



# *Bridges*

Community Assets – At the Core of Your Neighbourhood

**Willoughby City Council  
20 Year Asset Management Plans**

**2013/2014**



WILLOUGHBY CITY COUNCIL

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## **1. Executive Summary**

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This Asset Management Plan is to be read in conjunction with Council's Asset Management Policy & Strategy.

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### **1.1. What does council provide?**

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Council provides and maintains bridge structures to facilitate geographical links as part of the greater transport network in Council's Local Government Area. Bridge assets are an integral connecting part of the road and footpath network.

Council's bridge inventory is classified according to their sizes and types and consists of 22 major bridges, 8 major culverts, and 43 minor structures. The total replacement costs of all these structures and their related components are \$11.4M. Some of these structures have been included under other assets in valuation, such as ramps that form part of a building. However, they are considered to be part of bridge assets because of the higher risk they carry. Including them as a bridge inventory will ensure a more rigorous inspection regime.

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### **1.2. What does it cost?**

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Allocated funding for bridge assets for the 2013/2014 financial year is \$150K, however under the current budget it will drop to \$50K p.a. from 2014/2015 financial year onwards, rising by CPI every year. With this funding scenario, over 20 years, expenditures averages out to be approximately \$67K p.a. Compared to the lifecycle cost of \$263k p.a., this represents a gap of approximately \$196K p.a.

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### **1.3. How do we measure performance?**

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Currently Council's performance in bridge maintenance is measured primarily from their condition. For financial modelling purposes, Council set a target intervention level of condition 4 for each bridge component. In reality, as complex assets with many components, sometimes treatment works cannot be carried out on a component in isolation of the other components. Treatment works will therefore have to be considered both in terms of individual components and the overall structure. There are a number of bridge assets that have reached the intervention level, and Council is currently considering options for treatment works for major bridges at this condition. There is also one culvert in poor condition and remedial works have been carried out in 2012/2013 to relieve the culvert of further loading, thereby arresting its deterioration.

Other factors, such as functionality and capacity have not been included in the assessment of bridge condition at this stage.

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### **1.4. What are the risks?**

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Bridge assets carry inherently higher risk due to their nature as suspended structures. This is reflected in the rigorous inspection regime that requires specialised skills and carried out periodically by structural engineers. As there is not a high quantity of major bridges and culverts within the Willoughby LGA, bridge condition is used to prioritise works required, along with recommendations given by structural engineers in terms of essential safety related works that have to be carried out.

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## **1.5. Community consultation**

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Community consultation specifically relating to asset management was completed in 2013 as part of Council's community engagement strategy. Bridges have not been included in this consultation process. However there was a general acknowledgement that bridge management is an area requiring specialised technical expertise.

Consultation results show that the community rates 80% satisfaction level for all assets in general. The community's expectations regarding asset condition largely align with Council's for the majority of assets, and in some cases, the community's expectations appeared to be lower than Council's. Target levels of service that were assumed by staff initially. Maintenance and renewal works have therefore remained unchanged following the consultation process.

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## **1.6. What does the future hold?**

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As bridge assets were not allocated separate funding until the recent years, historical information on bridge expenditure is often embedded in footpath or road works. Data and information on bridge condition is still at an early stage, but on-going monitoring of their condition is planned to improve on future maintenance forecasting.

Ownership and maintenance responsibility is one issue that requires further investigation for bridges, as sometimes this involves past agreements between Council and other parties where the ownership and responsibility may not have been carried over to new owners when properties were sold.

Current funding level is still inadequate as reflected in the funding gap, and in the past Council has had to rollover several years' funding to enable works to be carried out. Planning processes and budgeting for bridges are, however, still at its early stage compared to other infrastructure assets. The quality and accuracy of Council's reporting on its Asset Management plans will further improve when the Asset Management System is linked with future asset construction and renewal programs via the work order process.

## 2. Introduction

This Asset Management Plan (henceforth referred to as the *Plan*) forms part of Council's Resourcing Strategy under the NSW Integrated Planning and Reporting Framework. It is to be read in conjunction with Council's Asset Management Policy and Improvement Strategy (AMIS), to which frequent reference is made to avoid repetition within the Plan. The AMIS should be consulted for relationships between this Plan and other documents in the Integrated Planning & Reporting Framework.

### 2.1. Background

The purpose of this Plan is to demonstrate the sustainable provision and maintenance of all of the assets covered in the Plan and the services that rely on those assets. This Plan is a working document that spells out in detail the current state of assets, future plans for their management, associated costs and performance targets. It is designed so that it may be referenced by Council staff and members of the community alike.

The bridge assets included in this plan are bridges, culverts and other suspended structures within the Willoughby LGA that are owned and/or managed by Council. Only structures that Council fully controls or owns have been included for valuation and financial forecast in this plan. The full listing of these structures may be found in Section 0. It should be noted that there are some structures where ownership and/or maintenance responsibility have not yet been finalised. These structures have not been included in this plan.

