Member of the Surbana Jurong Group

Technical Memorandum

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Attachments	n/a		

1. Introduction

SMEC has been engaged by the Queensland Government, through the Department of Housing, Local Government, Planning and Public Works (DHLGPPW) to undertake the design of the Bundaberg East Levee (BEL) wall, large flood gates and pump station to protect East Bundaberg from flooding.

The proposed Bundaberg East Levee site is located in an urban, residential, and mixed-use area adjacent to the southern bank of Burnett River in Bundaberg, Queensland and comprised of two levee wall sections.

The project site is bounded by Walla Street to the west, Bourbong Street and Cran Street to the South, Bundaberg Sugar Mill to the east, and the Burnett River to the North.

The levee will protect the central business district and residential areas from Burnett River flooding, intersecting Saltwater Creek on the western section of the levee and Distillery Creek on the eastern section of the levee near the Bundaberg Sugar Mill site, as illustrated in Figure 1-1.

Figure 1-1: Indicative Levee Alignment.

2. Purpose of This Report

The purpose of this report is to produce a concept level stormwater management plan to inform adequate information for an initial drainage design. A drainage strategy is proposed for local catchments intercepted by the levee.

3. Assumption and Risks

- The design is based on the available LIDAR data and the proposed design is conceptual. The detail design has not been conducted yet.
- Existing underground stormwater network will be maintained where it does not clash with the construction of the levee.
- The existing stormwater network obtained from existing council GIS data does not contain invert level information and the assessment is based on this GIS data only. Furthermore, the alignment of some pipes in the dataset were incorrect, engineering judgement has been applied to connect pits in a logical manner based on the terrain.
- This investigation has only considered drainage assets and required relocations. Other services and assets will be considered as part of the detailed design process.

4. Reference Documents

- LIDAR contour obtained from ELVIS by ICSM
- QUDM – Queensland Urban Drainage Manual
- Stormwater Management Guidelines – Part 1 – Stormwater Quantity Assessment by Bundaberg Regional Council
- Stormwater Management Guidelines – Part 2 – Stormwater Quality Assessment by Bundaberg Regional Council
- Water Futures Bundaberg – Bundaberg East Level by James Davidson Architect
- State Planning Policy 2017 - Appendix 2 – Stormwater management design objectives

5. Design Criteria

The Stormwater Management Plan has been completed as per the standard design criteria provided in Bundaberg Regional Council Stormwater Management Guidelines. Key design criteria are outlined in Table 5-1.

Table 5-1: Key Design Criteria.

Item	Criteria
Open drain design event	10% AEP
Drainage pipe design event	10% AEP
Cross drainage	2%
Climate Change factor	20%
Coastal boundaries	0.8m increase in sea level (MHWS = 1.16m AHD)
Pollutant load reduction target	Total suspended solids -85% Total Phosphorus = 60% Total Nitrogen = 45% Gross pollutant = 90%
Peak 63% AEP design discharge	Limit to pre-development peak 63% AEP discharge

We note that for this stage of the Stormwater Management Plan, only conceptual design of stormwater diversions have been completed to identify approximate layout and scope of works required to address the impacts of the levee on existing local stormwater drainage systems. No hydrologic or hydraulic analysis has been completed to determine pipe or swale sizing for these works. A more detailed assessment will be completed during the next phase of design to ensure that there is no material worsening to any part/s of State-controlled roads, particularly during events where the levee is no required / flood gates shut.

Proposed drainage solutions for some catchments involve discharging to the creeks adjacent to the levee. Proposed flood gates at Saltwater Creek and Distillery Creek will engaged during a Burnett River (regional) flood event with associated pump stations utilised to manage the adverse impacts of backwater within the levee protected local catchment.

6. Drainage Design

The levee spans over several local catchment boundaries. There are a total of 12 local catchments which the levee alignment interacts with. The layout and extent of each of the catchment boundaries are shown in Figure 6-1 below.

