STORMWATER

MANAGEMENT STRATEGY 2017

CITY OF Albany

Document Development Officer:	**Document Owner:**
Senior Civil Engineering Officer - Drainage	Executive Director Infrastructure & Environment

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FOREWORD

Albany has an urban drainage system that collects and conveys stormwater to outfall expediently and safely with minimal disturbance. We manage the network for the safety of our community whilst aiming to minimise damage to property, infrastructure and the natural environment.

Where rainfall exceeds soil storage and evaporation, gravity draws excess water downhill where it accumulates into ever increasing volumes that we see as seeps, flows in gutters and streams that grow into rivers draining the rainfall from the land back to the ocean.

This process is governed by nature, and as such the receiving and passage of stormwater across the land is the responsibility of the landowner. Where stormwater flows across lands managed by the City, the City manages this flow to the benefit of the community.

This Strategy describes the parameters and policy settings that the City seeks to adopt in its management of stormwater across City of Albany controlled lands.

The Strategy is an overarching document that forms the first part of three distinct stormwater plans.

1.

Strategy – sets out policy and best practice settings for managing stormwater and sets priorities for modelling and evaluating the existing system, which directs the future investment in system improvements.

2.

Albany Arterial Drainage Plan – is a process that numerically modelled the reticulated stormwater system using design rain storm events that seek to predict performance against criteria listed in the Strategy. This modelling evaluated and predicted with high confidence the performance of the current system. The modelling prioritised areas of deficiency against the Strategy settings and listed individual rectification tasks with general engineering solutions that can be budgeted over time.

3.

Stormwater Asset Management Plan - directs future spending to meet the 'levels of service' objectives of the Stormwater Strategy as modelled in the Arterial Drainage Plan.

IF IT NEVER RAINS, THEN WE'LL NEVER GROW.

Anon

SUMMARY

The City of Albany Stormwater Management Strategy 2017 (the Strategy) provides an overarching direction for managing the conveyance of stormwater and floodwater to protect the social, economic and environmental assets within the community.

The purpose of the Strategy is to provide the City of Albany (the City) and its community with robust and objective criteria to guide local government decision making about stormwater planning and investment.

The Strategy is based on three foundation principles:

- **Protect private and public infrastructure,**
- **Manage public safety,**
- **Protect environmental assets**

from the effects of uncontrolled storm and flood waters.

STRATEGIC CONTEXT

The Strategy is a part of a broader policy and strategic planning framework developed by the City. Key drivers are the City's Community Strategic Plan to be a clean, green and sustainable Albany.

KEY DRIVERS

CLEAN, GREEN AND SUSTAINABLE

INTRODUCTION

Albany is Western Australia's first European settlement and its extensive heritage infrastructure represents the historical growth of the City since its establishment.

Albany town site was developed over a number of decades when open drainage was accepted as suitable infrastructure. As community expectations change, some residential areas have been upgraded with kerb and pipe drainage systems. In many of these areas, the systems were sized for lower density housing but now have reduced capacity to effectively convey storm flows with increasing development.

As pipes reach the end of their service life, the City evaluates the need for resizing pipe systems to manage infill development, higher density housing and fully paved road infrastructure.

Current expectations from landowners living with open drains within the suburbs are that open drains should be retrofitted with pipes and roads kerbed. As infill drainage is expensive and not always necessary, not all areas will be upgraded in this way. Open swale drains will be maintained and upgraded with routine road renewal.