Until recent years, bridge assets in the Willoughby LGA have not been included as a separate asset class with its own funding source. Since bridges are a connecting element in road segments or footway in parks and reserves, works on bridge assets were categorised under these respective asset groups. This Asset Management Plan aims to establish bridge assets separately to recognise the inherently higher risk they carry, and therefore deserve a separate inspection, maintenance and renewal regime.

Bridge assets within road reserves are generally managed by Council's Engineering Services Branch, whereas those in parks, bushland, sportsground and playground are managed by Open Space Branch. Some suspended structures also fall within the responsibility of Property Branch, such as ramps to buildings and the jetty structure at Northbridge Baths.

The methodology in this asset management plan covers all bridge assets that are maintained by Willoughby City Council. Bridge assets within the Willoughby LGA are classified into three categories as follows:

- **Major bridges** include bridges and other suspended structures, such as suspended decks and ramps.
- **Major culverts**, which includes pedestrian subways and stormwater culverts
- **Minor structures**, which includes bridges, culverts and other suspended structures that are generally minor in dimension, and may cover boardwalks, stairways, etc.

Both major bridges and major culverts are defined as having a cross sectional area of at least 3m<sup>2</sup> spanned by the structure. The span is measured in the direction of the traffic served by the structure. This is consistent with VicRoads' definition of a "bridge", whose Bridge Inspection Manual has been adopted by Council for condition assessment. A bridge, according to the VicRoads manual, is defined as "structure with a span or diameter 1.8m or greater, or a waterway area 3m<sup>2</sup> or greater"<sup>1</sup>.

Minor structures, on the other hand, are suspended structures that have cross sectional area of less than 3m<sup>2</sup>. These may be small pedestrian bridges, culverts, boardwalks, suspended stairs, etc. These structures are

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<sup>1</sup> VicRoads Bridge Inspection Manual (2004)

mostly located in the parks and reserves and are therefore generally maintained by the Open Space Branch of Willoughby Council.

The quantity and replacement values of each of the three categories are shown in the table below.

**Table 2.1 Assets covered by this Plan**

Asset category	Quantity	Replacement Value (\$) as of 30 June 2013*
Major bridges	22 structures	\$ 8,581 k
Major culverts	8 structures	\$ 2,226 k
Minor structures	43 structures	\$ 587 k
TOTAL	73 structures	\$ 11,394 k

\*The replacement values include all structures and associated components. Some of the structures included in the replacement value may have been included in Council's financial statements as part of a different asset group, e.g. suspended ramps that form part of a building (see structure numbers STRBR-020 & STRBR-021). These structures have been included in this Bridge Management Plan as Council has recognized that these particular structures carry higher risk due to their nature and are therefore subjected to more rigorous regular inspections. However, figures of financial forecast in this plan exclude the value of these assets, as funding for maintenance and renewal are also accordingly sourced from budgets allocated to those other asset classes.

In addition to the structures listed above, there are also other bridges, culverts and suspended structures within the Willoughby LGA whose maintenance responsibilities lie with other agencies, such as RailCorp, Roads and Maritime Services, and Sydney Water. These structures have been identified in Council's asset management systems as being the maintenance responsibility of others. There is one road bridge on Lady Game Drive over Blue Gum Creek whose maintenance responsibility is shared between Willoughby City Council and Ku-ring-gai Council.

Bridges over or under the railway line are covered in a separate interface user agreement between RailCorp and the relevant road authorities, which may be Council or Council and RMS depending on particular circumstances. In general, RailCorp is responsible for the civil and electrical infrastructures of these bridges, whereas Council is responsible for the pavement on the bridge deck, the road marking and signages, and RMS is responsible for the speed limit advisory signage where they exist. However, this may vary and would depend on memorandums of understanding developed on a case by case basis. Table 2.2 lays out responsibilities for those assets not covered by this Plan.

**Table 2.2 Assets NOT covered by this plan.**

Asset category	Plan covering asset category	Division/branch responsible
Bridges and suspended structures within the LGA not owned or maintained by Council	N/A	N/A

Key stakeholders in the preparation and implementation of this plan and their respective roles are listed in Table 2.3.

**Table 2.3 Key stakeholders and roles relating to asset management planning**

Stakeholder	Role
Asset Management Controller	Coordinates preparation of plan, ensures links are retained between relevant asset management planning documents, assists with information flows into and from this Plan.
Infrastructure Services Director	Approval of capital programs, maintenance and inspection schedules and risk management.
Engineering Assets Group	Preparation of Plan, data collection and updating, long term planning and prioritisation of works.