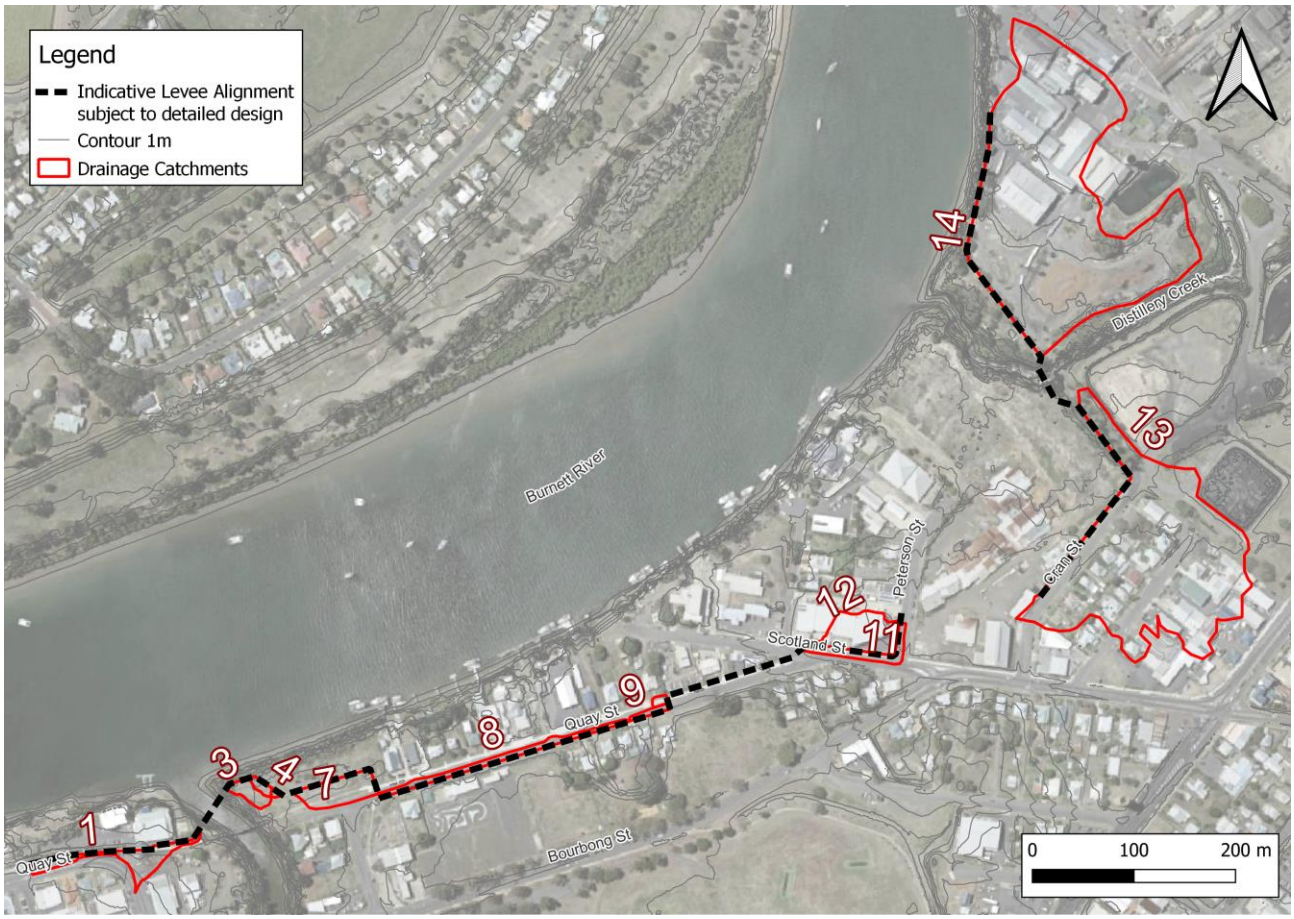

Figure 6-1: Drainage Catchments.

A summary of key catchment details is shown in Table 6-1.

Table 6-1: Drainage Catchment Details.

Catchment ID	Area (m^2)	Fraction Impervious (%)
1	1,748	80
3	607	5
4	61	5
5	217	5
7	1,831	15
8	1,323	100
9	220	100
10	134	100
11	1,005	100
12	2,497	100
13	27,129	80
14	38,038	60

6.1 Catchment 1

The levee is located between the existing footpath on the south and a Rowers building area on the north. The levee blocks the existing surface runoff path from the south to the north.

The preliminary design process has indicated that this levee may be either permanent or temporary. Notwithstanding, it is proposed that the existing pipe and culvert be maintained through the levee. A non-return value / gate is currently proposed.