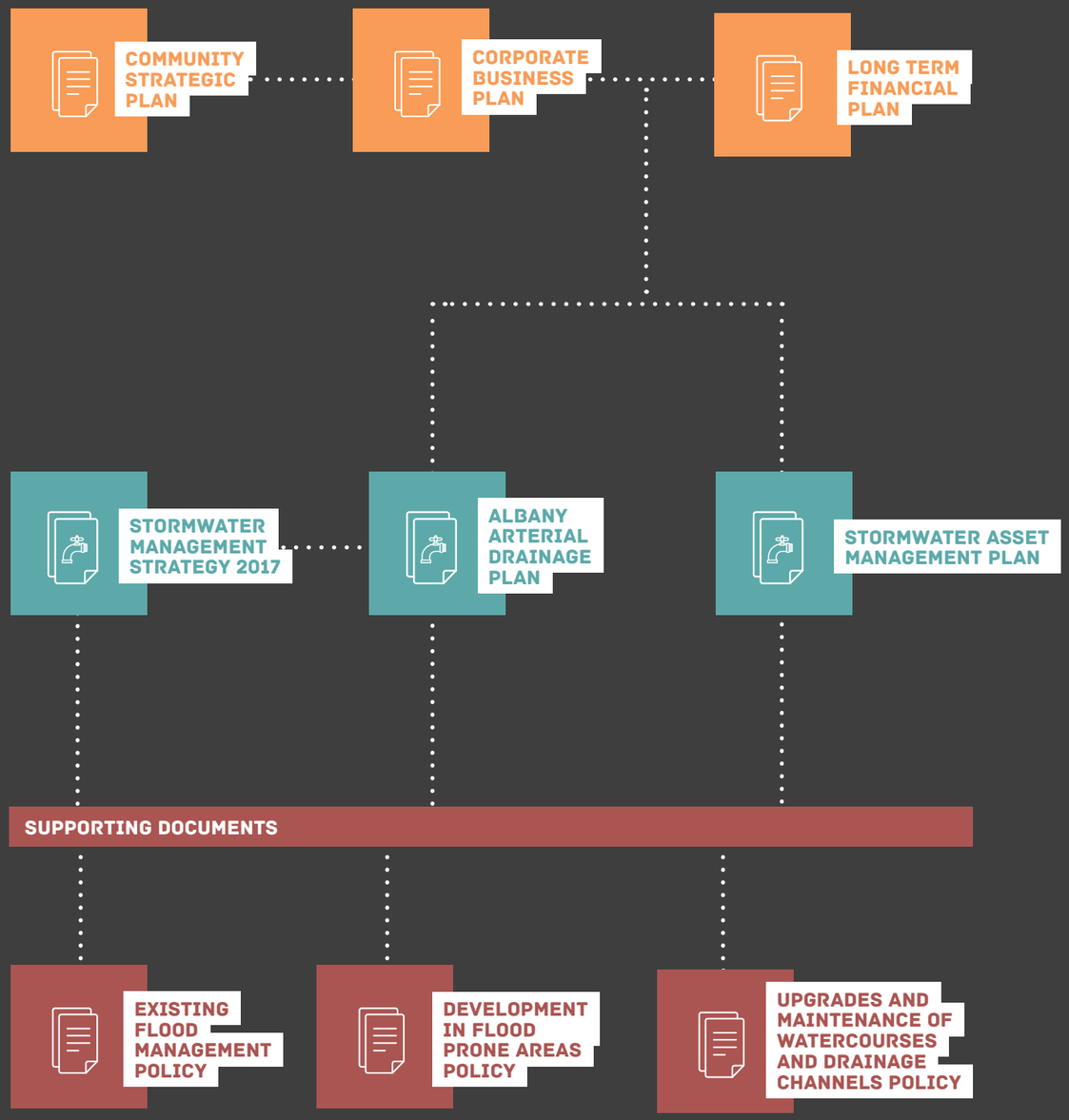
Historically, the City sought to discharge stormwater into waterways and estuaries (such as Yakamia Creek) and little provision was given to the detention (holding) or attenuation (slowing) of stormwater. Landowners seeking to reduce waterlogging by connecting property drainage to the road drainage networks have altered catchment hydrology and the storage capacities of catchments have less capacity to buffer major storms.

Surface topography may direct overland stormwater flows through private property, and landholders need an understanding that this is a natural consequence of water flowing downhill.

In some instances, it may be important to preserve these flow routes and inform future property owners by identification and formalisation. Where possible, roads are used as overland floodroutes however, not all water can be directed through City managed land.

Formalising of flood routes may take the form of caveats on title or planning conditions restricting development in floodways to protect infrastructure.

