District Council of Streaky Bay

Streaky Bay

Stormwater Management Plan

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B	Final	DJ	DK	DJ	6 Jan 2011

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1 Introduction

This Stormwater Management Plan (SMP) for the township of Streaky Bay has been prepared in accordance with the requirements of the *Guideline Framework for Uniform Catchment Based Stormwater Management Planning by Local Government Councils* dated August 2006.

This Stormwater Management Plan provides an overview of the existing catchments and issues relating to current stormwater management. It also provides an overview of the opportunities to improve stormwater management to both address flood protection and the sustainable management of this resource and the environment.

This Stormwater Management Plan has been developed strictly in accordance with the guideline framework whereby the productive and sustainable use of stormwater, reduction of pollution impacts, and enhancement of natural watercourses and ecosystems are key principles, in addition to flood minimization.

This Stormwater Management Plan is proposed as a means of ensuring that the above goals are achieved in an integrated and coordinated manner. This document contains:

- A summary of existing information relevant to management of stormwater in the catchment;
- Catchment specific objectives for management of stormwater runoff from the catchment;
- Potential management strategies that may be used to meet the identified management objectives;
- Estimated costs and benefits associated with each of the strategies
- A clear definition of the priorities, responsibilities and timeframe for implementation of the Stormwater Management Plan.

The Streaky Bay Stormwater Management Plan has been developed in association with the development of a Streaky Master Plan, undertaken by Master Plan. In addition to Council staff, the plan has been prepared in consultation with the local community, business groups and relevant State Government departments and agencies including the Eyre Peninsula NRM Board. Consultation activities and the development of both Plans have been performed in an integrated approach to ensure that the issues and opportunities have been recognised in an consistent manner.

2 Catchment Features

2.1 Catchment Boundary

The *Stormwater Management Planning Guidelines* require that all Stormwater Management Plans contain a clear description of the area to which the plan relates. Within areas outside of metropolitan Adelaide, Stormwater Management Plans are to be prepared where needed for complete townships.

The catchment boundary for the purposes of this Stormwater Management Plan, was determined through consideration of those catchments influenced by the existing township and areas zoned for future residential growth.

The catchment boundary is shown in Figure 2.2, which has a total area of 2238 ha. Of this area, approximately 870 ha is within the extent of current and potential future urban area.

Approximately half of the township drains north to the coast through 14 outlets along the foreshore. The remaining portion of the town drains inland to the south-east, into a natural low-lying area. The catchment has been subdivided into sub catchments based on the available road grading information, drainage layout information and site inspections. These sub catchments are also shown in Figure 2.2.

2.1.1 Sub-catchment Descriptions

Coastal Catchments

The northern portion of urban area abutting the coastline drains to the Bay from a number of separate drainage systems. The size of the individual separate catchments that comprise this subcatchment range from 0.1 to 2.6ha. These catchments include the more densely developed areas associated with the central business district and older urban areas.

Figure 2.1 Streaky Bay foreshore

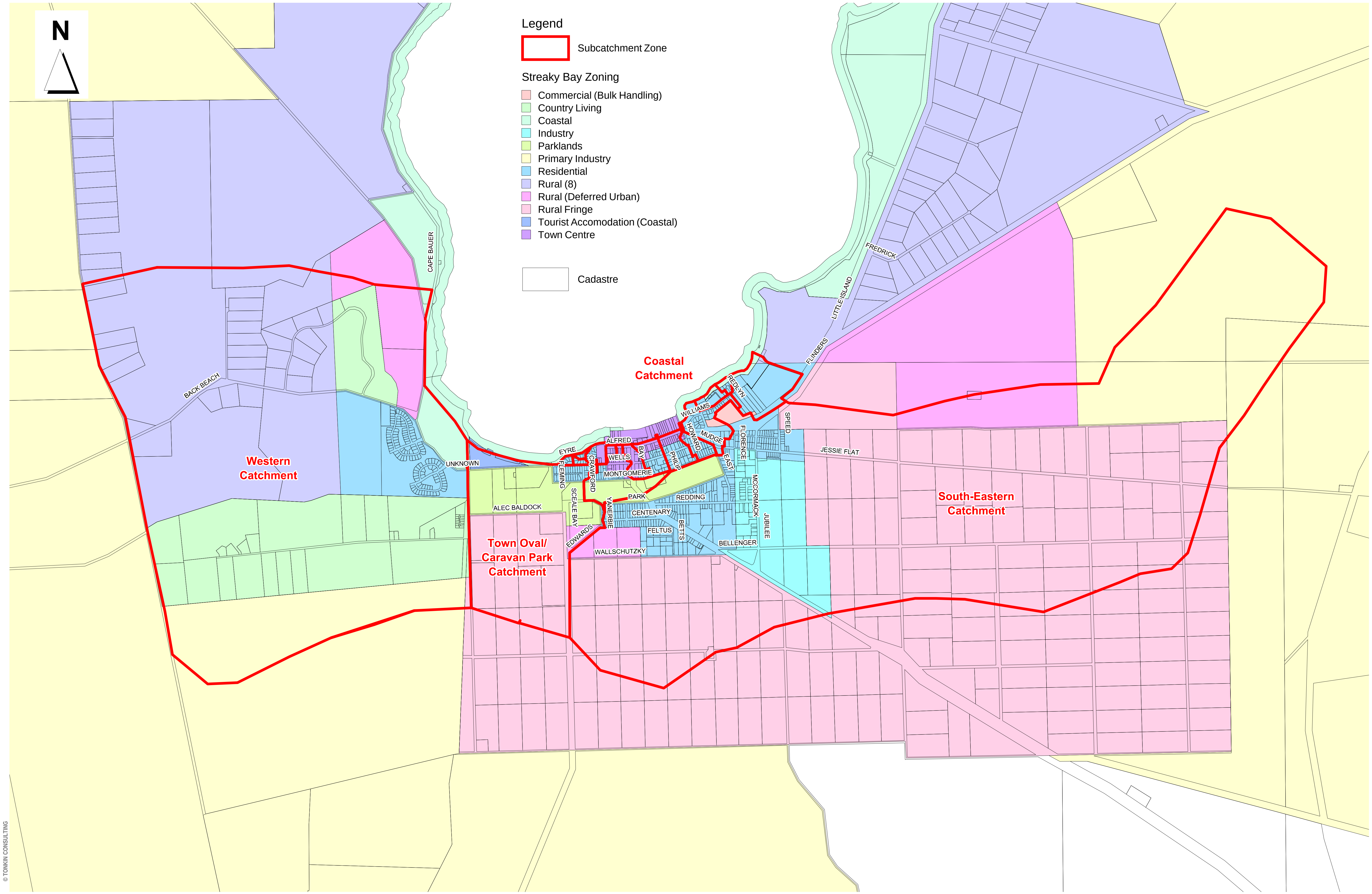
Town Oval / Caravan Park Catchment

This catchment consists of 137 hectares of predominantly rural land. Two stormwater detention basins located adjacent to Wells Street collect and store most of the runoff. One near the waste water treatment plant was used for winter storage. Excess runoff discharges towards the Bay through the Caravan Park at Wells St.

South-Eastern Catchment

The South-Eastern catchment drains to a natural depression (salt pan) with no direct outfall. The catchment contributing to this depression is estimated to be approximately 1130 hectares. The majority of this area is used for general farming. Therefore, currently the runoff from this catchment would be infrequent but would result in low-lying areas being at risk of flooding.

Approximately 78 hectares of vacant land east of Jubilee Road, including areas subject to flooding, has been zoned for industrial land use. More investigations in regard to this area are recommended.



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Filename:	Figure2-1.wor
Drawn:	Simon Callaghan
Date:	22/12/2010

-500 0 500 1000 1500m

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Streaky Bay Stormwater Management Plan Catchment Boundary

Figure 2.2

Western Catchment

The Western catchment consists of 890 hectares of rural land. Currently most of the Catchment is undeveloped and no drainage systems exist to cater for the existing runoff. All stormwater runoff discharges towards the Bay. As future rural living development will significantly increase the runoff from this catchment and drainage systems will need to be planned.

