- Impervious fractions (total impervious area, effective impervious area, indirectly connected area, and pervious area) for each sub-catchment have been calculated based on guidance provided in Melbourne Water's AM STA 6200 Flood Mapping Projects Specification Appendix 14 (Melbourne Water, 2020).

#### 2.2.1.8 Storages

Two existing retarding basins have been modelled in the catchment:

- Retarding basin between the Waurn Ponds rail line and Baanip Boulevard:
  - Stage-storage relationship developed using available LIDAR (see Section 2.1)
  - Pipe outfall configuration has been adopted based in information available from City of Greater Geelong underground drainage alignments (see Section 2.1)
  - A loss coefficient of 2.1 on the pipe outfall has been adopted based on information available in Melbourne Waters standards and specifications for loss coefficients for pits and junctions (Melbourne Water, 2017)
- Smith Street retarding basin, located at the corner of Smith Street and Barwarre Road

- The flow from this basin has been determined based on information available in the draft Marshall Precinct Stormwater Management Strategy developed by Neil Cragie (Cragie, 2017). For details refer to Section 2.2.1.9.

#### 2.2.1.9 Diversions

Three diversions have been modelled in the catchment. These diversions are located along the Waurn Ponds rail line at the following locations:

- Hansen Drive
- Reserve Road
- Smith Street retarding basin

These diversions have been modelled based on information available in the draft Marshall Precinct Stormwater Management Strategy developed by Neil Cragie (Cragie, 2017), as shown in Figure 2.

| |
|---|
| Hansen Drive outfalls 3*600 mm and 1*600 mm. Total capacity 1.7 $m^3/s$ (~10 year ARI), all excess flows transferred as overland flows northwards around rail reserve. |
| Reserve Road outfalls 1 * 1050 mm and 2*600 mm. Total capacity 3 $m^3/s$, 50% of excess flows assumed to overflow railway at Reserve Road, the balance transferred northwards as overland flow around the railway reserve. |
| Smith Street outfall 2*750 mm diameter. Total capacity 1.7 $m^3/s$, all excess flows transferred north around railway reserve-no return back to the Marshall Precinct. |

**Figure 2: Summary of RORB model diversions (Cragie, 2017)**

#### 2.2.1.10 Validation

The following catchment parameters have been adopted for the existing conditions RORB model:

- m = 0.8
- $k_c = 2.2 \times A^{0.5}$: (E.M. Laurenson, R.G. Mein, and R.J. Nathan, 2010) – Eqn 2.5
  - Marshall Creek catchment, $k_c = 4.5$
  - Marshall North catchment, $k_c = 1.69$

This $k_c$ for the Marshall Creek catchment results in a flow at Barwon Heads Road that is comparable to previous studies for the catchment. These are shown in Table 4.

**Table 4: Existing conditions model validation**

| Location | 1% AEP flow ($m^3/s$) | | |
|---|---|---|---|
| | Armstrong Creek Urban Growth Area – Marshall Precinct – Stormwater Management Strategy (SWMS) (Cragie, 2017) | Draft Marshall Precinct Structure Plan (PSP) – Stormwater Management Strategy (SWMS) (Alluvium and Water Modelling Solutions, 2019) | RORB – Existing conditions |
| **Marshall Creek at Barwon Heads Road** | 11.9 | 12.1 | 11.7 |

### 2.2.2 DEVELOPED CONDITIONS

Where required the sub-catchment delineation, reach alignments, reach types, and impervious fractions were adjusted to represent the developed conditions.

#### 2.2.2.1 Sub-Catchments and Reaches

The developed conditions RORB model has been created for the estimation of 1% flows. Reach types have been selected accordingly. The developed conditions RORB model layout is shown in Figure 3.

Sub-catchment delineation and reach types have been determined based on information available from the most recent draft of the Marshall Precinct Structure Plan received 31/05/2022 (currently not publicly available).

The catchment diversion for the Horseshoe Bend Precinct is included in the developed conditions model. It has been assumed that all catchment area to the south of the proposed Bellarine Link is diverted east to the Horseshoe Bend Precinct.

#### 2.2.2.2 Impervious Fractions

For the developed conditions model the impervious fraction for sub-catchments within the Marshall Precinct have been calculated using the following methodology:

- Land use has been defined for each sub-catchment using the future precinct layout as per the most recent draft of the Marshall Precinct Structure Plan received 31/05/2022 (currently not publicly available).
- Impervious fractions (total impervious area, effective impervious area, indirectly connected area, and pervious area) for each sub-catchment have been calculated based on guidance provided in Melbourne Water's AM STA 6200 Flood Mapping Projects Specification Appendix 14 (Melbourne Water, 2020).
- As per (Cragie, 2017) the sub-catchments that include the footprint of the proposed Bellarine Link (sub-catchments H, L and N) have been treated as rural land. This places the requirement on the future development of Bellarine Link to incorporate the necessary drainage measures to effectively maintain rural runoff conditions.

#### 2.2.2.3 Storages

Two existing retarding basins are modelled in the developed conditions. The two existing conditions basins are detailed in 2.2.1.8.

One proposed retarding basin, WLRB03, is modelled in the developed conditions. A conceptual design has been undertaken for the trunk drainage downstream of WLRB03. This concept was done to provide an accurate representation of the tailwater conditions impacting the WLRB03 outlet. The process to derive the WLRB03 outlet conditions included:

- Complete head loss calculation across the siphon arrangement, assuming appropriate tailwater conditions. Head loss calculations were complete in accordance with Queensland Urban Drainage Manual (QDUM), (Institute of Public Works Engineering Australasia, Queensland Division, 2016). The headwater levels determined at the siphon for the 1% AEP storm event are shown in Table 5.
- A Hydraulic Grade Line (HGL) analysis was then complete on the WLRB03 outlet pipe. The siphon headwater levels were used as the tailwater condition for the WLRB03 outlet pipe.
  - ku values have been adopted based on information available in Melbourne Waters standards and specifications for loss coefficients for pits and junctions along the main drain (Melbourne Water, 2017)
  - HGL analysis was complete for three design flows, to create a Height-Discharge relationship for WLRB03. The resultant Height-Discharge relationship for WLRB03 is shown in Table 6
- The Height-Discharge relationship found in Table 6 was then inserted into the Marshall PSP RORB model.
- Based on the analysis outlined, the WLRB03 outlet has been sized as a 1650mm diameter RCP.

**Table 5: Summary of head loss across siphon for the 1% AEP storm event**

| Description | Head loss (m) | HGL |
|---|---|---|
| Siphon Tailwater (1% AEP level in downstream waterway) | NA | RL 7.10 |
| Grate inlet | 0.40 | |
| Inlet pit (90deg bend) | 0.47 | |
| Pipe friction | 0.06 | |
| Surcharge chamber | 0.37 | |
| Upstream Siphon Headwater | NA | RL 8.39[1] |

[1] RL 8.39 is a 1D representation of the HGL, and conservatively used as the WLRB03 outlet tailwater for the Marshall PSP RORB model. Flows are expected to engage the spillway located above siphon infrastructure in storm events larger than the 10% AEP. 2D analysis in the detailed design phase of the assets may decrease the tailwater implications for WLRB03, resulting in less storage required. Modifications to storage requirements due to detailed design of WLRB03 and the siphon must be approved by the relevant authorities.

**Table 6: WLRB03 HSQ**

| Height (RL) | Storage ($m^3$)[2] | Discharge ($m^3/s$) |
|---|---|---|
| 9.17 | 0 | 0 |
| 9.5 | 245 | 0.48 |
| 10.0 | 2,286 | 2.08 |
| 10.5 | 6,986 | 2.45 |
| 11.0 | 13,455 | 2.6 |
| 11.5 | 21,421 | 2.85 |

#### 2.2.2.4 Diversions

Four diversions have been modelled in the developed conditions model. The three diversions detailed in 2.2.1.9 are assumed to be relevant for the developed conditions model.

One inflow/outflow diversion is modelled to describe a 20% AEP diversion in catchment AD1. A 1350mm diameter Main Outfall Sewer (MOS) traverse's catchment AD1. The diversion has been modelled to limit underground stormwater drainage crossings along the MOS.

#### 2.2.2.5 Catchment Parameters

The following catchment parameters have been adopted for the existing conditions RORB model:

- m = 0.8
- Marshall Creek catchment, $k_c$ = 4.31
  - The $k_c$ value for the developed conditions Marshall Creek catchment has been determined from the value $k_c/D_{av}$ ratio for the existing conditions model.
- Marshall North catchment, $k_c$ = 1.69

[2] The Height-Storage relationship has been derived from a 3D conceptual design undertaken of the WLRB03 using 12D.

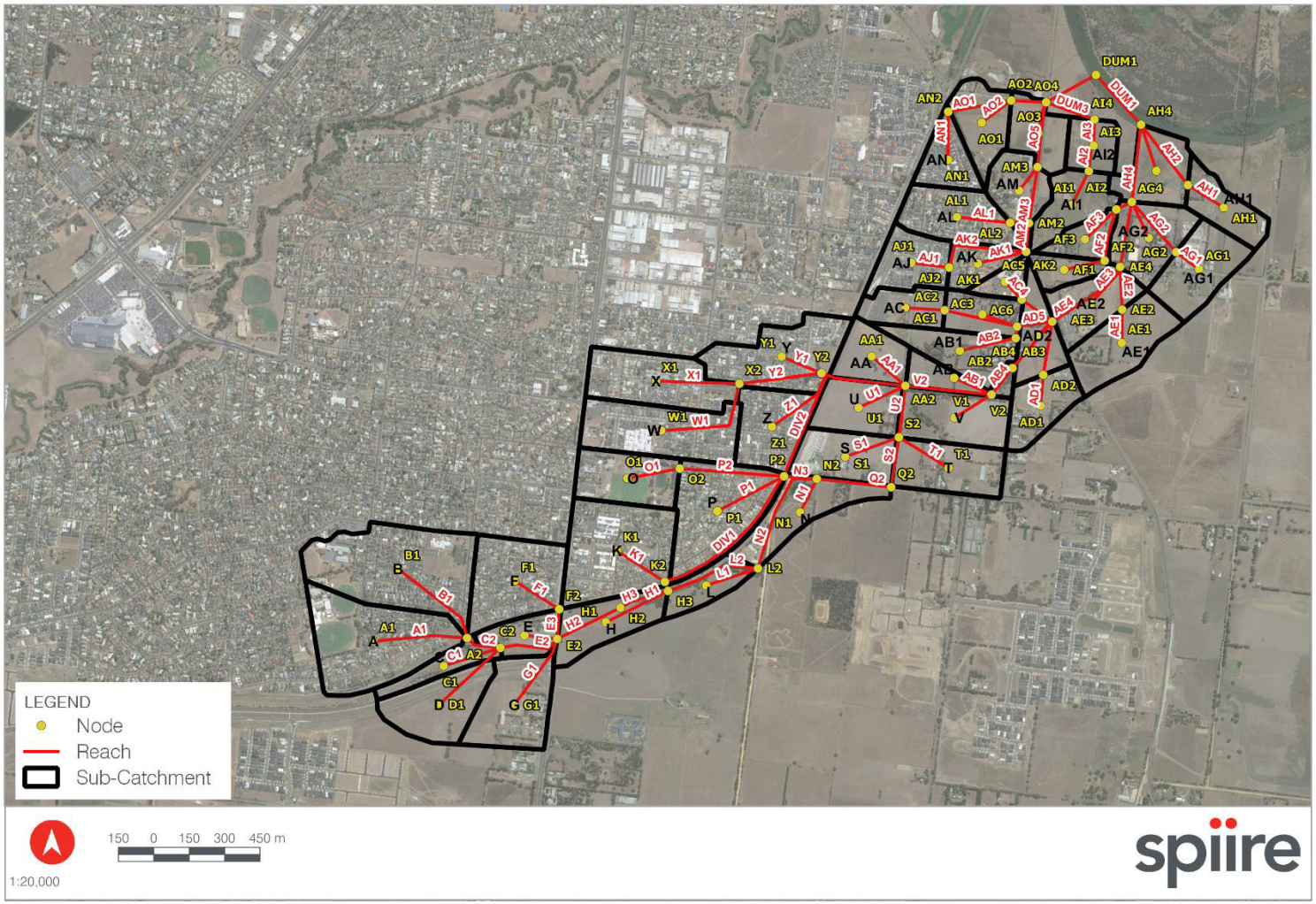



**Figure 3: Developed conditions RORB model layout**

### 2.2.3 RESULTS

The 1% AEP and 20% AEP storm event results at two critical locations for the existing and developed conditions RORB models are shown in Table 7. The flows in Table 7 are for the temporal pattern one above calculated median for the critical duration at the respective location.

**Table 7: RORB model results**

| Location | Existing Conditions | | Developed Conditions | |
|---|---|---|---|---|
| | 1% AEP Flow ($m^3/s$) | 20% AEP Flow ($m^3/s$) | 1% AEP Flow ($m^3/s$) | 20% AEP Flow ($m^3/s$) |
| **Marshall Creek at Barwon Heads Road (Node AD4)** | 11.7 (2hr TP28) | 3.8 (4.5hr TP5) | 8.9 (1hr TP23) | 3.6 (4.5hr TP5) |
| **Marshall Creek at Barwon River (Node AH4)** | 12.6 (3hr TP25) | 4.1 (4.5hr TP5) | 10.9 (1.5hr TP26) | 4.0 (4.5hr TP5) |

Table 7 shows that the peak flow in the Marshall Creek catchment in the developed conditions decreases at Barwon Heads Road and at the catchment outfall into the Barwon River. This decrease in peak flow can be attributed to the proposed WLRB03 and a decrease in catchment size because of the catchment diversion for the Horseshoe Bend Precinct.

Table 8 shows the storage and associated peak flood level of WLRB03 in the developed conditions.

**Table 8: Marshall Creek Catchment Proposed Storage**

| Location | Storage ($m^3$) | Peak Elevation (m AHD) | Peak Outflow ($m^3/s$) |
|---|---|---|---|
| **WLRB03** | 13,500 | RL 11.0 | 2.6 |

## 2.3 SOUTH EASTERN CATCHMENT

### 2.3.1 EXISTING CONDITIONS

#### 2.3.1.1 Sub-Catchments and Reaches

The RORB sub-catchments have been delineated using available LIDAR data, contour data, and underground drainage alignment data (see Section 2.1).

The Barwon Heads Road Duplication Project is part of the existing conditions sub-catchment delineation.

Reach types have been adopted based on a visual assessment of aerial imagery and available drainage alignment data. The existing conditions RORB model has been created for the estimation of 1% flows. Reach types have been selected accordingly. The existing conditions RORB model layout is shown in Figure 4.

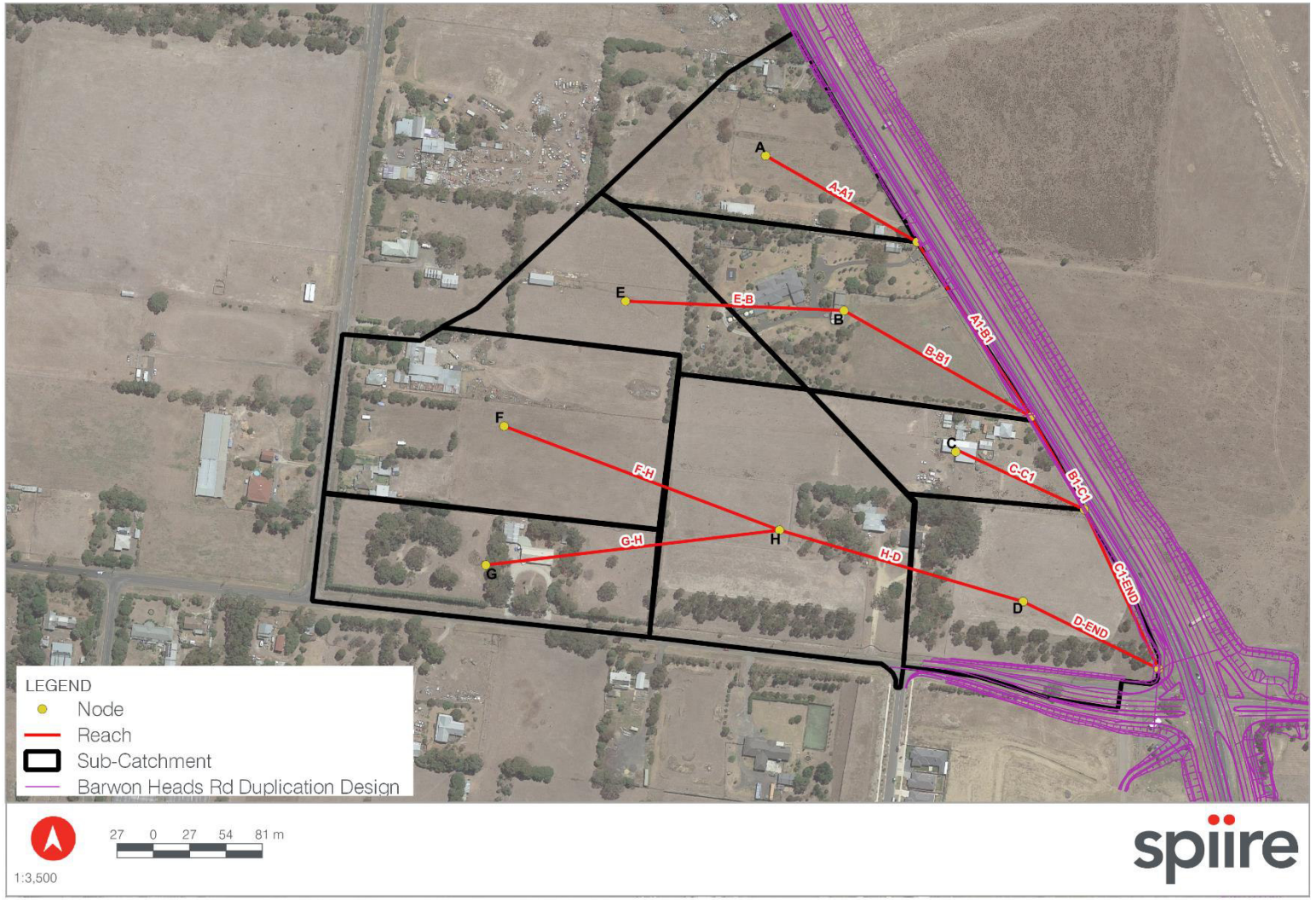



**Figure 4: Existing Conditions RORB model layout**

#### 2.3.1.2 Rainfall Depths

Refer to Section 2.2.1.2 for adopted rainfall depths.

#### 2.3.1.3 Losses

Refer to Section 2.2.1.3 for adopted loss parameters.

#### 2.3.1.4 Pre-Burst depths

Refer to Section 2.2.1.4 for adopted pre-burst parameters.

#### 2.3.1.5 Temporal Patterns

Temporal patterns were adopted from the Australian Rainfall and Runoff 2019 Data Hub ([redacted] (Editors), 2019). The catchment is located in the Southern Slopes Mainland temporal pattern region.

#### 2.3.1.6 Areal Reduction Factors

Refer to Section 2.2.1.6 for adopted ARF factors.

#### 2.3.1.7 Impervious Fractions

The impervious fraction for each sub-catchment has been calculated using the following methodology:

- Land use has been defined for each sub-catchment using publicly available planning scheme information (Department of Environment, Land, Water and Planning, 2021)
- Impervious fractions (total impervious area, effective impervious area, indirectly connected area, and pervious area) for each sub-catchment have been calculated based on guidance provided in Melbourne Water's AM STA 6200 Flood Mapping Projects Specification Appendix 14 (Melbourne Water, 2020).

#### 2.3.1.8 Storages

No existing retarding basin infrastructure is present in the South Eastern catchment.

#### 2.3.1.9 Validation

The following catchment parameters have been adopted for the existing conditions RORB model:

- m = 0.8
- $k_c = 2.2 \times A^{0.5}$: ([redacted]) – Eqn 2.5
  - South Eastern catchment, $k_c = 0.92$

**Table 9: Existing conditions model validation**

| Location | 1% AEP flow ($m^3/s$) | |
|---|---|---|
| | Rational Calculation | RORB – Existing conditions |
| **Marshall Creek at Barwon Heads Road** | 0.66 | 0.61 (2hr TP28) |

### 2.3.2 DEVELOPED CONDITIONS

Where required, the sub-catchment delineation, reach alignments, reach types, and impervious fractions were adjusted to represent the developed conditions.

#### 2.3.2.1 Sub-Catchments and Reaches

The developed conditions RORB model has been created for the estimation of 1% flows. Reach types have been selected accordingly. The developed conditions RORB model layout is shown in Figure 5.

Sub-catchment delineation and reach types have been determined based on information available from the most recent draft of the Marshall Precinct Structure Plan received 31/05/2022 (currently not publicly available).

The Bellarine Link Preliminary Drainage Strategy is part of the developed conditions sub-catchment delineation.

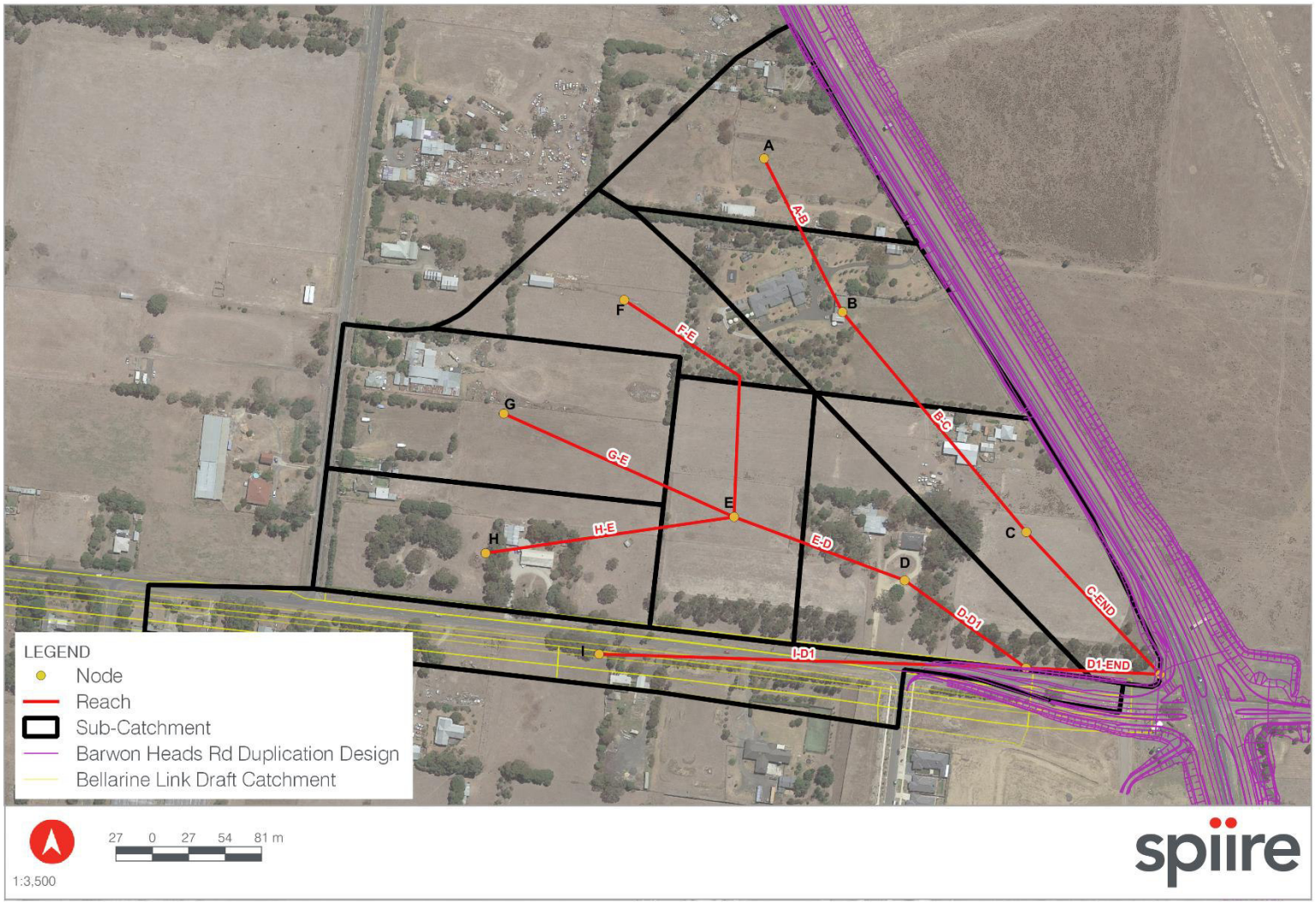



**Figure 5: Developed Conditions RORB model layout**

#### 2.3.2.2 Impervious Fractions

For the developed conditions model the impervious fraction for sub-catchments within the Marshall Precinct have been calculated using the following methodology:

- Land use has been defined for each sub-catchment using the future precinct layout as per the most recent draft of the Marshall Precinct Structure Plan received 31/05/2022 (currently not publicly available).
- Impervious fractions (total impervious area, effective impervious area, indirectly connected area, and pervious area) for each sub-catchment have been calculated based on guidance provided in Melbourne Water's AM STA 6200 Flood Mapping Projects Specification Appendix 14 (Melbourne Water, 2020).

#### 2.3.2.3 Storages

One proposed retarding basin is modelled in the developed conditions

- Proposed WLRB02 sits upstream of Reserve Rd and retards flows from the large upstream catchment.
  - Stage-storage relationship developed using a conceptual 3D design surface
  - Weir-Pipe relationship allows for a 675mm diameter drain outfall at 1 in 500 grade.

#### 2.3.2.4 Catchment Parameters

The following catchment parameters have been adopted for the existing conditions RORB model:

- m = 0.8
- Marshall Creek catchment, $k_c$ = 0.94
  - The $k_c$ value for the developed conditions South Eastern catchment has been determined from the value $k_c/D_{av}$ ratio for the existing conditions model.

### 2.3.3 RESULTS

The results for the existing and developed conditions RORB models are shown in Table 10. The flows in Table 10 are for the temporal pattern one above calculated median for the critical duration at the respective location.

**Table 10: RORB model results**

| Location | Existing Conditions | | Developed Conditions | |
|---|---|---|---|---|
| | 1% AEP Flow ($m^3/s$) | 20% AEP Flow ($m^3/s$) | 1% AEP Flow ($m^3/s$) | 20% AEP Flow ($m^3/s$) |
| **South Eastern Catchment at Barwon Heads Road** | 0.6 (2hr TP28) | 0.1 (4.5hr TP2) | 0.6 (1.5hr TP29) | 0.3 (3hr TP5)[3] |

Table 10 shows that the peak flow in the South Eastern catchment in the developed conditions is retarded to pre-development flows.

Table 11 shows the storage and associated peak flood level modelled in the developed conditions.

**Table 11: South Eastern Catchment Proposed Storage**

| Description | Storage ($m^3$) | Peak Elevation (m) |
|---|---|---|
| **WLRB02** | 4,270 | RL 7.5 |

[3] The results show that the selected outlet configuration will not fully restrict peak flows in the 20% AEP storm event. The outlet must be refined during detailed design of WLRB02 to restrict post-developed to the pre-developed 20% AEP storm event flows.

# 3. HYDRAULICS

## 3.1 INPUTS

The following inputs where used to develop the TUFLOW model:

- Draft Marshall Precinct Structure Plan (PSP) – Stormwater Management Strategy (SWMS) (Alluvium and Water Modelling Solutions, 2019)
- 1 metre LIDAR captured in 2017 (vertical accuracy unknown) – provided by Water Technology April 2020
- Concept 3D design surface of SB01 and SB02, siphon and downstream waterway reach with 1 metre cell size.
- 1 metre Barwon Heads Road Duplication 3D design surface (received 16-12-2021).
- Underground drainage alignments – provided by City of Greater Geelong April 2021
- AM STA 6200 Flood Mapping Projects Specification (Melbourne Water, 2020)
- Underground drainage design as per Barwon Heads Road Duplication WP3 Marshalltown Road to Reserve Road (BECA, 2021)
- Bellarine Link Preliminary Drainage Strategy (MRPV-BLKDS-ARP-CDP04-DRG-9101 – Bellarine Link Prelim Draft Drainage Strategy Sheet 1, Received 28/03/2022)
- Underground drainage design as per Marshall PSP SWMS Concept Design Plans, Appendix 3 (Spiire, 2022).
- RORB hydrograph inflows based on the critical duration and temporal pattern for the 1% AEP storm event, as outlined in Section 2. The critical duration and temporal pattern for the Marshall Creek catchment and South East catchment are shown in Table 12. Refer to Table 7 and Table 10 for further details.

**Table 12: 1% AEP Critical Storm Inputs**

| Description | Critical Duration | Temporal Pattern |
|---|---|---|
| Marshall Creek Catchment Existing Conditions | 2 hour | TP28 |
| Marshall Creek Catchment Developed Conditions | 1 hour | TP23 |
| South East Catchment Developed Conditions | 1.5 hour | TP29 |

## 3.2 TUFLOW RUN PARAMETERS

A summary of the TUFLOW run parameters for this assessment is shown in Table 13.

**Table 13: TUFLOW run parameters**

| Parameter | Marshall Creek Catchment | South East Catchment |
|---|---|---|
| TUFLOW version | 2020-10-AA | 2020-10-AC |

| Parameter | Marshall Creek Catchment | South East Catchment |
|---|---|---|
| Solution Scheme | HPC | HPC |
| Grid Size | 3m | 2m |
| Storm Event | 1% AEP | 1% AEP |
| Downstream Boundary Condition | HT (Barwon River Water Level at RL 1.0)[4] | HT (4.03m to represent HGL in pipe[5])<br>HQ (b = 0.01) |

The materials adopted for the model are shown in Table 14, in accordance with ARR Guidelines, Book 6 – Flood Hydraulics ([redacted], (Editors), 2019).