A swale spoon drain is proposed in front of the levee on the south side to direct flows along the levee towards the existing pit and culvert and down to Saltwater Creek. .. Rock beaching may be required where flows are now being channelised at the downstream end of the swale towards the river and creek in order to avoid erosion (allow for approx. 2x2m rock apron).

The concept drainage design layout for Catchment 1 is presented in Figure 6-2. It is proposed that the design will be refined during later stages to ensure that no material worsening to Quay St and Toonburra St.

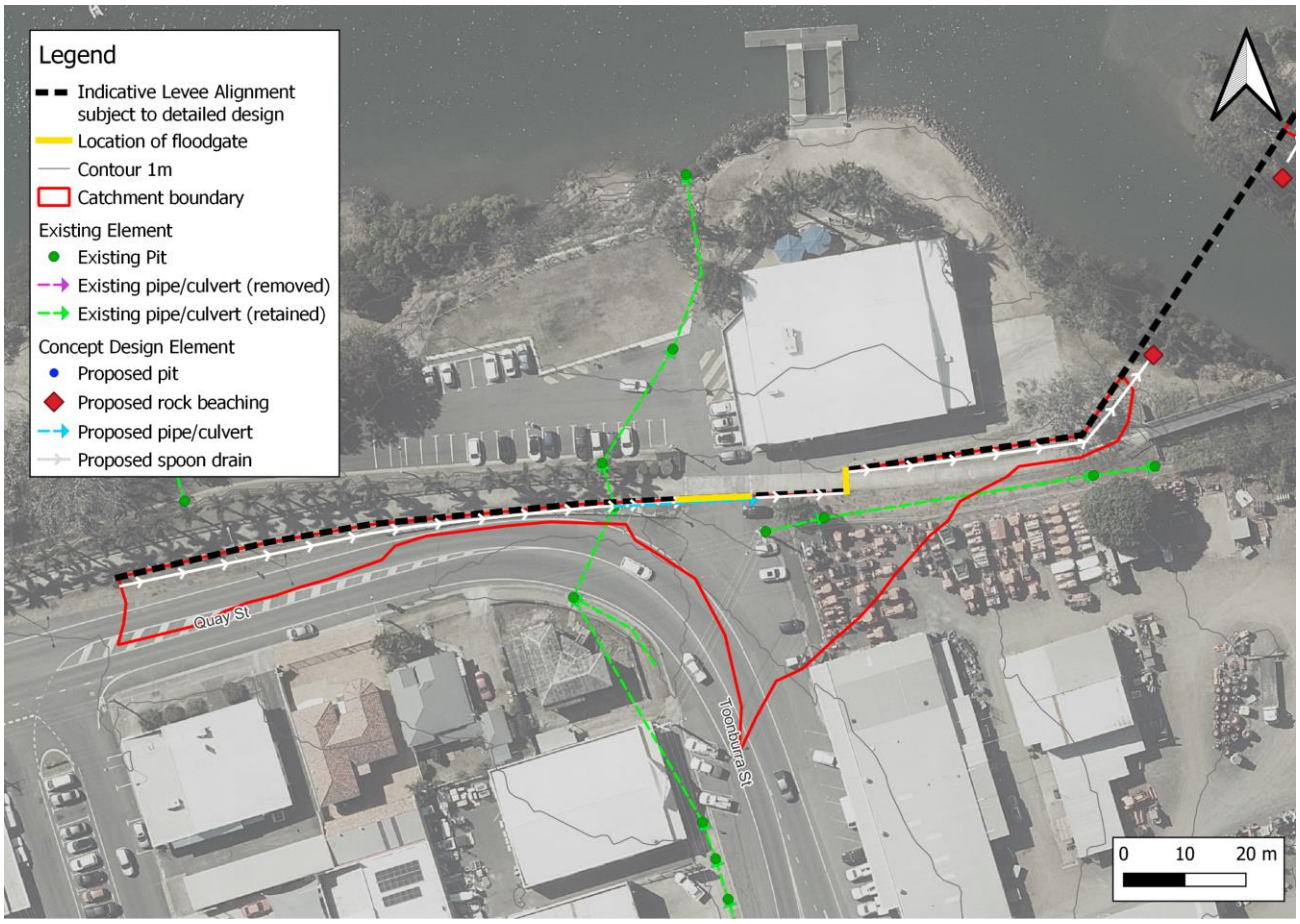

Figure 6-2: Catchment 1 Concept Drainage Design Layout.