Approximately 71 hectares of vacant land south of the samphire wetland area have been zoned for residential housing. Around 30 hectares of this land been approved for development with the civil infrastructure in place. The developments approved to date rely on on-site retention storages. Excess runoff follows natural drainage and discharges to the western side of the bay.

2.2 Rainfall and Stormwater Availability

Streaky Bay has a mean annual rainfall of 379mm, with rainfall of greater than 1mm falling on 61 days per year on average (Bureau of Meteorology online climate statistics). Record annual high and low annual rainfall totals are 194mm (1959) and 633mm (1992) respectively. Streaky Bay is south of Goyder's Line (a rainfall boundary nominated to indicate the edge of the area suitable for agriculture, which approximates a rainfall average of 254mm).

Based on the existing level of development, stormwater runoff volumes generated by each of the major catchments have been estimated as summarised in Table 2.1 below.

Table 2.1 Annual Urban Stormwater Runoff Volumes

Catchment	Annual Urban Stormwater Runoff (ML)
Coastal Catchments	44ML
Town Oval / Caravan Park Catchment	6ML
South- Eastern Catchment	24ML
Western Catchment	14ML*

* Subject to increase as Greenfield development continues

2.3 Development and Planning Zone Changes

The existing zoning for the Streaky Bay township is also presented in Figure 2.2. A Township Master Plan (MasterPlan, 2010) has been developed for Streaky Bay, concurrent with the development of this Stormwater Management Plan. Rezoning of some areas to provide for future growth has been carefully considered, given the recent considerable residential development activity in Streaky Bay. The appeal of the district's coastal areas to tourists and retirees and expected expansion of the mining industry will generate population growth and demand for additional housing. Two ongoing land divisions, located immediately north (Blancheport Rise, refer Figure 2.3) and south of the existing township provide evidence of this growth.

Some changes to the development zoning have been proposed as part of this review. From a stormwater management perspective, changes to zoning that will affect future rates of runoff generation include:

- Rezoning of the salt plan area east of Jubilee Road from Industry to Conservation / Reserve

- Extension of the southern residential boundary to in line with Wallchutzky Road.
- Expansion of residential development south of the Blancheport Rise development area
- New Industry land south of Mudge Terrace and east of the salt plan area
- New residential land along the coast north of Back Beach Road

These areas, together with proposed Country Living zones, are shown in Figure 2.4.

Figure 2.3 Blancheport Rise development

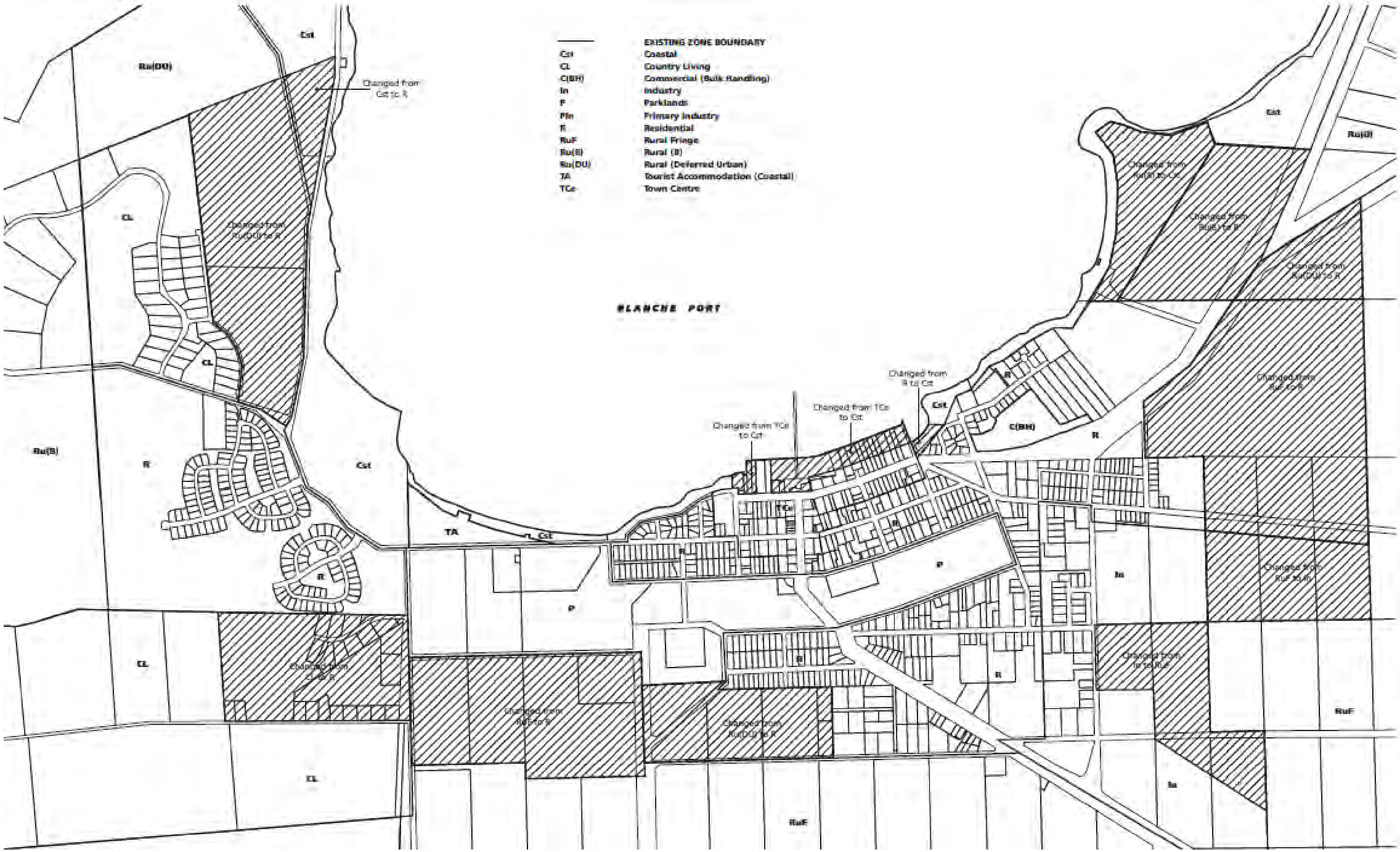


Figure 2.4 Future Zoning (Masterplan, 2010) Streaky Bay Existing Stormwater Infrastructure

2.4 Existing Stormwater Infrastructure

Figure 2.6 shows the location of existing stormwater infrastructure within the catchment.