Stakeholder	Role
Engineering Works Services Group	Construction and maintenance of assets.
Engineering Projects Group	Design and consultation.
Financial Services Branch	Receipt of fair value valuations at end of financial year, provision of budgets from the long term financial plan, receipt of projections relating to expenditure gaps.
Progress associations, community	Determination of service level targets, feedback about new/upgraded assets
Councillors	Financial and planning decisions, community representation
Insurers and risk management staff	Risk management

## 2.2. Goals and objectives of asset management

The overarching principle, goals and objectives of asset management are those described in the AMIS and are not repeated here. Council's community strategic plan – the Willoughby City Strategy – identifies a number of outcomes in order to achieve the overall vision for the community, and any of the strategies for achieving these outcomes rely on asset management strategies. The outcomes as they relate to the assets covered in this Plan are listed in Table 2.4 along with the strategies for achieving those outcomes.

**Table 2.4 Outcomes and Strategies from the Willoughby City Strategy as they relate to assets**

Outcome as listed in the Willoughby City Strategy	Strategies within this Plan that will assist in achieving the outcome
2.1.2 The community values the natural environment	Providing safe pedestrian links through and between bushland areas.
4.2.1 Increased use of active and public transport	Providing links for a complete footways and shared paths network.

This Plan contains the works programs, maintenance and inspection regimes and actions for improvement that should be followed to ensure the outcomes in the Willoughby City Strategy, as they relate specifically to the assets covered by the Plan, are achieved.

## 2.3. Plan framework

This Plan contains the following information that will enable Council to achieve sound strategic management of its vast asset stock:

- Current and target levels of service provision and strategies to address gaps (Section 3)
- The impacts of current and future demand on the delivery of services and strategies to address them (Section 4)
- Activities associated with managing Council's assets throughout their life cycles (Section 5)
- A summary of the funds required to provide services and meet targets (Section 6)
- A summary of current business processes and asset management practices (Section 7)
- Actions to ensure improved management of the assets covered by this Plan (Section 8)

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## **2.4. Core and advanced asset management**

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The difference between core and advanced asset management is explained in the AMIS.

This Plan has been prepared using an advanced, or bottom-up, approach. Data is available concerning the dimensions, condition and value of all assets covered by this Plan, and this data has formed the basis for all planning and financial projections. Data concerning the performance of Council's assets over time will improve assumptions relating to financial projections, such as the degradation rate or the useful life of the assets. This Plan will therefore become more advanced each time it is revised.

### 3. Levels of Service

The level to which services are provided by Council, termed *levels of service*, is an important factor in asset management planning. Council needs to know the type of assets required to deliver certain services, how many of them are needed, where they should be located, the quality that is expected from them, the level of maintenance required and the level of risk that might be considered acceptable. There are financial implications for all of these decisions.

The AMIS provides all necessary detail about Council's approach to determining target levels of service. Only information relating specifically to the assets covered by this Plan can be found in this Section.

#### 3.1. Legislative requirements

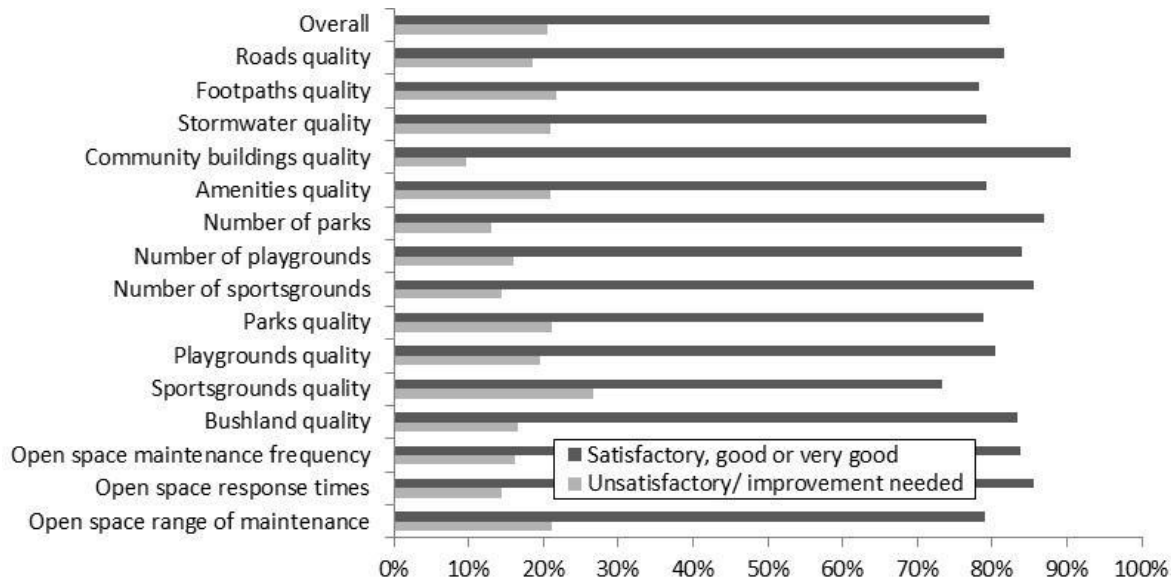
While most levels of service are set in consultation with the community, the provision of certain services and assets must take place according to existing legislation. The legislative requirements that relate to this Plan are listed in Table 3.1