**Table 14: TUFLOW model materials**

| Material/Description | Manning's n |
|---|---|
| Pasture and grasses/conservation | 0.05 |
| Roads | 0.02 |
| Light bushland | 0.07 |
| Medium density bushland | 0.10 |
| Unvegetated Creek | 0.04 |
| Vegetated Creek | 0.07 |
| Open Water[6] | 0.035 |
| Low Density Residential | 0.2 |
| Concrete Weir | 0.015 |

[4] Assumption of Barwon River Water Level is consistent with Barwon Heads Road Duplication TUFLOW model (BECA, 2021) and previous draft Marshall PSP SWMS TUFLOW model (Alluvium and Water Modelling Solutions, 2019).

[5] Refer to drainage design as per Marshall PSP SWMS Concept Design Plans, Appendix 3 (Spiire, 2022).

[6] Open Water locations include existing farm dams and proposed WSUD assets. The static water level in existing farm dams are captured by the LIDAR information, outlined in Section 3.1. No additional initial water levels (IWL) have been modelled for existing farm dams as there is no accurate information on Normal Water Level (NWL) in the farm dams.

## 3.3 MARSHALL CREEK CATCHMENT

This assessment aims to be a simplified, condensed model that focuses on presenting a flood impact assessment for properties downstream of the Marshall PSP.

### 3.3.1 EXISTING CONDITIONS

#### 3.3.1.1 Hydraulic Model Extent

The TUFLOW Model boundary is shown in Figure 6.

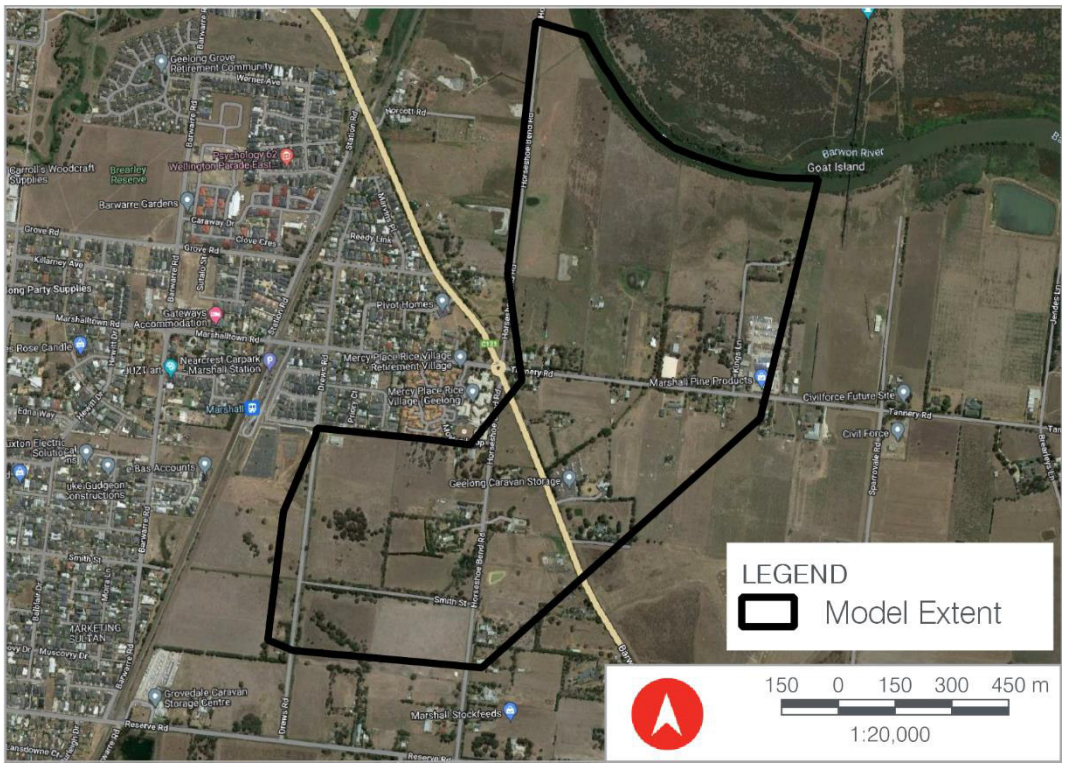



**Figure 6: Marshall Creek Model Extent**

#### 3.3.1.2 Bed Roughness

Bed roughness has been defined as Manning's values. The Manning's n values adopted for this assessment are shown in Table 14.

#### 3.3.1.3 Drainage Network

The drainage network for the existing conditions model has been developed from the information detailed in Section 3.1.

No blockage factors have been applied on culverts under Horseshoe Bend Road, Barwon Heads Road and Tannery Road, consistent with the Barwon Heads Road Duplication flood model (BECA, 2021).

#### 3.3.1.4 Boundary Conditions

Rainfall hydrographs, as per Section 3.1, have been input into the model using 2d_sa_r boundary conditions.

One downstream boundary condition has been modelled, as per Table 13.

### 3.3.2 DEVELOPED CONDITIONS

#### 3.3.2.1 Hydraulic Model Extent

The TUFLOW Model boundary for the developed conditions is the same as shown in Figure 6.

#### 3.3.2.2 Bed Roughness

Bed roughness has been defined as Manning's values. The Manning's n values adopted for this assessment are shown in Table 14.

#### 3.3.2.3 Drainage Network

The drainage network for the developed conditions model has been developed from the information detailed in Section 3.1.

The proposed siphon has been modelled using the methodology described in Table 15.

**Table 15: Siphon Modelling Methodology**

| Siphon Component | Methodology |
|---|---|
| Downstream Surcharge Pit | Q Type Pit with Pit Inlet Curve, as per the following parameters:<br>▸ Pit Dimensions;<br>– 5m Length<br>– 2m Width<br>▸ 50% Blockage<br>▸ 85% Open (allowance for grates) |

| Siphon Component | Methodology |
|---|---|
| 2x 1350mm diameter pipes | CF Type Pipe (Fixed loss approach), as per the following parameters:<br>▸ Exit loss coefficient = 1.0[7]<br>▸ Entry loss coefficient = 1.6[8] |
| Upstream Inlet Pit | Q Type Pit with Pit Inlet Curve, as per the following parameters:<br>▸ Pit Dimensions;<br>– 5m Length<br>– 2.5m Width<br>▸ 50% Blockage<br>▸ 85% Open (allowance for grates) |

#### 3.3.2.4 Boundary Conditions

Where applicable, the inflow boundary conditions for the developed conditions scenario have been amended to account for the proposed development.

The inflow hydrograph that represents flow upstream of the siphon infrastructure has been proportionally split between the following:

- Direct inflow into the bottom of the siphon pit to describe flows from incoming main drains (1d_bc_p) and,
- Flows input into the upstream SB01 to describe flows overland flows from residential development entering the siphon through the inlet pit (2d_sa_r)

The hydrograph proportion is shown in Table 16

[7] Exit loss coefficient set at maximum of 1.0 as per Table 5-3 of the TUFLOW manual (BMT, 2018). This loss is in the same order of magnitude as the exit loss coefficient as per HGL calculations described in Section 2.2.2.3. These losses have been applied to the siphon to account for losses in the upstream and downstream pits at the siphon. As such no additional losses have been applied to the upstream and downstream pits in the model.

[8] Entry loss coefficient adopted from HGL calculations as described in Section 2.2.2.3. This loss has been applied as a form loss coefficient on the siphon, (Form Loss = 1.60). Loss coefficients were determined in accordance with Melbourne Water Guidance for loss coefficient for pits and junctions, (Melbourne Water, 2017).

**Table 16: Inflow Hydrograph Summary – Siphon Infrastructure**

| Inflow Description | Hydrograph Proportion[9] |
|---|---|
| Direct inflow to pit (1d_bc) | 61% |
| Overland inflow through inlet pit (2d_sa) | 39% |

#### 3.3.2.5 Flood Mitigation

Flood mitigation for the Marshall Creek Catchment consists of the following elements:

- Flood Storage and associated infrastructure for WLRB03, detailed in Section 2.2.2.3 and Table 8.

It has been assumed that all catchment area to the south of the proposed Bellarine Link is diverted east to the Horseshoe Bend Precinct, as detailed in Section 2.2. Though it is not a formal mitigation measure, this catchment diversion does contribute to management of peak flows in the developed condition scenario.

### 3.3.3 RESULTS

A flood impact assessment has been completed to demonstrate no detrimental impact downstream of the proposed Marshall PSP development. This assessment has been completed by comparing the critical duration and temporal pattern for the 1% AEP storm event for the developed and existing conditions scenarios as described in Section 2.2.3, and shown in Table 17.

**Table 17 1% AEP critical duration for the Marshall Creek catchment at Barwon Heads Road**

| Description | Critical Duration | Temporal Pattern |
|---|---|---|
| Marshall Creek Catchment Existing Conditions | 2 hour | TP28 |
| Marshall Creek Catchment Developed Conditions | 1 hour | TP23 |

An afflux map (change in maximum water surface elevation) for the 1% AEP is shown in Appendix A.

## 3.4 SOUTH EASTERN CATCHMENT

This assessment aims to validate the functionality of drainage infrastructure proposed in WLRB02. No existing conditions modelling has been complete as no flood impact assessment is required for the South Eastern Catchment.

### 3.4.1 DEVELOPED CONDITIONS

#### 3.4.1.1 Hydraulic Model Extent

The TUFLOW model for the South Eastern catchment is a modification of the Barwon Heads Road Duplication WP3 Marshalltown Road to Reserve Road TUFLOW model (BECA, 2021).

[9] The proportion percentages have been calculated based on the flows running through the main drains when the peak siphon flow occurs.

The model has been modified to include the proposed WLRB02 design surface, and associated infrastructure. The modified model aims to focus only on the South Eastern catchment extents. The TUFLOW Model boundary is shown in Figure 7.

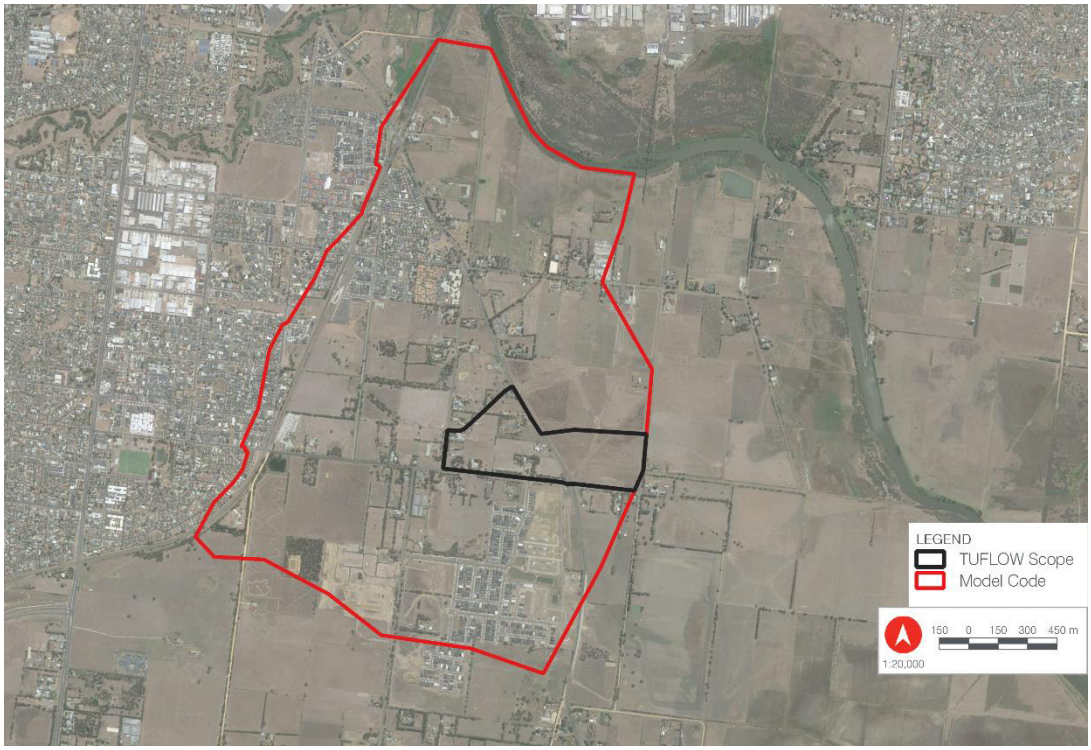



**Figure 7: South Eastern Catchment Model Extent**

### 3.4.1.2 Bed Roughness

Bed roughness has been defined as Manning's values. The Manning's n values adopted for this assessment are shown in Table 14.

### 3.4.1.3 Drainage Network

The drainage network for the developed conditions model has been developed from the information detailed in Section 3.1.

- The outfall pipe from WLRB02 was modelled in accordance with the drainage design as per Marshall PSP SWMS Concept Design Plans, Appendix 3 (Spiire, 2022).

### 3.4.1.4 Boundary Conditions

The Barwon Heads Road Duplication model (BECA, 2021) uses the Rain-on-Grid methodology, which incorporates excess rainfall time-series to each active cell in the 2D model domain, using a 2d_rf_r.

The 2d_rf_r has been deleted in the South Eastern Catchment area, and replaced by a inflow hydrograph, as per Section 3.1, using 2d_sa_r to describe flows entering WLRB02.

Several boundary conditions are present in the TUFLOW model. However, only two are relevant to the modified TULFOW model's scope, as described in Table 13.

#### 3.4.1.5 Flood Mitigation

Flood mitigation for the Marshall Creek Catchment consists of the following elements:

- Flood Storage and associated infrastructure for WLRB02, detailed in Section 2.3.2.3 and Table 11.

### 3.4.2 RESULTS

A summary of the critical results from the TUFLOW model compared to the RORB modelling is shown in Table 18.

**Table 18: WLRB02 1% AEP Level and Piped Outflow TUFLOW and RORB comparison**

| Description | TUFLOW results | RORB results |
|---|---|---|
| WLRB02 1% AEP Level (m AHD) | 7.70 | 7.50 |
| Piped outflow (m3/s) | 0.53 | 0.60 |

The RORB results are based on a Weir-Pipe relationship, as described in 2.3.2.3. This means that any HGL/tailwater effects have been ignored. The TUFLOW results are based on a HT boundary condition, which represents HGL effects within the outfall pipe. This results in a lower piped outflow, and a higher peak storage. Further HGL analysis must be complete during detailed design.

# 4. RESULTS ASSUMPTIONS AND LIMITATIONS

In addition to the assumptions and limitations stated previously in this assessment, the following assumptions and limitations apply to this assessment:

- The RORB model has been developed for the estimation of 1% AEP and 20% AEP flows only
- The catchment area along Horseshoe Bend Road, located south of RORB sub catchments Q & R (see Figure 1), is assumed to be diverted to the east as part of the Charlemont development.
- Flow diversions in the RORB model at the Waurn Ponds railway have been adopted from previous work undertaken by Neil M Cragie (Cragie, 2017)
- The potential impacts of climate change have not been considered in this assessment.
- Two existing retarding basins have been modelling in the catchment. From inspection of aerial imagery and available Geelong City Council GIS data a further four drainage basins exist within the catchment that have not been included in the model.
- RORB has not been used to size retarding basins for catchments within the commercial bulky goods area, which drain to catchment outlet AO4. This has been undertaken using the Swinburne Tech methodology, which is detailed within the Marshall PSP SWMS (Spiire, 2022).
- The TUFLOW model has been developed to quantify flood impact for the critical 1% AEP storm event. The TUFLOW model also verifies that the proposed hydraulic structures, and waterway design, from SB01 through to Barwon Heads Road is functional.
- Existing culvert geometry and levels have been sourced from the existing TUFLOW model complete for the Draft Marshall Precinct Structure Plan – Stormwater Management Strategy (Alluvium and Water Modelling Solutions, 2019)
- WL01 is not included in the design surface of the TUFLOW model. WL01 is primarily offline to flows, with a transfer function to feed low water volumes through the wetland. It is considered conservative, from a flooding perspective, to assume all flows continue through the high-flow bypass in WL01.

# 5. RECOMMENDATIONS

The following are recommendations for the refinement of the hydrologic and hydraulic modelling for the potential future phases of the stormwater management strategy:

- Consideration of the potential impacts of climate change
- Further assessment and refinement as required of flow diversions within the catchment because of the Waurn Ponds rail line.
- Refinement of the RORB model to better represent the Marshall Creek and Marshall North catchments as individual catchments i.e. separate into two models if / as required.
- Refinement of the RORB model to represent all retarding basins / storages in the catchment.
- Detailed survey required to accurately document hydraulic structures, existing services and existing surface.
- Refinement of TUFLOW hydraulic modelling as required

# 6. REFERENCES


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Institute of Public Works Engineering Australasia, Queensland Division. (2016). *Queensland Urban Drainage Manual, Fourth Edition.*

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# APPENDIX A – 1% AEP AFFLUX MAPPING

# Marshall Creek Catchment 1% AEP Flood Mapping

Developed 1hour TP03 minus Existing 2hour TP08 Afflux Depth (m)

## NOTATIONS

File Ref: 307575-AFFLUX
Plan: W GIS AF01
Rev: 01
Date: 09.09.2022

Flood Results: Afflux Depth

## LEGEND

Model Boundary

Afflux Depth (m)

- <= -0.2
- -0.2 - -0.1
- -0.1 - -0.05
- -0.05 - -0.02
- -0.02 - 0.02
- 0.02 - 0.05
- 0.05 - 0.1
- 0.1 - 0.2
- > 0.2

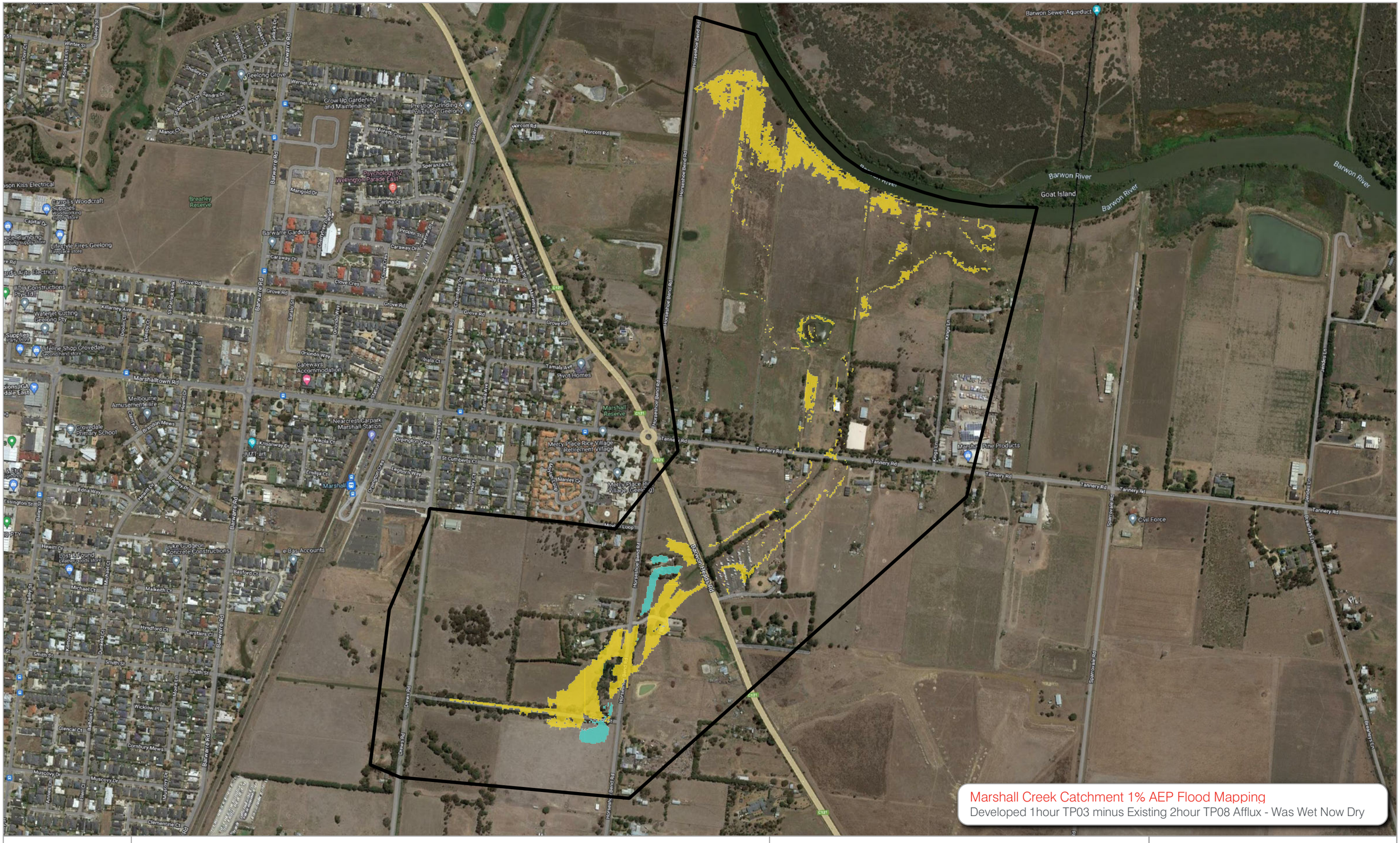
1:7,500

76 0 76 152 228 m

Coordinate System: GDA 1994 MGA Zone 55
Paper size A3 Landscape

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ABN 55 050 029 635




## NOTATIONS

File Ref: 307575-AFFLUX
Plan: W GIS AF02
Rev: 01
Date: 09.09.2022

Flood Results: Afflux Wet/Dry

## LEGEND

Model Boundary

Afflux Mapping
- Was Wet Now Dry
- Was Dry Now Wet

1:7,500

76 0 76 152 228 m

Coordinate System: GDA 1994 MGA Zone 55
Paper size A3 Landscape

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# APPENDIX 2

# MUSIC MODELLING METHODOLOGY

# 1. WATER QUALITY ANALYSIS

Wetland sizing and water quality modelling of the proposed Marshall PSP area has been undertaken using the Model for Urban Stormwater Improvement Conceptualisation (MUSIC) Version 6.2.1. The MUSIC model was setup consistent with requirements defined in MUSIC – Modelling Approach and Parameters, Design Note 3 (City of Greater Geelong, November 2019).

## 1.1 Rainfall Data

The 'Geelong North' reference region indicated in the *City of Greater Geelong MUSIC – Modelling Approach and Parameters* has been adopted as the region for the Marshall PSP area. A 10-year rainfall period of 1970 – 1980 with an average annual rainfall of 533mm at a 6 minute time step has been adopted.

## 1.2 Source Nodes

Source Nodes have been adopted as per the *City of Greater Geelong MUSIC – Modelling Approach and Parameters*.

The fraction impervious for each catchment has been approximated during the RORB modelling analysis using a combination of existing aerial imagery, zoning based on the *Draft Marshall Precinct Structure Plan (City of Greater Geelong, July 2019)* and parameters from the *AM STA 6200 Flood Mapping Projects Specification (Melbourne Water, July 2020)*. The MUSIC model has adopted these values to provide consistency throughout the Marshall PSP area's hydrologic and water quality modelling.

Soil parameters adopted are consistent with *Melbourne Water's MUSIC Guidelines Chapter 5 (2018)* and are as follows:

- Soil Storage Capacity (mm) = 120
- Field Capacity (mm) = 50
- Treated as mixed urban catchment for pollutant concentration data

## 1.3 Model Configuration

The contributing catchments included in the Marshall PSP MUSIC model is shown in Figure 1.The MUSIC model configuration for the Marshall PSP area is provided in Figure 2

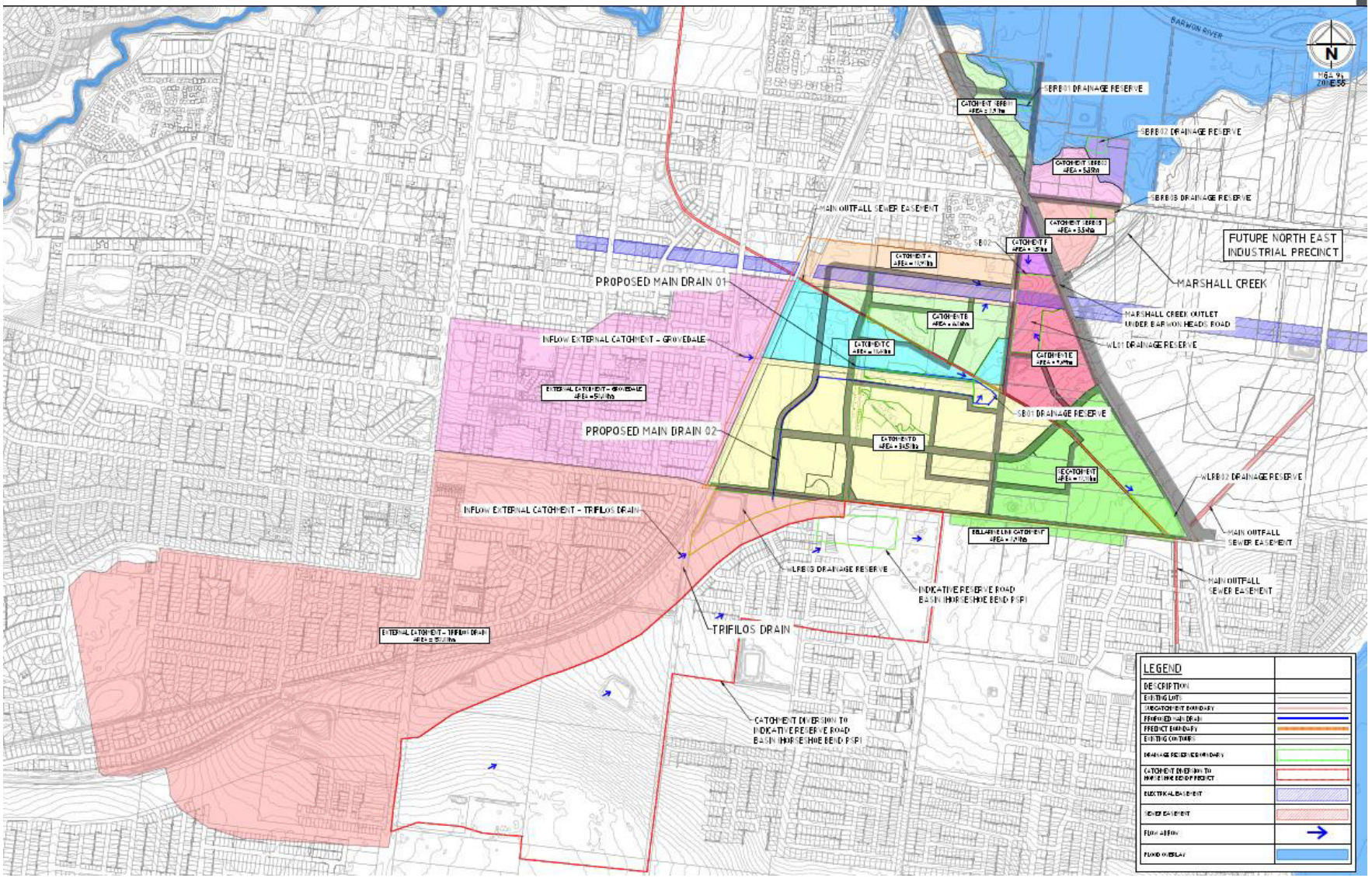



**Figure 1: MUSIC Contributing Catchments (Refer to relevant SWMS Appendix 3 for further detail)**

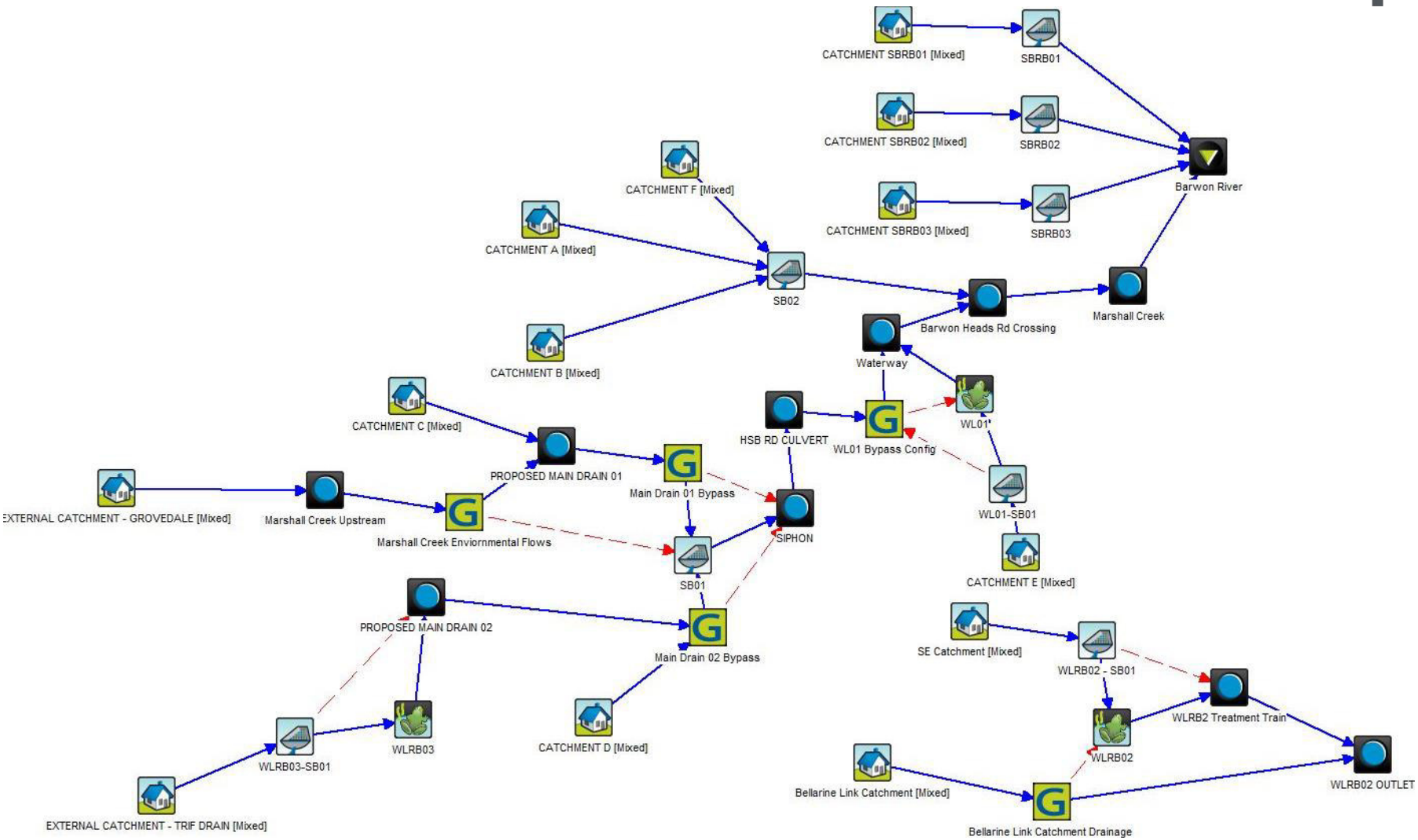



**Figure 2 - Marshall PSP Area MUSIC Model Configuration**

Secondary links have been used to represent bypass arrangements from sediment basins to junctions downstream of their adjacent wetlands. WLRB01 and WLRB03 are also modelled with low flow bypasses to satisfy residence time and inundation frequency requirements. This was necessary due to the volumetric effect of the large external catchments. The external catchment source loadings are excluded from the pollutant removal treatment train. Table 1 describes the proposed treatment and bypass nodes.