6.2 Catchments 3 – 7

The proposed levee, pump control building and hard stand area will block flows from minor catchments 3 – 5 which previously drained to the north, introducing trapped low points which require a drainage solution to avoid ponding at these locations.

The proposed drainage solution is to have the hardstand area drain to a treatment solution south of the pump station wing wall and then drain into Saltwater Creek. Rock beaching may be required at the outlet location to avoid erosion associated with channelisation of flows (allow for approx. 2x2m rock apron).

Catchment 7 drains to a location in the levee where a floodgate will be present. The floodgate will typically be disengaged when no flood risk is present, allowing for both the flow of traffic and the flow of water from catchment 7 to pass along the existing surface of Quay Street.

The concept drainage design layout for Catchments 3 - 7 is presented in Figure 6-3.

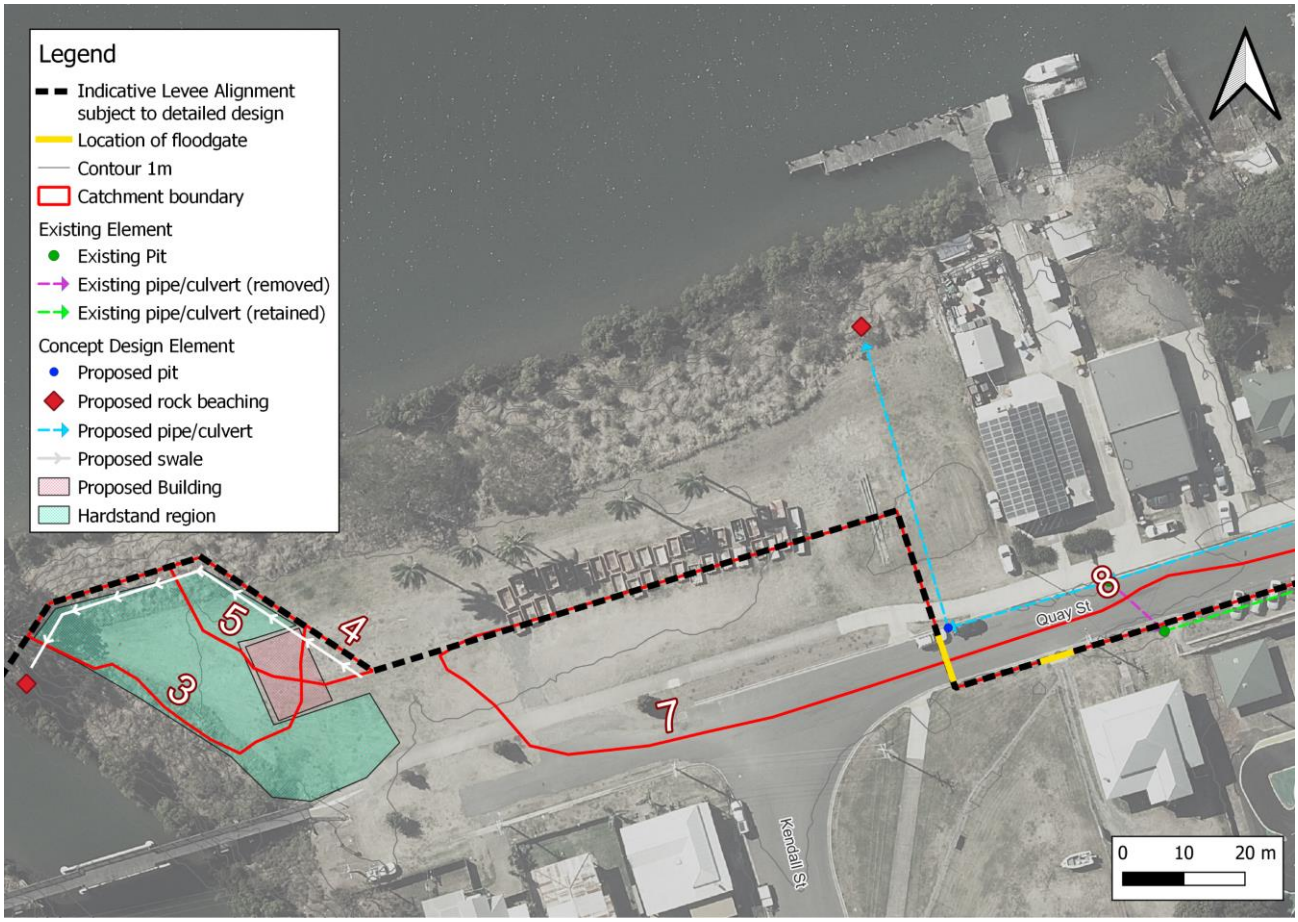

Figure 6-3: Catchments 2-7 Concept Drainage Design Layout.