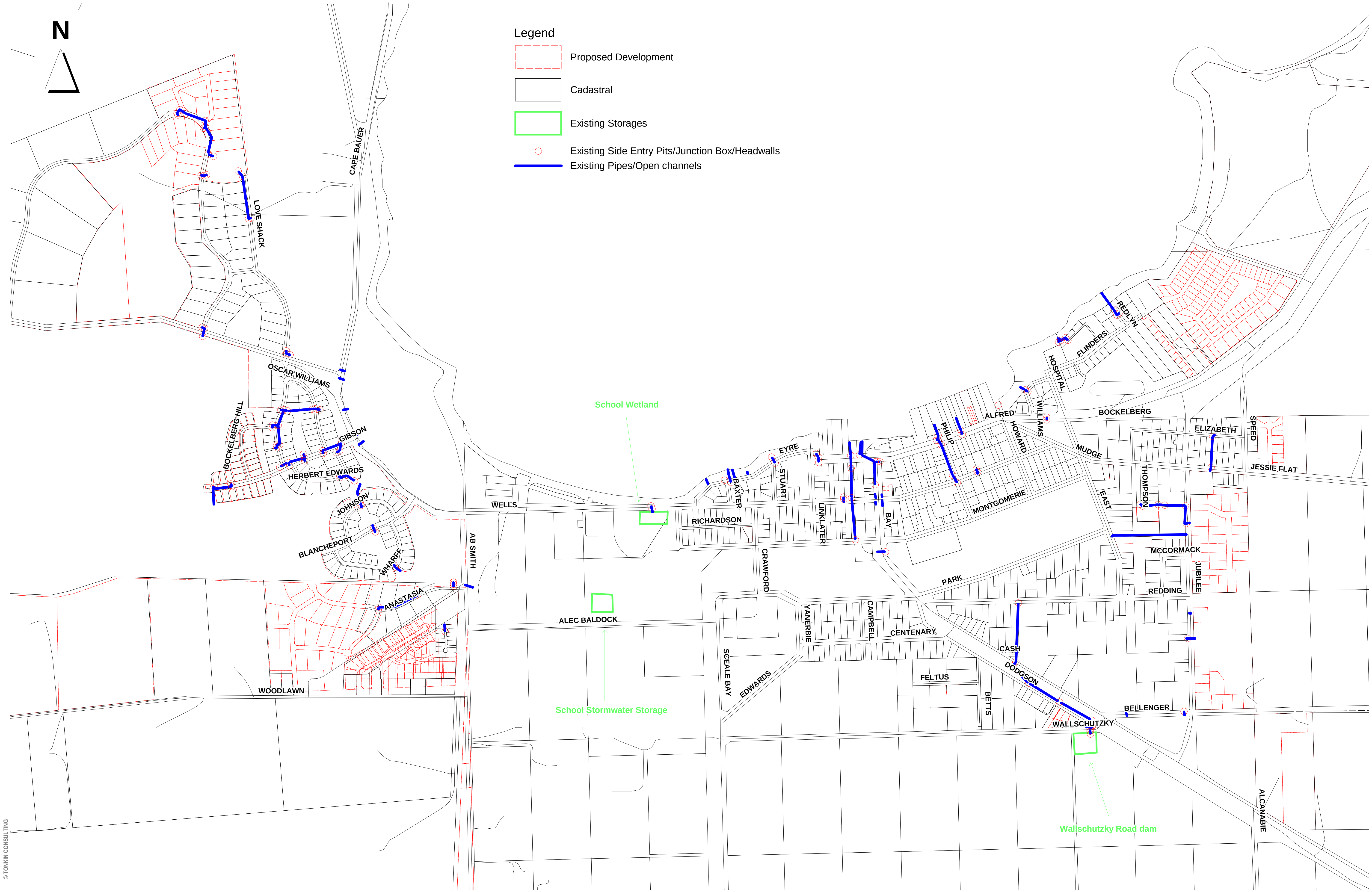
The following infrastructure elements are shown in the Figure:

- Underground drainage systems (pipes and box culverts)
- Open channel systems
- Detention Basins
- Dams
- Wetlands

There are no known existing gross pollutant traps, pumping stations, aquifer recharge sites and other WSUD features within the catchment.

The school wetland and reuse system (shown in Figure 2.5 below) is understood to be owned and operated by the school.

Figure 2.5 Streaky Bay Area School wetland



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MAP DETAILS

Cadastral Data:	PBBI Australia
Drainage Data:	Tonkin Consulting
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Filename:	streaky_existing_infrastructures_A3L.wor
Drawn:	Irene Xiong
Date:	22/09/2009

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Scale: 1:12,000

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Streaky Bay SMP

Streaky Bay Existing Stormwater Infrastructure

Figure 2.6

2.5 Existing Drainage Performance

2.5.1 Hydrological Modelling

An ILSAX model has been assembled to assess the performance of the existing stormwater infrastructure in Streaky Bay. The ILSAX hydrological model is a design and analysis tool for urban stormwater drainage systems. ILSAX simulates the rainfall-runoff process on urban catchment, developing flow hydrographs at each entry point to a pipe or channel system, then routing and combining flows through a drainage network. The ILSAX program model includes a hydrological model to calculate flows from sub-catchments with different properties, and allows for the distances and travel times for flows between these sub-catchments.

The model was used to assess the current drainage standard. A second model was then created to explore drainage upgrade opportunities and water reuse options based on the ultimate level of development.

Runoff coefficients for sub-catchment were determined from land uses, aerial photography and site inspections. Data for each sub-catchment was specified individually to represent the proportion of that area that is deemed to be impervious for most of the catchments (eg. rooves, paved areas). For those older residential areas, the impervious areas were further separated into directly connected (i.e. direct discharge to street watertable) and indirectly connected impervious fractions (i.e. discharge via an overland flow path to the street watertable).

Typical ranges of runoff coefficients for the old residential sub-catchments were:

- 0.14 - 0.16 for the directly connected impervious fraction
- 0.13 - 0.16 for the indirectly connected impervious fraction

The percentages of directly connected impervious areas used in the modelling for each of the sub-catchments are shown in Figure 2.8. For the older residential areas, half of the impervious areas were indirectly connected to the drainage system.

Times of concentration have been calculated for each of the sub-catchments based on the longest length of the flow path to the nearest pit of the catchment. Wetting up period, the slope and roughness of the surface were also taken into account. Due to the general nature of the township, time of concentration for the sub-catchments close to the coastal line were generally short ranging from 8 to 15 minutes. Time of concentration for large rural areas was typically in the ranges of 25 to 60 minutes.

An initial loss/continuous loss model was used to model runoff from the pervious portion of the catchments. An initial loss of 45mm and a continuing loss of 3mm/hr were applied to all of the design rainfall events.

Pipe size information was provided by Council, while pipe gradients were assessed from survey stringlines taken of the road network.

2.5.2 Evaluated Performance

A number of issues have been identified across the network. Issues of note are discussed in detail below.

General

Drains through private properties

It is understood that most drains through private properties are not formally recognised through easements. This has the potential to create obstacles for Council in the future to retain these existing drainage paths, and does not provide Council with the required authority to maintain and upgrade drainage systems to meet existing and future needs.

Inlets

Many inlets are of a form, design or condition that does not achieve an appropriate capacity, to transfer flows into the underground drain. This creates the unfortunate situation whereby the capacity of some drainage systems are not exploited to their full potential.

Elizabeth Street / Mudge Terrace

Current drainage arrangements at this location result in stormwater runoff being discharged into low-lying private property, creating and nuisance and flood risk issues. Future development in this area is likely to increase the rate of discharge reaching the low point and exacerbate this issue.

Redding Road / Flinders Highway / Wallschulzky Road

The system drains towards the detention basin located at the corner of Wallschulzky Road and Flinders Highway. Modelling has indicated the drain, from Redding Road, along Flinders Highway to the detention basin is with or exceed 5 year ARI standard except the section across the northern side of Flinders Hwy. This is resulting in occasional flooding to the adjacent areas following large rainfall events.

There is an issue at the southern end of Betts St due to the lack of a defined stormwater flow path through to Wallschulzky Road, causing nuisance to a private property.

Bay Road

While an underground system is aligned in the lower section of Bay Road, high gutter flows are experienced down to the start of this system, with some bypass likely to occur at the top end of this system.