**Table 1: Summary of Treatment/Bypass Nodes**

| Node | Area ($m^2$) | Low Flow Bypass ($m^3/s$) | High Flow Bypass ($m^3/s$) | Comment/Note |
|---|---|---|---|---|
| WLRB03-SB01 | 1,500 | 0.0 | 2.3 | 3 year clean out frequency |
| WLRB03 | 2,500 | 0.2 | 0.6 | 3 day residence time |
| Marshall Creek Environmental Flows | NA | 0.4 | 100 | Environmental flows to sustain native vegetation in Marshall creek. |
| Main Drain 01 Bypass | NA | 0.0 | 0.35 | Online to External Catchment – Grovedale. Low flows continue to SB01 |
| Main Drain 02 Bypass | NA | 0.0 | 1.2 | Online to External Catchment – Trifilos Drain. Low flows continue to SB01 |
| SB01 | 1,010 | 0.0 | 100 | 3 year clean out frequency |
| SB02 | 630 | 0.0 | 0.7 | 5 year clean out frequency |
| WL01 Bypass Config | NA | 0.2 | 0.7 | Online to all External catchments. Low flows continue to WL01 |
| WL01-SB01 | 450 | 0.0 | 0.4 | 5 year clean out frequency |
| WL01 | 4,100 | 0.0 | 100 | 3 day residence time |
| Bellarine Link Catchment Drainage | NA | 0.0 | 0.25 | 20% AEP flows (up to 0.25$m^3/s$) bypass WLRB02. High flows (above 0.25m3/s) flow to WLRB02. |
| WLRB02-SB01 | 575 | 0.0 | 0.65 | 5 year clean out frequency |
| WLRB02 | 2,700 | 0.0 | 0.3 | 3 day residence time |
| SBRB01 | 390 | 0.0 | 0.2 | 5 year clean out frequency |
| SBRB02 | 390 | 0.0 | 0.2 | 5 year clean out frequency |
| SBRB03 | 390 | 0.0 | 0.2 | 5 year clean out frequency |

### 1.4 Results

Table 2 shows the treatment train effectiveness of the proposed system at node 'Barwon River', which represents the entire portion of Marshall PSP which drains to Marshall Creek The source loads 'EXTERNAL CATCHMENT – GROVEDALE' and EXTERNAL CATCHMENT – TRIF DRAIN' (refer Figure 2) have been taken away from the total source loads generated by the Marshall PSP area documented in Table 2.

**Table 2: Summary of Treatment Train Effectiveness at Barwon River Node**

| | Loads generated by Marshall PSP | Loads generated by external catchments | Total loads removed by PSP WSUD assets | % Reduction of PSP sources |
|---|---|---|---|---|
| Flow (ML/yr) | 257 | 488 | 13 | 5 |
| Total Suspended Solids (kg/yr) | 49,400 | 92,600 | 77,900 | 158 |
| Total Phosphorus (kg/yr) | 103 | 192 | 121 | 118 |
| Total Nitrogen (kg/yr) | 730 | 1380 | 410 | 56 |
| Gross Pollutants (kg/yr) | 11,600 | 22,100 | 31,030 | 268 |

Table 3 shows the treatment train effectiveness of the proposed system at node 'WLRB02 Treatment Train'.

**Table 3: Summary of Treatment Train Effectiveness at WLRB02 Treatment Train Node**

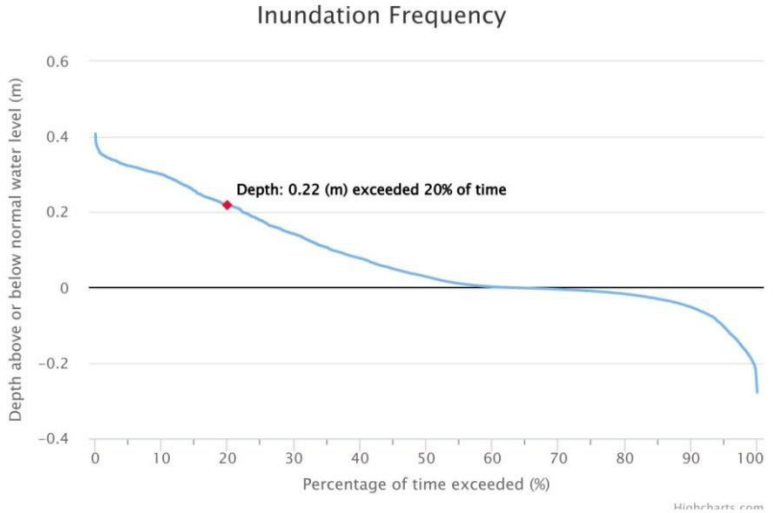
| | Loads generated by Marshall PSP | Total loads removed by PSP WSUD assets | % Reduction |
|---|---|---|---|
| Flow (ML/yr) | 51 | 4 | 8 |
| Total Suspended Solids (kg/yr) | 10,200 | 8,470 | 83 |
| Total Phosphorus (kg/yr) | 21 | 15 | 70 |
| Total Nitrogen (kg/yr) | 147 | 68 | 46 |
| Gross Pollutants (kg/yr) | 2,310 | 2,307 | 99 |

### 1.4.1 Inundation Frequency

The Melbourne Water MUSIC Auditor tool has been used to ensure that an adequate effective water depth has been maintained. This ensures survival of aquatic plant species and to ensure the following requirements are met:

- The effective water depth (permanent pool depth plus depth above NWL) must not exceed half the average plant height for more than 20% of the time.
- The average water level (exceeded 50% of the time) should not be more than 50mm above normal water level.
- Residence time (time that a particle of water spends in the wetland) should be 72hrs more than 90% of the time.

The outputs of this analysis for WL01, WLRB02 and WLRB03 is shown in Figure 3, Figure 4 and Figure 5 respectively.




Report

File: WL01_FLUX_FILE.csv
Shallow marsh zone meets deemed to comply criteria

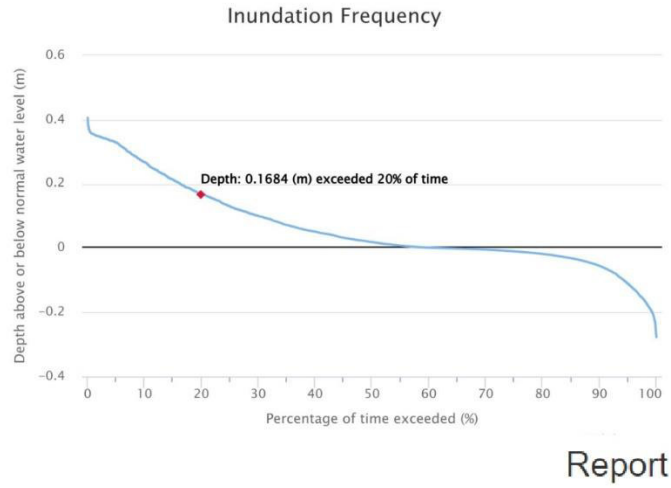
Deep marsh zone meets deemed to comply criteria

Water level exceeded for 20% of time: 0.22 m

Water level exceeded for 50% of time: 0.029 m
·Effective water level is within 50 mm of normal water level and is acceptable.

90th Percentile Residence Time: 3 days

**Figure 3: WL01 MUSIC Auditor Results**




Report

File: WLRB02_FLUX_FILE.csv
Shallow marsh zone meets deemed to comply criteria

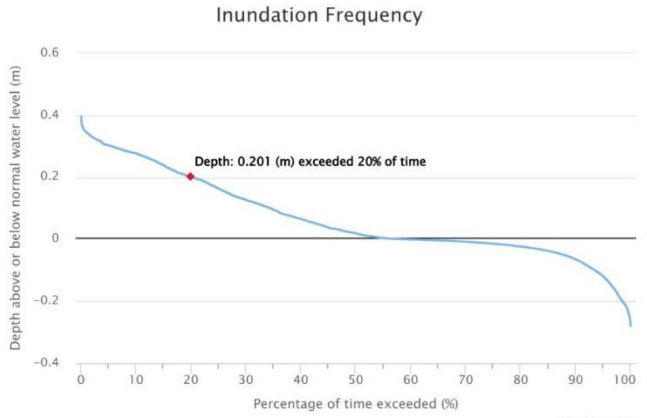
Deep marsh zone meets deemed to comply criteria

Water level exceeded for 20% of time: 0.1684 m

Water level exceeded for 50% of time: 0.01885 m
Effective water level is within 50 mm of normal water level and is acceptable.

90th Percentile Residence Time: 3 days

**Figure 4: WLRB02 MUSIC Auditor Results**




Report

File: WLRB03_FLUX_FILE.csv
Shallow marsh zone meets deemed to comply criteria

Deep marsh zone meets deemed to comply criteria

Water level exceeded for 20% of time: 0.201 m

Water level exceeded for 50% of time: 0.0186 m
Effective water level is within 50 mm of normal water level and is acceptable.

90th Percentile Residence Time: 3 days

**Figure 5: WLRB03 MUSIC Auditor Results**

# APPENDIX 3

# PRELIMINARY DESIGN PLANS

# MARSHALL PRECINCT STRUCTURE PLAN

## STORMWATER DRAINAGE DCP CONCEPT DESIGN

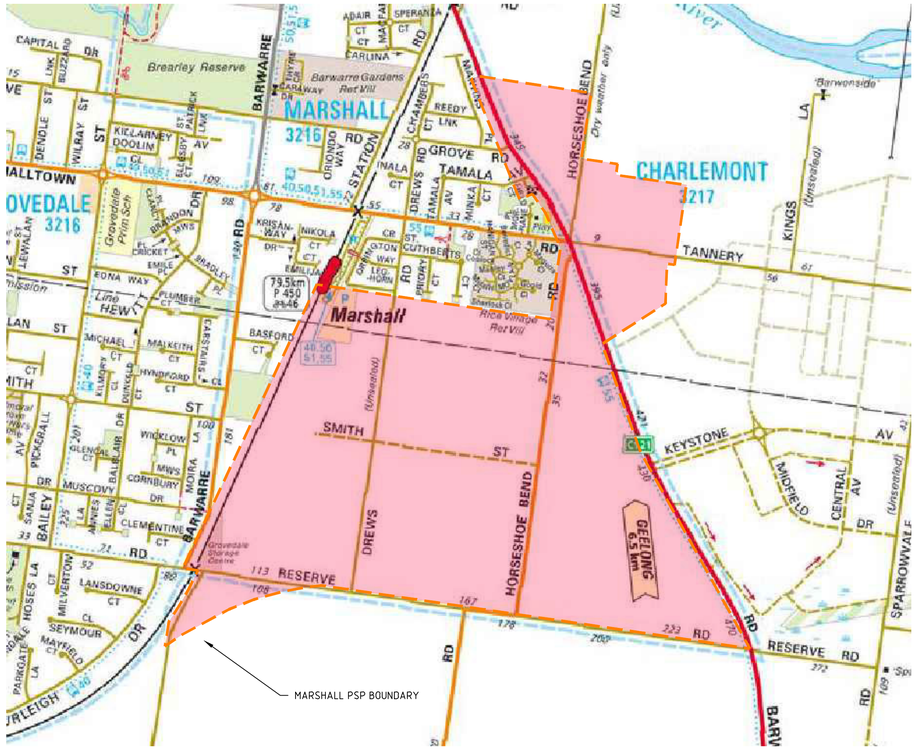
## CITY OF GREATER GEELONG

### GENERAL NOTES

1. ALL LEVELS ARE TO AUSTRALIAN HEIGHT DATUM AND ALL CO-ORDINATES ARE TO MAP GRID OF AUSTRALIA (MGA) ZONE 55.
2. ALL WORKS TO BE CARRIED OUT IN ACCORDANCE WITH GENERAL CONDITIONS OF CONTRACT, MELBOURNE WATER STANDARDS, COUNCIL STANDARDS, APPROPRIATE STANDARD DRAWINGS AND TO THE SATISFACTION OF THE SUPERINTENDENT.
3. TBM'S TO BE RE-ESTABLISHED BY THE LICENSED SURVEYOR IF FOUND TO BE MISSING AT THE COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR WILL BE RESPONSIBLE FOR CARE AND MAINTENANCE OF TBM'S THEREAFTER.
4. BEFORE COMMENCING WORK ON THE TRENCHES IN EXCESS OF 1.5m DEEP, NOTICE OF SUCH PROPOSAL IS TO BE SENT TO THE WORKCOVER AUTHORITY IN ACCORDANCE WITH CLAUSE 5.1.27 OF THE VICTORIAN OH&S REGULATIONS 2007.
5. ALL EXCAVATIONS FOR DRAINAGE WORKS ARE TO BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS OF THE VICTORIAN WORK COVER AUTHORITY.
6. ALL EXISTING SURFACE LEVELS SHOWN ON THE ENGINEERING DRAWINGS HAVE BEEN INTERPOLATED FROM A DIGITAL TERRAIN MODEL. THESE LEVELS HAVE BEEN USED AS THE BASIS FOR ALL ENGINEERING DESIGN AND DETERMINATION OF QUANTITIES AND ARE ACCURATE TO WITHIN ±0.05m.
7. ALL VARIATIONS MUST BE APPROVED BY SUPERINTENDENT PRIOR TO UNDERTAKING ANY WORKS.
8. ALL BATTERS STEEPER THAN 1 IN 4 ARE TO BE PLANTED OUT IN ACCORDANCE WITH THE LANDSCAPE PLANS.
9. ALL BATTERS SHALL BE 1 IN 6, UNLESS OTHERWISE SHOWN.
10. THE LOCATION OF EXISTING SERVICES SHOULD BE DETERMINED BY THE CONTRACTOR PRIOR TO COMMENCING ANY EXCAVATION BY CONTACTING ALL LOCAL SERVICE AUTHORITIES. ANY EXISTING SERVICES SHOWN ON THESE DRAWINGS ARE OFFERED AS A GUIDE ONLY AND ARE NOT GUARANTEED AS CORRECT. ANY DISTURBANCE OR DAMAGE TO EXISTING SERVICES SHALL BE AT THE CONTRACTOR'S EXPENSE.
11. NO FILL OR STOCKPILING OF MATERIAL IS TO BE PLACED ON ANY RESERVE FOR PUBLIC OPEN SPACE UNLESS OTHERWISE DIRECTED OR APPROVED BY THE SUPERINTENDENT.
12. DISTURBED AREAS OUTSIDE THE LANDSCAPE CONTRACT MUST BE TOP SOILED AND HYDROSEEDED WITH APPROVED GRASSES. TEMPORARY FENCING MUST BE ERECTED TO PREVENT ACCESS TO TREATED AREAS.
13. CONTRACTOR TO PREPARE AN ENVIRONMENTAL MANAGEMENT PLAN (SEMP) AND FORWARD TO THE SUPERINTENDENT PRIOR TO COMMENCEMENT OF ANY WORKS. CONSIDERATION SHOULD BE MADE TO MWC DRAINAGE DESIGN MANUAL AND CONTROL OF EROSION ON CONSTRUCTION SITES BY DEPT. CONSERVATION FORESTS & LANDS, 1987. DE-WATERING MUST BE IN ACCORDANCE WITH THE EPA'S GUIDELINE "CONSTRUCTION GUIDELINES FOR MAJOR CONSTRUCTION SITES" DECEMBER 1995. THE CONTRACTOR MUST CONSTRUCT THE WORKS IN ACCORDANCE WITH THE APPROVED SEMP. WORKS TO BE CONSTRUCTED IN ACCORDANCE WITH THIS PLAN.
14. WHERE REQUIRED ANY BUILDINGS, TROUGHS, FENCES AND OTHER STRUCTURES ON SITE ARE TO BE REMOVED AS DIRECTED BY THE SUPERINTENDENT. THE COST OF REMOVAL IS TO BE INCLUDED IN THE OVERALL EARTHWORKS FIGURE UNLESS A SPECIFIC ITEM FOR REMOVAL IS DENOTED IN THE SCHEDULE.
15. NO BLASTING TO BE CARRIED OUT WITHOUT OBTAINING COUNCIL AND SUPERINTENDENT'S WRITTEN PERMISSION. RESTRICTED BLASTING WITHIN 20m OF WATER MAINS AND WITHIN 6m OF TELSTRA CONDUITS.
16. THE CONTRACTOR IS TO REFER TO THE LANDSCAPE PLANS FOR ALL REESTABLISHMENT WORKS.
17. THE CONTRACTOR SHALL OBTAIN A ROAD OPENING PERMIT FROM THE RELEVANT AUTHORITY FOR ANY WORKS WITHIN EXISTING ROAD RESERVES AND COMPLY WITH THE REQUIREMENTS.
18. FOR THE DURATION OF PROCLAIMED WATER RESTRICTIONS THE CONTRACTOR SHALL CONFORM TO THE RESTRICTIONS AND ANY OTHER WATER CONSERVATION REQUIREMENTS IMPOSED BY THE WATER AGENCY.
19. ALL TREES AND SHRUBS ARE TO BE RETAINED UNLESS OTHERWISE SHOWN. IF CONSTRUCTION NECESSITATES THEIR REMOVAL, WRITTEN PERMISSION MUST BE OBTAINED FROM THE SUPERINTENDENT.
20. ALL TREES AND SHRUBS MUST BE PRESERVED AND PROTECTED AT ALL TIMES. IF CONSTRUCTION NECESSITATES THEIR REMOVAL, WRITTEN PERMISSION MUST BE OBTAINED FROM THE SUPERINTENDENT. TREES NOT SPECIFIED FOR REMOVAL ARE TO BE PROTECTED WITH APPROPRIATE EXCLUSION FENCING PRIOR TO COMMENCEMENT OF ANY WORKS.
21. NO NATIVE VEGETATION SHALL BE DESTROYED, FELLED, LOPPED RINGBARKED OR UPROOTED WITHOUT THE CONSENT OF THE RESPONSIBLE AUTHORITY. VEGETATION AND TREES ARE TO BE PROTECTED WITH APPROPRIATE EXCLUSION FENCING PRIOR TO COMMENCEMENT OF ANY WORKS.
22. DURING THE CONSTRUCTION AND MAINTENANCE PERIOD SILT FENCES ARE TO BE PLACED DOWNSTREAM OF ALL EXPOSED AREAS, AND SILT BARRIERS ARE TO BE PLACED UPSTREAM OF ALL PITS. THE SILT FENCES AND SILT BARRIERS ARE TO BE CHECKED AND MAINTAINED UNTIL THE END OF THE MAINTENANCE PERIOD.
23. ALL EXCAVATED ROCK AND SURPLUS SPOIL TO BE REMOVED AND DISPOSED OFF SITE UNLESS NOTED OTHERWISE.
24. FILLING MATERIAL IS TO BE IN ACCORDANCE WITH THE SPECIFICATION, AS 3798-2007 & TO THE SATISFACTION OF COUNCIL AND THE SUPERINTENDENT.
25. THE CONTRACTOR IS TO HAND OR HYDROEXCAVATE PROVE ALL EXISTING SERVICES EFFECTING THE WORKS PRIOR TO COMMENCEMENT OF CONSTRUCTION. THE CONTRACTOR IS TO NOTIFY THE SUPERINTENDENT OF ANY SERVICES THAT MAY HINDER THE SAFE CONSTRUCTION OF THE WORKS SUCH THAT THE DESIGN CAN BE ALTERED AS REQUIRED.
26. ALL DRAINAGE PIT LIDS ARE TO BE LOCKABLE UNLESS OTHERWISE NOTED.

### ASSET RECORDING

1. UNLESS OTHERWISE DIRECTED BY THE SUPERINTENDENT, THE PRINCIPAL'S PROJECT SURVEYOR WILL UNDERTAKE 'AS CONSTRUCTED' SURVEYS OF VARIOUS PARTS OF THE WORKS THROUGHOUT THE CONSTRUCTION AND PREPARE THE ASSET RECORDING INFORMATION NECESSARY TO SATISFY THE REQUIREMENTS OF THE RELEVANT AUTHORITIES. REFER TO THE SPECIFIC CLAUSES WHERE 'AS CONSTRUCTED' SURVEY IS REQUIRED TO BE UNDERTAKEN.




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## LOCALITY PLAN

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**WARNING**
BEWARE OF UNDERGROUND/OVERHEAD SERVICES
THE LOCATION OF SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.SPECIAL CONSIDERATION SHOULD BE GIVEN TO CONSTRUCTION PROCEDURES UNDER OVERHEAD ELECTRICITY TRANSMISSION LINES.

## DRAWING SCHEDULE

| Sheet Number | SHEET TITLE | REV | Sheet Number |
|---|---|---|---|
| WF100 | GENERAL NOTES | D | 1 |
| WF400-WG02 | MUSIC CATCHMENT PLAN | D | 2 |
| WF400 | KEY SHEET | D | 3 |
| WF401 | WLRB02 OUTFALL KEY SHEET | D | 4 |
| WF402 | WLRB03 DRAINAGE RESERVE | D | 5 |
| WF403 | MAIN DRAIN LAYOUT | D | 6 |
| WF404 | SB02 DRAINAGE RESERVE | D | 7 |
| WF405 | WL01 DRAINAGE RESERVE | D | 8 |
| WF406 | COMMERCIAL PRECINCT LAYOUT | D | 9 |
| WF407 | WLRB02 DRAINAGE RESERVE | D | 10 |
| WF408 | WLRB02 OUTFALL | D | 11 |
| WF420 | DRAINAGE LONG SECTION - SHEET 1 | D | 12 |
| WF421 | DRAINAGE LONG SECTION - SHEET 2 | D | 13 |
| WF422 | DRAINAGE LONG SECTION - SHEET 3 | D | 14 |
| WF423 | DRAINAGE LONG SECTION - SHEET 4 | D | 15 |
| WF440 | TYPICAL SECTIONS - SHEET 1 | D | 16 |
| WF441 | TYPICAL SECTIONS - SHEET 2 | D | 17 |
| WF442 | TYPICAL SECTIONS - SHEET 3 | D | 18 |
| WF443 | TYPICAL SECTIONS - SHEET 4 | D | 19 |
| WF444 | TYPICAL SECTIONS - SHEET 5 | D | 20 |
| WF445 | TYPICAL SECTIONS - SHEET 6 | D | 21 |
| WF446 | TYPICAL SECTIONS - SHEET 7 | D | 22 |
| WF460 | SIPHON DETAIL | D | 23 |
| WF461 | TYPICAL DETAILS - SHEET 1 | D | 24 |

## LEGEND

| DESCRIPTION | |
|---|---|
| NWL | |
| EDD LEVEL | |
| PRECINCT BOUNDARY | |
| EXISTING SEWER | S |
| PROPOSED SEWER | S |
| EXISTING TELECOM | T |
| EXISTING OVERHEAD ELECTRICAL | OE |
| EXISTING WATER | DW |
| EXISTING GAS | G |
| EXISTING OPTIC FIBRE | OF |
| EXISTING NON-DRINKING WATER | NDW |
| EXISTING STORMWATER PIPE | |
| PROPOSED STORMWATER PIPE | |
| PROPOSED STORMWATER STRUCTURE | |
| INDICATIVE DRAINAGE RESERVE | |
| TOP OF BATTER | |
| SURFACE CONTOUR MINOR | 169.00 |
| SURFACE CONTOUR MAJOR | 168.90 |
| EXISTING CONTOUR | |
| INDICATIVE 1% AEP FLOOD LEVEL | |
| 20m NO GO RADIUS TO PYLON | |
| 30m NO GO RADIUS TO PYLON | |
| EXISTING CHANNEL INVERT | |
| EXISTING PYLON | |
| PROPOSED CHANNEL INVERT | |
| CHANGE IN GRADE | |
| RAILWAY DUPLICATION | |
| BARWON HEADS ROAD DUPLICATION | |
| ROCKWORK | |
| ACCESS TRACK | |
| SHARED USER PATH | |
| INDICATIVE BELLARINE LINK ROAD RESERVE | |
| INDICATIVE MARSHALL PSP MAJOR ROAD RESERVE | |
| ELECTRICAL EASEMENT | |
| SEWER EASEMENT | |
| SEDIMENT DRY OUT AREA | |
| VEGETATION TO BE REMOVED | |
| VEGETATION TO BE RETAINED | |
| NEIP DRAINAGE RESERVE | |
| NEIP CADASTRE | |
| EXISTING TREE TO RETAIN WITH TPZ | |
| EXISTING TREE TO BE REMOVED | |
| FLOOD OVERLAY ZONE | |
| STATION PRECINCT | |
| EXISTING OPEN CHANNEL | |
| INDICATIVE RPV DRAINAGE PIPE | |
| INDICATIVE RPV DRAINAGE STRUCTURE | |
| INDICATIVE BELLARINE LINK DRAINAGE PIPE | SWD |

| Rev | Amendments | Approved | Date |
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
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**MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN**
**STORMWATER DRAINAGE GENERAL NOTES**
**GENERAL NOTES**
---
CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF100** Rev **D**

file name 307575WF100_WL.dwg layout name WF100 plotted by Georgia Gruszewski
file location G:\307\307575\Integrated water\CAD plot date 23/12/2022 11:17 AM Sheet of Sheets

BARWON RIVER

N

MGA 94
ZONE 55

SBRB01 DRAINAGE RESERVE

CATCHMENT SBRB01
AREA = 2.97ha

SBRB02 DRAINAGE RESERVE

CATCHMENT SBRB02
AREA = 5.35ha

SBRB03 DRAINAGE RESERVE

CATCHMENT SBRB03
AREA = 3.56ha

MAIN OUTFALL SEWER EASEMENT

SB02

CATCHMENT F
AREA = 1.51ha

FUTURE NORTH EAST
INDUSTRIAL PRECINCT

CATCHMENT A
AREA = 10.97ha

MARSHALL CREEK

PROPOSED MAIN DRAIN 01

CATCHMENT B
AREA = 8.06ha

MARSHALL CREEK OUTLET
UNDER BARWON HEADS ROAD

INFLOW EXTERNAL CATCHMENT - GROVEDALE

CATCHMENT C
AREA = 10.81ha

WL01 DRAINAGE RESERVE

CATCHMENT E
AREA = 9.69ha

EXTERNAL CATCHMENT - GROVEDALE
AREA = 50.00ha

SB01 DRAINAGE RESERVE

PROPOSED MAIN DRAIN 02

CATCHMENT D
AREA = 38.52ha

SE CATCHMENT
AREA = 17.10ha

WLRB02 DRAINAGE RESERVE

INFLOW EXTERNAL CATCHMENT - TRIFILOS DRAIN

BELLARINE LINK CATCHMENT
AREA = 2.90ha

MAIN OUTFALL
SEWER EASEMENT

WLRB03 DRAINAGE RESERVE

INDICATIVE RESERVE ROAD
BASIN (HORSESHOE BEND PSP)

MAIN OUTFALL
SEWER EASEMENT

TRIFILOS DRAIN

EXTERNAL CATCHMENT - TRIFILOS DRAIN
AREA = 152.00ha

CATCHMENT DIVERSION TO
INDICATIVE RESERVE ROAD
BASIN (HORSESHOE BEND PSP)

| LEGEND | |
|---|---|
| DESCRIPTION | |
| EXISTING LOTS | |
| SUBCATCHMENT BOUNDARY | |
| PROPOSED MAIN DRAIN | |
| PRECINCT BOUNDARY | |
| EXISTING CONTOURS | |
| DRAINAGE RESERVE BOUNDARY | |
| CATCHMENT DIVERSION TO HORSESHOE BEND PRECINCT | |
| ELECTRICAL EASEMENT | |
| SEWER EASEMENT | |
| FLOW ARROW | |
| FLOOD OVERLAY | |

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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# MARSHALL PRECINCT STRUCTURE PLAN
## CONCEPT DESIGN
### CATCHMENT PLANS
### MUSIC CATCHMENT PLAN

---

CITY OF GREATER GEELONG

PRELIMINARY

Drg No WF400-WG02

Rev A

file name:307575-WG-DEVELOPED_CATCHMENTS.dwg layout name:C-Layout plotted by:Georgia Gruszewski
file location:G:\307\307575\Integrated water\CAD\ plot date:23/12/2022 11:19 AM Sheet 1 of 1 Sheets