**Table 3.1 Legislative requirements impacting on management of assets covered by this Plan**

Legislation	Impact on management of assets
Rail Safety Act 2008	<i>Rail Safety Act</i> obliges rail transport operators and roads authorities to identify and assess and manage, so far as is reasonably practicable, risks to safety that may arise from railway operations carried out on rail infrastructure wholly or partly because of the existence of any rail or road crossing that is part of a road.
NSW Local Government Act 1993	Sets out role, purpose, responsibilities and powers of local governments including the preparation of a long term financial plan and resourcing strategy in conjunction with asset management plans for sustainable service delivery.
Roads Act 1993	Sets out the role and responsibilities of road authorities and the rights of members of the public who use public roads.
Road Transport (General) Act 2005	Provides for the administration and enforcement as well as review of the road transport legislation, ultimately aiming to improve road safety and transport efficiency.
Road Transport (Safety and Traffic Management) Act 1999	Provides for a system of safety and traffic management, ultimately aiming to improve safety and efficiency of transport on roads and road related areas, and the efficiency of road transport administration.
Disability Services Act 1993	Sets out principles to be applied with respect to persons with disabilities and objectives for service providers and researches, and provides for funding of appropriate disability services and research and development activities.
Disability Discrimination Act 1992 Disability Discrimination and Other Human Rights Legislation Amendment 2009	Sets out responsibilities to ensure persons with disabilities have the same rights and access to the provision of goods, facilities and services.
Occupational Health and Safety Act 2000	Sets out responsibilities to secure the health, safety and welfare of persons at work.
Environmental Planning and Assessment Act 1979 Environmental Planning and Assessment Regulation 2000	Sets out the responsibilities for environmental planning between the different levels of government in the state in managing, developing and conserving resources to promote social and economic welfare of the community and a better environment.

### 3.2. Customer research and expectations

Council has undertaken a comprehensive community engagement program to determine the community's level of satisfaction with, and expectations for, Council's assets. The results of a detailed survey in 2013 indicated that levels of satisfaction with each major asset class were overwhelmingly high. These are summarised in Figure 3.1.



**Figure 3.1 Levels of satisfaction with Council's assets (100+ surveys completed in 2013)**

Expectations for assets were determined through comments from the same detailed survey as well as an online forum with high participation and consultation with a panel of 40 community members who had to opportunity to become very informed about Council's assets and asset management processes.

Bridges were not covered as a separate item during the community engagement. Many structures under bridges are considered assets with inherently higher risk, and therefore require specialised skills in the condition assessment, maintenance and works program. However, bridges are often considered as part of the footpath and road network, of which the community gave over 80% satisfaction rating.

### 3.3. Target levels of service

As mentioned in the previous section, bridges were not covered as a separate item during the community engagement. Many structures under bridges are considered assets with inherently higher risk, and therefore require specialised skills in the condition assessment, maintenance and works program.

Bridges are complex structures made up of different components. Each component is assessed and rated individually, and these individual ratings are used to determine an overall structure rating. Target levels of service are based on overall structure rating to determine prioritisation, however for financial modelling purposes, optimisation based on each individual component having an intervention threshold of condition 4.

**Table 3.2 Target levels of service for assets covered by this Plan.**

Asset type, category or hierarchy	Target level of service
All bridges	No structure in poor condition (equivalent to Condition 4 or worse)

Levels of service also need to be identified for factors other than physical condition and appearance. For the assets covered by this Plan, measures of service delivery that have not yet been developed but which are relevant include:

- Quantity & location
- Capacity
- Functionality
- Responsiveness
- Legislative compliance

These factors are already taken into account informally in everyday management, but have not been formally documented or measured. In broad terms the targets for these measures of service delivery are described and compared to current performance in Table 3.3 in the next section.

### 3.4. Current levels of service

Target level of service which has been formally documented and applied in Council's operation is to intervene when a bridge structure reaches what is considered as poor condition. Currently there are some structures that are rated as being in poor condition; the culvert at The Bulwark is one, but work has been carried out in 2012/2013 to alleviate loading for one, and; repair options are being investigated for the jetty structure at Northbridge baths.

Other measures of level of service have not yet been developed, but the table below describes these measures in general sense with a target level and compare them to the current performance.