Alfred Terrace

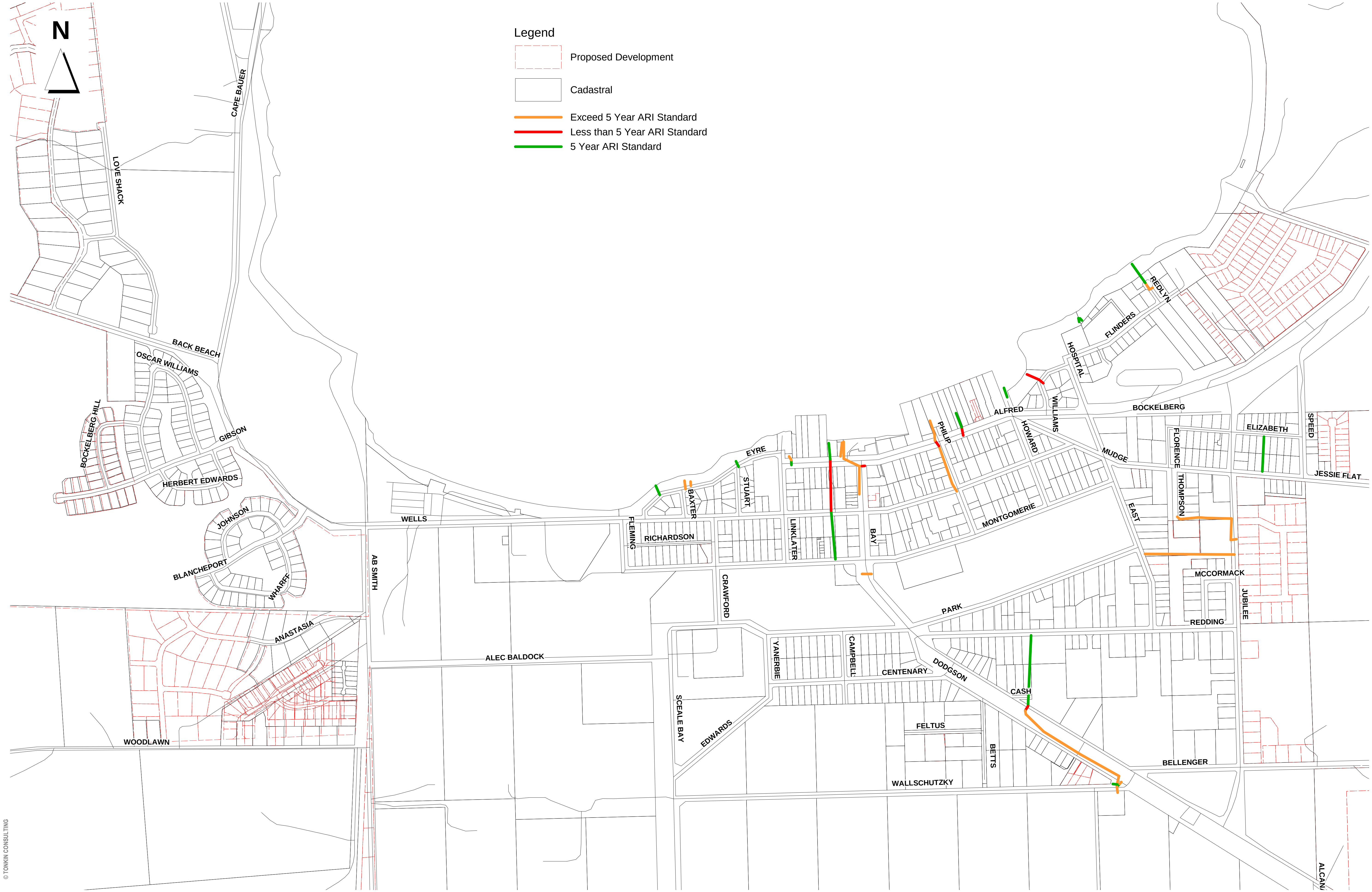
A series of systems drain Alfred Terrace through to the Bay. Performance of these systems is generally adequate, with an exception at a trapped low point where insufficient inlet capacity and drain capacity creates a flood risk to a low-lying property.

East Terrace / Jubilee Road System

This system includes some sections that take the form of a small open channel through private properties. Runoff discharges to the natural low point on Jubilee Road (adjacent to the salt pan). The channel appears to be informal in nature and there is a risk that future development will further obstruct this drain if the corridor is not appropriately recognised through minor swale construction works and establishment of easements.

Blancheport Rise Land Development

Stages of this development are ongoing, with stages commencing from the lower (coastal) land, extending up the hillside. Runoff from this area will discharge towards the Samphire wetland that discharges into the Bay. While some stormwater infrastructure is being provided into these developments, no information was available which indicates that an overall drainage strategy has been developed for the orderly staged development of this land development. There is a risk that future developments further up the hillside will impact on lower recently developed land if this is not properly considered. There is evidence that some allotments have been created in the natural flow path of upstream land, and hence some works will be required to provide appropriate protection to these properties.



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Drawn:	Irene Xiong
Date:	22/09/2009

0 0.25 0.5 0.75km

Scale: 1:10,000

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Existing Drainage Performance

Figure 2.7

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MAP DETAILS

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Date:	21/01/2010

0 0.25 0.5 0.75km

Scale: 1:12,000

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Sub-catchments Impervious Area Fraction

Figure 2.8

2.6 Previous Investigations and Reports

There are no known previous studies investigation stormwater drainage within Streaky Bay.

However, other reports have been considered which are considered to have some influence over aspects associated this Stormwater Management Plan, as described below.

Streaky Bay Community Wastewater Management System – Wastewater Re-use, Scoping Study Report (HDS Australia, 2009)

This Study was commissioned to assess the adequacy, capacity and capability of the existing system to meet future demands of population growth and environmental performance. The scoping study report, which includes recommendations for upgrades and future direction in management of the system, provides detail regarding the volumes of treated wastewater that is reused for irrigation of the town's golf course and foreshore areas, and highlights that current supply does not meet demand.

Streaky Bay Samphire Wetland Preferred Management Plan (Connell Wagner, 2003)

This report presents the findings of a Study assessing the opportunities for future management of the samphire wetland area, located immediately north of the Streaky Bay Caravan Park. A number of alternative options were also developed following consultation with the community and other key stakeholders (which generally consisted in greater excavation to form permanent water bodies), with a preferred plan (shown in Figure 2.9 below) documented in the report.

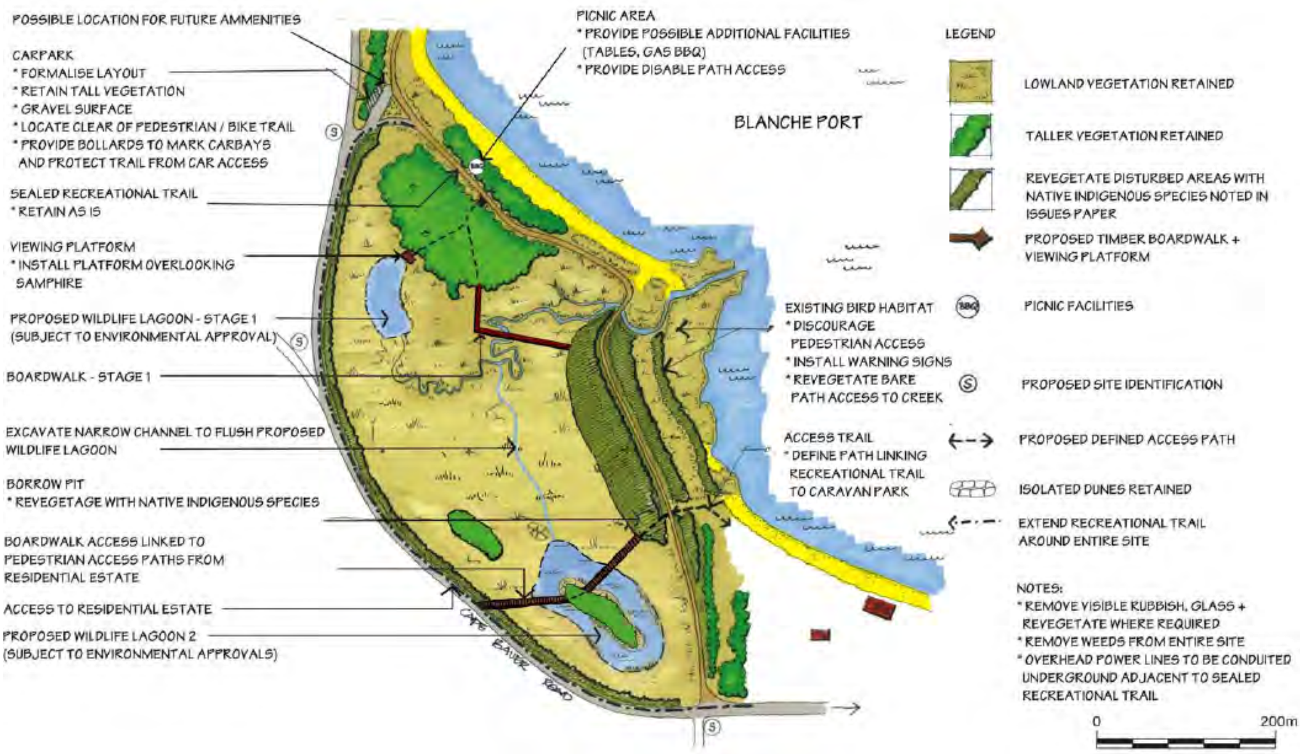


Figure 2.9 Samphire Wetland Concept Plan (Connell Wagner, 2003)

Since the time that this report was released, no works have been implemented and it is now understood that this report no longer represents Council's position in relation to the proposed use of this area. The consultation process undertaken during the development of this Stormwater Management Plan produced a number of responses preferring that the site be protected and maintained. In the consideration of stormwater management strategies for the expanding residential development (Blanche Port Rise) to the immediate west, it has been assumed that protection of the existing environment is the preferred approach.