BARWON RIVER

N

MGA 94
ZONE 55

EXISTING OPEN CHANNEL TO BARWON RIVER

COGG FLOOD OVERLAY (FO) ZONE IN MARSHALL PSP SITE AREA

SBRB01

SBRB02

SBRB03

BARWON HEADS ROAD

MARSHALLTOWN ROAD

MARSHALL RAILWAY STATION

TANNERY ROAD

FUTURE NORTH EAST INDUSTRIAL PRECINCT

ELECTRICITY EASEMENT

BARWARRE ROAD

SMITH STREET RETARDING BASIN

MAIN OUTFALL SEWER EASEMENT

SB02

REFER TO WF406 FOR DETAIL

PROPOSED WL01 DRAINAGE RESERVE

WL01

SPARROWVALE ROAD

REFER TO WF405 FOR DETAIL

MARSHALL CREEK

MAIN DRAIN NORTH

PROPOSED SB02 DRAINAGE RESERVE

INDICATIVE MRPV BARWON HEADS ROAD DUPLICATION

SMITH STREET

SB01

REFER TO WF404 FOR DETAIL

MAIN DRAIN SOUTH

INDICATIVE RPV RAILWAY LINE DUPLICATION

DREWS ROAD

HORSESHOE BEND ROAD

REFER TO WF403 FOR DETAIL

BARWON HEADS ROAD

MAIN OUTFALL SEWER EASEMENT

PROPOSED WLRB02 DRAINAGE RESERVE. REFER TO WF401 FOR KEY SHEET

PROPOSED WLRB02 DRAINAGE RESERVE

EXISTING OPEN CHANNEL TO BARWON RIVER

GEELONG/COLAC RAIL LINE

WLRB03

WLRB02

RESERVE ROAD

FUTURE BELLARINE LINK

INDICATIVE HORSESHOE BEND PRECINCT DRAINAGE RESERVE

PROPOSED WLRB03 DRAINAGE RESERVE

PROPOSED WLRB02 OUTFALL

EXTERNAL CATCHMENTS REDIRECTED TO SPARROVALE WETLAND VIA OUTFALL DRAINAGE

REFER TO WF402 FOR DETAIL

## LEGEND

- EXISTING LOTS
- EXISTING OPEN CHANNEL
- PROPOSED STORMWATER PIPE
- RAILWAY DUPLICATION
- PRECINCT BOUNDARY
- BARWON HEADS ROAD DUPLICATION
- EXISTING CONTOURS
- DRAINAGE RESERVE
- HORSESHOE BEND PSP DRAINAGE RESERVE
- ELECTRICAL EASEMENT
- SEWER EASEMENT
- EXISTING TREE TO RETAIN WITH TPZ
- EXISTING TREE TO BE REMOVED
- NEIP DRAINAGE RESERVE
- VEGETATION TO BE RETAINED
- MARSHALL STATION PRECINCT
- INDICATIVE BELLARINE LINK ROAD RESERVE
- INDICATIVE MARSHALL PSP MAJOR ROAD RESERVE
- FLOOD OVERLAY

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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

LAYOUT PLAN
KEY SHEET
---
CITY OF GREATER GEELONG

PRELIMINARY

Drg No 307575WF400
Rev D

file name 307575WF400.dwg Layout name WF400 plotted by Georgia Gruszewski
file location G:\30\307575\Integrated Waters\ACAD plot date 23/12/2022 11:20 AM Sheet of Sheets

FUTURE NORTH EAST INDUSTRIAL PRECINCT

HORSESHOE BEND ROAD

BARWON HEADS ROAD

MAIN OUTFALL SEWER EASEMENT

RESERVE ROAD

FUTURE BELLARINE LINK

PROPOSED WLRB02 DRAINAGE RESERVE

WLRB02

EXISTING OPEN CHANNEL TO BARWON RIVER

PROPOSED WLRB02 OUTFALL

REFER TO WF407 FOR DETAIL

INDICATIVE FUTURE BELLARINE LINK STAGE 2

WLRB02 PIPED OUTLET

EXISTING OPEN CHANNEL TO BARWON RIVER

BARWON RIVER

EXISTING OPEN CHANNEL TO BARWON RIVER

WATERMARK ESTATE

GLENLEIGH ESTATE

ACCESS TRACK

WLRB02 OUTFALL CHANNEL DIRECTED TO SPARROWVALE

REFER TO WF408 FOR DETAIL

REFER TO WD407 CONTINUATION A FOR DETAIL

SPARROVALE WETLANDS

HORSESHOE BEND PRECINCT

BARWON HEADS ROAD

SPARROVALE ROAD

REFER TO WD407 CONTINUATION B FOR DETAIL

SPARROVALE LINEAR WETLAND

REFER TO WD407 CONTINUATION C FOR DETAIL

SPARROWVALE LINEAR WETLAND OUTLET

N

MGA 94 ZONE 55

## LEGEND

- EXISTING LOTS
- EXISTING OPEN CHANNEL
- PROPOSED STORMWATER PIPE
- RAILWAY DUPLICATION
- PRECINCT BOUNDARY
- BARWON HEADS ROAD DUPLICATION
- EXISTING CONTOURS
- DRAINAGE RESERVE
- HORSESHOE BEND PSP DRAINAGE RESERVE
- ELECTRICAL EASEMENT
- SEWER EASEMENT
- EXISTING TREE TO RETAIN
- EXISTING TREE TO BE REMOVED
- NEIP DRAINAGE RESERVE
- VEGETATION TO BE RETAINED
- MARSHALL STATION PRECINCT
- INDICATIVE BELLARINE LINK ROAD RESERVE
- INDICATIVE MARSHALL PSP MAJOR ROAD RESERVE
- FLOOD OVERLAY

| Rev | Amendments | Approved | Date |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

## LAYOUT PLAN
## WLRB02 OUTFALL KEY SHEET

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CITY OF GREATER GEELONG

PRELIMINARY

Drg No 307575WF401

Rev D

file name 307575WF400 WL dwg, layout name WF401 plotted by Georgia Gruszewski
file location \\spiire\geelong\Data\307575\Integrated Water\CAD plot date 23/12/2022 11:20 AM Sheet of Sheets

BARWARRE ROAD

EXISTING RESIDENTIAL AREA

MARSHALL PRECINCT

FUTURE ROAD RESERVE

RESERVE ROAD

FUTURE BELLARINE LINK

HORSESHOE BEND PRECINCT

GEELONG/COLAC RAIL LINE

TRIFILOS DRAIN

INDICATIVE HORSESHOE BEND PRECINCT DRAINAGE RESERVE

N

MGA 94 ZONE 55

INDICATIVE SHARED USER PATH (SUP03)

INDICATIVE FUTURE RPV INLET IL 11.70

PROPOSED INLET PIT SIZED TO CONVEY 0.6m3/s TREATMENT FLOW TO WSUD ASSETS

PROPOSED WEIR TO BE SET AT RL 10.8

INDICATIVE OFF-ROAD SHARED USER PATH WITHIN DRAINAGE RESERVE

MAIN DRAIN SOUTH

EXISTING SERVICES TO BE PROVEN DURING DETAIL DESIGN

PROPOSED WLRB03 OUTLET. MAIN DRAIN TO SB2. REFER TO WF402 FOR DETAIL

WETLAND CONTROL PIT

AUXILIARY SPILLWAY OVER ROAD RL 11.2m AND DIRECTED SOUTH-EAST DOWN RESERVE ROAD

NATIVE VEGETATION AREA 4

TREATMENT FLOW LOCATION 1

PROPOSED SEDIMENT BASIN. REFER TO WF461 FOR TYPICAL SEDIMENT BASIN DETAIL

INDICATIVE FUTURE RPV DRAINAGE DESIGN

525ø

3x600mmW x450mmH

INDICATIVE FUTURE RPV INLET IL 10.9

1050ø

EXISTING RESIDENTIAL DRAINAGE LEVELS UNKNOWN

A WF440

INDICATIVE FUTURE RPV INLET IL 11.4

CULVERT POOL RL 10.5m

EXISTING TRIFFILOS DRAIN TO BE FORMALISED INTO BYPASS CHANNEL

INDICATIVE FUTURE RPV RAILWAY LINE DUPLICATION DESIGN

INDICATIVE ROCK CHUTE TO REDUCE GRADES IN CHANNEL

4x900mmW x300mmH

1200ø

INDICATIVE FUTURE RPV INLET IL 10.9

INDICATIVE SHARED USER PATH (SUP09)

INDICATIVE FUTURE RPV DRAINAGE DESIGN

EXISTING INLET CULVERTS TO REMAIN

WLRB03 - SB01 - 1500m²

WLRB03 WETLAND - 2,500m²

RETARDATION STORAGE - 13,800m²

NWL 10.5

NWL 9.60

EDD 9.95

NWL 9.30

EDD 9.65

NWL 9.17

1% AEP LEVEL 11.0

TREATMENT FLOW LOCATION 2

PROPOSED EXTENSION OF TRIFFILOS DRAIN WATERWAY

WETLAND LOW-FLOW BYPASS

WLRB03 SED DRY OUT SIZE = 1445m²

NWL 12.7

CULVERT POOL NWL RL12.7m

INDICATIVE FUTURE FOOTBRIDGE LOCATION

MARSHALL PSP BOUNDARY

INDICATIVE SHARED USER PATH (PORTION OF SUP06)

EXISTING TRIFFILOS DRAIN FLOW PATH

INDICATIVE SHARED USER PATH (SUP07)

INDICATIVE 1% AEP FLOOD LEVEL RL 11.00m

CULVERT POOL NWL 9.17m

WETLAND OUTLET PIPE

PROPOSED WETLAND. REFER TO WF462 FOR TYPICAL WETLAND BATHYMETRY DETAIL

EXISTING SERVICE RELOCATION MAY BE REQUIRED. TO BE CONFIRMED DURING DETAILED DESIGN

INDICATIVE ACCESS TRACK

19

20

21

## HYDRAULIC OVERVIEW

| DESCRIPTION | FLOW (m³/s) | COMMENT |
|---|---|---|
| LOW FLOW BYPASS | <0.05 | |
| HIGH FLOW BYPASS | >0.6 | |
| 1% AEP INFLOW | 6.6 | |
| 1% AEP OUTFLOW | 2.6 | |
| TREATMENT FLOWS | | |
| LOCATION 1 | 0.6 | |
| LOCATION 2 | FLOWS BETWEEN 0.05-0.6 | |

| | |
|---|---|
| TREATMENT FLOW | → |
| HIGH FLOW BYPASS | → |
| LOW FLOW BYPASS | → |
| BASIN OVERSPILL | → |
| INFLOW | → |
| OUTFLOW | → |

NOTE:
ALL INDICATIVE FUTURE INLETS FROM RAILWAY DUPLICATION MUST BE REVIEWED AND TIE INTO PROPOSED BASIN DESIGN. ILS SHOWN ON THIS LAYOUT HAVE BEEN TAKEN FROM THE RPV DRAINAGE DESIGN DRAWINGS, RECIEVED 26-05-2021. IT IS ASSUMED THAT THE INDICATIVE FUTURE INLETS DO NOT INCREASE EXISTING PEAK FLOWS

| Rev | Amendments | Approved | Date |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

## LAYOUT PLAN

## WLRB03 DRAINAGE RESERVE

---

CITY OF GREATER GEELONG

PRELIMINARY

Drg No 307575WF402

Rev D

file name 307575WF402 WL.dwg layout name WF402 plotted by Georgia Gruszewski
file location G:\307575\Integrated water\ACAD plot date 23/12/2022 11:21 AM Sheet of Sheets

STATION PRECINCT

FUTURE ROAD RESERVE

EXISTING 1350ø MAIN OUTFALL SEWER

NATIVE VEGETATION AREA 3

INFLOW LOCATION 1

INDICATIVE FUTURE INLETS FROM RAILWAY DUPLICATION PROJECT IL 10.0. IT IS ASSUMED THAT NO PEAK INCREASE OF FLOW

UPSTREAM SECTION OF MARSHALL CREEK TO BE INCREASED IN CAPACITY AND REVEGETATED. REFER TO WF440 FOR TYPICAL SECTION

PROPOSED CULVERT CROSSING FOR INDICATIVE FUTURE ROAD RESERVE

REFER INSET 01

MAIN DRAIN TO CONVEY HIGH FLOWS TO DOWNSTREAM SB2

LOW ENVIRONMENTAL FLOWS TO BE CONVEYED THROUGH MARSHALL CREEK AND NATIVE VEGETATION AREA 2

DOWNSTREAM SECTION OF MARSHALL CREEK TO HAVE NATIVE VEGETATION RETAINED. REFER TO WF440 FOR TYPICAL SECTION

MAIN DRAIN NORTH TO BE DESIGNED TO HAVE NO IMPACT TO NATIVE VEGETATION

MAIN DRAIN NORTH

MARSHALL CREEK

SMITH STREET

INDICATIVE FUTURE SHARED USER PATH (SUP 08)

25.00m WATERWAY CORRIDOR

PROPOSED CULVERT CROSSING FOR FUTURE ROAD CROSSING

GEELONG/COLAC RAIL LINE

MAIN DRAIN SOUTH

EXISTING SMITH STREET GRAVEL ROAD TO BE MAINTAINED AS 'GREENWAY'

INDICATIVE FUTURE SHARED USER PATH (SUP 01)

NATIVE VEGETATION AREA 2

ROCKED BATTER TO PROVIDE ARMOURING THROUGH DIVERTED CREEK INLET ZONE

SB01

FOR SB02 DRAINAGE RESERVE DETAILS REFER TO WF403

DREWS ROAD

NATIVE VEGETATION AREA 1

FUTURE ROAD RESERVE

PROPOSED MAIN DRAIN OUTLET FROM WLRB03

INFLOW LOCATION 2

## INSET 01

DIVERSION PIT. LOW FLOWS TO SMITH ST REACH VIA 450mmø AND OVERFLOWS THROUGH MAIN DRAIN

WATERWAY IL 8.90m

2700mmWx600mmH

LOW FLOWS VIA 450 DIA RCP OUTLET IL 8.85m

INDICATIVE SHARED USER PATH (SUP 08)

EXTEND LOW FLOW CHANNEL UP TO 450mmø ENDWALL

INDICATIVE SHARED USER PATH (SUP 01)

1:500@ A1 / 1:1000@ A3 SCALE 0 5 10 15 20 25

N

MGA 94 ZONE 55

## HYDRAULIC OVERVIEW

| DESCRIPTION | FLOW ($m^3/s$) | COMMENT |
|---|---|---|
| LOW FLOW BYPASS | <0.4 | ENVIRONMENTAL FLOWS TO MARSHALL CREEK & NATIVE VEGETATION AREA 2 |
| HIGH FLOW BYPASS | >0.4 | |
| 1% AEP INFLOW LOCATION 1 | 1.7 | EXISTING RETARDED OUTFLOW |
| 1% AEP INFLOW LOCATION 2 | 2.6 | WLRB03 RETARDED OUTFLOW |

| | |
|---|---|
| TREATMENT FLOW | → |
| HIGH FLOW BYPASS | → |
| LOW FLOW BYPASS | → |
| BASIN OVERSPILL | → |
| INFLOW | → |
| OUTFLOW | → |

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH AND CULVERT CROSSING UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

H 1:1000 SCALE @ A1 0 10 20 30 40 50

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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

LAYOUT PLAN
MAIN DRAIN LAYOUT
---
CITY OF GREATER GEELONG

PRELIMINARY

Drg No 307575WF403 Rev D

file name: 307575WF403 WL dwg Layout name: WF403 plotted by: Georgia Gruszewski
file location: G:\307575\Integrated Water\CAD plot date: 29/12/2022 11:22 AM Sheet of Sheets

OVERSPILL POINT AT HORSESHOE BEND ROAD APPROX RL 7.7m

UPGRADE EXISTING CULVERTS TO 4x1200ø OR EQIVALENT AT IL 5.8m

CULVERT POOL
NWL RL 5.8m

PROPOSED DRAINAGE RESERVE BOUNDARY

NWL 5.8

4 x 1200ø

FOR WL1 DETAIL REFER TO WF404

FOR WL1 DETAIL REFER TO WF404

NWL 5.8

NWL 5.90
EDD 6.25

NWL 6.08
EDD 6.55

N
MGA 94
ZONE 55

INDICATIVE CONSTRUCTED WATERWAY.
REFER TO WF442 FOR TYPICAL DETAIL

WATERWAY IL 5.8m

E WF447

EXISTING 1350ø MAIN OUTFALL SEWER

HORSESHOE BEND ROAD

PROPOSED DRAINAGE RESERVE BOUNDARY

INDICATIVE SHARED
USER PATH (SUP 04)

PIPED BYPASS FLOWS FROM EXISTING UPSTREAM RB (BYPASS FLOW 2)

FILL EXISTING CHANNEL DOWNSTREAM OF SB02

GAP FLOW 2

D WF447

TREATMENT FLOW 2

WATERWAY IL 6.0m

INDICATIVE SHARED USER PATH
CROSSING EXISTING CREEK

MARSHALL CREEK

INDICATIVE CULVERT CROSSING

ROCKED BATTER TO PROVIDE ARMOURING
THROUGH DIVERTED CREEK INLET ZONE

INDICATIVE SHARED
USER PATH (SUP 01)

SB01 NWL AREA =
1010m²
NWL RL = 6.1m

SIPHON POOL
NWL RL 6.0m

HARDSTAND AREA FOR VEHICULAR
ACCESS TO SIPHON PITS

2x1350ø SEWER SIPHON CROSSING IL 2.04m TO CONVEY
6.87m³/s. REFER TO WF460 FOR SIPHON DETAIL

10m WIDE 200mm DEPTH WEIR SLAB OVERSPILL FOR EMERGENCY SIPHON
BLOCKAGE. CREST AT RL 7.3m WITH SURROUNDING ROCK BEACHING

PIT 05 PROPOSED TO BE DIVERSION PIT THAT CONVEYS LOW FLOW FROM
INTERNAL CATCHMENT. LOW FLOWS FROM WLRB03 TO CONTINUE TO SIPHON PIT

TREATMENT FLOW 1

NWL 6.1
EDD 6.45

MAINTENANCE ACCESS TRACK

PIPED BYPASS FLOWS FROM WLRB3 (BYPASS FLOW 1)

GAP FLOW 1

INDICATIVE FUTURE SHARED USER
PATH (PORTION OF SUP 04)

SB01 SED DRYOUT AREA = 788m2

## HYDRAULIC OVERVIEW

| DESCRIPTION | FLOW ($m^3/s$) | COMMENT |
|---|---|---|
| GAP FLOWS ( = MAX 1% AEP FLOW - MAX 20% AEP FLOW) | | |
| LOCATION 1 | 2.4 | GAP FLOW INTO SB02 |
| LOCATION 2 | 0.9 | GAP FLOW INTO SB02 |
| PIPED BYPASS FLOWS | | |
| LOCATION 1 | >1.2 UP TO 2.8 | WLRB3 1% AEP BYPASS |
| LOCATION 2 | >0.3 UP TO 1.1 | EXISTING UPSTREAM RB 1% AEP BYPASS |
| TREATMENT FLOWS | | |
| LOCATION 1 | 1.2 | |
| LOCATION 2 | 0.3 | |
| OUTFLOW | | |
| OUTFLOW | 6.9 | |

| | |
|---|---|
| TREATMENT FLOW | → |
| HIGH FLOW BYPASS | → |
| LOW FLOW BYPASS | → |
| BASIN OVERSPILL | → |
| INFLOW | → |
| OUTFLOW | → |
| GAP FLOW | → |

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| D | SHARED USER PATH, ACCESS TRACK AND CULVERT CROSSING UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

H 1:500
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0 5 10 15 20 25

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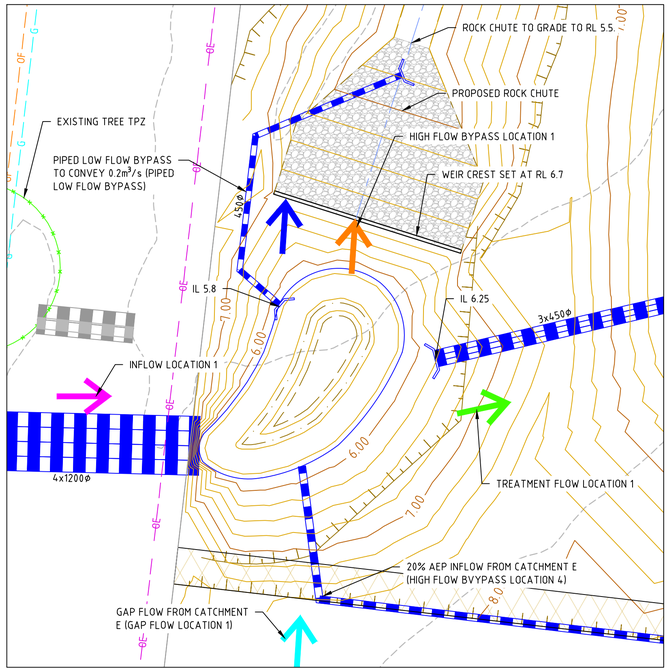
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Date 29-08-22

# MARSHALL PRECINCT STRUCTURE PLAN
# CONCEPT DESIGN
## LAYOUT PLAN
## SB02 DRAINAGE RESERVE
---
CITY OF GREATER GEELONG

PRELIMINARY
Drg No 307575WF404
Rev D

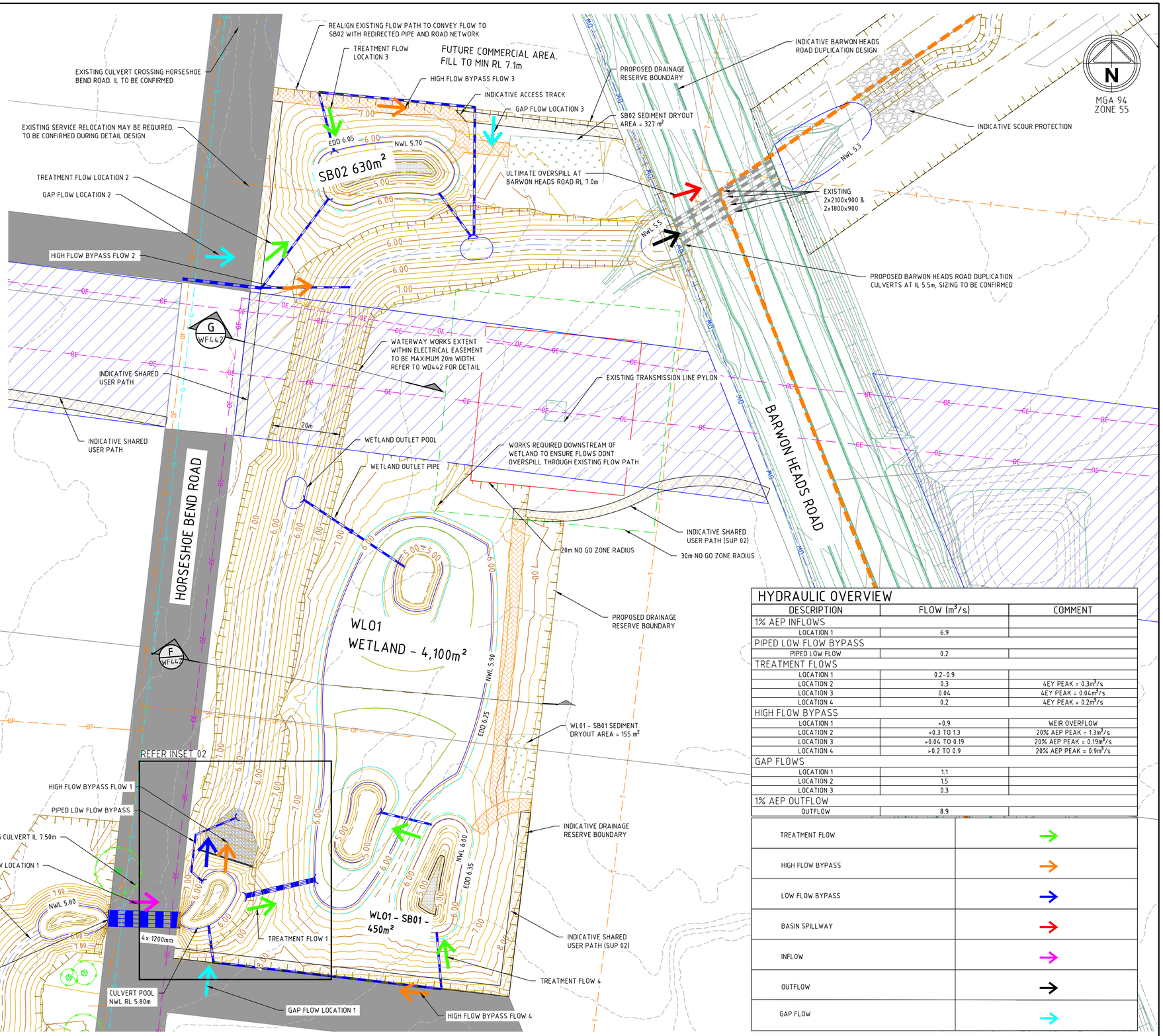
file name 307575WF400 WL dwg, layout name WF404, plotted by Georgia Gwozewski
file location G:\3M\307575\Integrated Water\ACAD plot date 23/12/22 11:22 AM Sheet of Sheets




INSET 02

1:250@A1 SCALE 1:500@A3 — 0 2.5 5 7.5 10 12.5






H 1:600 SCALE @ A1 — 0 6 12 18 24 30

## HYDRAULIC OVERVIEW

| DESCRIPTION | FLOW ($m^3/s$) | COMMENT |
|---|---|---|
| 1% AEP INFLOWS | | |
| LOCATION 1 | 6.9 | |
| PIPED LOW FLOW BYPASS | | |
| PIPED LOW FLOW | 0.2 | |
| TREATMENT FLOWS | | |
| LOCATION 1 | 0.2-0.9 | |
| LOCATION 2 | 0.3 | 4EY PEAK = $0.3m^3/s$ |
| LOCATION 3 | 0.04 | 4EY PEAK = $0.04m^3/s$ |
| LOCATION 4 | 0.2 | 4EY PEAK = $0.2m^3/s$ |
| HIGH FLOW BYPASS | | |
| LOCATION 1 | >0.9 | WEIR OVERFLOW |
| LOCATION 2 | >0.3 TO 1.3 | 20% AEP PEAK = $1.3m^3/s$ |
| LOCATION 3 | >0.04 TO 0.19 | 20% AEP PEAK = $0.19m^3/s$ |
| LOCATION 4 | >0.2 TO 0.9 | 20% AEP PEAK = $0.9m^3/s$ |
| GAP FLOWS | | |
| LOCATION 1 | 1.1 | |
| LOCATION 2 | 1.5 | |
| LOCATION 3 | 0.3 | |
| 1% AEP OUTFLOW | | |
| OUTFLOW | 8.9 | |

| | |
|---|---|
| TREATMENT FLOW | → |
| HIGH FLOW BYPASS | → |
| LOW FLOW BYPASS | → |
| BASIN SPILLWAY | → |
| INFLOW | → |
| OUTFLOW | → |
| GAP FLOW | → |

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

## LAYOUT PLAN

## WL01 DRAINAGE RESERVE

---

CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF405** Rev **D**

file name 307575WF405 WL dwg Layout name WF405 plotted by Georgia Gruszewski
file location G:\307575\Integrated Water\ACAD plot date 23/12/2022 11:23 AM Sheet of Sheets

BARWON HEADS ROAD

HORSESHOE BEND ROAD

TANNERY ROAD

MARSHALL CREEK

BARWON RIVER

SBRB1.
390m² SEDIMENT POND
725m³ RETARDING BASIN
NWL = 2.1m
EDD = 0.35m
1% AEP PEAK LEVEL = 3.1m

47m² SEDIMENT DRYOUT

EXISTING VEGETATION TO BE PROTECTED

EXISTING PIPED OUTFALL TO ROADSIDE SWALE

375ø OUTLET PIPE TO OUTLET UNDER ULTIMATE HORSESHOE BEND ROAD. COVER ASSESSMENT TO BE DETERMINED IN CONJUNCTION WITH ROAD DESIGN

OUTLET TO DRAINAGE SWALE IL 2.0m

EXISTING FLOWS CONVEYED DOWN HORSESHOE BEND ROAD TO BARWON RIVER

APPROXIMATE BARWON RIVER
1% AEP FLOOD LEVEL AT RL 4.40

ROCK RIFFLE

SBRB3.
390m² SEDIMENT POND
890m³ RETARDING BASIN
NWL = 4.6m
EDD = 0.35m
1% AEP PEAK LEVEL = 5.9m

EXISTING FARM DAM

SBRB2 TO OUTFALL TO EXISTING SWALE DRAIN AT RL 1.7

57m² SEDIMENT DRYOUT

79m² SEDIMENT DRYOUT

SBRB2.
390m² SEDIMENT POND
970m³ RETARDING BASIN
NWL = 2.0m
EDD = 0.35m
1% AEP PEAK LEVEL = 3.36m

EXISTING FARM DAM

MARSHALL CREEK ULTIMATE WATERWAY WORKS TO BE TRIGGERED BY NEIP DEVELOPMENT

45.0m WATERWAY CORRIDOR

EXISTING 2x1500ø CULVERT.
UPSTREAM IL 4.0
DOWNSTREAM IL 3.9

NEIP DRAINAGE RESERVE

ROCK RIFFLE

OUTLET TO MARSHALL CREEK IL 4.5m

ROCK RIFFLE

EXISTING CULVERTS UNDER TANNERY ROAD TO BE UPGRADED AS PART OF MARSHALL CREEK ULTIMATE WATERWAY WORKS

INDICATIVE FUTURE SHARED USER PATH

55.0m WATERWAY CORRIDOR

ROCKED OUTLET TO BARWON RIVER

MGA 94 ZONE 55

N

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
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H 1:1250 SCALE @ A1 0 12.5 25 37.5 50 62.5

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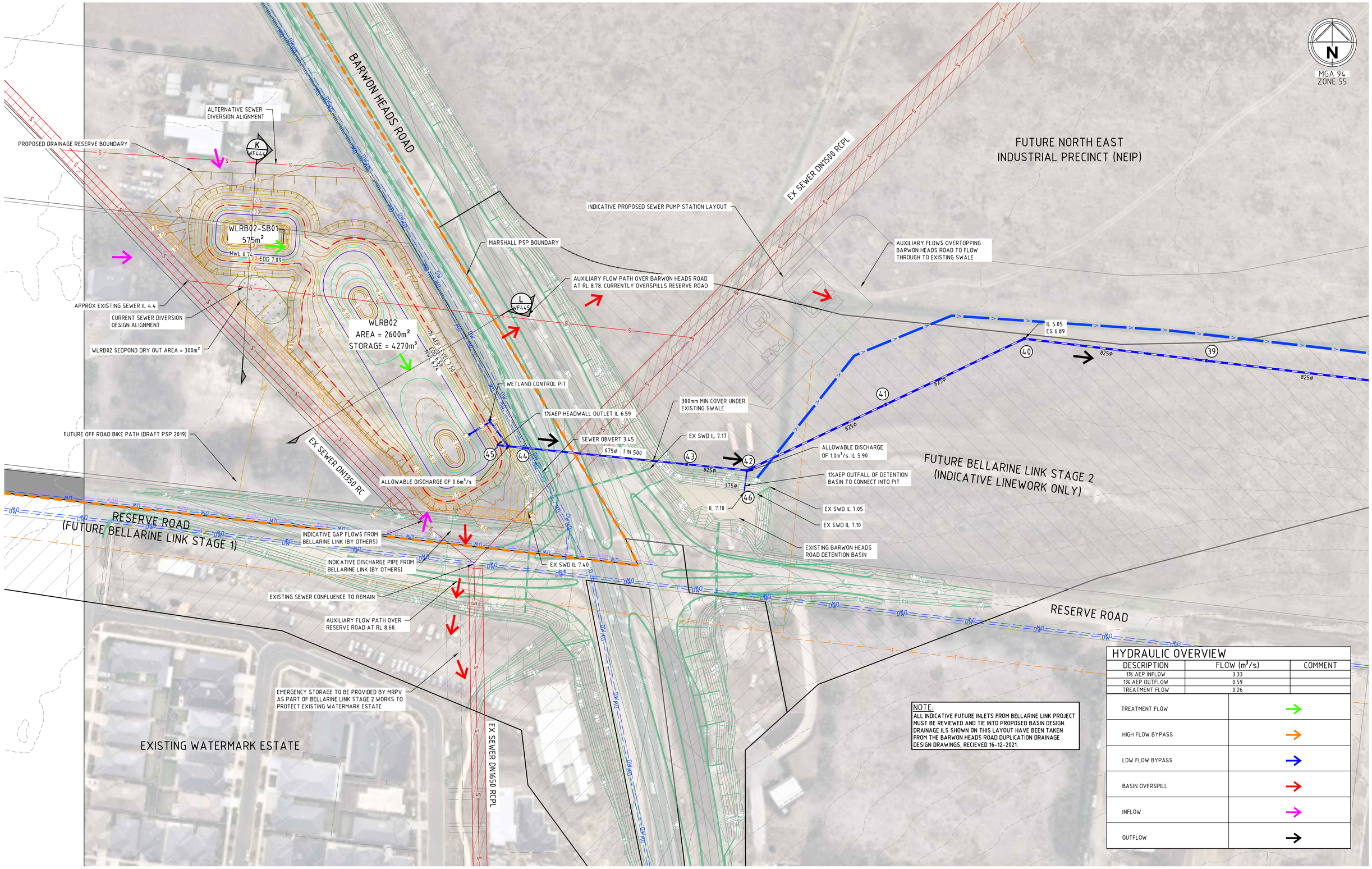
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

LAYOUT PLAN
COMMERCIAL PRECINCT LAYOUT
---
CITY OF GREATER GEELONG

PRELIMINARY Drg No 307575WF406 Rev D

file name 307575WF406 WL.dwg layout name WF406 plotted by Gregorio Gruszewski
file location G:\307575\Integrated water\ACAD plot date 23/12/2022 11:23 AM Sheet of Sheets




| HYDRAULIC OVERVIEW | | |
|---|---|---|
| DESCRIPTION | FLOW ($m^3/s$) | COMMENT |
| 1% AEP INFLOW | 3.33 | |
| 1% AEP OUTFLOW | 0.59 | |
| TREATMENT FLOW | 0.26 | |

| | |
|---|---|
| TREATMENT FLOW | → |
| HIGH FLOW BYPASS | → |
| LOW FLOW BYPASS | → |
| BASIN OVERSPILL | → |
| INFLOW | → |
| OUTFLOW | → |

NOTE:
ALL INDICATIVE FUTURE INLETS FROM BELLARINE LINK PROJECT MUST BE REVIEWED AND TIE INTO PROPOSED BASIN DESIGN. DRAINAGE ILS SHOWN ON THIS LAYOUT HAVE BEEN TAKEN FROM THE BARWON HEADS ROAD DUPLICATION DRAINAGE DESIGN DRAWINGS, RECIEVED 16-12-2021.