**Table 3.3 Target and current levels of service**

Service Criteria	Level of Service	Measurement Scale	Target Performance	Current Performance.
Quality	Physical condition	0-5 rating scale. Satisfies relevant Australian standards.	Within the next 20 years, no bridges to be worse than condition 4 or equivalent. Meets relevant Australian Standards.	Northbridge baths Jetty structure is ranked fair to poor, The Bulwark Culvert is ranked critical however works have been carried out to alleviate loading on structure.
	Aesthetic condition	Repairs are currently undertaken based on physical condition and risk. This factor is to be determined in future levels of service	To be determined in future levels of service	To be determined in future levels of service
Quantity	Provision of linkages	Time saved through connectivity.	Cost benefit analysis is less than 1.	No requests for additional linkages.
Capacity	Appropriate to demand:	Traffic demand is not restricted by the structure. Flooding is will not cause damage to private property.	Appropriate to meet traffic demand and flow requirements.	No known CSR requests to increase capacity.
Functionality	Fitness for purpose	Bridges are appropriate for location and traffic volume and stormwater flow requirements.	Bridges are appropriate for location and traffic volume and stormwater flow requirements.	No known CSR requests to increase capacity.

<b>Service Criteria</b>	<b>Level of Service</b>	<b>Measurement Scale</b>	<b>Target Performance</b>	<b>Current Performance.</b>
Responsiveness	Inspect, make-safe or repair	Response times and number of insurance claims received by Council	High-risk safety issues* attended to immediately. Other issues to be inspected within 2 weeks, and if appropriate works will be prioritised within allocated budget. No insurance claims received by Council	No known claims to date.
Conservation items	Maintain conservation status	Y, N or N/A	To maintain sandstone as the principal construction material where necessary.	Current maintenance practice is to repair sandstone culverts with sandstone.
Legislative compliance	Compliant or not	Y, N or N/A	Y	Any new bridges constructed to comply with relevant Australian Standards.

## 4. Future demand

This section assesses current and likely future demand, and presents demand management strategies to ensure that the needs of the community continue to be met.

### 4.1. Demand forecast

Factors affecting demand include population change, changes in demographics, seasonal factors, consumer preferences and expectations, economic factors, environmental awareness, changing land use, etc.

The NSW Department of Planning, through the NSW State Plan, the Sydney Metropolitan Strategy, and the Inner North Subregional Strategy, has identified requirements for Willoughby Council to provide for increased population and employment capacity. The Inner North Subregional Strategy in particular has identified Chatswood as a major shopping and business centre. This may require zoning changes in Council's Local Environmental Plan (LEP). The population is forecast to increase to approximately 78,000 between 2010 and 2031, which equates to a total increase of 13.40%<sup>2</sup>. Employment is expected to increase by approximately 16,000 during the same period.

### 4.2. Demand management plan

Demand for new services will be catered for through a combination of managing and upgrading of existing assets; and/or providing new assets. Demand management practices include non-physical solutions, which may include but is not limited to policy changes, and customer education.

Opportunities identified to date for demand management are shown in the table below. Further opportunities will be developed in future revisions of this asset management plan.

**Table 4.1 Demand Management Plan Summary**

Service Activity	Demand Management Plan
Provision of new bridges	<p>Development applications will be assessed to ensure that access or egress to or from the site is appropriate and in some instances new bridges or other forms of suspended structures may be required. Construction of new bridges may be a condition of consent for the development.</p> <p>Although rare, from time to time service authorities may require installing a bridge to carry their services across valleys or creeks. Council may require these authorities to upgrade their bridge to cater for access requirements in the area.</p>
Upgrade of existing bridges	<p>New development applications may result in a change of access requirements for a site. An assessment of any existing bridge capacity will be made as part of the application review, and as a result an upgrade of existing bridges may be required as part of the conditions of consent of the development.</p> <p>Service authorities may wish to utilise bridges to carry new services. Upgrade to the structure by these service authorities may be required in these situations.</p> <p>The Road and Maritime Services may approve higher vehicle mass limits into the future on some roads. Council will provide feedback about bridge capacity if required to the RMS and request funding if required.</p>

<sup>2</sup> Willoughby City Council Population Forecasts (<http://forecast2.id.com.au/Default.aspx?id=234&pg=5000>)

### 4.3. Changes in technology

Technology changes are forecast to more than likely have a positive effect on the delivery of services covered by this plan in the following areas.

**Table 4.2 Changes in technology and forecast effect on service delivery**

Technology Change	Effect on Service Delivery
Implementation of electronic asset management system	Key areas of concern in service delivery will be identified and addressed as implementation progresses and more data becomes available on level of service criteria. Service provision is also expected to become more efficient, enabling increased service delivery.
Improvements in data capture, analysis and monitoring	Accurate and up-to-date asset registers will lead to more accurate works planning and financial data. This will enable a more pro-active approach in asset management.
Changes in construction and material technology	Improved construction and/or material technology could potentially extend the life of bridge assets and may result in more cost-efficient repair methods.