Streaky Bay Oval Precinct Master Plan & Management Options (Wendy Davidson Enterprises and Swanbury Penglase Architects, 2009)

The plan was prepared to provide direction for the future upgrades of facilities within the Oval precinct. Of relevance to the Stormwater Management Plan, is the nomination of areas adjacent to Wells Street for stormwater wetlands / basins, particularly to receive runoff generated by the Oval Precinct, as per an extract from the plan shown in Figure 2.10 below. These ponds would utilise areas which currently contain old excavations.

Figure 2.10 Extract from Oval Precinct Master Plan (WDE & SPA, 2009)

3 Stormwater Management Objectives

3.1 Stormwater Management Goals

The key issues assessed as being required to be addressed in the development of this plan for the management of stormwater runoff in Streaky Bay include:

- Drainage and Flood Protection
- Water Quality
- Water Use
- Environmental Protection and Enhancement
- Asset Management

Arising from these issues, broad objectives for management of urban stormwater runoff have been identified as follows:

Goal 1: Flood Management

- Provide and maintain an adequate degree of flood protection to existing and future development, and management of nuisance flows.

Goal 2: Water Quality Improvement

- Improve water quality to meet the requirements for protection of the receiving environment and downstream water users.

Goal 3: Water Reuse

- Maximise the use of stormwater runoff for beneficial purposes while ensuring sufficient water is maintained for environmental purposes.

Goal 4: Amenity, Recreation & Environmental Enhancement

- Where possible, develop land used for stormwater management purposes to facilitate recreation use, amenity & environmental enhancement.

Goal 5: Asset Management

- Ensure the condition of stormwater infrastructure is suitable for its intended purpose.

The development of a Stormwater Management Plan for Streaky Bay requires these broad objectives to be further refined to identify catchment specific management objectives. These specific objectives have enabled targeted management strategies to be identified and assessed.

3.2 Catchment Specific Objectives

3.2.1 Drainage and Flood Protection

Australian Rainfall and Runoff (IE Aust, 2000) provides some guidance on design standards for urban stormwater drainage. The design standard is embodied in the major-minor principle, which aims to ensure that development is protected from inundation in a 100 year ARI event. Under the major-minor principle, the drainage system is considered to be comprised of a minor (generally underground) component that prevents nuisance flooding of roadways resulting from relatively frequent storm events, and a major component (generally along surface flow paths such as roads and reserves) that carries excess runoff during more substantial storm events. The combined capacity of the minor and major system components should be sufficient to carry the peak flow produced by a 100 year ARI event. A design standard of between 2 and 5 years is generally adopted for the minor system.

Within areas that are already developed, the ability to provide the same level of protection from flooding as in an area of new development is generally limited by the layout of existing roads and reserves and by the topography.

In these areas the selection of an appropriate design standard to protect property that is at risk of inundation therefore requires the exercise of engineering judgement to balance the cost of the works against the benefits obtained.

Components making up the existing drainage system have been broadly categorised into two components:

Lateral or Feeder Drains (minor system)

These drains collect runoff from streets within the catchment and have the primary function of preventing nuisance flooding of roadways.

Surface flood flow paths, Drainage of trapped low points (major system)

Areas surrounding major flood flow paths and trapped low points generally carry a greater risk of inundation due to the tendency for floodwaters to accumulate at these locations.

The existing standard for each of these components varies across the catchment. In the design of future works, the following standards are recommended:

- Lateral Drains: 2-5 year ARI
- Drainage of trapped low points: 100 year ARI (with ponding in roadways tolerable during these events), reducing to 20 year ARU where the cost of achieving the higher standard cannot be justified

Flood Management Objectives

Based on the above, the following catchment specific objectives for management of flooding within the Streaky Bay catchments have been set. Due to the different constraints that are present in new and existing areas of development, different objectives have been set for each of these areas.

For new development undertaken within the catchment the following flood management objectives will apply:

Objective 1.1

- Protect all properties from inundation in a 100 year ARI event.

Objective 1.2

- Provide an underground drainage system having a minimum capacity sufficient to carry a 2-5 year ARI flow.

Objective 1.3

- Ensure that runoff from any new development does not increase the degree of flood risk to other properties for all events up to a 100 year ARI.

Within areas of existing development within the catchment, the following flood management objectives will apply:

Objective 1.4

- Where economically and practically viable, protect existing development from inundation in a 100 year ARI event. A lower standard of flood protection may be adopted where physical and economic constraints limit the ability to achieve a 100 year ARI level of protection. Where a lower standard is adopted, this should be justified based on an assessment of the saving in construction costs relative to the increase in flood damage costs.

Objective 1.5

- Where economically and practically viable, provide an underground drainage system having sufficient capacity to carry a 5 year ARI event. A lower underground drainage standard (as low as 2 year ARI) may be adopted in existing developed areas provided that adequate surface flow paths are available to carry major flows and the consequences of nuisance flooding of roadways are not significant.

3.2.2 Water Quality Improvement

While no impacts from existing practices have been reported, given the critical nature of the coastal marine environment of this region it is appropriate that the importance of water quality, particularly where discharged to the bay, be recognised as an important issue. Specific water quality issues within the catchment include:

- Gross Pollutant Management

The main retail and commercial precincts, with which generation of gross pollutants would ordinarily be associated, discharge directly into the bay. Gross pollutants reduce visual amenity, particularly in the main commercial foreshore area. Gross pollutants can also be a hazard to marine fauna.

- Sediment Export

Large quantities of sediment can reduce the quality of water in the ocean and prevent sunlight penetration, and hence affecting the growth of seagrasses. Discharge of sediments from stormwater particularly into the Bay will always be detrimental to the environment.

Sediment export also has the potential to impact on the ecology and amenity of the samphire wetland area.

- Pollutant Point Sources

Spill of contaminants (which might be more generally associated with fuel stations, boat ramp loading areas and industrial operations) that would detrimentally affect the ocean should be managed within the catchment.

In order to address these issues, the following catchment specific objectives for management of water quality have been set:

Objective 2.1

- Minimise the quantity of gross pollutants discharged into the ocean to reduce visual nuisance and danger to wildlife.

Objective 2.2

- Minimise the quantity of sediment and nutrients discharged into the ocean to improve amenity and water quality.

Objective 2.3

- Intercept pollutants at source from land uses and activities having a high potential for pollutant generation, in particular sediment and spills.

3.2.3 Water Reuse

Two water reuse schemes are in use in Streaky Bay, these being the reuse of treated effluent (golf course and foreshore irrigation) and (minor) reuse of stormwater (Streaky Bay Area School oval). Despite these schemes, there is demand for more (irrigation) water, for use in completely satisfying the demands of the golf course, and to meet the needs of other reserve areas. Harvesting of runoff will also have an associated positive effect of reducing the quantity of stormwater (and associated pollutants) into the bay.

Based on the above the following objectives for water use have been adopted:

Objective 3.1

- Where economically viable, utilise stormwater runoff for beneficial purposes within catchment scale facilities.

3.2.4 Amenity, Recreation & Environmental Enhancement

Opportunities for environmental enhancement in association within management of stormwater will be will be associated with construction of new stormwater management facilities in areas of open space or along existing natural gullies.

Development of multiple use drainage open space requires a careful consideration of the interaction between drainage provision, environmental enhancement, water quality and recreation provision. By application of appropriate principles and implementation of suitable guidelines it is possible to serve a range of needs while at the same time providing a suitable drainage system. In doing so, advantages can be compounded beyond those which may be achieved if each component were considered in isolation.

The following general objectives have therefore been set:

Objective 4.1

- Within new developments, encourage the use of open space provided for drainage infrastructure for other purposes such as amenity enhancement, passive or active recreation and environmental enhancement.

Objective 4.2

- Where new stormwater management facilities are constructed on existing open space, maximise the community use and benefit derived from the facility and ensure that opportunities for biodiversity, amenity and environmental enhancement are realised.

Objective 4.3

- Where possible provide linear open space running parallel with major open channel drainage routes.

3.2.5 Asset Management

Some degree of existing drainage structural degradation is likely to occur and they will reduce the ability of the drainage system to act as per its original design intent.