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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H 1:750 SCALE @ A1 0 7.5 15 22.5 30 37.5

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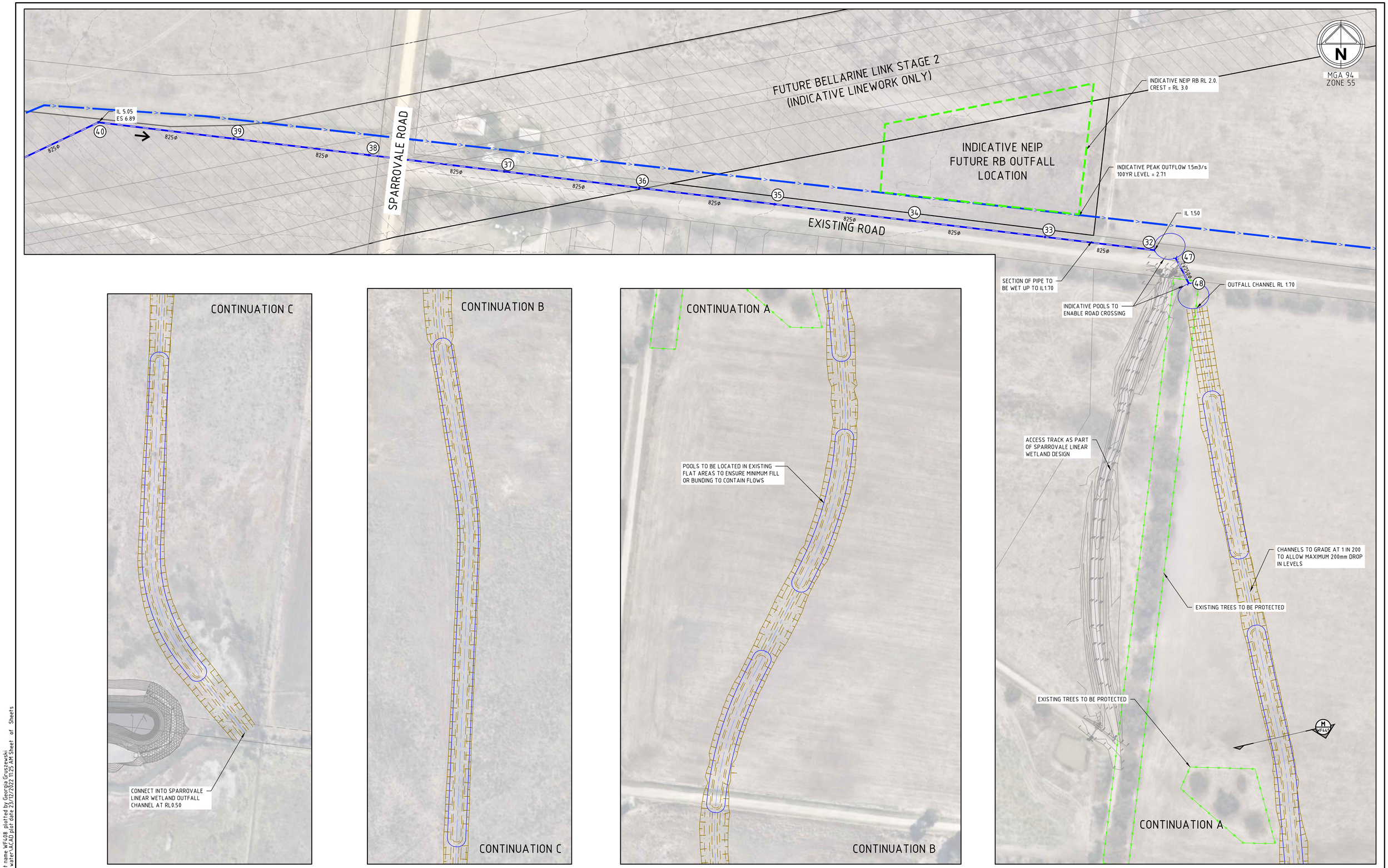
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**LAYOUT PLAN**
**WLRB02 DRAINAGE RESERVE**
---
CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF407** Rev **D**

file name 307575WF400_WL.dwg layout name WF407 plotted by Georgia Gruszewski
file location G:\3Pi\307575\Integrated water\ACAD plot date 23/12/2022 11:24 AM Sheet of Sheets




| Rev | Amendments | Approved | Date |
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| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| B | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

## LAYOUT PLAN
## WLRB02 OUTFALL

---

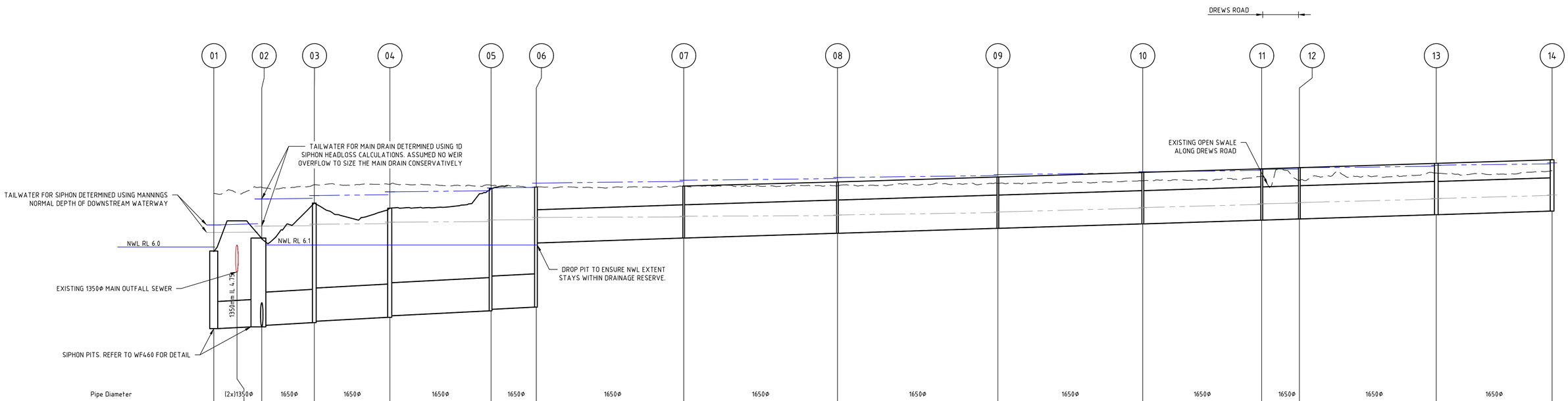
CITY OF GREATER GEELONG

**PRELIMINARY** Drg No 307575WF408 Rev D

file name: 307575WF408 plt dwg Layout name: WF408 plotted by: Georgia Gruszewski
file location: G:\307575\Integrated Waters\ACAD\ plot date: 23/12/2022 11:25 AM Sheet of Sheets

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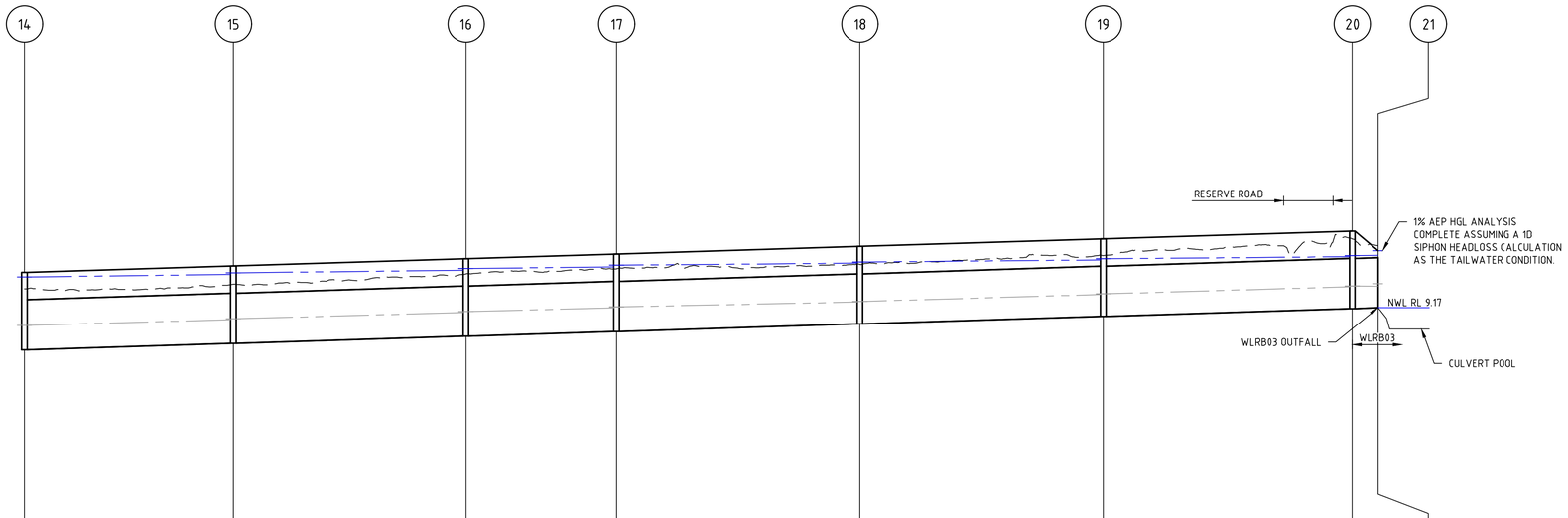
1. THE HGL FOR BOTH THE 20% AEP AND 1% AEP STORM EVENT IS SHOWN FOR THE PROPOSED MAIN DRAINS.
2. THE TOP OF PITS HAVE BEEN RAISED TO GIVE MAIN DRAINS A MINIMUM OF 1.2m COVER TO INDICATE POSSIBLE FILL EXTENT.
3. MAIN DRAINS HAVE BEEN MODELLED USING 1D SIPHON HEADLOSS CALCULATIONS. NO WEIR FLOW OVER THE SIPHON CROSSING HAS BEEN CONSIDERED TO SIZE THE MAIN DRAINS & WLRB03 STORAGE CONSERVATIVELY. FURTHER DESIGN PROGRESSION IS REQUIRED TO ACCURATELY SIZE THE PROPOSED MAIN DRAINS.

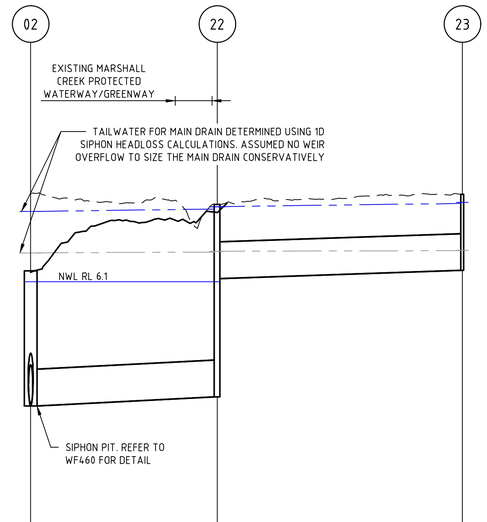



| | | |

NOTES:

1. THE HGL FOR BOTH THE 20% AEP AND 1% AEP STORM EVENT IS SHOWN FOR THE PROPOSED MAIN DRAINS.
2. THE TOP OF PITS HAVE BEEN RAISED TO GIVE MAIN DRAINS A MINIMUM OF 1.2m COVER TO INDICATE POSSIBLE FILL EXTENT.
3. MAIN DRAINS HAVE BEEN MODELLED USING 1D SIPHON HEADLOSS CALCULATIONS. NO WEIR FLOW OVER THE SIPHON CROSSING HAS BEEN CONSIDERED TO SIZE THE MAIN DRAINS & WLRB03 STORAGE CONSERVATIVELY. FURTHER DESIGN PROGRESSION IS REQUIRED TO ACCURATELY SIZE THE PROPOSED MAIN DRAINS.

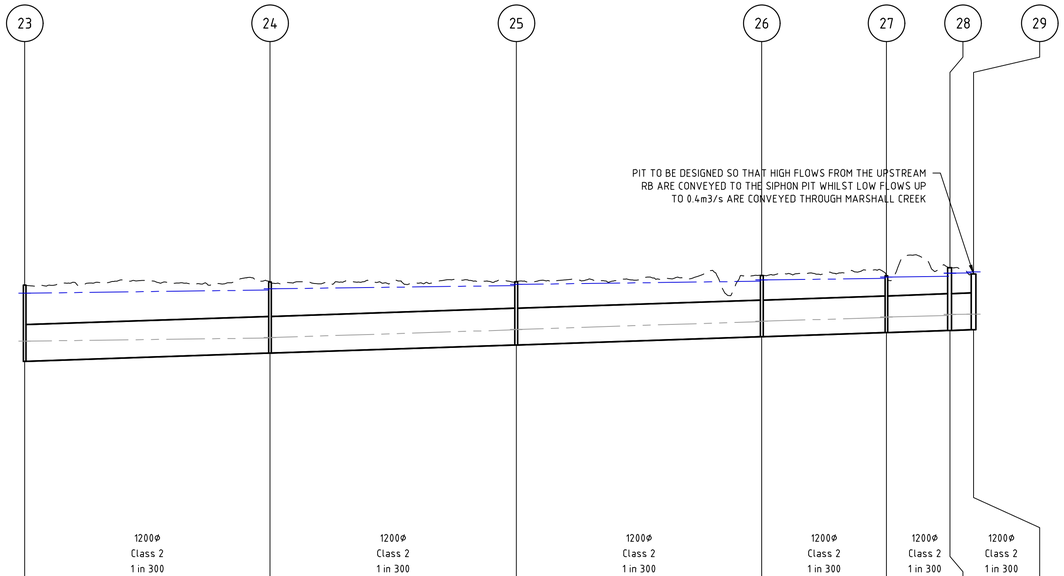


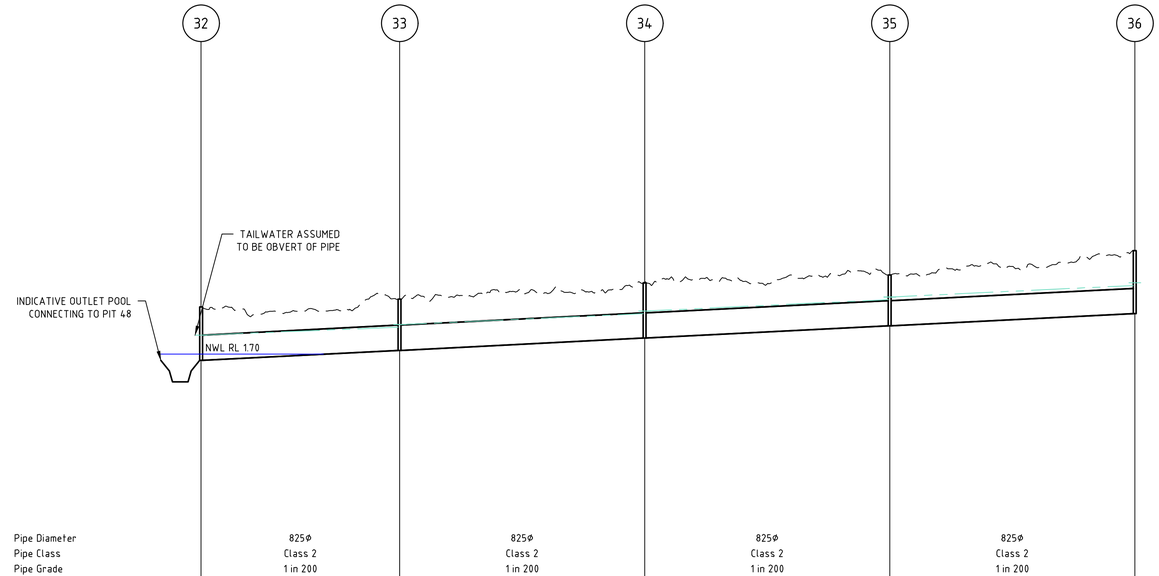

| | | |

NOTES:

1. THE HGL FOR BOTH THE 20% AEP AND 1% AEP STORM EVENT IS SHOWN FOR THE PROPOSED MAIN DRAINS.
2. THE TOP OF PITS HAVE BEEN RAISED TO GIVE MAIN DRAINS A MINIMUM OF 1.2m COVER TO INDICATE POSSIBLE FILL EXTENT.
3. MAIN DRAINS HAVE BEEN MODELLED USING 1D SIPHON HEADLOSS CALCULATIONS. NO WEIR FLOW OVER THE SIPHON CROSSING HAS BEEN CONSIDERED TO SIZE THE MAIN DRAINS & WLRB03 STORAGE CONSERVATIVELY. FURTHER DESIGN PROGRESSION IS REQUIRED TO ACCURATELY SIZE THE PROPOSED MAIN DRAINS.




| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Pipe Diameter | | 1200ø | | 1200ø | | 1200ø | 1200ø | 1200ø | 1200ø |
| Pipe Class | | Class 2 | | Class 2 | | Class 2 | Class 2 | Class 2 | Class 2 |
| Pipe Grade | | 1 in 300 | | 1 in 300 | | 1 in 300 | 1 in 300 | 1 in 300 | 1 in 300 |
| Velocity (m/s) | | Vf=1.990 | | Vf=1.990 | | Vf=1.990 | Vf=1.990 | Vf=1.990 | Vf=1.990 |
| Pipe Flow (m3/s) | | Qa 20%=0.802<br>Qa 1%=1.405 | | Qa 20%=0.802<br>Qa 1%=1.405 | | Qa 20%=0.802<br>Qa 1%=1.405 | Qa 20%=0.802<br>Qa 1%=1.405 | Qa 20%=0.802<br>Qa 1%=1.405 | Qa 20%=0.802<br>Qa 1%=1.300 |
| Pipe Capacity (m3/s) | | Qcap=2.251 | | Qcap=2.251 | | Qcap=2.251 | Qcap=2.251 | Qcap=2.251 | Qcap=2.251 |
| DATUM | -3.00 | | | | | | | | |
| DEPTH TO INVERT | 2.487 | 2.487 | 2.320 | 2.320 | 2.063 | 2.063 | 2.003 | 2.003 | 1.858 | 1.858 | 2.053 | 2.053 | 1.819 |
| DESIGN INVERT LEVEL | 6.466 | 6.466 | 6.733 | 6.733 | 7.001 | 7.001 | 7.268 | 7.268 | 7.403 | 7.403 | 7.472 | 7.472 | 7.498 |
| 20% AEP HGL | 7.112 | 7.125 | 7.228 | 7.241 | 7.496 | 7.509 | 7.763 | 7.776 | 7.898 | 7.911 | 7.967 | 8.001 | 8.006 |
| 1% AEP HGL | 8.652 | 8.691 | 8.795 | 8.834 | 8.939 | 8.978 | 9.082 | 9.121 | 9.174 | 9.213 | 9.240 | 9.343 | 9.351 | 9.385 |
| FINISHED SURFACE LEVEL | 8.953 | | 9.053 | | 9.064 | | 9.271 | | 9.261 | | 9.525 | | 9.317 |
| EXISTING SURFACE LEVEL | 8.953 | | 9.053 | | 9.064 | | 9.271 | | 9.261 | | 9.525 | | 9.317 |
| CHAINAGE | 140.899 | L=80.090m | 220.990 | L=80.393m | 301.383 | L=80.161m | 381.544 | L=40.697m | 422.241 | L=20.748m | 442.988 | L=7.654m | 450.642 |




| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Pipe Diameter | | 825ø | | 825ø | | 825ø | 825ø | 825ø |
| Pipe Class | | Class 2 | | Class 2 | | Class 2 | Class 2 | Class 2 |
| Pipe Grade | | 1 in 200 | | 1 in 200 | | 1 in 200 | 1 in 200 | 1 in 200 |
| Velocity (m/s) | | Vf=1.900 | | Vf=1.900 | | Vf=1.900 | Vf=1.900 | Vf=1.900 |
| Pipe Flow (m3/s) | | Qa=0.981 | | Qa=0.981 | | Qa=0.981 | Qa=0.981 | Qa=0.981 |
| Pipe Capacity (m3/s) | | Qcap=1.015 | | Qcap=1.015 | | Qcap=1.015 | Qcap=1.015 | Qcap=1.015 |
| DATUM | -8.00 | | | | | | | |
| DEPTH TO INVERT | 1.740 | 1.740 | 1.675 | 1.675 | 1.808 | 1.808 | 1.662 | 1.662 | 2.054 |
| DESIGN INVERT LEVEL | 1.500 | 1.500 | 1.824 | 1.824 | 2.224 | 2.224 | 2.624 | 2.624 | 3.024 |
| 1% AEP HGL | 2.325 | 2.579 | 2.665 | 3.023 | 3.109 | 3.482 | 3.568 | 3.941 | 4.027 |
| FINISHED SURFACE LEVEL | 3.240 | 3.499 | 4.032 | 4.286 | 5.078 |
| EXISTING SURFACE LEVEL | 3.240 | 3.499 | 4.032 | 4.286 | 5.078 |
| CHAINAGE | 0.000 | L=64.801m | 64.801 | L=80.000m | 144.801 | L=80.000m | 224.801 | L=80.000m | 304.801 |

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

H 1:500 SCALE @ A1 V 1:50
0 5 10 15 20 25
0 0.5 1.0 1.5 2.0 2.5

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Designed [redacted] Checked [redacted]
Authorised [redacted](PE0008360) Date 29-08-22

# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

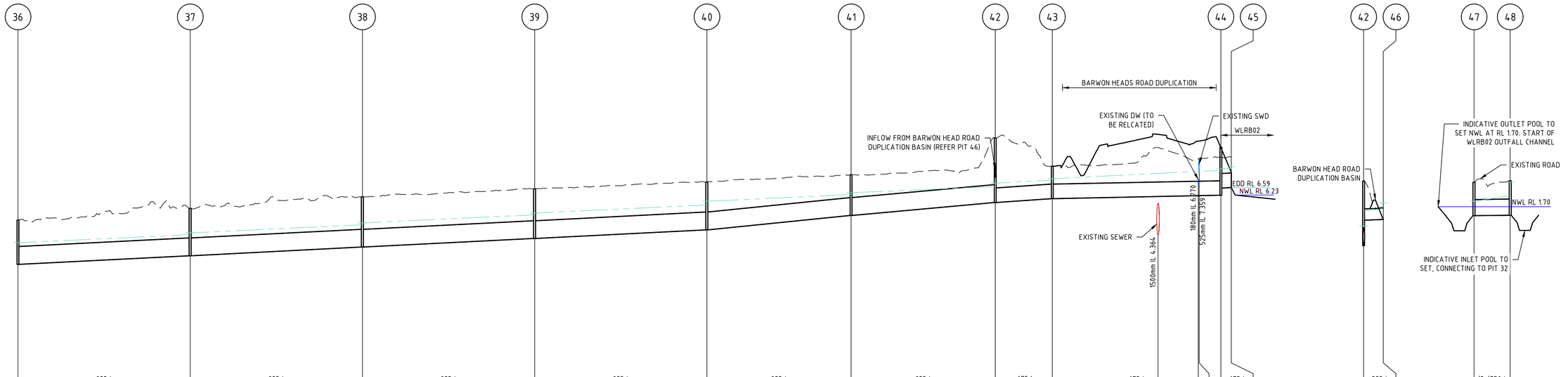
## DRAINAGE LONGITUDINAL SECTIONS
## DRAINAGE LONG SECTION - SHEET 3

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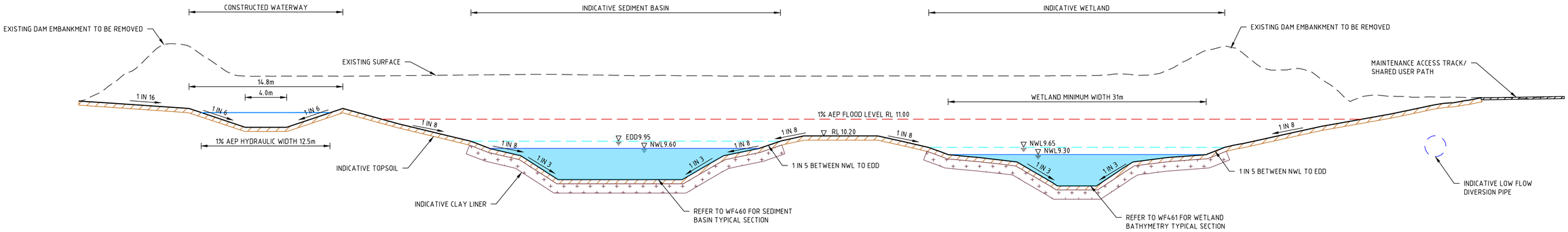
CITY OF GREATER GEELONG

PRELIMINARY Drg No 307575WF422 Rev D

file name 307575WF420 WF dwg layout name WF422 plotted by Gwenaelle Gruszewski
file location G:\307\307575\Integrated water\ACAD plot date 23/12/2022 11:25 AM Sheet of Sheets