### 4.4. New assets from growth

New assets that are required to accommodate growth will be constructed by Council or by developers who may be required to install new or upgrade existing assets in order to cater for the requirements of their development. At present, Council has no reason to identify any new bridge assets for construction within the road reserves. In parks and reserves, footway track widening occurs from time to time according to the demand and available funding and may require upgrade of existing minor structures.

Constructing new bridge assets will require ongoing operational and maintenance funding requirements. Upon the construction, these funding requirements are identified and considered in developing forecasts of future operating, maintenance, and renewal costs in the following section.



## 5. Lifecycle management plan

This section details how Council plans to manage and operate the assets covered by this Plan to achieve target levels of service (Section 3.3).

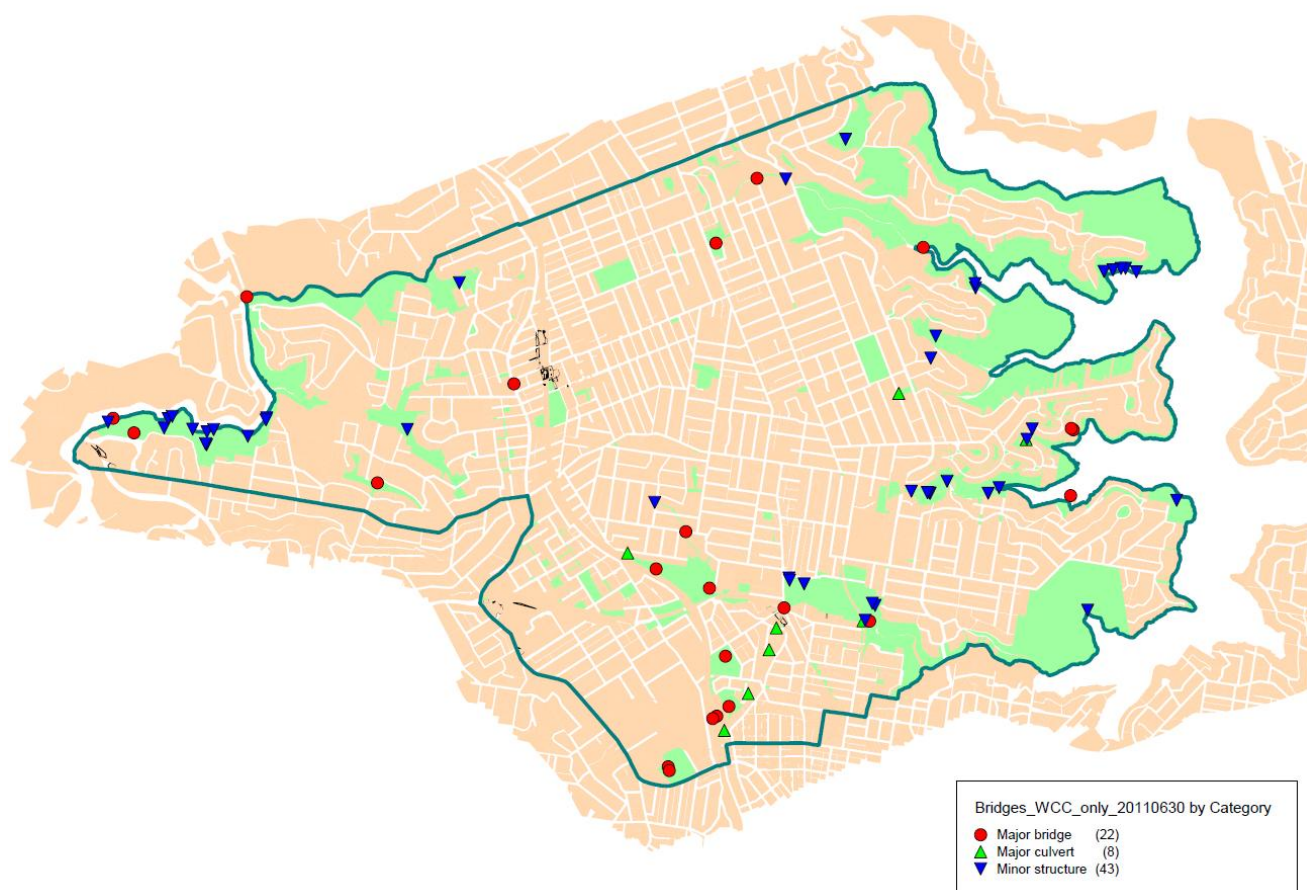
### 5.1. Background data

#### 5.1.1. Physical parameters

The methodology Council is responsible for all bridge assets under Council's care and control. The assets included in this asset management plan is summarised in Table 2.1.