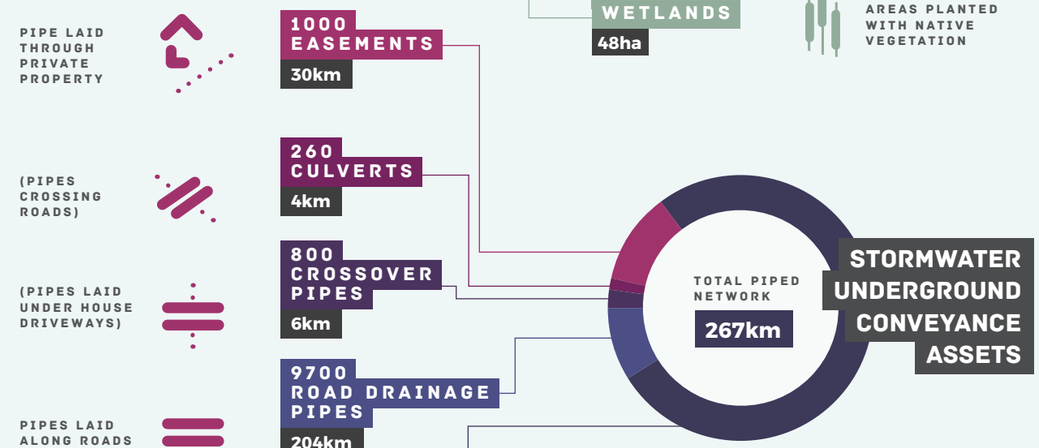
5.0
DOCUMENT FRAMEWORK

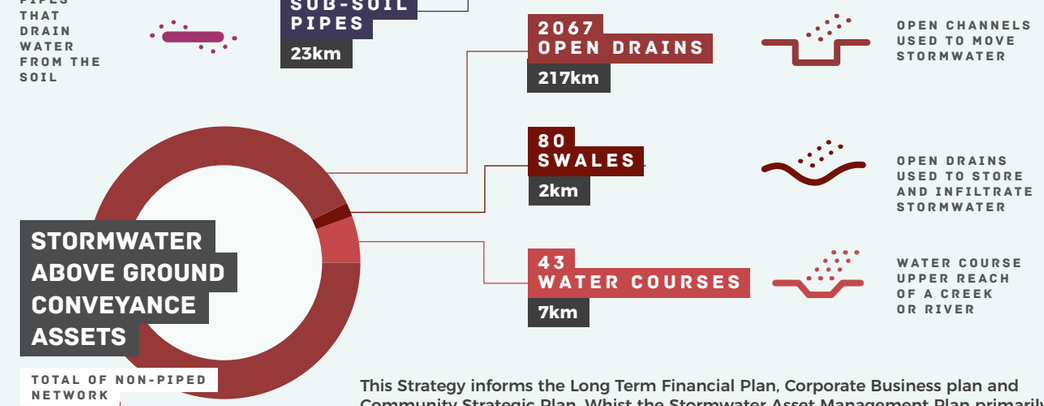


STORMWATER ASSETS

WHAT WE HAVE

- **8 LAKES** 4.6ha — LARGE, PERMANENT OPEN WATER
- **28 PONDS** 5.9ha — SMALLER, PERMANENT OPEN WATER
- **27 BASINS** 4.8ha — HOLDS WATER FOR FILTERING OR INFILTRATION
- **22 SEDIMENT BASINS** 1.7ha — SMALL BASINS THAT CATCH SAND AND MUD
- **5 WETLANDS** 48ha — SHALLOW WET AREAS PLANTED WITH NATIVE VEGETATION





This Strategy informs the Long Term Financial Plan, Corporate Business plan and Community Strategic Plan. Whist the Stormwater Asset Management Plan primarily guides the renewal expenditure and sets service levels, the Strategy is the guiding document for upgrades, policy settings and improvements to stormwater systems.

The Strategy is underpinned by historical reporting, mathematical modelling and a number of supporting documents. These include a number of policies and a fully modelled drainage network to identify areas that do not meet the Strategy's levels of service and set priorities to most effectively direct spending.

CHALLENGES

CHANGES IN MEAN RAINFALL

Stormwater is runoff generated after the soil becomes saturated or the rate of infiltration cannot meet the rate of rain falling. Accordingly, future changes to climate patterns and the associated altering of rainfall volume and intensities will affect stormwater runoff.

By 2070 a decrease of 5–20% mean rainfall is predicted depending on high or low greenhouse emission scenarios.

Natural climate variations combined with anthropogenic impacts on weather patterns will affect seasonal stormwater events. Winter and spring rainfall is likely to decrease, whereas changes in summer and autumn rainfall are less certain.

CHANGES IN DROUGHT AND EXTREME RAINFALL

Current models predict that potential evapotranspiration will increase over Western Australia. When these changes are combined with the projected declines in rainfall, an increase in aridity and drought occurrence is likely.

Climate projections show an increase in daily precipitation intensity over much of the state, except the far south-west and central parts. The number of dry days is expected to increase significantly everywhere. This suggests that future rainfall patterns for many areas will have longer dry spells interrupted by heavier precipitation events.