36
37
38
39
40
41
42
43
44
45
42
46
47
48
BARWON HEADS ROAD DUPLICATION
INFLOW FROM BARWON HEAD ROAD DUPLICATION BASIN (REFER PIT 46)
EXISTING DW (TO BE RELCATED)
EXISTING SWD
WLRB02
EDD RL 6.59
NWL RL 6.23
180mm IL 6.170
525mm IL 7.359
1500mm IL 4.364
EXISTING SEWER
BARWON HEAD ROAD DUPLICATION BASIN
INDICATIVE OUTLET POOL TO SET NWL AT RL 1.70. START OF WLRB02 OUTFALL CHANNEL
EXISTING ROAD
NWL RL 1.70
INDICATIVE INLET POOL TO SET, CONNECTING TO PIT 32

| | | |



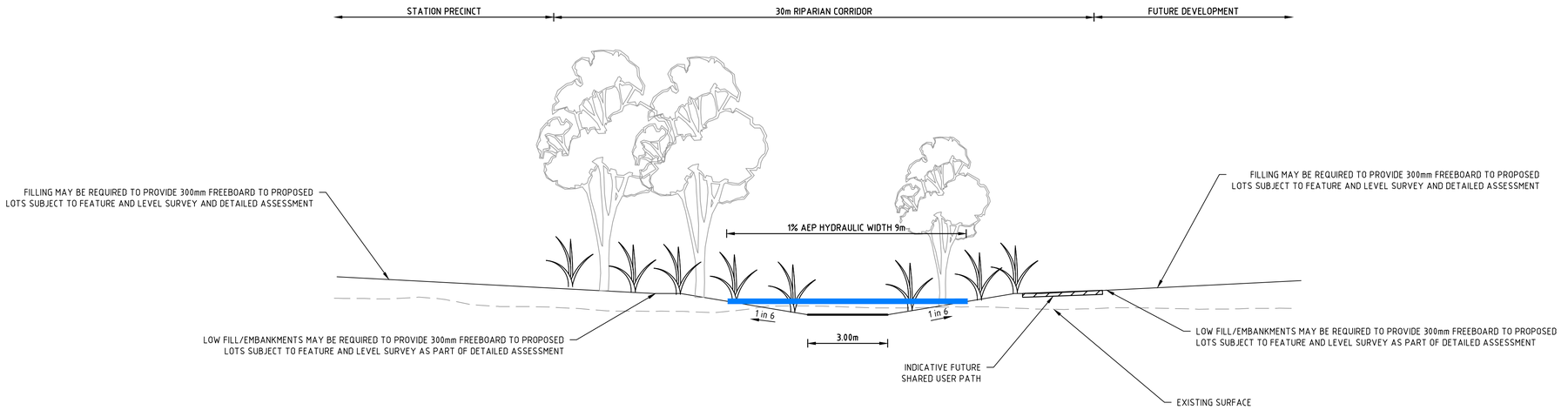

## WLRB03 TYPICAL SECTION

SECTION A

H 1:200 SCALE @ A1 V 1:100

0 2 4 6 8 10

0 1 2 3 4 5




## MARSHALL CREEK - ENHANCED WATERWAY

SECTION B

NOT TO SCALE

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| | | | |
| | | | |
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**

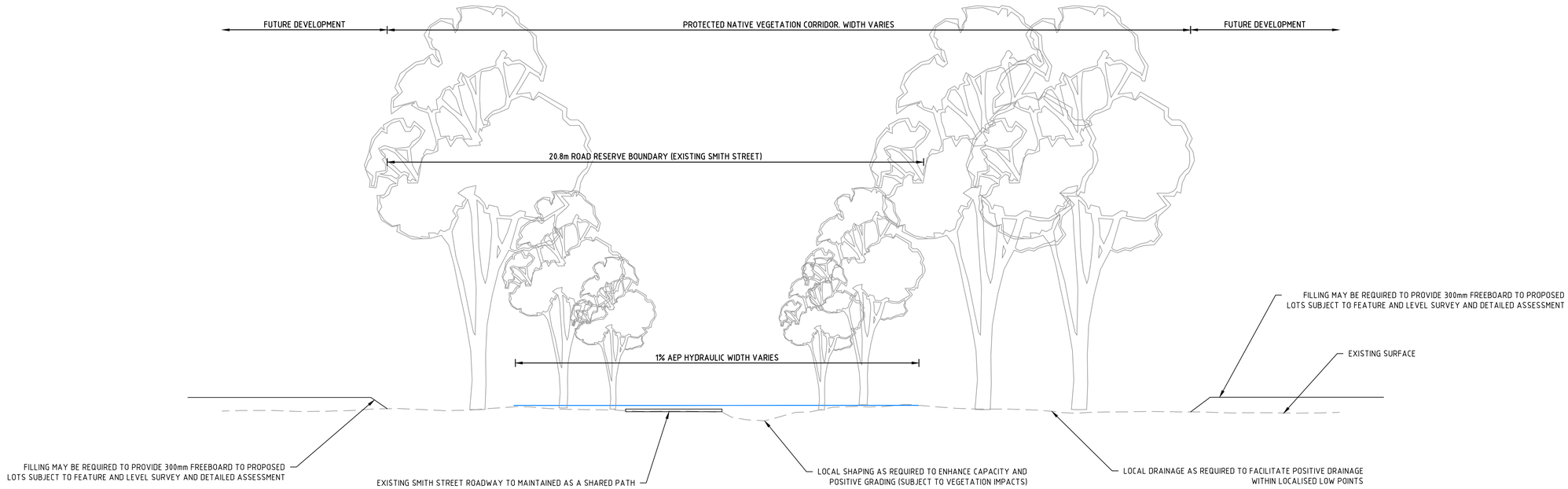
**TYPICAL SECTIONS - SHEET 1**

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CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF440** Rev **D**

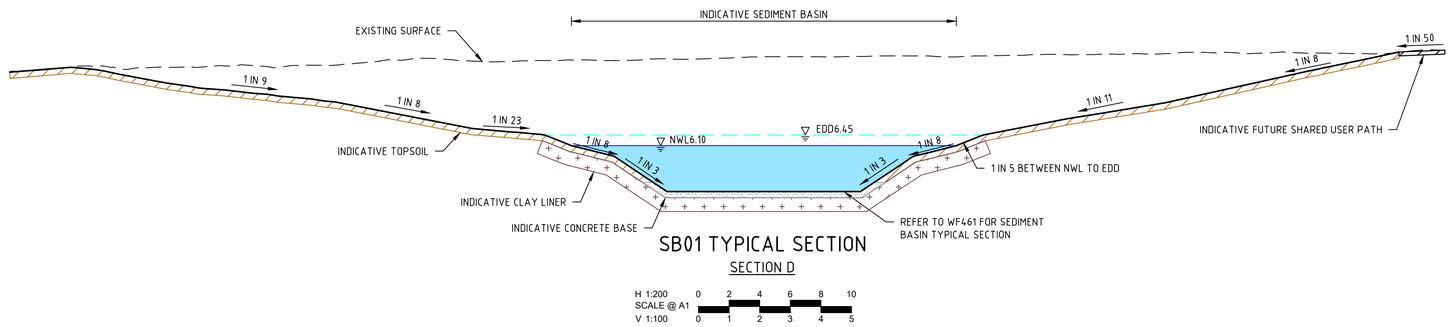
file name: 307575WF410 WF dwg layout name: WF410 plotted by: Georgia Gruszewski
file location: G:\3W\307575\unregarded\arch\ AC AD plot date: 29/12/2022 11:25 AM Sheet of Sheets




MARSHALL CREEK - PROTECTED WATERWAY/GREENWAY

SECTION C

NOT TO SCALE




SB01 TYPICAL SECTION

SECTION D

H 1:200 SCALE @ A1 V 1:100

0 2 4 6 8 10

0 1 2 3 4 5

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

SECTIONS

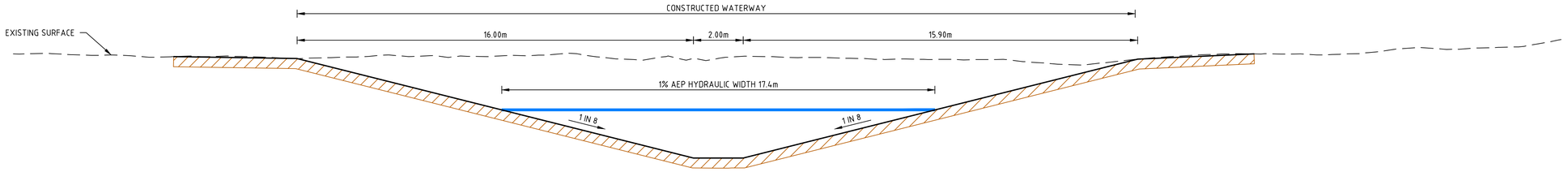
TYPICAL SECTIONS - SHEET 2

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CITY OF GREATER GEELONG

PRELIMINARY Drg No 307575WF441 Rev D

file name: 307575WF440 WF dwg layout name: WF441 plotted by: Georgia Gruszewski
file location: G:\3W\307575\Integrated Water\CAD plot date: 29/12/2022 11:25 AM Sheet of Sheets



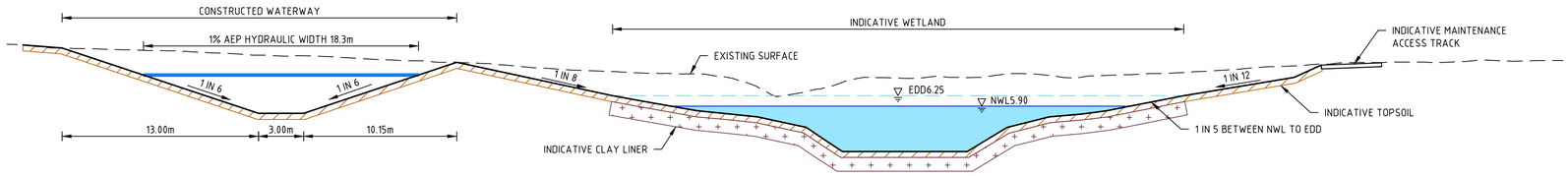

## SB01 WATERWAY TYPICAL SECTION

SECTION E

H 1:100 SCALE @ A1 V 1:50

0 1 2 3 4 5

0 0.5 1.0 1.5 2.0 2.5



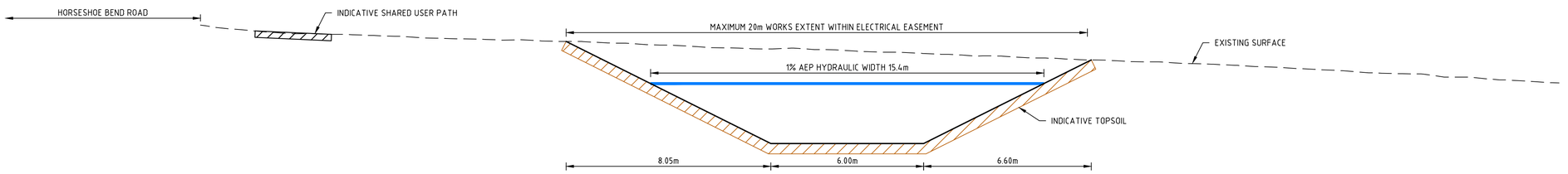

## WL01 TYPICAL SECTION

SECTION F

H 1:200 SCALE @ A1 V 1:100

0 2 4 6 8 10

0 1 2 3 4 5




## WL01 - WATERWAY THROUGH ELECTRICAL EASEMENT

SECTION G

H 1:100 SCALE @ A1 V 1:50

0 1 2 3 4 5

0 0.5 1.0 1.5 2.0 2.5

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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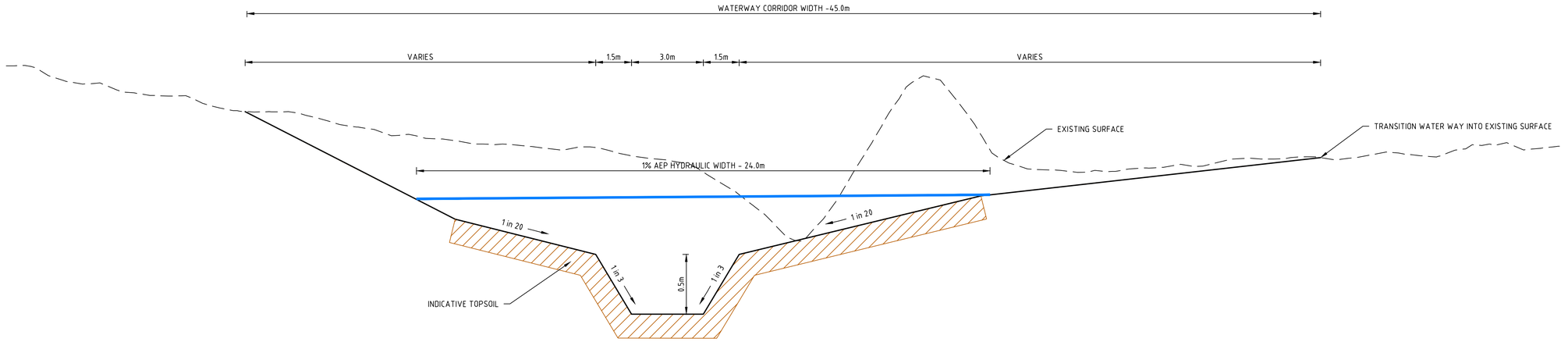
Designed [redacted]
Checked [redacted]
Authorised [redacted](PE0008360)
Date 29-08-22

# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**
**TYPICAL SECTIONS - SHEET 3**
---
CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF442** Rev **D**

file name 307575WF442 WF.dwg layout name WF442 plotted by Georgia Gruszewski
file location G:\30\307575\Integrated Waters\ACAD\ plot date 23/12/2022 11:25 AM Sheet of Sheets



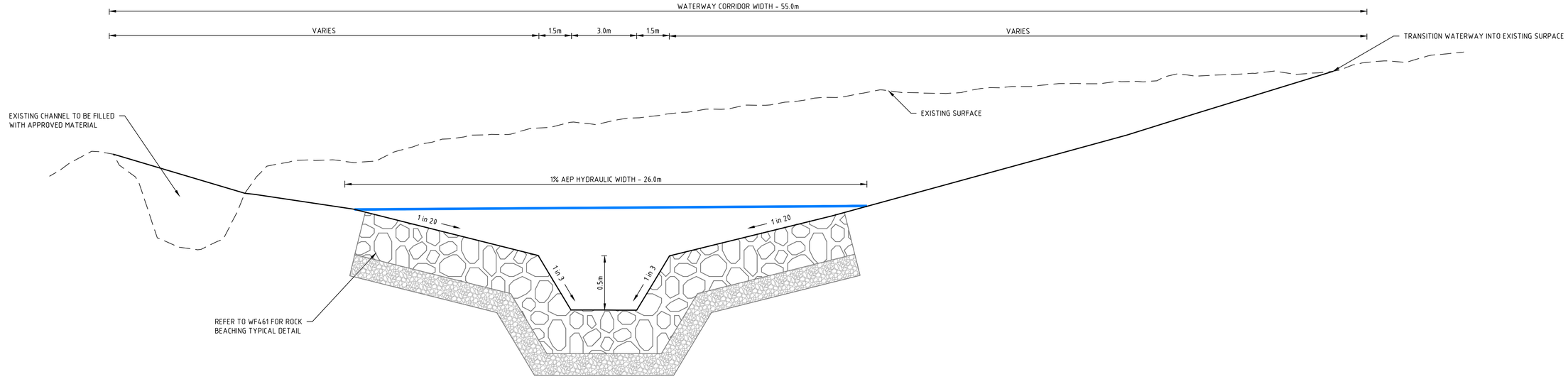

## WATERWAY SECTION - BARWON HEADS ROAD TO TANNERY ROAD

SECTION H

H 1:100 SCALE @ A1 V 1:20

0 1 2 3 4 5

0 0.2 0.4 0.6 0.8 1.0




## WATERWAY SECTION - TANNERY ROAD TO BARWON RIVER

SECTION I

H 1:100 SCALE @ A1 V 1:20

0 1 2 3 4 5

0 0.2 0.4 0.6 0.8 1.0

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**

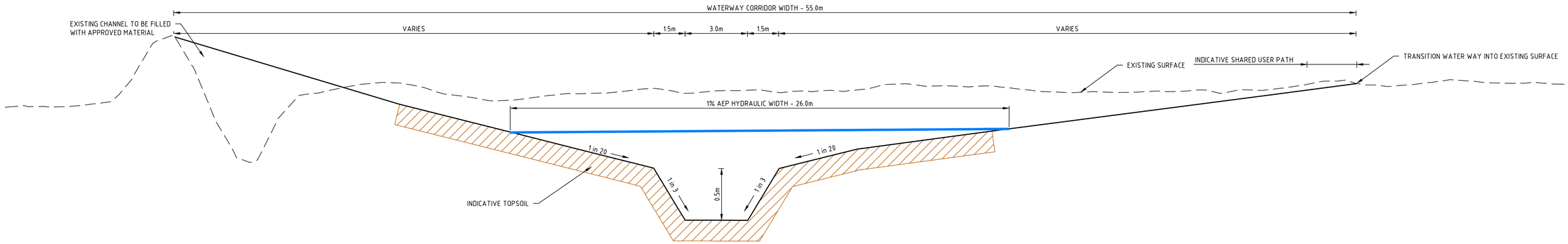
**TYPICAL SECTIONS - SHEET 4**

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CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF443** Rev **D**

file name: 307575WF443 WF dwg layout name: WF443 plotted by: Georgia Gruszewski
file location: G:\3W\307575\Integrated Water\ACAD plot date: 29/12/2022 11:25 AM Sheet of Sheets



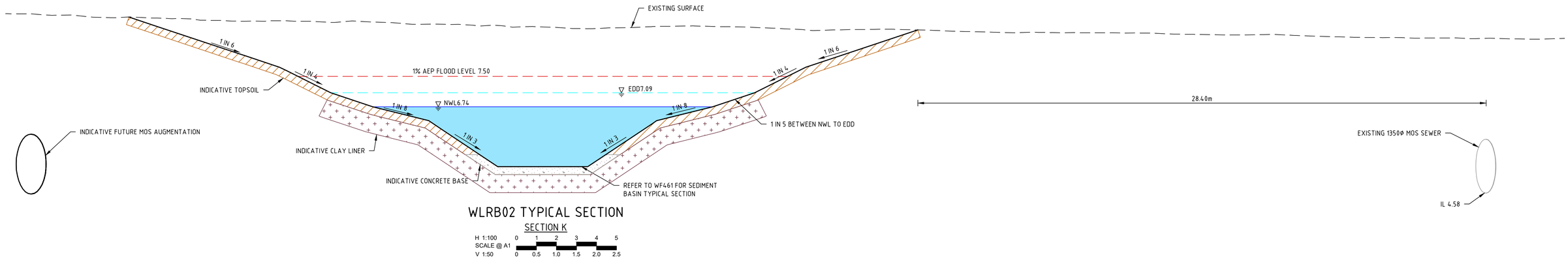

## WATERWAY SECTION - TANNERY ROAD TO BARWON RIVER

SECTION J

H 1:100 SCALE @ A1 V 1:20

0 1 2 3 4 5

0 0.2 0.4 0.6 0.8 1.0




## WLRB02 TYPICAL SECTION

SECTION K

H 1:100 SCALE @ A1 V 1:50

0 1 2 3 4 5

0 0.5 1.0 1.5 2.0 2.5

| Rev | Amendments | Approved | Date |
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| | | | |
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**

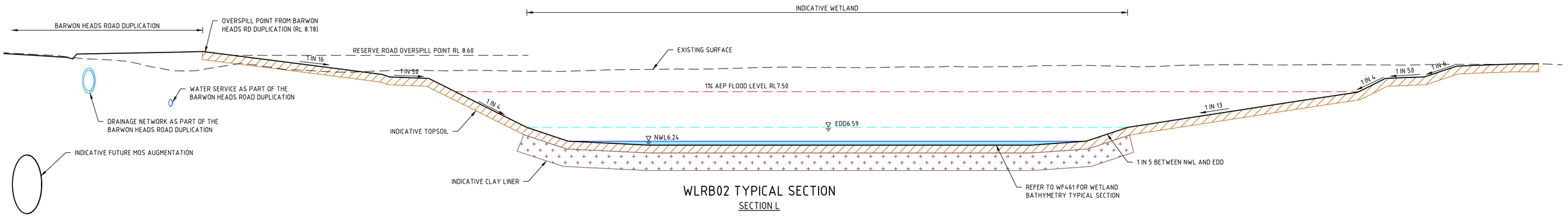
**TYPICAL SECTIONS - SHEET 5**

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CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF444** Rev **D**

file name: 307575WF410 WF dwg layout name: WF444 plotted by: Georgia Gruszecki
file location: G:\314\307575\Integrated Water\ACAD plot date: 29/08/2022 11:25 AM Sheet of Sheets

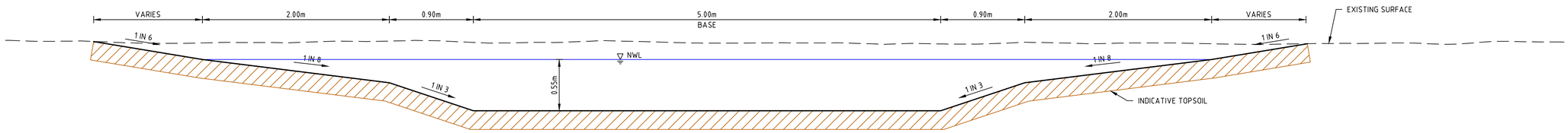



## WLRB02 TYPICAL SECTION

SECTION L

H 1:100 SCALE @ A1
V 1:50

0 1 2 3 4 5
0 0.5 1.0 1.5 2.0 2.5




## WLRB02 OUTFALL CHANNEL TYPICAL POOL SECTION

SECTION M

H 1:25 SCALE @ A1

0 0.25 0.50 0.75 1.00 1.25

| Rev | Amendments | Approved | Date |
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| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
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Date 29-08-22

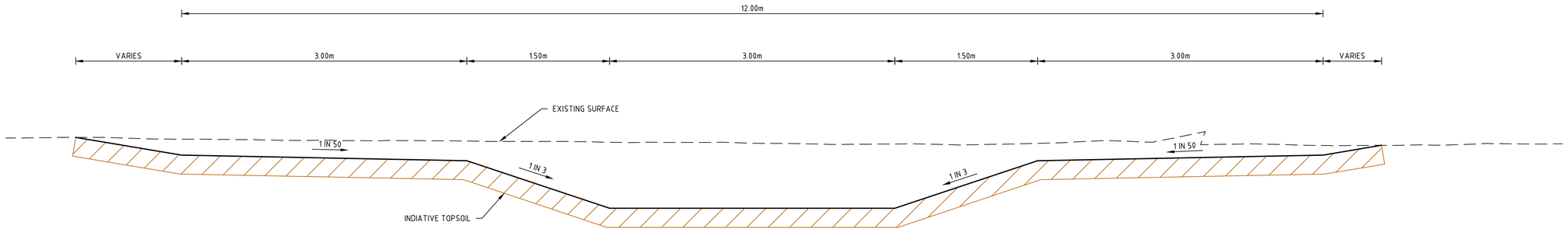
# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**
**TYPICAL SECTIONS - SHEET 6**
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CITY OF GREATER GEELONG

**PRELIMINARY**

Drg No **307575WF445**
Rev **D**

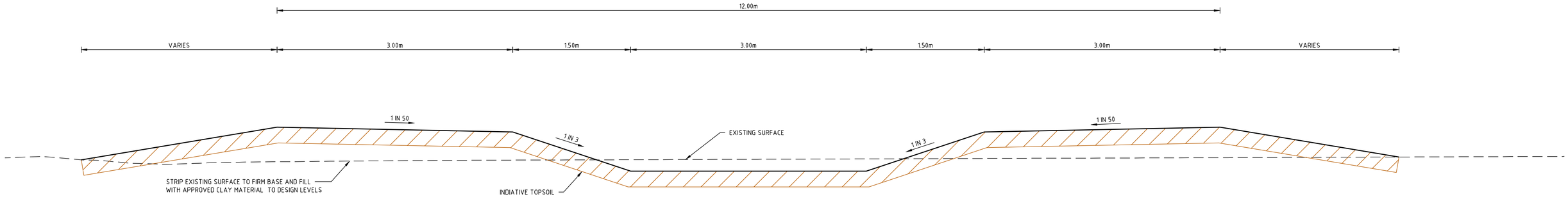
file name: 307575WF410 WF dwg layout name: WF445 plotted by: Georgia Gruszewski
file location: G:\3W\307575\Integrated Water\CAD\ plot date: 29/12/2022 11:25 AM Sheet of Sheets




## WLRB02 OUTFALL CHANNEL - IN CUT

TYPICAL SECTION

H 1:25 SCALE @ A1 0 0.25 0.50 0.75 1.00 1.25




## WLRB02 OUTFALL CHANNEL - IN FILL

TYPICAL SECTION

H 1:25 SCALE @ A1 0 0.25 0.50 0.75 1.00 1.25

| Rev | Amendments | Approved | Date |
|---|---|---|---|
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| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| B | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| A | ISSUED TO COUNCIL | N.G | 26-08-22 |

H 1:200 SCALE @ A1 0 2 4 6 8 10
V 1:100 0 1 2 3 4 5

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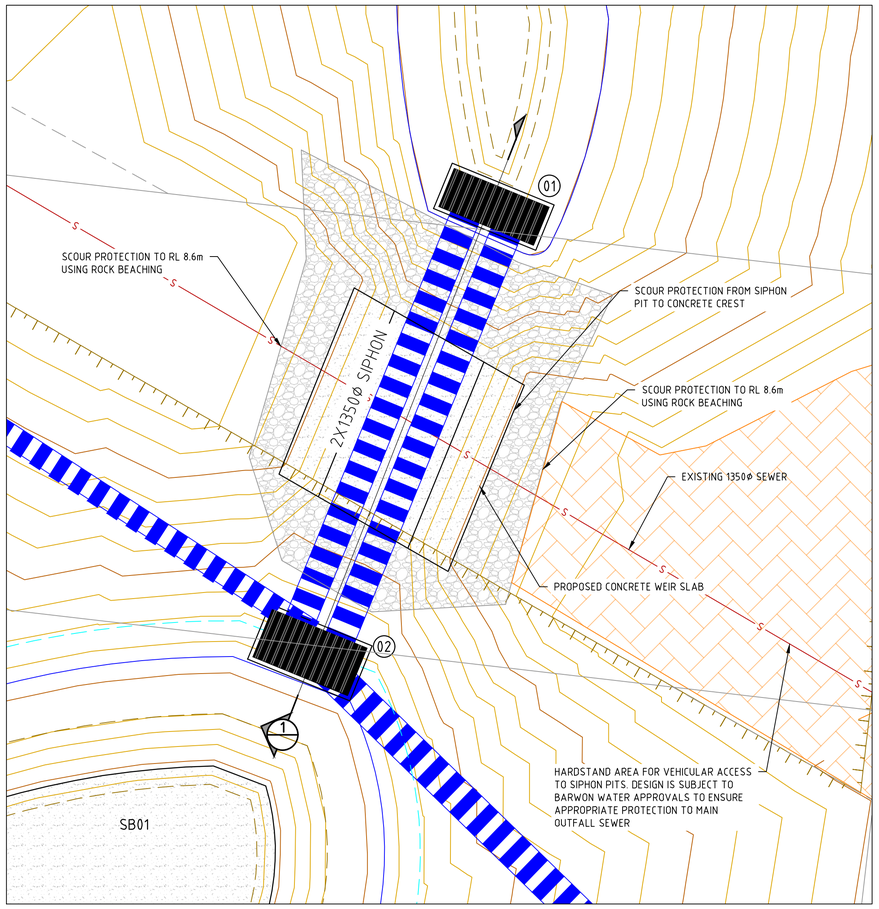
Designed [redacted] Checked [redacted]
Authorised [redacted] (PE0008360) Date 29-08-22

# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

**SECTIONS**
**TYPICAL SECTIONS - SHEET 7**
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CITY OF GREATER GEELONG

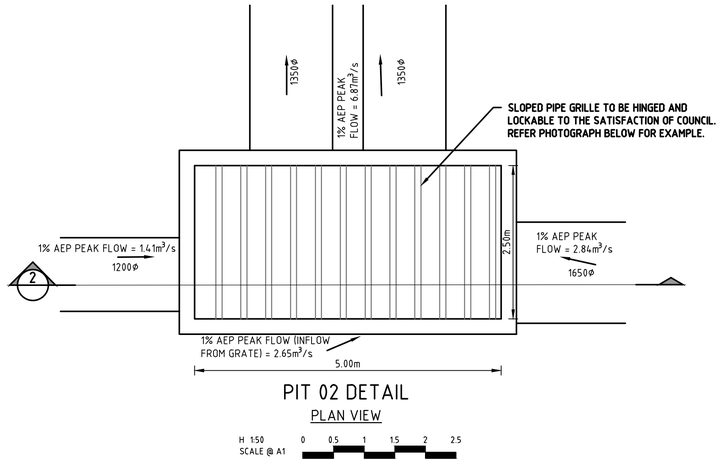
**PRELIMINARY** Drg No **307575WF446** Rev **D**

file name: 307575WF410 WF dwg layout name: WF446 plotted by: Georgia Gruszewski
file location: G:\3W\307575\Integrated Water\CAD plot date: 29/12/2022 11:25 AM Sheet of Sheets




## SIPHON LAYOUT PLAN

H 1:150 SCALE @ A1 0 1.5 3 4.5 6 7.5




## PIT 02 DETAIL

PLAN VIEW

H 1:50 SCALE @ A1 0 0.5 1 1.5 2 2.5

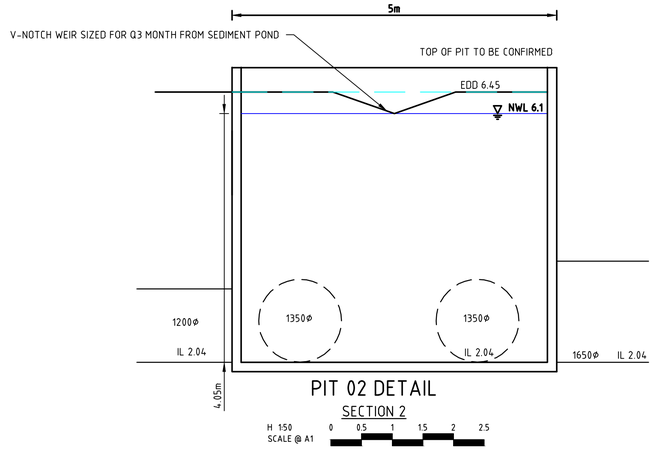
NOTE: ALL DESIGN AROUND MAIN OUTFALL SEWER IS SUBJECT TO BARWON WATER REQUIREMENTS AND APPROVALS