6.3 Catchment 8

The levee intersects three pipes which originally carried flows from the northern side of Quay Street to the south.

In order to minimise the number of pipes which cross the levee, new pipes are introduced to the north of Quay Street to pick up flows draining from the north to the south. These pipes run at a minor adverse grade towards the west and ultimately discharge to the Burnett River. Rock beaching is advised at the outlet to avoid erosion due to concentrated flows (allow for approx. 2x2m rock apron). Existing pipes which previously crossed from north to south along Quay Street are to be removed.

Quay Street through this area has a typical crowned geometry. The road could be regraded to remove this crown and ensure the high point of the road cross-section geometry is located at the base of the levee, directing water to drain away from the levee and into the drainage network. Alternatively , if the road is not regraded additional pits and pipes could be required to drain the portion of the road that drains towards the levee. Further options will be explored during the next phase of design to determine the most feasible solution.

Drainage along the southern side will remain the same and drain to existing pits.

The concept drainage design layout for Catchment 8 is presented in Figure 6-4.

Figure 6-4: Catchment 8 Concept Drainage Design Layout.

6.4 Catchments 9 - 10

Catchment 9 can run overland along the northern side of the levee along the curb of Quay Street. No, significant drainage works required in this location.

Catchment 10 will be free to drain overland longitudinally along Quay Street flowing through the floodgate which will be typically open when no flood risk is present. The concept drainage design layout for Catchments 9 - 10 is presented in Figure 6-5.

If a high point is required along the longitudinal road geometry at the location of the floodgate, catchments 9 and 10 can drain to the west along Quay Street and flows be captured by the system proposed for catchment 8.

During flood events, when the gates are closed, runoff from these small catchments may collect up against the wall and levee.