Increased intensity of extreme rainfall events is projected with high confidence.

COMMUNITY EXPECTATION AND GOVERNANCE DECISION-MAKING CRITERIA

Albany town planning and urban expansion have shown consistent growth since the first civilian town plans and land allocations in 1832.

Through the decades, road and drainage design has migrated from open street drainage to pipe systems. To provide accessibly priced residential land, some suburban areas remain drained with unkerbed, open roadside swales.

Market demand for fully serviced urban development has resulted in revised developmental guidelines requiring developers to provide fully serviced lots in inner suburbs. Complementary demand for larger rural residential lots has also seen extensive development of areas that are partially serviced with open swale drains on rural and special residential designed layouts.

This diversity of older suburbs, new suburbs and rural-styled suburbs displaying different standards of development has fueled landowner sentiment that levels of local government service lack parity across the City's urban areas.

When a resident reports a drainage issue, all requests are received and responded to as a Customer Service Request. This will then usually result in an inspection of the complaint by a City Officer to ascertain the cause of the issue and to identify if any immediate remedial action is warranted.

Where a cause can be identified as being a City responsibility and an immediate solution is apparent, most often the issue is rectified under maintenance protocols.

Where an issue falls outside maintenance protocols, a future works design protocol is initiated that will identify the problem against the three stormwater guiding principles of this strategy and a fourth principle to determine the justification of ratepayer's investment. The fourth principle of 'Meets public good' tests the proposition that the works are a legitimate local government responsibility and parity and value to all ratepayers can be assured. The four principles are:

- **protect private and public infrastructure**
- **manage public safety**
- **protect environmental assets**
- **meets the public good.**

Where all these four principles are met, a future project is assigned. This process seeks to rank and budget a future project and where a project budget exceeds $15,000, the project will be assigned as a 'Capital Works' to be prioritised and approved by Council in future budget years.

MAJOR STORMS UTILISE ROADS AND PARKS AS OVERLAND FLOOD ROUTES

PONDS IN RECREATIONAL PARKS ARE USED TO ATTENUATE STORM FLOWS

STORMWATER HARVESTED AND STORED FOR IRRIGATING SPORTS OVALS

RESPONDING TO THE CHALLENGES

The Strategy guides the City's responses to challenges based on three foundation principles.

1.

PROTECT INFRASTRUCTURE:

To provide protection for infrastructure that may be damaged from floods or conveyance of stormwater.

2.

MANAGE PUBLIC SAFETY:

To limit the risk of injury to residents from flow of water and inundation from stormwater drainage systems during flood events.

3.

ENVIRONMENTAL PROTECTION:

To maintain the natural flow of stormwater and floodwaters through the landscape and support the social and environmental services provided by local ecosystems.

PROTECT INFRASTRUCTURE & MANAGE PUBLIC SAFETY

SYSTEM WEAKNESSES

To responsibly justify and plan future investment against identified issues, the City has undertaken hydrological modelling of the Albany drainage systems. This work is documented in 'Albany Arterial Drainage Modelling 2017'.

The modelling has identified 93 system weaknesses relating to stormwater flowing through private properties or presenting an overland flood route risk caused by the road overtopping in a minor rainfall storm event of up to a 5 year recurrence probability.

The modelling also identified 10 issues relating to risks of overland flood routes overtopping into private properties in a major event greater than a 5 year storm. These classes also demonstrate a safety and erosion risk of fast-flowing water on roads and drains

The estimated to remediate these weaknesses is $6.1 million (2017 - dollar value). This estimate does not include smaller stormwater drainage problems that occur as a result of overtopping trapped low points and road geometries. These works make up many requests each year, and are often funded as 'unscheduled works' because they usually do not exceed $15,000.

These works are explained in the Stormwater Asset Management Plan - 2017 which is Part 3 of this Strategy.

Table 1 shows the number of issues modelled as potential weaknesses across listed localities. The Class 1-4, list the category of the issue and may be considered analogous to priorities of importance. The table also totals estimated cost of remedial projects associated with each locality.