NOTE: LEVELS OF MAIN OUTFALL SEWER SHOWN HERE ARE APPROXIMATES ONLY AND MUST BE PROVEN TO INFORM DETAILED DESIGN



## PIT SLOPING PIPE GRILLE EXAMPLE

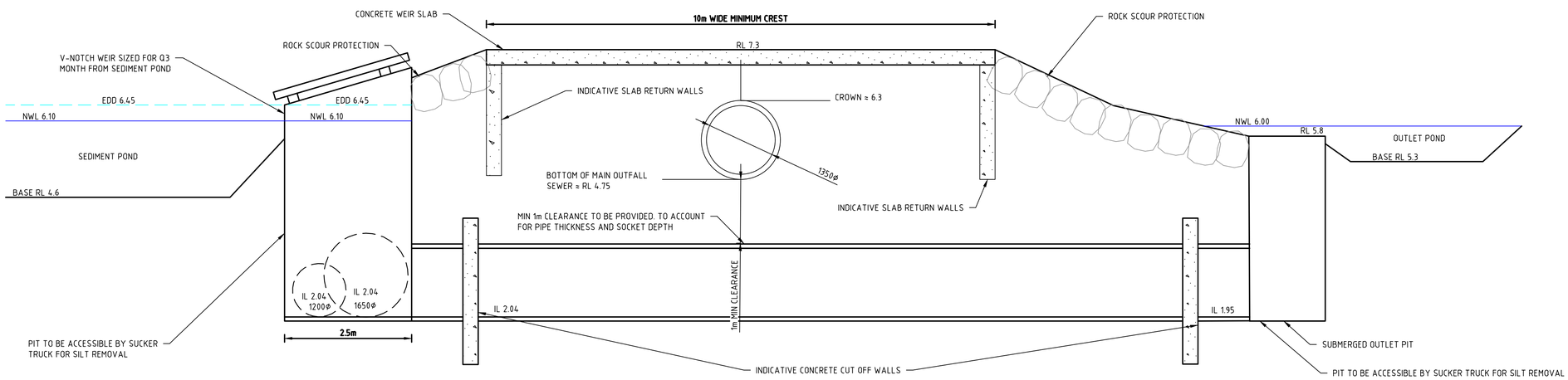
ISOMETRIC VIEW




## PIT 02 DETAIL

SECTION 2

H 1:50 SCALE @ A1 0 0.5 1 1.5 2 2.5




## SEWER SIPHON CROSSING

SECTION 1

H 1:50 SCALE @ A1 0 0.5 1 1.5 2 2.5

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH AND SIPHON DETAIL UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

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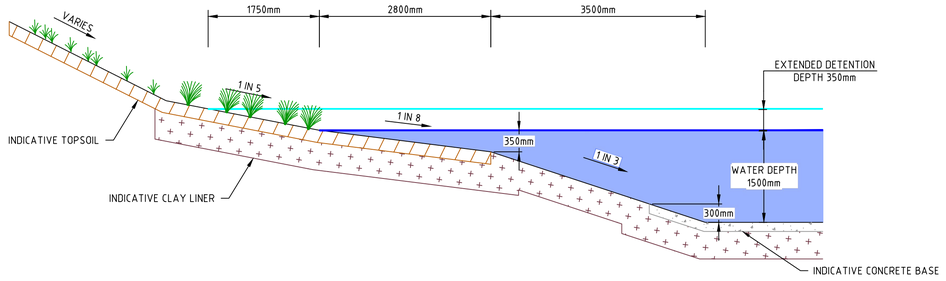
# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

DETAILS
SIPHON DETAIL
---
CITY OF GREATER GEELONG

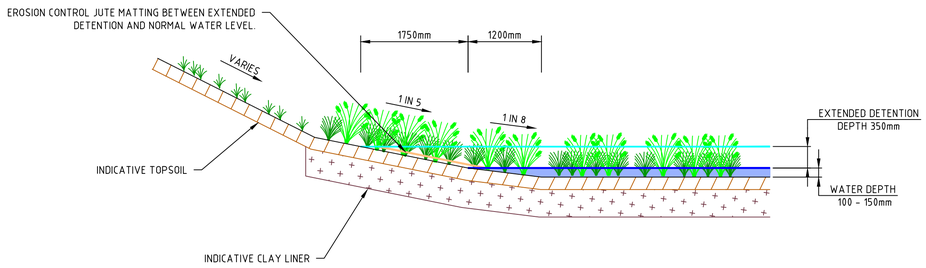
PRELIMINARY

Drg No 307575WF460 Rev D

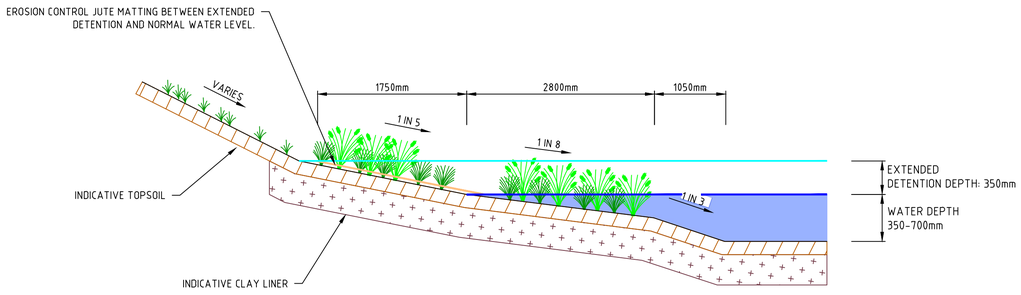
file name 307575WF460 WL dwg layout name WF460 plotted by Georgia Gruszewski
file location G:\3M\307575\Integrated water\CAD\ plot date 23/12/2022 11:25 AM Sheet of Sheets



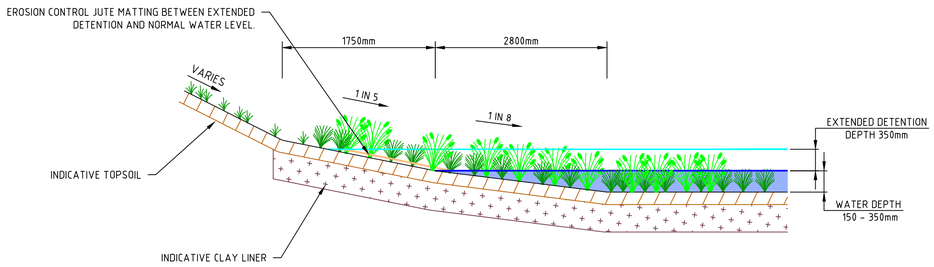

## SEDIMENT BASIN
(SHOWN AT 1500mm DEPTH)



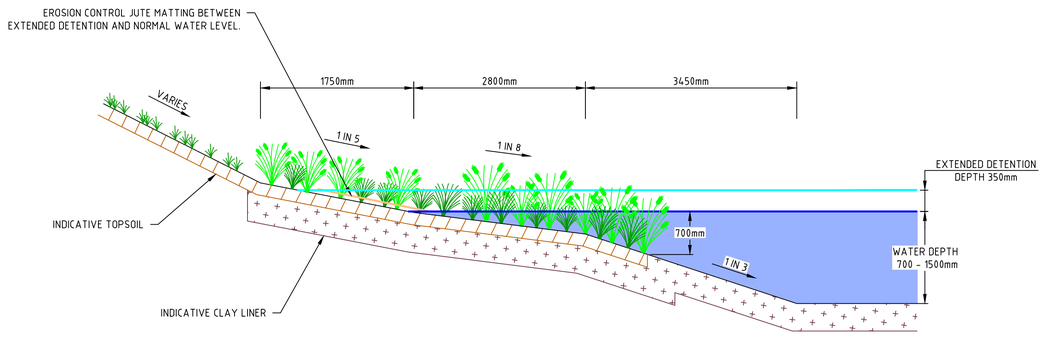

## SHALLOW MARSH (SM)
100-150mm DEPTH
(SHOWN AT 150mm DEPTH)




## SUBMERGED MARSH (DM)
350-700mm DEPTH (SHOWN AT 700mm DEPTH)




## DEEP MARSH (M)
150 - 350mm DEPTH
(SHOWN AT 350mm DEPTH)




## OPEN WATER (OW)
>700mm DEPTH
(SHOWN AT 1500mm DEPTH)

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | SHARED USER PATH UPDATES | N.G | 23-12-22 |
| C | LABELLING SHARED USER PATH - REISSUED TO COUNCIL | N.G | 09-09-22 |
| B | ISSUED TO COUNCIL | N.G | 26-08-22 |
| A | PRELIMINARY ISSUE FOR COMMENT | ---- | 06-09-21 |

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# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN
**DETAILS**
**TYPICAL DETAILS - SHEET 1**
---
CITY OF GREATER GEELONG

**PRELIMINARY** Drg No **307575WF461** Rev **D**

file name: 307575WF469 WL dwg layout name: WF461 plotted by: Georgia Gruszewski
file location: G:\3W\307575\Integrated water\ACAD plot date: 29/12/2022 11:25 AM Sheet of Sheets

# APPENDIX 4

# SELECT RELEVANT AUTHORITY COMMUNICATION

[redacted]

**From:** [redacted]
**Sent:** Wednesday, 17 March 2021 5:02 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Marshall PSP: proposed works around existing Barwon water assets

Hi [redacted],

Comments as follows –

**Siphon Crossing of Main Outfall Sewer:**

- The embankment between the 2 sediment ponds would need to be wide enough to allow safe excavation to the outfall sewer pipe if ever required. The minimum width is to be the minimum distance of either 10 metres, or twice the depth to 500mm below invert level, for sections where duplication of the sewer is not planned, or 20 metres where duplication is planned. We do not want a situation where it is not possible, or extreme construction measures are required to excavate and reach our pipe due to the risk of the embankment failing. Potential widening of the existing BW easement may be required and match in with the required room required.
- If sediment ponds are proposed to have water in them often, we need to understand the saturation zones associated with them. Also need to consider the embedment material of the existing outfall sewer to ensure water does not infiltrate this and change its performance.
- You have mentioned no concrete protection is proposed as we commented on the need to access the pipe. Noted the pipes would be designed to "1% AEP", but would need to ensure the "rare" event of flows overtopping the sewer do not create any heightened risk of washing away the cover over our pipe (noting you have mentioned it is relatively shallow through this section). If this is seen as a risk, maybe concrete protection over the spilling path crossing the sewer would need to be reconsidered?
- The Main Outfall Sewer (MOS) is shown as shallow in this area (sketch provided shows 600mm cover). We believe it may be deeper so encourage you to prove the depth, and only after review of an Activities Method Statement (AMS) before any provings are performed. We can discuss the AMS process in more detail if need be. As well as the design itself, at a later stage BW will need information on how the construction loads are going to be managed over the outfall sewer during any construction works.
- Need to ensure the design and method for installing/ boring the pipe underneath the outfall does not cause any localised settlement, undermining the outfall sewer. This is to be confirmed by geotechnical investigations etc.
- Need to ensure measures are in place to prevent inadvertent damage to the outfall after development (i.e. no vehicle access tracks over the top of sewer other than designated road crossings, and only pedestrian access/ shared user paths, etc. in other locations).

**Retarding Basin WL02**

- In general the MOS sitting under the wetland or any overland flow path is not permitted. Any embankments are to be located with sufficient clearance from the MOS, such that the pipe can be safely excavated (same clearances apply as already mentioned above).
- Our Planners have already made the following comments to CoGG as part of the PSP process, and are still applicable. In summary, those comments made were –

  *It is desirable for the Marshall PSP to be able to progress independently of this potential Main Outfall Sewer relocation. That is:*
    - *It is recommended drainage assets be redesigned to take into account the existing alignment of the sewer.*

- *The current and future alignment of the sewer be shown and some protections placed on this alignment.*
- *Land use be based on the existing alignment.*

**Landscaping**

As there is no planned duplication for most of the MOS through this area, landscaping requirements can include minor vegetation and pathways, so long as the pipeline is within public land. Specifics can be discussed later when landscaping is being planned.

Regards,

[redacted]

[redacted]
Project (Technical) Officer - Urban Growth Areas | Enterprise Project Delivery
**Barwon Water**
T: 03 5226 9159
55 – 67 Ryrie Street (PO Box 659) Geelong VIC 3220
www.barwonwater.vic.gov.au

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**From:** [redacted]
**Sent:** Monday, 1 March 2021 12:02 PM
**To:** Land Development <development@barwonwater.vic.gov.au>
**Cc:** [redacted]
**Subject:** Marshall PSP: proposed works around existing Barwon water assets

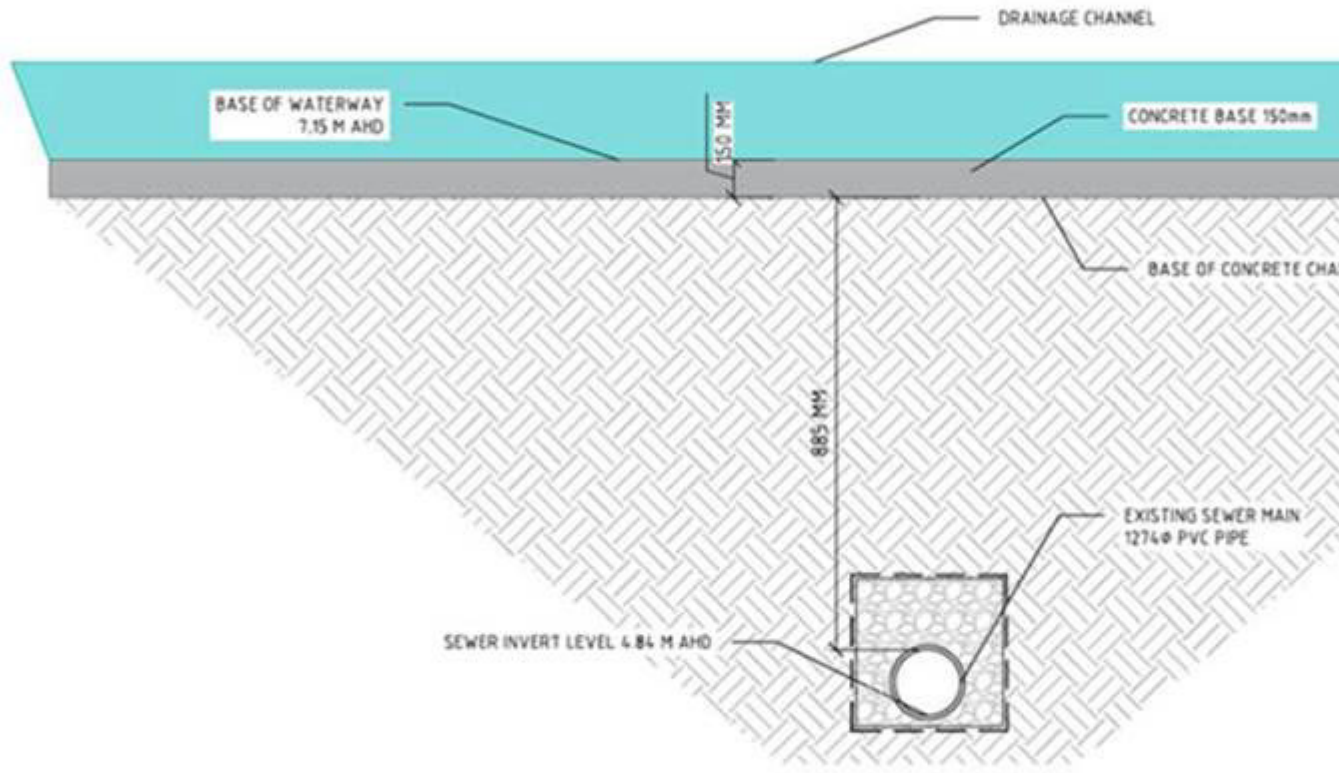
Hi [redacted]

Thank you for our recent meeting with Spiire and Council, regarding the strategic design of a future stormwater drainage system, as part of Marshall Precinct. In summary:

- A draft Stormwater Management Strategy (SWMS) was prepared in 2019 by Alluvium Consulting, and allowed Marshall Creek to be conveyed over the top of the sewer easement – an extract of this report shows this concept proposal.
- A Spiire peer review of the draft SWMS found that the Alluvium concept may not be feasible, due to the requirement for a main stormwater drain from upstream (approx. 1650 dia), which drives down levels. The SWMS concept was also found to require significant filling upstream, and based on these two factors, an alternative sewer crossing arrangement was considered.
- Sheet WC902 on Attachment *307575 – DWG – 05 – V – SWMSREVIEW* shows an alternative arrangement with a sediment pond either side of the trunk sewer. The intent of this arrangement is to provide a sediment pond as part of the water quality treatment train, while providing a mechanism to transfer flows, by a piped siphon arrangement, underneath the sewer (these pipes would be bored).

- Attachment *G004 005 siphon sketch* shows a concept of this arrangement. It was noted during our meeting that Barwon Water would not support a concrete apron above the sewer, as this would prevent future access. Therefore, it is proposed that these siphon pipes would have a 1% AEP capacity, to limit an flows overtopping the sewer to rare events. No concrete protection is proposed.
- Additionally, a sediment basin and wetland, co located within a retarding basin, is proposed in the southeast corner of the Marshall precinct, at the corner of Reserve Road and Barwon Heads Road (refer WL02 on Sheet WC902 - Attachment *307575 – DWG – 05 – V – SWMSREVIEW).* The conceptual engineering details for this asset are currently being development, however, we are aware that Barwon Water are undertaking upgrade works in this vicinity.

We would be grateful if Barwon Water could advise on any conditions or requirements, in relation to the future stormwater drainage works at these two locations. Our intent is to develop a SWMS which fully accommodates all Barwon Water requirements, and provides functional designs which all for these requirements.




Should you require any additional information, please don't hesitate to contact me.

[redacted]

[redacted]
Associate
Integrated Water

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[redacted]

**From:** [redacted] >
**Sent:** Friday, 30 April 2021 3:11 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** Environment notes from Marshall PSP drainage meeting

Hi [redacted]

Nice to meet you today.

As discussed, here is a brief summary of the points raised by Environment today:

- Consideration needs to be given to pipes/trenching/soil disturbance in an adjacent to areas of native vegetation and trees (i.e. indicative pipe shown along Smith Street would result in impacts to mapped native vegetation)
    - Happy to discuss options further as we progress i.e. piping around these patches
- We need to consider the interface with patches on native vegetation to prevent future loss/impacts at the time of development. Suggest the use of buffers (i.e. paths) to ensure we can protect areas to be retained and that we don't find ourselves in on-going debate with encroachment on patches of retention from hard edges of fences/developable land/back of kerb etc
- Environment has noted gilgai in the area, it is important to protect these areas where possible/where vegetation is going to be retained to assist with long term survival and recruitment of native vegetation
- Consideration for the protection or replacement of natural flows in areas, especially where there are Red Gums which require periods of inundation for recruitment/natural regeneration.

If you have any questions please let me know, or we can discuss further on site next week.

Kind regards,
[redacted]

[redacted]
Strategic Environmental Planner
Environment & Waste Department
City of Greater Geelong

[redacted]

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[redacted]

**From:** [redacted]
**Sent:** Wednesday, 2 June 2021 3:41 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Marshall PSP SWMS review

Hi [redacted],

We can support the siphon proposal in-principle. I still have some concerns, mainly around build up of sediment in the pipe which can likely be managed through functional design.

It would be great to get a fairly detailed assessment of sediment transport and build up rates which can inform an expected maintenance regime. I'm assuming this will need cleaning out at various intervals. This can also feed into an assumed blockage factor for the pipe in respect of hydraulic modelling, assuming all flood events happen at the end of maintenance interval periods. Also I assume the pipe entry and exit will be grilled to prevent large objects getting in there.

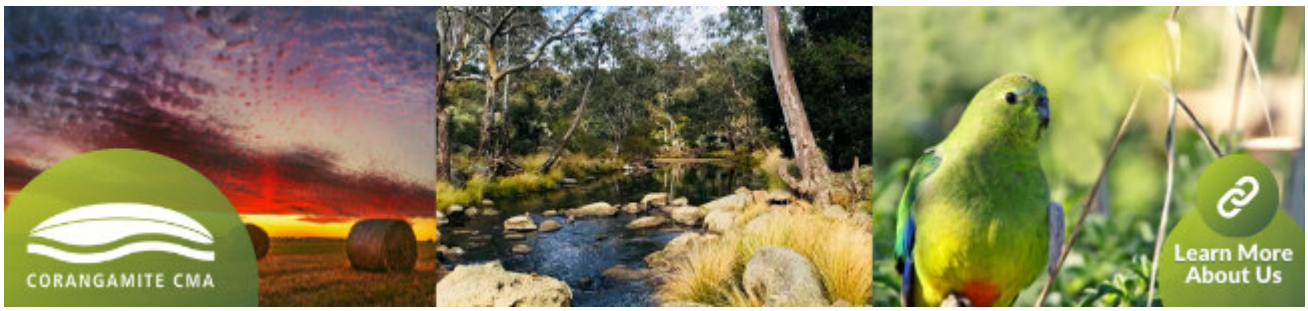
Another thing that should be considered is maintenance method. In an old job I used to clean out a triple interceptor (fun times) and it was helpful to be able to dig out the sludge from under the pipe invert. I'm assuming a 4m deep pit isn't viable for a number of reasons so wondering how this could be maintained/cleaned out in the event of full blockage? Hydro blasting would take a lot of water and a very large pump, for example.

I understand maintenance is primarily a CoGG concern but it would be helpful for all involved if these matters were understood and accepted prior to assuming the siphon will be installed.

I think the other items from the meeting notes memo are a matter for future versions of the SWMS.

Regards,
[redacted]

[redacted]
Project Officer - Floodplains | Corangamite Catchment Management Authority | PO Box 159 (64 Dennis St) Colac VIC 3250.
[redacted]
[redacted]
[redacted]
Web: www.ccma.vic.gov.au




I acknowledge the Traditional Owners of the land on which we work, and pay my respects to their Elders, past, present and future.

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**From:** [redacted]
**Sent:** Sunday, 30 May 2021 2:28 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Marshall PSP SWMS review

Hi [redacted],

Just touching base about this, as Spiire are now progressing this project and will soon be undertaking functional design for the future DCP items as part of the drainage strategy.

If CCMA have any further queries or concerns (please also refer to meeting minutes from a previous email I sent on 20/04/21) about our proposals – would appreciate some prompt advise, otherwise we will proceed on the understanding CCMA has no outstanding queries or concerns.

Thanks [redacted], and feel free to ring if you want to discuss.

Cheers

[redacted]
Associate
Integrated Water

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**From:** [redacted]
**Sent:** Thursday, 22 April 2021 5:04 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** FW: Marshall PSP SWMS review

Hi [redacted],

Following our meeting with Council earlier this week regarding the Marshall PSP drainage strategy, please find attached an information package for your review of the proposed siphon arrangement on Marshall Creek.

Note that this was part of a peer review Spiire did on behalf of Council, so there are some details which are not relevant, however, the bullet point on page 2 of the letter titled “the sewer crossing” describes the reasoning behind the siphon. The supplemented plans and sketches provide additional explanation.

Note the challenge with this system is the drainage outlet under Barwon Heads Road (IL 5.5m) compared with the nearby trunk sewer crossing of Marshall Creek (crown approx. 6.3m, bottom approx. 4.75m).

We are about to commence an update to the strategy, and anticipate that the siphon proposal is the only feasible option. On the proviso that appropriate consideration is given to design, maintenance and longevity of the siphon, we would appreciate if CCMA could advise of In Principal support of this proposed arrangement.

Should you wish to discuss further, please don’t hesitate to contact me.

Cheers, [redacted]

[redacted]
Associate
Integrated Water

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**From:** [redacted]
**Sent:** Tuesday, 19 May 2020 2:54 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** Marshall PSP SWMS review

Hi [redacted],

We have now undertaken our review. Please find attached a summary letter, accompanied with plans and sketches.

Once you have had a chance to review and digest, we can catch up to discuss the next steps.

In the meantime, please get in touch if you require additional information.

Cheers, [redacted]

[redacted]
Associate
Integrated Water

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**From:** [redacted] >
**Sent:** Wednesday, 30 June 2021 3:46 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP
**Attachments:** AusNet Services - Your guide to planting near electricity lines.pdf

Hi [redacted],

Thank you so much for sending through the revised options for the stormwater drainage assets for our review. And apologies for the delay in responding to you, this had to be discussed and investigated internally.

AusNet Transmission Group's preferred option is Option Number 3.

With regard to tree planting on the easement, some planting is permitted on the easement and could be used to provide resilience to the erosion.
I've attached AusNet Services *'AusNet Services - Your guide to planting near electricity lines'* which details what is permitted on transmission easements, with the most relevant information for you being on page 4.

Please let me know if you need any more information.

Kind Regards,

[redacted]
Lines Asset Performance
Asset Management

AusNet services | missionzero

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Level 30, 2 Southbank Boulevard
Southbank VIC 3006 Australia
www.ausnetservices.com.au

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**From:** [redacted]
**Sent:** Friday, 18 June 2021 1:41 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

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Thanks [redacted]

With regards to our challenge in siting a drainage reserve in close proximity/within the Ausnet Easement immediately upstream of Barwon Heads Road, please find attached sketches showing 3 options.

- Option 1 is our preferred option from a stormwater and urban design perspective.
- Option 2 has least impact on the easement, but involves minor works within the tower no go zone
- Option 3 uses a waterway around tower (recognising the tower is moving further to towards Barwon Heads Road). We have shown this as 20m wide maximum, and will be used to convey flows from the wetland to the culverts on BHR. Normally the waterway would be planted to provide resilience to erosion, however, understand that trees aren't desirable under power lines. Another option would be to create a 20m wide max pool through the easement, which is a passive hydraulically (manages erosion risk), and would not require tree planting. The design still needs to be fleshed out, but we are seeking Ausnet's In Principal approval for one of these options.

Apologies in advance for being pushy, but this has now become very urgent for the project - a quick response would be greatly appreciated.

Feel free to call to discuss.

Thanks, [redacted]

[redacted]
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**From:** [redacted]
**Sent:** Friday, 11 June 2021 10:13 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

Morning[redacted],

Please find attached the elevation sketch for our transmission lines traversing the prospective catchment area west of Barwon Heads Rd.

It shows that the transmission lines are well above the 7.6m height limit between our new tower 52A and tower 51.

Let me know if you need further information.

Regards

[redacted]
**Connections Manager – Growth & Future Networks**
**Victoria Connections**

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damien.hale@ausnetservices.com.au
www.ausnetservices.com.au

---

**From:** [redacted]
**Sent:** Wednesday, 9 June 2021 7:32 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

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Hi [redacted]

Further to the below, would it also be possible to provide us with the proposed relocation of pylon? It is our understanding that this is being moved closer to Barwon Heads Road.

Thanks in advance, [redacted]

[redacted]
Associate
Integrated Water

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PO Box 4032 Geelong VIC 3220

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**From:** [redacted]
**Sent:** Wednesday, 9 June 2021 2:02 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

Hi [redacted]

We are currently reviewing the proposed wetland design through the Aunset Easement, immediately west of Barwon Heads Road.

A condition associated with the AST response (attached) is as follows:

*Minimum vertical clearance of 7.6 metres must be maintained between the ground and the transmission conductor in maximum sag conditions.*

We understand that the sag location is proposed to be relocated as part of the Barwon Heads Road duplication works, and therefore request information around levels of the proposed line within the vicinity of the future wetland, given this will change from existing.

Thanks in advance,

[redacted]
Associate
Integrated Water

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**From:** [redacted]
**Sent:** Wednesday, 5 May 2021 10:30 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

Morning [redacted]

Attached is the latest advice by the Land Management Group following review of the sketches provided.

Please review and advise if the drawings/plans can be updated according to the enclosed instructions.

There are also some queries around asset ownership which require some response.

Please contact Linas Spokevicius if you'd like to discuss further details on any of the items mentioned in the response.

Regards

[redacted]
**Connections Manager – Growth & Future Networks**
**Victoria Connections**

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www.ausnetservices.com.au

**From:** [redacted]
**Sent:** Tuesday, 4 May 2021 12:51 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Just following up on this again. How are you tracking with a response?

Regards
[redacted]

**From:** [redacted]
**Sent:** Friday, 23 April 2021 5:10 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

Hi [redacted]

Unfortunately the Easement group have been busy this week on site surveys.

They've advised me that they'll review the new proposed catchment areas and have a response by Friday next week.

Sorry for the delay.

Regards

[redacted]
**Connections Manager – Growth & Future Networks**
**Victoria Connections**

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damien.hale@ausnetservices.com.au
www.ausnetservices.com.au

**From:** [redacted]>
**Sent:** Friday, 23 April 2021 4:55 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

I'm just following up on [redacted] information below. How are you tracking with a response?

regards

[redacted]

100 BROUGHAM ST GEELONG
PO BOX 104 GEELONG VIC 3220 AUSTRALIA
WWW.GEELONGAUSTRALIA.COM.AU




We acknowledge the Traditional Custodians of the land, the Wadawurrung People of the Kulin Nation. We pay our respects to their Elders past and present, Elders in our community and our emerging leaders.

---

**From:** [redacted]
**Sent:** Wednesday, 14 April 2021 11:22 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Proposed stormwater drainage assets - Marshall PSP

Thanks for sending this through [redacted]

We really appreciate the efforts to minimise impact to the easement in that area.

I will have our Land Management team review the sketch as proposed and we will provide feedback by the end of next week.

I don't anticipate any major obstruction to the tower relocation project as a result of the new catchment area east of Horseshoe Bend Rd, however if your work was to proceed, what would be the likely start and end dates for construction?

Our tower works are currently pencilled in for August this year.