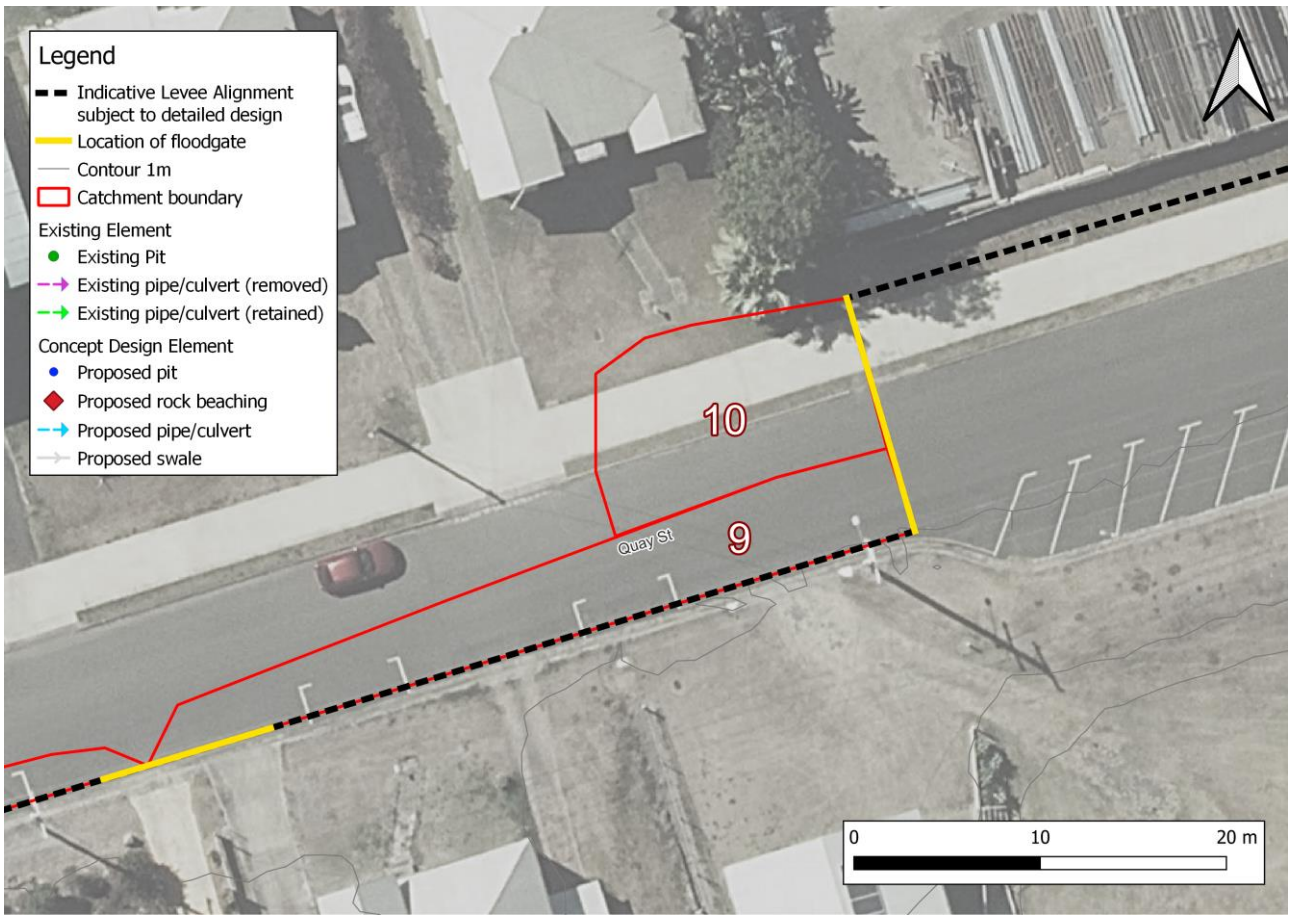

Figure 6-5: Catchments 9-10 Concept Drainage Design Layout.

6.5 Catchments 11 - 12

The majority of Catchment 12 will be accounted for via existing on-site drainage arrangements. There is a minor portion of Catchment 12 that appears to discharge to Scotland Street. A spoon drain or catch drain is proposed along the northern alignment of the levee to direct flows from this catchment towards the existing street drainage network via proposed pits and pipes which will pass flows under the property access points. Stormwater runoff from the buildings within catchment 12 can be connected to the proposed pits and pipes and be directed to towards the existing drainage network in the west to ensure there are no pipe connections made across the levee where previously stormwater may have been discharged to the curb of Scotland Street.

The spoon drain/catch drain will be designed for consideration with the existing footpath. It is noted that the roof of the structure drains to the north and discharges to School Lane. Opportunities for temporary levee wall are being explored in this area and will be confirmed during the next phase of design.

Catchment 11 can run overland along the southern side of the levee along the curb of Scotland Street passing through the open floodgate in order to ultimately discharge via the existing drainage network.

The concept drainage design layout for Catchments 11 - 12 is presented in Figure 6-6.

During flood events, when the gates are closed, runoff from these small catchments may collect up against the wall and levee.