TABLE 1: POTENTIAL STORMWATER WEAKNESSES BY CLASS ACROSS LOCALITY

Locality	Class 1 Stormwater flow through private properties in minor event	Class 2 Overtopping road/ inundation risk to properties minor event	Class 3 Fast water flow and inundation risk to properties major event	Class 4 Fast and erosive water velocity major event	Remediation Concept estimate Class 5 cost estimate classification
Bayonet Head	1	6	3	1	$219,800
Lakeside	11	17	4	0	$2,488,300
Yakamia	13	21	0	1	$1,829,600
Seppings	11	6	0	0	$888,500
Lower King	3	4	3	0	$673,100
Total all localities	39	54	10	2	$6,099,300

OPPORTUNITIES FOR ATTENUATING STORMS

Undeveloped vegetated catchments have many surface attributes to slow the flow of runoff. Natural vegetation promotes infiltration and slows overland flow.

When rain falls on natural vegetation much of the rain is absorbed by roots, the humus layer or is transported and stored within the groundwater system. When a catchment is cleared and developed into impervious surfaces such as roads, carparks and buildings, without adequate structural controls the natural hydrology is altered. This often leads to more rainwater flowing as surface runoff into streams and harbours. Stormwater can flow at high velocities, collecting pollutants along the way and causing soil erosion.

As urban planning and residential design (R-Codes) have increased residential densities, stormwater design standards have developed to account for increases in potential runoff. Where older suburbs do not meet changing stormwater design criteria, there is a need to retrofit attenuation capacity into the stormwater network to regulate the flow and reduce downstream effects of storm runoff.

Attenuation seeks to reduce the severity of flooding. This is normally achieved by holding back fast-flowing water and releasing it at a controlled rate. Examples of attenuation structures are dams, ponds or dry basins.

ATTENUATION **SEEKS TO REDUCE THE SEVERITY OF FLOODING.**

PHOTO: A WEIR INSTALLED 2016 IN MIRA MAR TO PROVIDE ATTENUATION WITHIN CULL LAKE.

STORMWATER PIPE SYSTEM RELIEVING PRESSURE USING ROADS FOR FLOOD ROUTING IN MAJOR STORMS

ROADS USED AS OVERLAND FLOOD ROUTES IN MAJOR STORMS

The City has several projects implemented to attenuate water within Yakamia and Parker Brook (McKail) catchments. These attenuation structures often form part of public open space and water features increase passive recreation and environmental values to neighborhoods.

Retrofitting attenuation structures into established neighborhoods is difficult because these structures can occupy large areas. The City has successfully retrofitted engineering structures into existing parks and ponds such as Cull Lake. This has been achieved at relative low capital cost by transforming existing recreational water features into active attenuation structures.

The City has identified a number of large-scale attenuation projects within undeveloped Crown land to implement in the future. These structures will double as developed reserves in areas that need increased recreational open space and also seek to improve water quality by bioremediation of stormwater pollutants using native wetland vegetation.

Smaller attenuation projects are planned to be retrofitted to older suburbs that seek to reduce severity of flooding and capture poor quality runoff from the light industrial areas.

STORMWATER REUSE

Harvesting urban stormwater for safe reuse has many potential benefits. It can help to reduce the effect of urban development on water quality and stream flow, whilst helping to meet water conservation objectives.

Stormwater harvesting involves collecting runoff from drains or creeks and reusing of stormwater is increasingly seen as a potential option for meeting water demands and other environmental objectives.

Despite a consistent Mediterranean climate with an average annual rainfall of 930mm, water for irrigating of parks and gardens is currently fully exploited and the City needs to develop alternative water resources to meet future demands.

The City's Infrastructure and Environment directorate has been designing and implementing stormwater reuse projects throughout the central sporting and recreational areas of Middleton Beach and Albany foreshore open space areas. Large areas of grass and public gardens are now irrigated by water captured as stormwater flow from Yakamia Creek, Eyre Park, Mt Melville and Festing Street. At present, harvested stormwater is mainly used for irrigating of sporting grounds, public parks and golf courses.

To complement development of the Centennial Sporting precinct, the City Infrastructure and Environment directorate has designed and built stormwater systems that recharge natural spongelite aquifers located within the precinct whilst also providing wells to recover stormwater for irrigation of sporting fields. These initiatives reduce the amount of runoff discharging into Oyster Harbour, and seek to rest and recharge important aquifers whilst making use of opportunistic rainfall events, particularly through drier summer months when irrigation demand is highest.

THE CITY WILL NEED TO DEVELOP ALTERNATIVE WATER RESOURCES TO MEET FUTURE DEMANDS.