Regards

[redacted]
**Connections Manager – Growth & Future Networks**
**Victoria Connections**

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damien.hale@ausnetservices.com.au
www.ausnetservices.com.au

**From:** [redacted]
**Sent:** Tuesday, 13 April 2021 4:53 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** Proposed stormwater drainage assets - Marshall PSP

**CAUTION:** This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Hi there [redacted]

Thanks very much for meeting with us today. As discussed, Spiire are currently preparing a Stormwater Management Strategy (SWMS) for Marshall PSP on behalf of City of Greater Geelong. In summary:

- The stormwater drainage outlet for the future Marshall Precinct is a culvert under Barwon Heads Road,  just to the north of the existing Ausnet easement.
- As this is the drainage outlet for the Precinct, a drainage reserve needs to be provided at this location, comprising a wetland co located and within a retarding basin.
- We propose to align the drainage reserve perpendicular to the easement, as shown on the attached sketch, outside 30m standoffs from existing power poles/pylons (see sketch).
- We propose a sediment pond within the easement to the west of Horseshoe Bend Road, as shown on the sketch. Again, this will be outside the 30m standoffs from existing power poles/pylons.

We would be most appreciative if Ausnet could take a look at this, and confirm that this is acceptable, which will allow us to finalise the SWMS. Note that we have made efforts to limit the impact to the Ausnet infrastructure.

Thanks in advance, [redacted]

[redacted]
Associate
Integrated Water

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[redacted]

**From:** [redacted]
**Sent:** Thursday, 10 February 2022 10:57 AM
**To:** [redacted]
**Subject:** FW: Draft Marshall PSP Informal Submission Response

---

**From:** [redacted]
**Sent:** Thursday, 10 February 2022 10:29 AM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** FW: Draft Marshall PSP Informal Submission Response

Hi [redacted]
See email to [redacted] below.
Regards,

[redacted]
**Co-ordinator Network Planning | Barwon Water**
55-67 Ryrie Street Geelong VIC 3220
T (03) 5226 2328 | M 0410 302 708 | www.barwonwater.vic.gov.au

---

**From:** [redacted]
**Sent:** Thursday, 2 July 2020 12:42 PM
**To:** [redacted]
**Cc:** [redacted]
**Subject:** RE: Draft Marshall PSP Informal Submission Response

[redacted]

Further to our phone conversation I wish to confirm the following items relating to Barwon Water's position on the Marshall PSP:

On the Main Outfall Sewer:

- Confirmation that the relocation of the Main Outfall Sewer is a long term project, and is not required by Barwon Water for many years (i.e. beyond 2030). The driver for this relocation in a shorter timeframe will be works directly over our sewer confluence, just south of Boundary Road.
- Based on the designs we have currently seen for the Barwon Heads Road duplication, the confluence is not impacted and therefore the sewer does not need to be moved for this project;
- A new Bellarine Link from the Surf Coast Highway to Barwon Heads Road is also unlikely to impact the confluence. It is more likely if and when the Bellarine Link continues east towards the Bellarine Highway. i.e. if a future grade separated interchange is proposed this would impact the confluence and require the relocation.
- Given these potentially long timeframes, it is desirable for the Marshall PSP to be able to progress independently of this relocation. That is:
    - It is recommend drainage assets be redesigned to take into account the existing alignment of the sewer.

- The current and future alignment of the sewer be shown and some protections placed on this alignment.
- Land use be based on the existing alignment.

- As per discussion, we confirm that the Main Outfall Sewer relocation costs should not be considered as part of the DCP for this PSP.

On Recycled Water:

- I can confirm that Class A recycled water is able to be provided to the entire precinct. There is also an expectation that it will be mandated for use, as it is throughout the rest of the Armstrong Creek UGA.

On the TGM Servicing Advice

- As discussed in our submission, there are several aspects of the TGM servicing report that have not been interpreted correctly from our advice to them. Our servicing letter provided to TGM (provided to CoGG) did not contain these inaccuracies and as such should be used as the basis for servicing advice. This advice, and our letter can be presented as an addendum at planning panel if required.

Happy to discuss this further or provide additional advice as necessary.

Kind Regards,

[redacted]
**Co-ordinator Network Planning | Barwon Water**
55-67 Ryrie Street Geelong VIC 3220
T (03) 5226 2328 | M 0410 302 708 | www.barwonwater.vic.gov.au

---

**From:** [redacted]
**Sent:** Monday, 15 June 2020 9:08 AM
**To:** [redacted]
**Subject:** Draft Marshall PSP Informal Submission Response

Hi [redacted]

I hope all is going well in this unique times?

Please find attached the the City's response to the Barwon Water informal submission on draft Marshall Precinct Structure Plan (PSP) *(please note: the submission is "informal" only because it has been received before the progression of the Planning Scheme Amendment for the PSP).*

It would be great to organise a phone meeting with you over the next couple of weeks to work through some of the issues, particularly the sewer line relocation funding nexus and the discrepancies between Barwon Waters comments and the comments provided (purportedly by Barwon Water) through a consultant prepared PSP Servicing Plan.

Thanks and I look forward to hearing from you soon,

[redacted]
Senior Strategic Planner
Planning Strategy

City of Greater Geelong

[redacted]

100 BROUGHAM STREET
PO BOX 104 GEELONG VIC 3220 AUSTRALIA

WWW.GEELONGAUSTRALIA.COM.AU







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# MEETING MINUTES

| | | | |
|---|---|---|---|
| **Meeting Title:** | Marshall PSP Stormwater Management Strategy review with CCMA | | |
| **Project Name:** | Marshall PSP | **Project No:** | 307575 |
| **Meeting Date:** | Wednesday, 14 April 2021 | | |
| **Location:** | Virtual meeting | | |
| **Meeting Chair:** | [redacted] | | |

| Attendees | Initials | Organisation |
|---|---|---|
| [redacted] | AD | Spiire |
| [redacted] | MC | CCMA |
| [redacted] | PSc | CoGG |
| [redacted] | PS | CoGG |
| [redacted] | SP | CoGG |
| [redacted] | CN | CoGG |
| [redacted] | AC | CoGG |

| Action | Action By: |
|---|---|
| **1. MARSHALL CREEK CORRIDOR WIDTH** | |
| ▸ AD described how previous advice from CCMA (13th August 2019) stated that clarity on waterway buffer widths was required.<br>▸ MC stated that in this case, it is appropriate to adopt *Melbourne Water Waterway Corridor Guidelines* to determine buffer and corridor widths for Marshall Creek.<br>▸ General agreement that the waterway corridor would comprise riparian zone and buffer zone, including community assets such as shared paths<br>▸ PS pointed out that substantial previous work has gone into the development of a draft PSP layout, including proposed Marshall Creek corridor (currently adopts 20 – 40m corridor) and if possible, corridor widths should be kept within these limits.<br>▸ **(Action) Spiire to undertake waterway corridor assessment as part of SWMS and submit assessment to CCMA for review and approval** | AD |
| **2. BARWON WATER SEWER – PROPOSED SIPHON** | |
| ▸ AD described the existing Barwon Water sewer forming a significant constraint to the proposed stormwater drainage system. Initial assessment suggests an open waterway over the top of the sewer will induce significant filling upstream, as part of future development. Therefore, a siphon arrangement is proposed to negate this filling.<br>▸ MC stated that a siphon is generally only considered when all other options are exhausted. | AD |

| Action | Action By: |
|---|---|
| ▸ **(Action) Spiire to provide CCMA with a background information package, which provides information of the assessment to date. This will also include details on the precedent siphon on Armstrong Creek, as part of the Warralilly development. Following this CCMA to provide advice on whether this arrangement has In Principal support**. | |
| 3. VOLUMETRIC IMPACTS TO DOWNSTREAM REACHES | |
| ▸ Both AC and MC asked whether future increased flow volumes are being considered as part of the SWMS, given possibility of land adjacent to Marshall Creek downstream of Tannery Rd becoming wetter, more frequently. AD advised that nothing specific had been looked at to date, but would investigate as part of the SWMS.<br>▸ **(Action) Spiire to review volumetric impacts to downstream reaches of Marshall Creek as part of SWMS and present back to Council and CCMA** | AD |
| 4. FLOW REGULATION IN MARSHALL CREEK, DOWNSTREAM OF RAIL LINE | |
| ▸ AD described how the flow regime within Marshall Creek, between the rail line and sewer, will need to be maintained such that the health of high value vegetation communities along the creek corridor is not compromised. This is proposed to be achieved by running main drainage pipes along the creek corridor, to the north and south (within adjacent road reserves). Flows from future development will be conveyed to the downstream drainage reserve, effectively by passing Marshall Creek and maintaining existing flow regime.<br>▸ **(Action) Spiire to ensure the SWMS fully considers flow regime through Marshall Creek, together with vegetation health, flow capacity and flood immunity of future development** | AD |
| 5. NORTH EAST INDUSTRIAL PRECINCT | |
| ▸ General discussion was had around the NEIP, which is proposed immediately downstream of Barwon Heads Road. AD highlighted that the NEIP SWMS included a retarding basin online to Marshall Creek, between Barwon Heads Road and Tannery Road. All agreed this should be fully reviewed and considered as part of the Marshall SWMS.<br>▸ (Action) Spiire to review NEIP SWMS and include requirements into Marshall PSP | AD |
| 6. DETRIMENTAL FLOOD IMPACTS | |
| ▸ AD described how broad shallow flooding across Marshall will be partly negated by the diversion of southern external catchments (Horseshoe Bend Precinct) to Sparrovale (as per endorsed SWMS). Remaining flooding across the site will be resolved by an appropriate drainage design, which will ensure no detrimental impacts to the downstream environment. This will be demonstrated through 2D modelling. Therefore, no specific compensatory floodplain storage required. | AD |

| Action | Action By: |
| --- | --- |
| ▸ **(Action) Spiire to provide SWMS will adequately demonstrates no detrimental impact to downstream properties.** | |

# Meeting Minutes

Minutes for internal and external meetings must be recorded using this template.
You may modify this template for your business unit but must retain the key sections below.

**Date:** 24/08/2022 **Time: 12:30 – 1:30pm**

**Location:** Online

**Program:** Regional Rail Revival - Surf Coast Highway to Marshall Station

**Work Package:** N/A

**Title:** PRV/CoGG/Djilang Drainage Update – Surf Coast Highway to Marshall

**Meeting Number:** 4

**Chair:** [redacted]

**Minute Taker:** [redacted]

**CM Record Number:** [RecordNumber]

**Information Security Classification:** **OFFICIAL**

| Attendees (Name, Organisation) | Apologies (Name, Organisation) |
|---|---|
| [redacted], Djilang | |
| [redacted], Djilang | |
| [redacted], CoGG | |
| [redacted], Djilang | |
| [redacted], CoGG | |
| [redacted], Water Technology | |

## Actions – previous

| # | Action | Owner | Due | Status | Update |
|---|---|---|---|---|---|
| 1. | Send through existing condition flows from Spiire hydrology to WPD. | [redacted] | | Complete | RORB flows provided by Spiire on 2/8/2022 |
| 2. | WPD to contract Bellarine Link team (WaterTech) | [redacted] | | Complete | |
| 3. | WPD to send query to CoGG about South Geelong Station hub | [redacted] | | Ongoing | Request sent to CoGG on 11/07/2022. Awaiting response. |
| 4. | Set up next update meeting | [redacted] | 22/7/22 | Complete | Meeting setup for 3/8/2022 |
| 5. | CoGG to send through 3D basin design to Djilang/RPV. | [redacted] | | Complete | Not available |
| 6. | Djilang to provide confirmation on ultimate basin. | [redacted] | Once Djilang are confident | Ongoing | Still working through design |

| # | Action | Owner | Due | Status | Update |
|---|---|---|---|---|---|
| | | | of design for basin | | |
| 7. | Set up next update meeting | [redacted] | End of August | Complete | |

## Key discussion points/decisions

| Who | Description |
|---|---|
| RC | • Welcome and asked for status update from different stakeholders |
| JB | • JB gave an update on the Waurn Ponds Duplication (WPD):<br>– Still working through the design, but looking more likely that WDP won't need the Trifilos basin at all. Currently the design is maintaining the existing flows as close to existing within the existing drain around the existing farm dam. As design is still progressing, things could still change. Therefore WPD design shouldn't constrain Bellarine Link or Marshall PSP works.<br>– Noted that a diversion of Trifilos drain is required due to Barwon water main works. Previous design iterations had drain crossing future Bellarine Link corridor, but based on latest Bellarine Link design, this would lead to potential clashes and also unacceptable flood impacts to private properties. Currently proposing to utilise a swale that has been built to facilitate construction of the Barwon water main. This temporary swale could be maintained until Bellarine Link is built.<br>– Timing of WPD works – associated design packages progressing to Final Design in the next 3-4 weeks<br>– Draft flood report to be issued to CCMA end September<br>– Flood mitigation measures are subject to approval from CCMA<br>• JB had additional questions<br>– Have CoGG reviewed the base case flood modelling report and is there an expectation that CoGG receive the design flood modelling report. PS/RC – not sure. RC to check stakeholder engagement schedule and respond to JB<br>– Property on Barwon Terrace, west of rail corridor. There is a channel that runs along the property boundary, and appears to be sitting partially in private property and partially in the rail corridor. Is channel subject to an easement? MW noted the CoGG GIS showed an easement. Asked JB to send through details to CoGG and will respond with property details |
| JT | • Not much progress on Bellarine Link. No update for area around Reserve Rd that is of interest to all 3 parties. Noted that report was provided 6-8 weeks, now been asked to update.<br>• Asked if there are any linear basins between SCH and Reserve Rd as part of the WPD design.<br>– JB - No linear basins between SCH and Reserve Rd, only replicating existing channels/drains |
| PS | • Spiire will provide final Marshall PSP 9 September 2022<br>• Asked about Marshall station precinct consultation through Engage Victoria. RC – not aware of Engage Victoria, will need to check what consultation is being undertaken.<br>• If WPD no longer propose to convert the Trifilos farm dam into a formal basin, will WPD still be acquiring the land around the basin? RC – not sure, will need to check with property acquisition team. Depends on what the original context/agreement was for needing to acquire the property, apart from drainage. |
| RC | • Suggested another meeting at the end of the September to finalise |

## Actions – new

| # | Action | Owner | Due | Status | Update |
|---|---|---|---|---|---|
| 1. | Set up next update meeting | [redacted] | Middle/end of September | | |

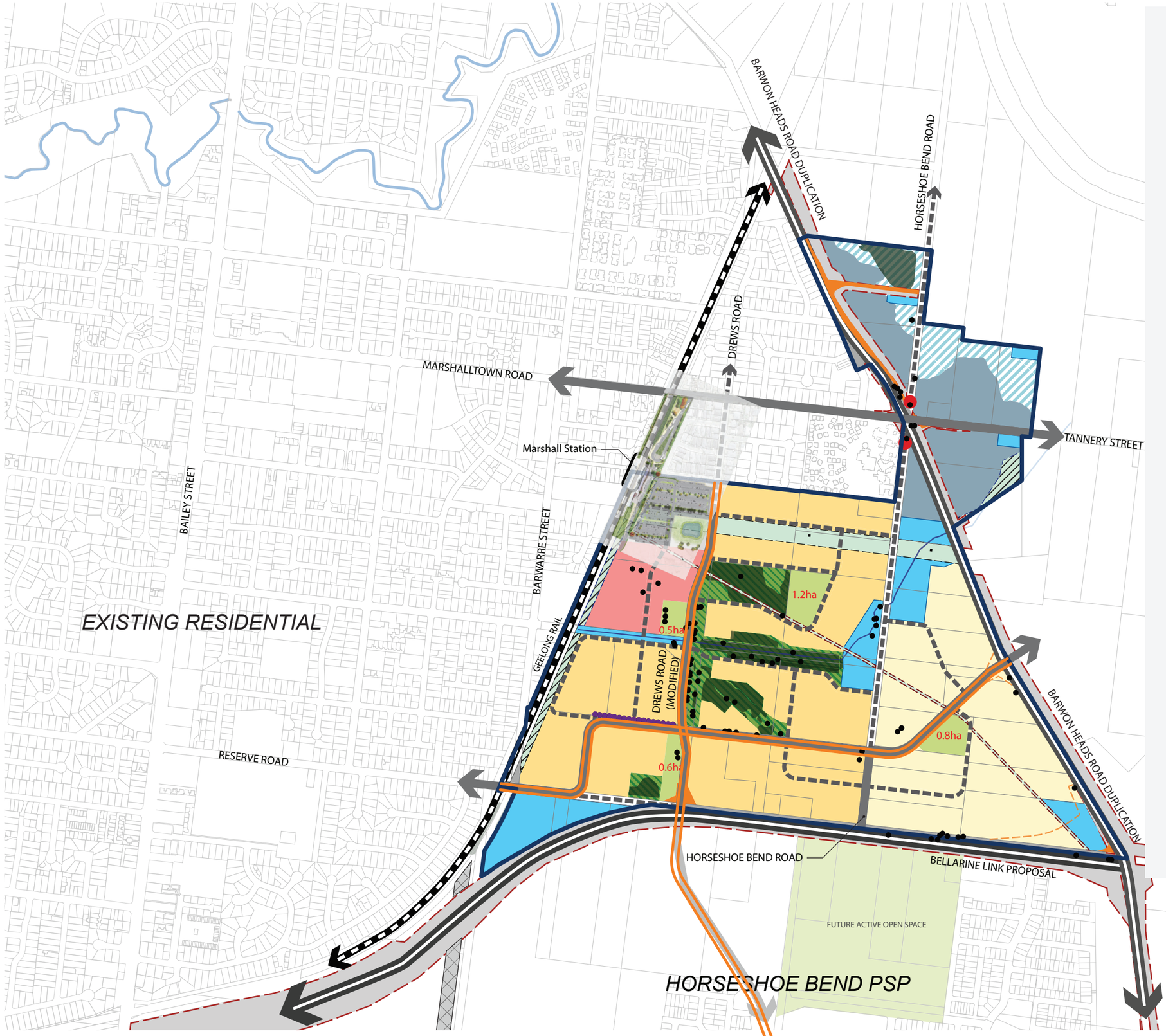
| # | Action | Owner | Due | Status | Update |
|---|---|---|---|---|---|
| 2. | WPD to send query to CoGG regarding drainage easement through private property | [redacted] | 26/08/2022 | | |
| 3. | Update on property acquisition at Trifilos basin | [redacted] | Next meeting | | |
| 4. | Follow up on Marshall station consultation through Engage Victoria | [redacted] | | | |

***Note:*** *A minute-taker must be nominated before each meeting and take responsibility for:*

- *recording key points, agreed outcomes, and action items (hardcopy or electronic)*
- *saving the completed record to an appropriate electronic file part*
- *placing any hardcopies on the file part as required.*

# APPENDIX 5

# FUTURE URBAN STRUCTURE




## LEGEND

- Precinct Boundary
- Standard Residential
- Medium Density Residential
- Transport Hub
- Station Precinct
- Commercial/Bulky Goods
- Credited (Unencumbered) Open Space
- Conservation
- Character Tree to be Retained
- Native Vegetation to be Protected
- Vegetation Area (Newly Mapped)
- Waterway / Drainage Line
- Drainage Reserve
- Central Waterway
- Railway and Station
- PAO (Public Acquisition Overlay)
- Arterial Road Projects Area
- Arterial Road Intersection Extent (Including Proposed Access Road)
- Potential Arterial Road Duplication Extent
- Road Truncation (Barwon Heads Road Duplication Project)
- Armstrong Creek Transit Corridor
- Main Outfall Sewer Easement
- Barwon Water Easement
- Electricity Easement and Transmission Tower
- Proposed FO (Flood Overlay)
- Arterial Road
- Connector Street
- Key Local Street (Widths Vary)

CITY OF GREATER GEELONG

# MARSHALL FUTURE URBAN STRUCTURE OPTION H

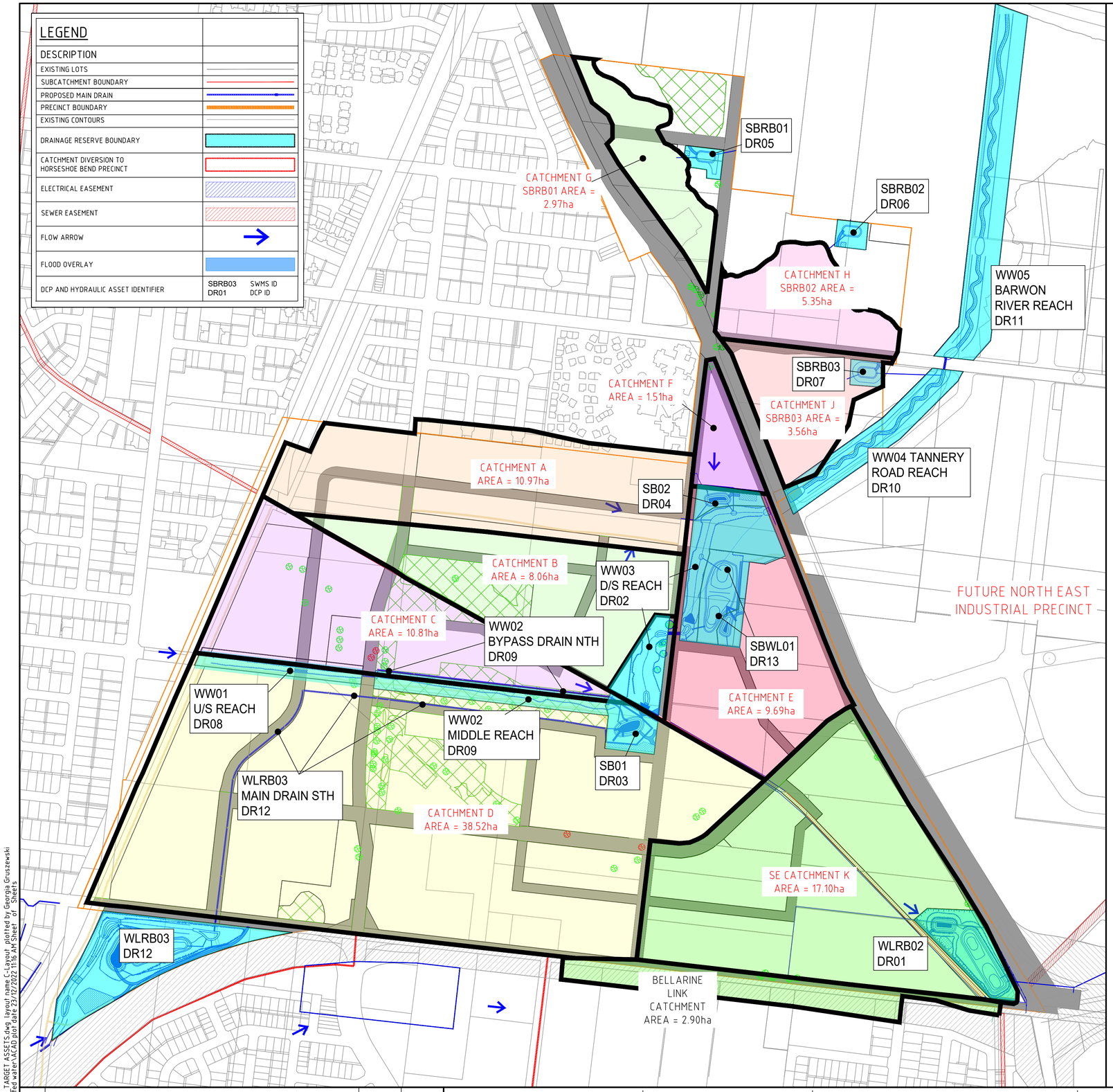
PROJECT NO.: **PRJ-16-1158** REVISION: **01** DATE: **15.06.2022** DRAWN BY: **PL**

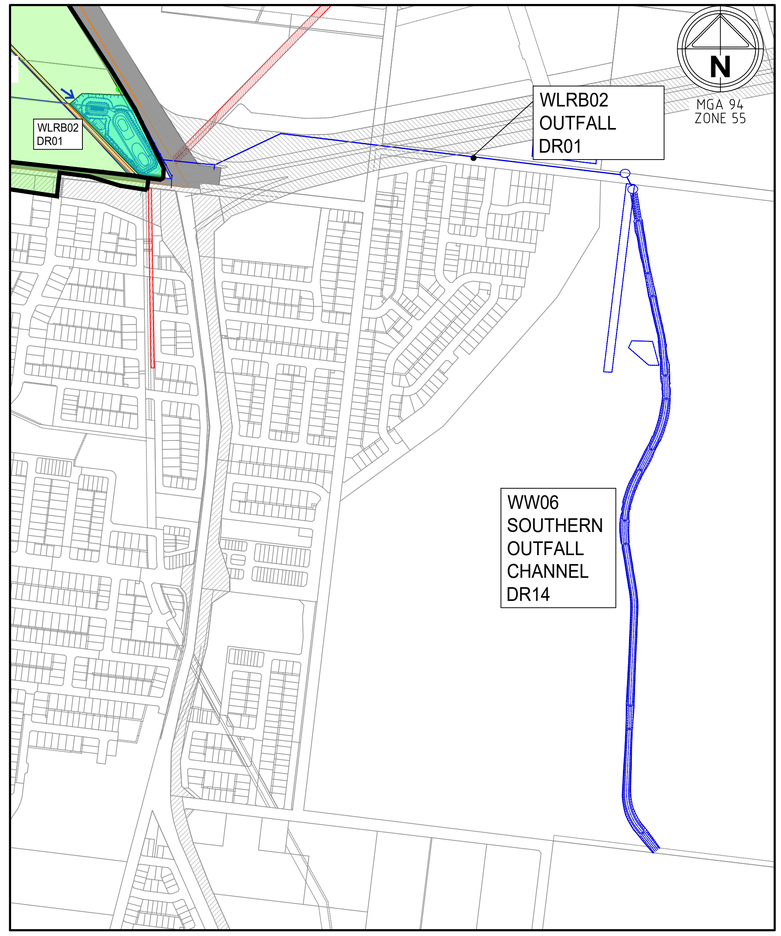
0 100m 200m 400m

# APPENDIX 6

# STAGING AND IMPLENTATION PLAN

| LEGEND | |
|---|---|
| DESCRIPTION | |
| EXISTING LOTS | |
| SUBCATCHMENT BOUNDARY | |
| PROPOSED MAIN DRAIN | |
| PRECINCT BOUNDARY | |
| EXISTING CONTOURS | |
| DRAINAGE RESERVE BOUNDARY | |
| CATCHMENT DIVERSION TO HORSESHOE BEND PRECINCT | |
| ELECTRICAL EASEMENT | |
| SEWER EASEMENT | |
| FLOW ARROW | |
| FLOOD OVERLAY | |
| DCP AND HYDRAULIC ASSET IDENTIFIER | SBRB03 DR01 SWMS ID DCP ID |




## STAGING AND IMPLEMENTATION TABLE

| CATCHMENT DELIVERY AREA | ASSET DELIVERY TRIGGER | DESCRIPTION | DCP INCLUDED | COMMENTS |
|---|---|---|---|---|
| Catchment A | SB02 - DR04 | Sedimentation Basin & connnection to BHRD culvert | Yes | |
| | WW03 - DR02 (Part) | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment B | SB02 - DR04 | Sedimentation Basin & connnection to BHRD culvert | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment C | SB01 - DR03 | Sedimentation Basin & connnection to Waterway | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW02 - DR09 (Part) | Waterway/path & Main Drain North Outfall | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW01-DR08 | Outfall & enviro flow, Waterway enhance and path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment D | SB01 - DR03 | Sedimentation Basin & connnection to Waterway | Yes | |
| | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW02 - DR09 | Major U/G SW & waterway/path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW01 - DR08 | Outfall & enviro flow, Waterway enhance and path | Yes | Permit SWMS to confirm extents required for flood protection |
| | WLRB03 - DR12 | Wetland/Retarding basin & Main Drain South Outfall | Yes | |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment E | WW03 - DR02 | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | SBWL01 - DR13 | Sedimentation Basin & Wetland | Yes | |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment F | SB02 - DR04 | Sedimentation Basin & connnection to BHRD culvert | Yes | |
| | WW03 - DR02 (Part) | Conveyance and connection to ex BHRD culverts | Yes | Permit SWMS to confirm extents required for flood protection |
| | WW04-DR10 & WW05-DR11 | Waterway Outfall Control | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| Catchment G | SBRB01 - DR05 | Sedimentation / Retarding Basin and outflow | Yes | |
| Catchment H | SBRB02 - DR06 | Sedimentation / Retarding Basin and outflow | Yes | |
| Catchment J | SBRB03 - DR07 | Sedimentation / Retarding Basin and outflow | Yes | |
| | WW04-DR10 & WW05-DR11 | Waterway Control through NEIP | Yes | Triggered when 57ha Marshall PSP is developed (50% contributing catchment) |
| SE Catchment K | WLRB02 - DR01 | Wetland Retarding basin and outfall pipe | Yes | |
| | WW06 - DR14 | Waterway Outfall Control | Yes | Triggered upon the first subdivision within SE Catchment K to the satisfaction of the responsible authority |

NOTE - MODELLING FOR DELIVERY OF INDIVIDUAL CATCHMENTS HAS NOT BEEN CONDUCTED. TARGET DELIVERY ITEMS IN ABOVE TABLE ARE ESTIMATED AND WILL NEED TO BE VERIFIED WITH DETAILED STORMWATER MANAGEMENT STRATEGIES FOR EACH DEVELOPMENT.

| Rev | Amendments | Approved | Date |
|---|---|---|---|
| D | IMPLEMENTATION TABLE UPDATED | N.G | 23/12/22 |
| C | IMPLEMENTATION TABLE UPDATED | A.D | 29/11/22 |
| B | SBWL01 COMBINED & STAGING & IMPLEMENTATION PLAN UPDATED | A.D | 21/11/22 |
| A | ISSUED FOR APPROVAL | A. D | 09/09/22 |

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Designed [redacted] Checked [redacted]
Authorised [redacted] (PE0008360) Date 09/09/2022

# MARSHALL PRECINCT STRUCTURE PLAN CONCEPT DESIGN

## CATCHMENT PLANS
## DCP - STAGING AND IMPLIMENTATION PLAN

CITY OF GREATER GEELONG

PRELIMINARY Drg No WF400-WG-DCP Rev D

file name 307575_WG-DEVELOPED_TARGET ASSETS.dwg layout name C-Layout plotted by Georgia Gruszewski
file location G:\307575\Integrated water\ACAD plot date 23/12/2022 11:16 AM Sheet 1 of 1 Sheets