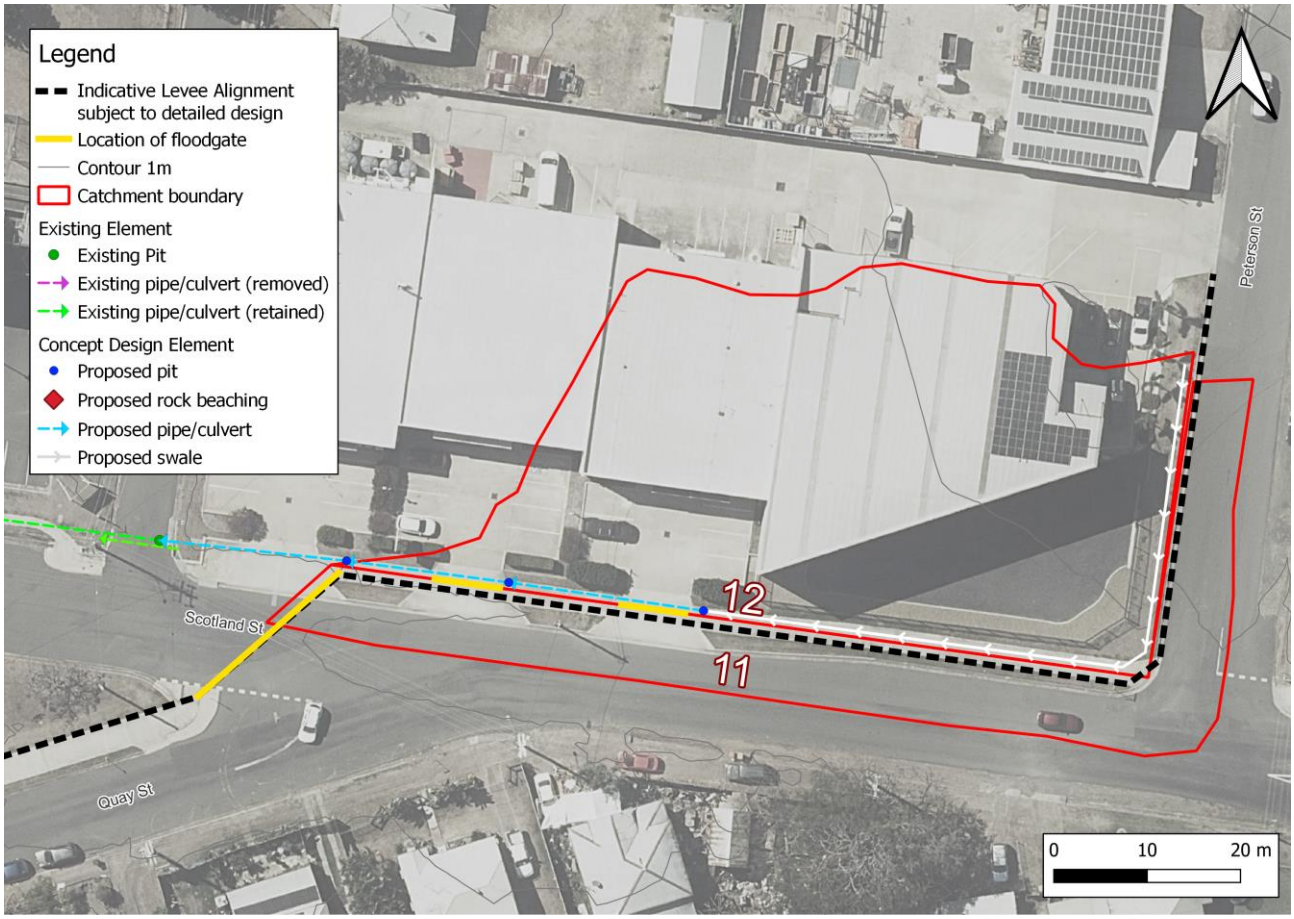

Figure 6-6: Catchments 11-12 Concept Drainage Design Layout.

6.6 Catchments 13 - 14

The levee continues along Cran Street, crossing Distillery Creek and ending adjacent to the Sugar Mill. Two local catchments are impacted by the levee alignment through this region.

Catchment 13 will require a swale running along the alignment of the levee to direct overland flows towards the proposed outlet at Distillery Creek. Rock beaching is proposed at the outlet to the creek in order to protect against channelised flows causing erosion of the bank (allow for approx. 2x2m rock apron).

Catchment 14 which previously drained overland towards the creek is now intercepted by the levee. Similarly, a swale is proposed along the levee alignment to capture overland flows and direct them to Distillery Creek where they will be discharged via rock beaching (allow for approx. 2x2m rock apron).

The concept drainage design layout for Catchments 13 - 14 is presented in Figure 6-7.