Without careful planning structural failure of existing infrastructure may necessitate immediate and expensive rectification. Careful asset management will allow for future planning to determine the timeline for replacement of assets.

The following general objectives have therefore been set:

Objective 5.1

- Maintain up to date information on the age and condition of existing drainage infrastructure by undertaking periodic inspections of drains.

Objective 5.2

- Ensure adequate maintenance is carried out to ensure each asset performs as intended.

4 Consultation and Communication

The development of the Stormwater Management Plan has been informed and shaped by a genuine process of community consultation. This process was undertaken in tandem with the development of the Township Master Plan, undertaken by MasterPlan, with Wendy Davidson Enterprises appointed by Council to manage the community and consultation process.

This consultation process commenced in November 2009 when the Chief Executive Officer wrote to all householders in the district, advising of a series of public meetings scheduled over three days on 1, 2 and 3 February 2010.

4.1 First Round

The first round of consultation was conducted through a series of workshops in early February 2010. Those groups, and the numbers who attended them, were as follows:

- Community: 78;
- Tourism: 9;
- Dev Assessment Panel: 6;
- Health: 6;
- Environment: 2;
- Developers: 12;
- Foreshore Owners: 28;
- Business Owners/Proprietors: 19;
- Elected Members: 7; and
- Education: 2.

The forums were coordinated and run by Wendy Davidson, with presentations by Graham Burns (MasterPlan) and Drew Jacobi (Tonkin Consulting).

The main stormwater management concerns, observations and suggestions arising from the first round of community consultation, including written submissions received were identified as:

- Give priority to stormwater capture, collection and re-use in Streaky Bay
- Identification of local and specific areas of concern where Council needs to improve or modify infrastructure

4.2 Second Round

A second round of consultation was conducted on 24, 25 and 26 May 2010 by Wendy Davidson and Graham Burns. This occurred after a special Council meeting on 27 April 2010 during which Graham Burns, Drew Jacobi and Wendy Davidson provided an overview of the draft Township Master Plan and draft Stormwater Management Plan reports.

As with the first round of consultation, all of the workshops were very well attended. The draft reports were well received, with the Stormwater Management Plan initiative to harvest and recycle stormwater widely supported.

4.3 Stakeholder Review

The draft Stormwater Management Plan was submitted for comment to the Eyre Peninsula Natural Resources Management Board, and to DTEI Stormwater Services (in their capacity as technical review for the Stormwater Management Authority).

Feedback received from these stakeholders has been incorporated into the final Stormwater Management Plan document.

5 Stormwater Management Strategies

5.1 Drainage and Flood Protection

A series of works have been identified to achieve improved drainage and flood protection performance standards across Streaky Bay. These works are shown on the plan presented in Figure 5.5, and described briefly below.

New Inlets

Greater use can be made of existing drainage systems through the replacement of existing inlets with new inlets, preferably double bay side-entry pits with deflector vanes and depressed gutter levels. A budget amount has been set aside for the replacement of 30 inlets. As part of these works, it may be appropriate to install raingarden's immediately upstream of new inlets to achieve water quality improvements.

Bockelberg Street

Improved protection to low lying properties in Bockelberg Street is proposed to be achieved through:

- Construction of a new drain from this trapped low-lying area, through to Williams Crescent
- Drain to also provide for collection of runoff in the undrained portion of the Flinders Highway adjacent to the silos, and collection of flows from the (defunct) culvert under the Flinders Highway at the reserve opposite Burke Street.

Alfred Terrace

Improved protection to a low lying property on Alfred Terrace is proposed to be achieved through a combination of:

- Collection of flows from Philip Street (that otherwise drain to the low point in Alfred Terrace) and discharge of these flows into the drain aligned in Philip Street
- Collection of flows from Howard Street (that otherwise drain to the low point in Alfred Terrace) and discharge of these flows into a new drain aligned in Howard Street
- Construction of additional inlets at the Alfred Terrace low point to improve inlet capacity

Blancheport Rise Development

A range of actions are proposed to appropriately protect existing development, and to plan for future development:

- Preparation of a drainage strategy, integrated with the proposed ultimate allotment layout for the balance of the land, that highlights key elements required to provide for the ultimate development of the land. This may identify works necessary in and around the lower portions of the development that have already been released.
- Creation of a swale / levee to redirect flows from the upstream catchment away from new development, and conveys these flows safely through the reserve between allotments to Back Beach Road.
- Creation of a vegetated swale alongside Back Beach Road, providing connectivity between the various land division outfalls, that provides for treatment of runoff prior to discharge into the samphire wetland area, and, for

as great a proportion as is found to be feasible, drainage of these flows into a future wetland adjacent to AB Smith Road.

Figure 5.1 Samphire wetland area below Blancheport Rise development

Jubilee Road

Provision of improved drainage in this industrial and residential low-lying land surrounding the salt pan is recommended to be achieved by:

- Construction of a drain along Jubilee Road collecting flows from Jessie Flat Road and Elizabeth Street. Part of this drain along Jubilee Road is proposed to take the form of an grass lined swale
- Construction of a drain extending along Redding Street, into East Terrace, to enable the drain through private land to be abandoned

The above works would convey flows through to a location on Jubilee Road, immediately south of Redding Street, that is within close proximity to the salt pan. The system could be designed to allow these flows to spill out into the salt pan area, although it should be noted that the opportunity for harvesting this water has been identified and is discussed further in Section 5.3 below.

Betts Road

Some works are necessary at the southern end of Betts Road to allow for these flows to safely pass into Wallschutzky Road. This is recommended to be achieved by:

- Construction of an open swale, with some sections of pipe as necessary to accommodate driveway crossings, through private property, to a point whereby this swale can drain into the Wallschutzky Road. Further consultation with property owners will be necessary to achieve this.
- In the long term, development of land further to the west of Betts Road is likely to require the construction of an underground drain in Wallschutzky Road, and it would then be prudent to ensure that this drain makes provision for a connection at Betts Road.

Greenfield Land Developments

The existing undeveloped land, together with the potential rezoning of land that will create additional scope for residential development, provides both opportunities and issues for Council to manage to ensure that development occurs in an orderly and integrated manner. The Stormwater Management Summary Plan presented in Figure 5.5 shows those 'greenfield' areas which are the subject of potential future rezoning, together with some of the major flow paths that will need to be managed within those developments, and the most appropriate destinations for discharges from each of these development areas. This represents a 'high level' overview of the issues and opportunities for each of the development areas, and it recommended that as proposal emerge for the development of each of these parcels of land, that the applicant be requested to prepare a drainage plan that addresses:

- Management of major flows through the site and appropriate setbacks of allotments / properties
- Management of flows generated within the site, including detention
- Management of flows discharged from the site, and required works beyond the site boundary
- Consideration of direction of runoff to locations where existing / future harvesting occurs
- Appropriate treatment of runoff (particularly to control sediments) where discharge to marine environments is proposed

These plans need to be prepared and approved early in the planning approval process for new development areas to ensure that Council is not left with the burden of retrofitting solutions that should otherwise have been provided as part of the original development.

5.2 Water Quality

Consistent with *Streaky Bay: Reducing stormwater impacts on coast and marine environments* (Designflow, 2010), improvements to water quality can be achieved through a combination of preventative measures and physical works. These preventative measures are recommended to include:

- Adopt best practice WSUD objectives into new works including streetscaping, road reconstructions and drainage upgrades
- Include a requirements for new development to demonstrate how new land development (say for land divisions of greater than 10 allotments) will achieve best practice WSUD objectives
- Council to require that effective Soil Erosion and Drainage Management Plans (SEDMPs) be observed during the course of land development works
- Develop an asset handover process for WSUD measures to ensure that all parties understand and agree to the future associated maintenance requirements

Physical works are recommended to include:

- A vegetated swale be constructed along Back Beach Road to provide a 'buffer' from the ongoing Blancheport Rise land development, and also to enable the improved management of runoff reaching Back Beach Road
- Along the foreshore, where a number of small stormwater catchment drain out to the bay, that consideration be given during future foreshore redevelopment works to the construction of short sections of vegetated swales to provide an opportunity for sediment capture

Concepts for these works were developed as part of the *Streaky Bay: Reducing stormwater impacts on coast and marine environments* report and these are reproduced in Figure 5.2, Figure 5.3 and Figure 5.4 below.