Council manages and is responsible for 73 structures classified as bridge assets; 22 major bridges, 8 major culverts, and 43 minor structures. This can be broken down further in terms of the structure type, such as road bridges, pedestrian bridges, ramps, boardwalks etc. For the full listing of these structures, see section 0. Materials used in the construction of these bridges vary, with the majority constructed from timber, and the remainder being constructed from concrete and steel.

The following map shows the location of the bridge assets maintained by Council.



**Figure 5.1 Locations of bridge assets maintained by Willoughby City Council**

Data collection for the assets covered by this Plan has been completed but data confidence varies depending on method of collection. The types of assets covered and the status of asset data are provided in Table 5.1.

**Table 5.1 Data available for the assets covered by this Plan.**

Asset category	Data confidence	Status of data
Bridges	90%	Data is fairly complete since most have been collected in details during previous inspection, but some components are not accessible, e.g. bearings, and hence could not be confidently assessed.

### 5.1.2. Asset capacity and performance

Council's bridge assets would have been designed to meet design standards applicable at the time of construction which may mean that some older structures may need to be re-assessed to determine if their loading capacity is adequate and relevant to today's bridge design standards. With regard to vehicle and pedestrian carrying capacity, bridges do meet current demands. Culvert capacities may need to be assessed as part of Councils floodplain risk management processes for stormwater.

### 5.1.3. Asset condition

The distribution of condition ratings amongst the assets covered by this Plan is described in this section. Council rates the physical conditions based on a standard 0-5 scale, where zero represents a brand new asset and five is the end of the expected life. For detail regarding the condition rating scale, see the AMIS.

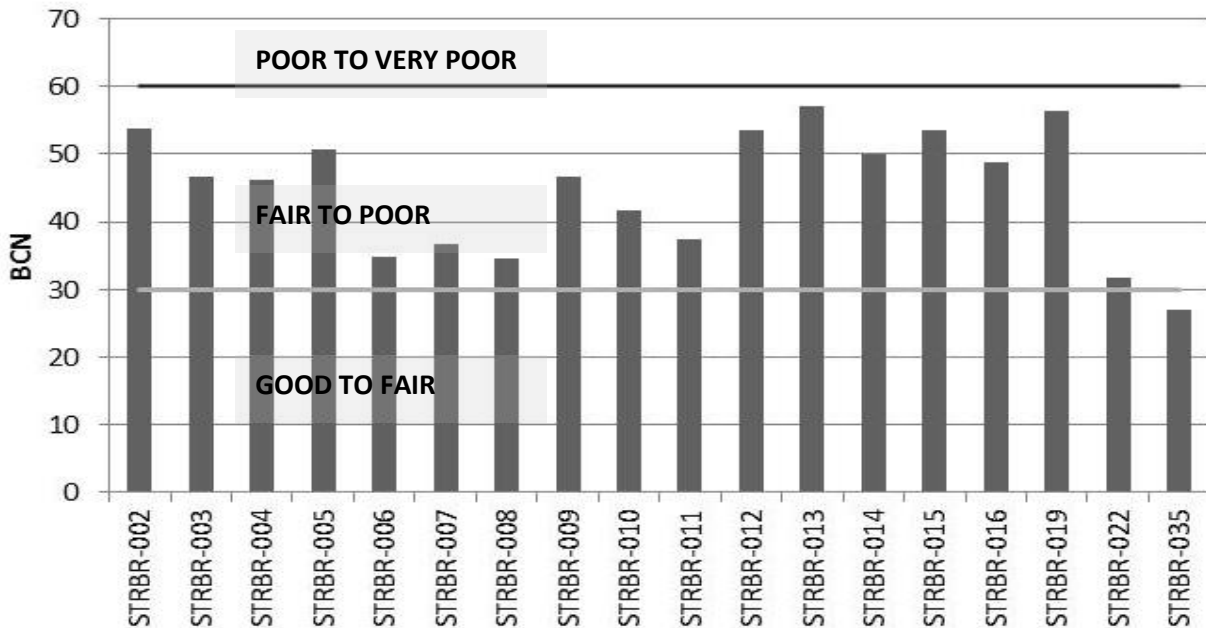
Minor structures are rated directly according the standard 0-5 scale. Major bridges and major culverts, however, have different inspection manuals, resulting in different condition rating scale. Condition distribution of the three types of bridge assets are therefore shown separately below. Note that only structures that have been valued as part of the bridges are included, e.g. suspended ramps that are part of a building are not included, as works on those ramps would be carried out as part of building works.

#### Major Bridges

Condition assessment of major bridges is based on the *VicRoads 2004 Bridge Inspection Manual*. As the major bridges are complex assets, a condition rating has been assigned for each component of the bridge. Following the method in the manual, individual component ratings are then used to calculate a Bridge Condition Number (BCN) for each bridge. Table 5.2 summarises the BCN with respect to the actual bridge condition.