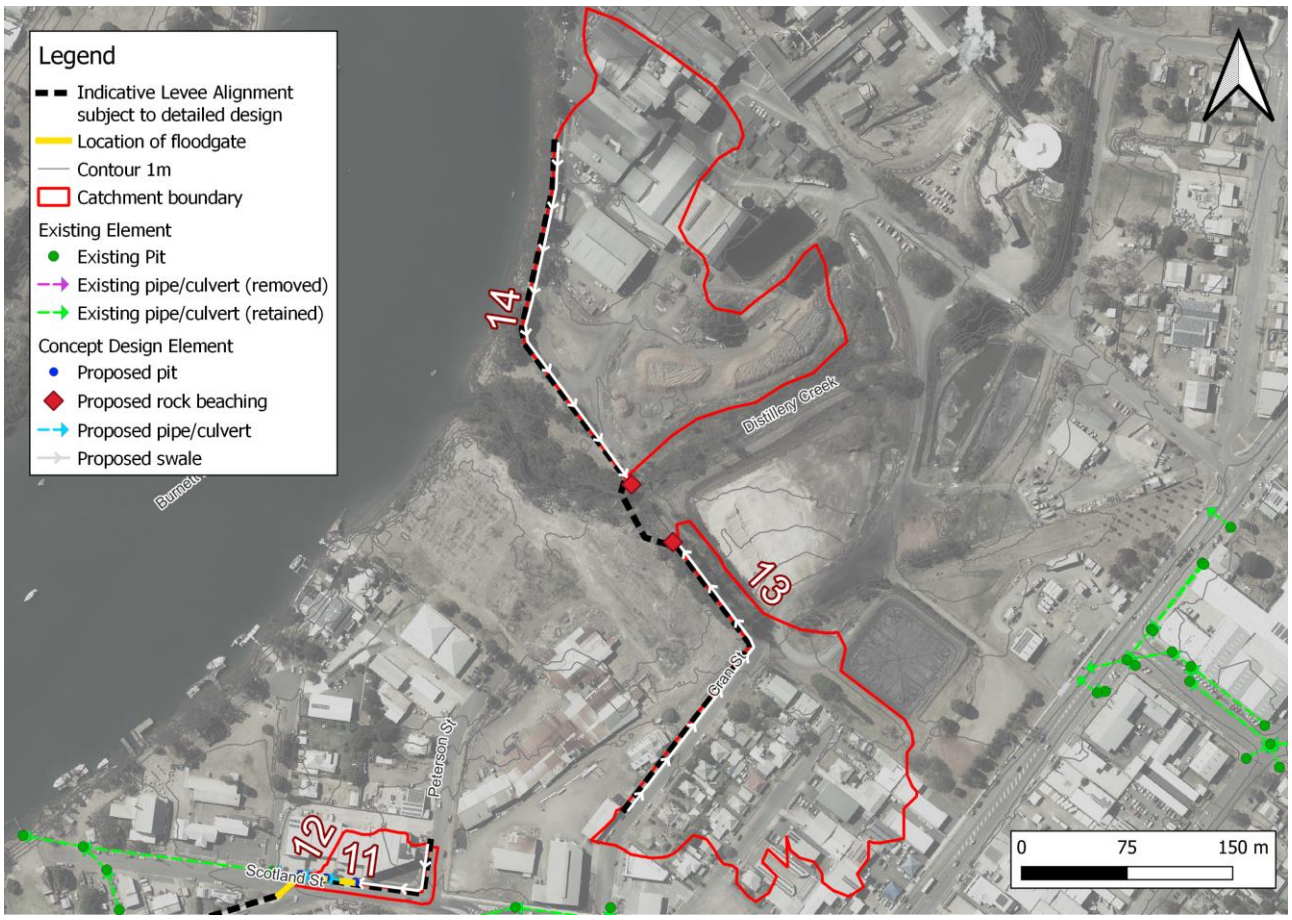

Figure 6-7: Catchments 13-14 Concept Drainage Design Layout.

7. Water Quality Assessment

The need for water quality treatment has been assessed for the whole length of the levee wall. For each catchment section, the catchment area that is being impacted by the levee wall is assessed against the existing catchment area without the wall.

For all 14 catchments, the levee wall does not alter the catchment area and changes to catchment imperviousness is negligible as the proposed levee is considered to be predominantly aligned on existing impervious surfaces. Therefore, assessment of water quality treatment methods is not required as the levee does not present adverse impact to the existing water quality.

8. Conclusion

The Bundaberg East Levee has been positioned in such a way that it does not present a significant impact to the existing stormwater management plan.

There are areas where the levee blocks the existing localised surface runoff flow paths. At these locations a combination of swales, road grading, pits and pipes have been proposed in order for a drainage solution to be achieved. A more detailed assessment will be required during the next phase of design to ensure that there is no material worsening to any part/s of State-controlled roads, particularly during events where the levee is no required / flood gates shut.