REUSING STORMWATER AND PUBLIC HEALTH CONSIDERATIONS

Currently, reusing stormwater for irrigation does not require external agency referral. Where the City is concerned about applying stormwater due to public health considerations, the City seeks advice from the Department of Health's Environmental Health Directorate.

Water Corporation manage gravity and pressure sewer services in Western Australia. When an incident such as power or system failure occurs, raw sewage can flow into stormwater systems and creeks.

When this occurs, Water Corporation have a legislative requirement to inform the City's Health Officers who in turn notify City irrigation technicians to cease stormwater harvesting until the spillage has been rectified.

ENVIRONMENT

OPPORTUNITIES TO IMPROVE WATER QUALITY AND ENVIRONMENTAL OUTCOMES

Stormwater is a valuable resource that has the potential to be more effectively managed in the City of Albany. Integrating the urban water cycle with the water supply, stormwater, groundwater management and environmental protection is more important in today's changing climate. Water sensitive urban design (WSUD) is a stormwater design philosophy that seeks to improve water quality whilst using that water to provide horticultural and environmental amenity without using scheme water. The City will support appropriately designed WSUD within new developments and subdivisions. The City has a program to design and implement WSUD drainage infrastructure upgrades designed to improve water quality, provide environmental outcomes and opportunities for passive recreation. These works will serve multiple objectives including stormwater attenuation to reduce the impacts of flooding to downstream catchments.

NODAL TREATMENT AND 'AT-SOURCE' TREATMENT

Nodal treatment describes a system of stormwater quality treatment that uses bio remediation (plants) to clean water and remove nutrients, provide habitat for animals and birds, and provide some attenuation from intense storms. Nodal treatment is an integration of pipe and pit streetscapes linked into larger recreational spaces that serve as stormwater treatment zones. This includes open streams, ponds and water features, sedge lands and open grassed spaces that may flood during intense storms.

An *at-source* treatment is a system that seeks to improve water quality at a street-capture level. The system uses capture pits and rain gardens that soak away water and irrigate tree plantings and ground vegetation. This system integrates efficiently with municipal carparks and is best suited in Albany to link to the pipe or open-channel drainage system because the town soils are shallow, often saturated and have lower infiltration capacity. At- source treatments need to be carefully designed and can require ongoing horticultural resourcing, therefore the whole-of-life cost needs to be considered before approval and implementation.

The City employs nodal and at-source WSUD where appropriate and has several large nodal treatment projects planned and ready to implement.

Recent developers in Albany have attempted to import WSUD principles from the Perth region's Swan Coastal Plain without considerating the local topography, hydrology and geology. Future development should only be approved to allow for creation of integrated and interconnected open spaces where amenity and aesthetics have not been sacrificed for drainage function. This includes ensuring that any WSUD projects are suitable for shallow soils with high gradients (slopes). Current practice on the Swan Coastal Plain for at-source infiltration may not be suitable for Albany residential streetscapes given the soil is shallow with underlying clay, lateritic and granitic basement layers.

Whilst it is generally accepted to allow suitable infiltration higher in the landscape, it should be recognised that natural saturated soil profiles of pre-development conditions may not be suitable or desirable for residents who are seeking to reduce waterlogging by passing water on downslope.