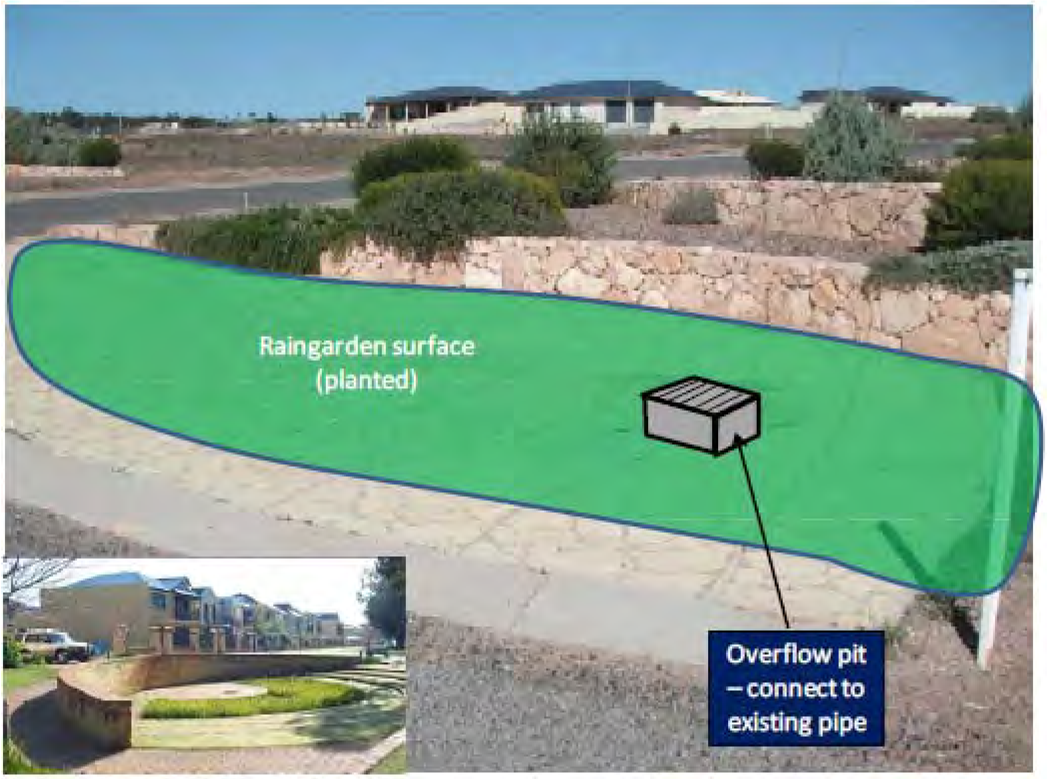


Figure 5.2 Gibson Way Entrance Raingarden concept (Designflow, 2010)

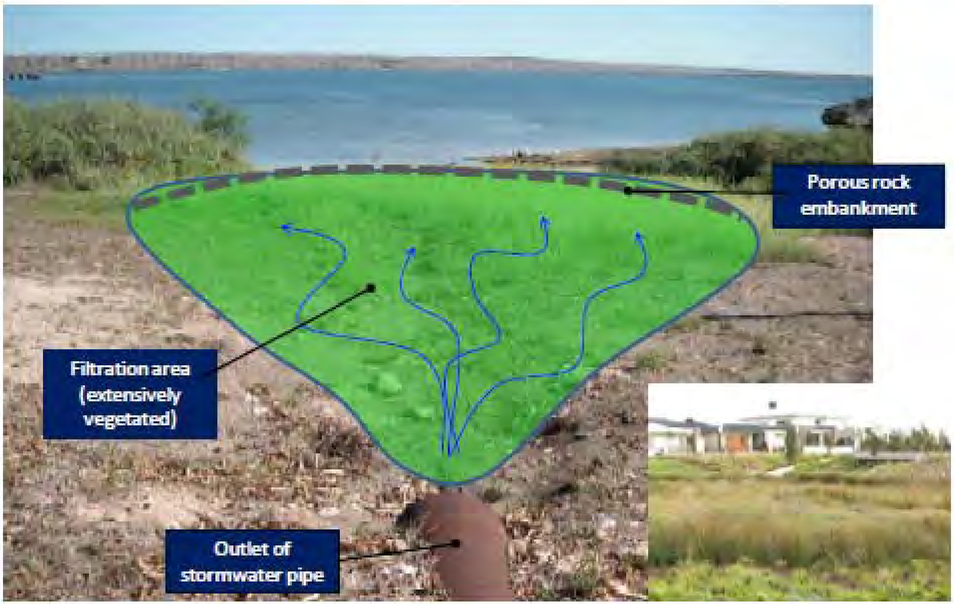


Figure 5.3 Williams Crescent Filtration area concept (Designflow, 2010)

Figure 5.4 Philip Street raingarden concept (Designflow, 2010)

5.3 Water Reuse

The opportunity for stormwater harvesting and reuse within Streaky Bay has been investigated, with a scheme presented as part of this Plan that provides the opportunity for reuse (for irrigation) of up to 30 - 40 ML/year on average (reuse rates increasing through more aggressive use of stored water). This would be achieved through:

- Pumping of stormwater flows from Jubilee Road to the Wallschutzky Road dam
- Enlargement and lining of the Wallschutzky Road dam. The scheme as presented in this report would require the annexing of adjacent privately owned land to create an enlarged dam volume of 20 ML.
- Pump Station at the Wallschutzky Road dam and rising main to connect this storage to the School stormwater dam
- Construction of a (small capacity) gravity drain from Bay Road to the School wetland, via the Eyre Terrace foreshore, to divert all low flows (up to the 3 month ARI flow) to the school wetland
- Connection of the School Stormwater dam to the Winter Storage Treated Effluent pond, allowing for stormwater to be reuse through the existing treated effluent distribution system

Future greenfield land development of the town could enable further development of this scheme through:

- Construction of a wetland / storage in the vicinity of the Wells Road / AB Smith
- Pump station and rising main to transfer these flows to the School storage dam

In determining whether to proceed with this opportunity, regard needs to be given to the predicted future increases in wastewater flows (due to development), against an assessment of Council's ultimate irrigation demand associated with existing and proposed future green spaces.

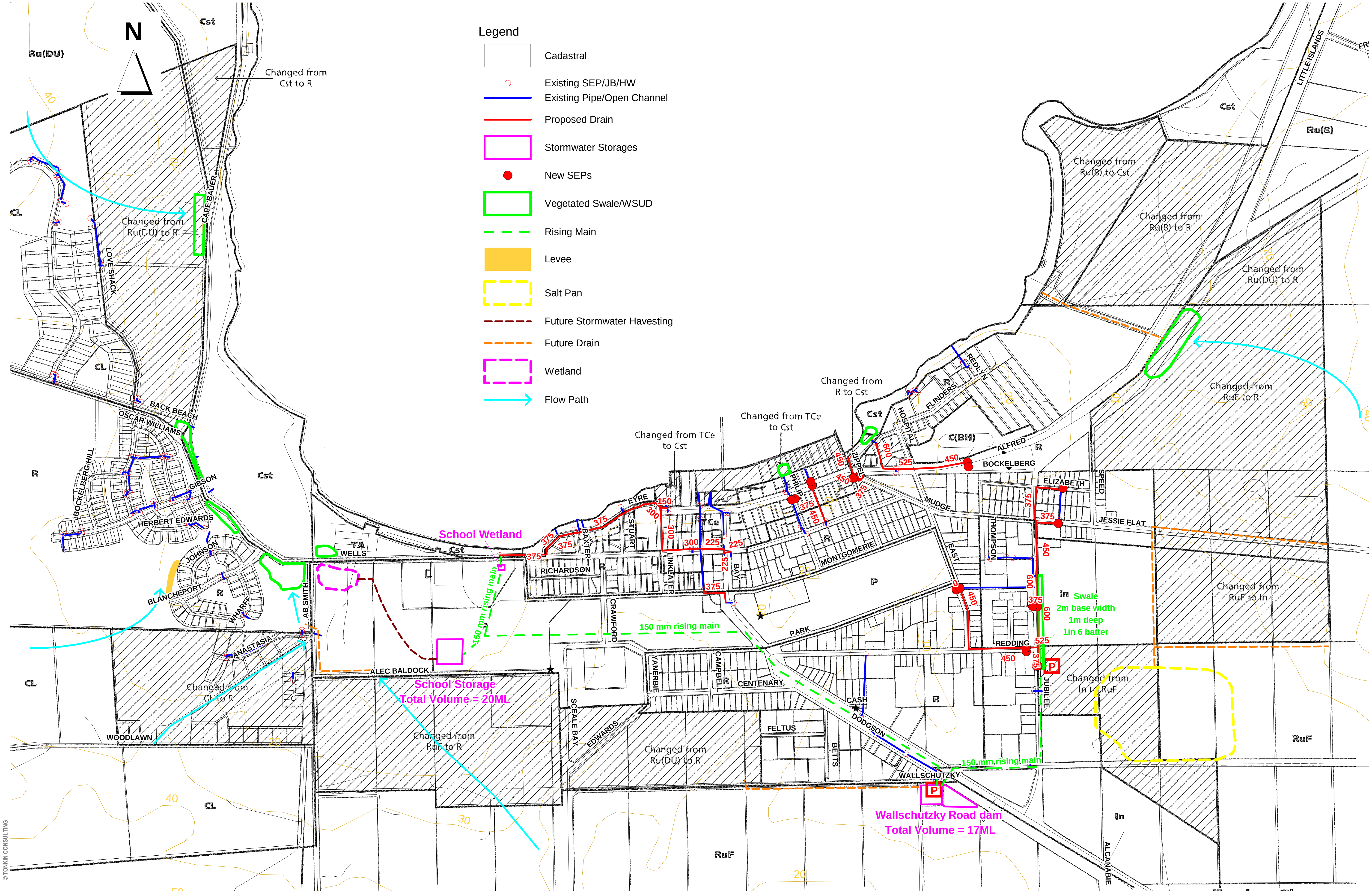
The feasibility of ASR in Streaky Bay has not been assessed for the purposes of this Plan. Regardless of whether ASR is technical feasible at Streaky Bay, it is not considered to be a viable option due to the costs of establishing such a system relative to the small volumes of stormwater available for harvesting, and the availability of land for surface storage.

5.4 Amenity, Recreation & Environmental Enhancement

The objectives defined in this area will be achieved through the delivery of the other works described above. In particular, any works along the foreshore area, which is the focus of most of the town's local and tourist activity, must ensure that these objectives are observed.

5.5 Asset Management

Council is already committed to asset management practices that include reporting on stormwater assets. Over time it is recommended that this be extended to include a program of periodic inspection and maintenance to ensure that the investments made in infrastructure achieve the intended outcome.



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MAP DETAILS

Cadastral Data:	PBBI Australia
Drainage Data:	Tonkin Consulting
Job Number:	2009.0900
Filename:	Figure5-1.wor
Drawn:	Irene Xiong
Date:	10/03/2010

0 0.25 0.5 0.75km

Scale: 1:12,000

District Council of Streaky Bay

Streaky Bay SMP

Stormwater Management Summary Plan

Figure 5.5

6 Costs, Benefits and Funding Arrangements

6.1 Strategy Action Costs, Benefits and Priority Summary

The strategies outlined in Section 5 have been costed and presented in summary form in Table 6.1, together with a brief description of the benefits realised through implementation of each action.

A priority rating (High – Medium – Low) has been assigned to each of the actions, based on judgement guided by a higher priority bias towards:

- Performing works that provide protection to properties that currently have a relatively low level of flood protection
- Works that achieve relatively high benefits, proportionate to cost

Notwithstanding the above, it is likely that there will be some instances where it would be appropriate for Council to be flexible with priorities as the timing for respective greenfield developments becomes clearer.

6.2 Funding, Responsibility

All specific actions identified in Table 6.1 are the responsibility of Council to lead, fund and implement.

None of the 'drainage and flood protection' projects identified are of a sufficient size (serve catchments greater than 40ha) in order to qualify for funding from the Stormwater Management Authority. It should also be noted that the Stormwater Management Authority will generally not provide funding for works that provide for the development of new land.

Council may be able to secure funding for components of the stormwater harvesting proposal, on an opportunistic basis as funding schemes are available, however it should be noted that most previous Commonwealth / State based grant schemes have relied on matching contributions from Local Government.

The Eyre Peninsula Natural Resources Management Board may provide support for projects that improve the quality of water discharged to the marine environment, such as the construction of vegetated swales and other WSUD initiatives along the foreshore.

6.3 Implementation Timeframe

The actions outlined in this plan will require progressive implementation over many years, in order to be accommodated sustainably within Council's budget.

Given that none of the actions will attract funding support from the Stormwater Management Authority, the obligation on Council to advise the Stormwater Management Authority of its planning in this regard is considered to be reduced.

Nevertheless, the following timeframe is proposed for the implementation of the plan:

- High Priority actions – Complete in 5 years (2015)
- Medium Priority actions – Complete in 10 years (2020)

- Low priority actions – Complete in alliance with other works where opportunities arise such as road reconstruction, land development activities
- Water Reuse scheme – When external funding opportunities become available

Table 6.1 Upgrade Works Summary

Priority	Item	Design ARI (yrs)	Budget Capital Cost	Potential Funding Sources	Flood Mitigation Benefits	Water Harvesting Benefits	Water Quality Benefits	Other Benefits
High	Side-entry pit upgrades	5	$90,000	-	Reduction in nuisance flooding	-	-	-
High	Alfred Terrace trapped low point protection works	20	$300,000	-	Protects 1 low lying property on Alfred Terrace	-	-	-
High	Blancheport Rise overflow route	100	$50,000	-	Protects 5-10 properties	-	-	-
High	Bockelberg Street to Williams Crescent Drain	5	$270,000	-	Protects 2-3 homes	-	-	-
High	Betts Road flow path	100	$50,000	-	Protect 1 home from nuisance flows	-	-	-
Med	Jubilee Road stormwater drainage (Stage 1)	5	$370,000	-	Reduce flooding of low-lying land at Mudge Terrace	-	-	-
Med	Back Beach Road vegetated swales / raingardens	20	$50,000	NRM	-	Potential to provide flow transfer / treatment role in future reuse scheme	Reduce impact of development on samphire area, suspended solids discharged to Bay	Improved amenity / landscaping opportunity along Back Beach Road
Med	Foreshore vegetated swales / raingardens	5	$40,000	NRM	-	-	Reduce suspended solids discharged to Bay	-
Low	East Terrace / Redding Street drain (Jubilee Stage 2)	20	$300,000	-	Reduce nuisance flows	-	-	Avoid need to obtain easement
Low	Elizabeth St to Mudge Tce Drain (Jubilee Stage 3)	20	$110,000	-	Reduce nuisance flows	-	-	Avoid need to obtain easement
Low	Elizabeth St to Wallschutzky Road dam Stormwater Collection	-	$1,035,000	Potential SMA or Federal funding when offerred	Reduces impacts on salt pan	Up to 30 ML/ year reuse for irrigation	Some treatment achieved through capture and storage	Provides irrigation water that might allow Council to create additional reserves
Low	Connection of Wallschutzky Road dam to School Stormwater Dam	-	$780,000		Provides opportunity for dam to be emptied for subsequent events			
Low	Bay Road – Eyre Terrace Drain	-	$570,000		Reduce nuisance flows			

7 References

Connell Wagner (2003), Streaky Bay Samphire Wetland Preferred Management Plan

Designflow (2010), Streaky Bay: Reducing stormwater impacts on coast and marine environments

HDS Australia (2009), Streaky Bay Community Wastewater Management System – Wastewater Re-use, Scoping Study Report

MasterPlan (2010), Streaky Bay Township Master Plan

Planning SA (2010), DC Streaky Bay Development Plan

Stormwater Management Authority (2007), Guideline Framework for Uniform Catchment Based Stormwater Management Planning

Wendy Davidson Enterprises & Swanbury Penglase Architects (2009), Streaky Bay Oval Precinct Master Plan & Management Options