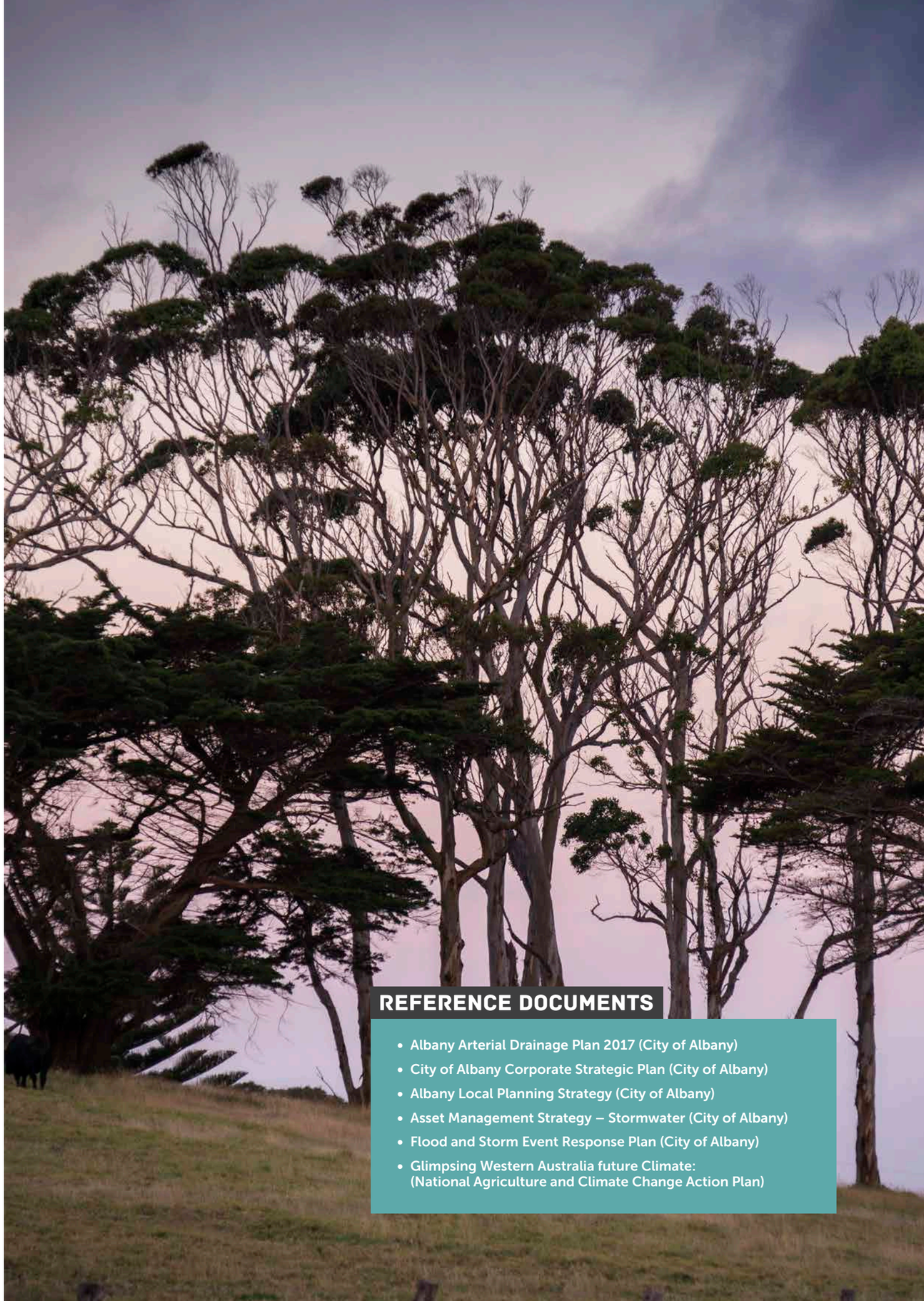
Whilst the City supports carefully designed WSUD projects, this strategy recommends implementing WSUD in nodes that would be better suited to soil infiltration and saturation. At-source WSUD can be used where careful planning and appropriate design to reduce horticultural inputs can be maintained.

The design of new stormwater and drainage systems will reduce water use, create more public open space, ecological corridors, and better drainage management by reducing nutrient issues and restore the natural flow regimes.

A major challenge faced by the City is the prevalence of high groundwater levels. This requires a comprehensive drainage systems that can limit WSUD and environmental objectives for water quality can be difficult to achieve.

There is a need to develop greater guidance for development in determining planning proposals in areas subject to risk of flooding and storm surge. Further flood mapping and policy around developing in flood-prone areas needs to integrate with stormwater planning. This is particularly important for areas within the lower Yakamia catchments and Lake Seppings floodplains. New developments and town planning need to maximise the potential and use of multi-function linear corridors which include open space, ecological corridors, drainage management and flood conveyance and detention.

WATER SENSITIVE URBAN DESIGN (WSUD) IS A STORMWATER DESIGN PHILOSOPHY THAT SEEKS TO IMPROVE WATER QUALITY WHILST USING THAT WATER TO PROVIDE HORTICULTURAL AND ENVIRONMENTAL AMENITY WITHOUT USING SCHEME WATER.



REFERENCE DOCUMENTS

- Albany Arterial Drainage Plan 2017 (City of Albany)
- City of Albany Corporate Strategic Plan (City of Albany)
- Albany Local Planning Strategy (City of Albany)
- Asset Management Strategy – Stormwater (City of Albany)
- Flood and Storm Event Response Plan (City of Albany)
- Glimpsing Western Australia future Climate: (National Agriculture and Climate Change Action Plan)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