**Table 5.2 Bridge Condition Number (BCN) summary for major bridges**

BCN	Condition
< 30	Good to fair. Structure is free of defects affecting structural performance, integrity and durability.
30 - 60	Fair to poor. Structure has defects which affect durability.
> 60	Poor to very poor. Structure has defects which affect the performance and structural integrity.



**Figure 5.2 Distribution of physical condition of major bridges as at 30 June 2013**

As shown above, the majority of structures classified as major bridges are in a fair condition, and none in poor condition. Previous generations of AM Plan showed STRBR-002 (Concrete bridge at Lower Gibbes St) and STRBR-019 (jetty structure in Northbridge Baths) as the two worst structures. However, this year, some of the timber bridges in the reserves (STRBR-012, STRBR-013, STRBR-015) have deteriorated and are now reaching closer to the poor to very poor mark. This is because the timber structures have shorter life and therefore degrade more quickly.

Level 2 inspections of all major bridges and culverts is due to be carried out in 2013/2014 financial year. This inspection may result in the condition rating above, depending on the actual degradation rate of the bridge components. Results from the inspection will also enable Council to check the validity of some of the assumptions that have had to be made, including the estimated useful life of the timber bridges.

Funding has been set aside in Council’s Long Term Financial Plan to prepare some rehabilitation options for the Northbridge Baths jetty to be funded in future works programs. Additionally, designs are also being prepared for the bridge at Lower Gibbes St for rehabilitation. Even though STRBR-035 has a “Good to fair” rating overall, this is a pedestrian bridge over Pacific Highway, and being a busy state road, carries a higher risk. Council has had to carry out some maintenance work on this bridge during the 2012/2013 financial year, and design options for canopy replacements are currently being considered.

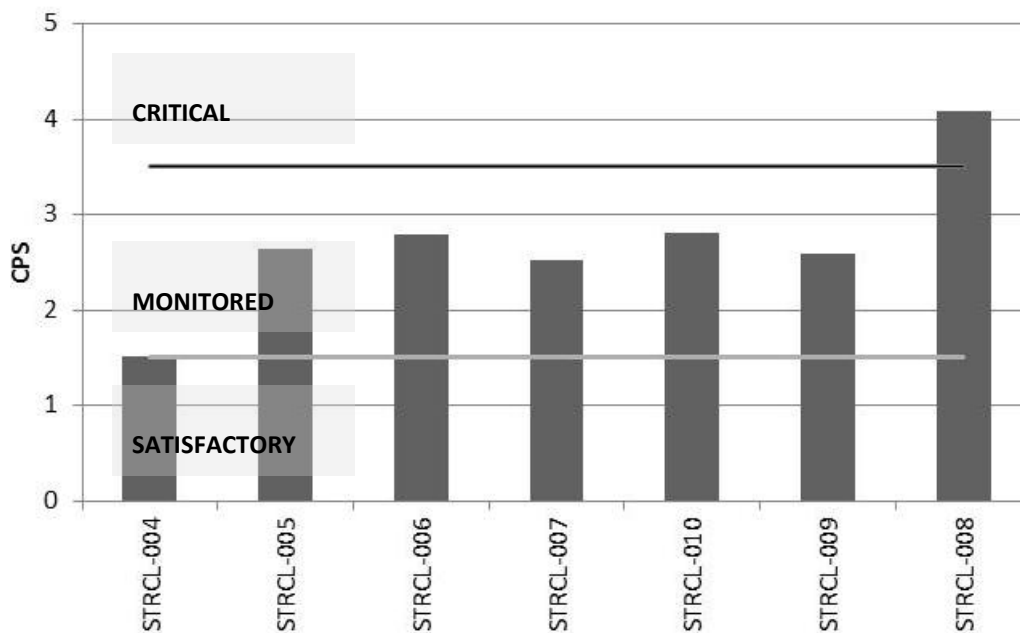
**Major Culverts**

Condition assessment for major culverts is carried out using the methodology described in the publication: *An Asset Management Approach for Drainage Infrastructure & Culverts – Midwest Regional University Transportation Centre*. Similar to the major bridges, major culverts are further broken down into components, and condition rating is assigned to each component, which is then used to calculate the Culvert Performance Score (CPS) for each major culvert. The table below summarises the performance score with respect to the culvert condition.

**Table 5.3 Culvert Performance Score (CPS) summary for major culverts**

Performance Score	Zone	Zone Meaning
< 1.5	Satisfactory	Safe
1.5 - 3.5	Monitored	Intermediate
> 3.5	Critical	Danger

The condition distribution of Council’s major culverts as at 30 June 2013 is shown in the figure below. For more details on each individual structure, refer to section 0. Note that only 7 out of the 8 major culverts have a CPS assigned; the one remaining major culvert is located below ground and has consequently been inspected using CCTV, and assessed on the 0-5 scale, and was rated as Condition 2.5.



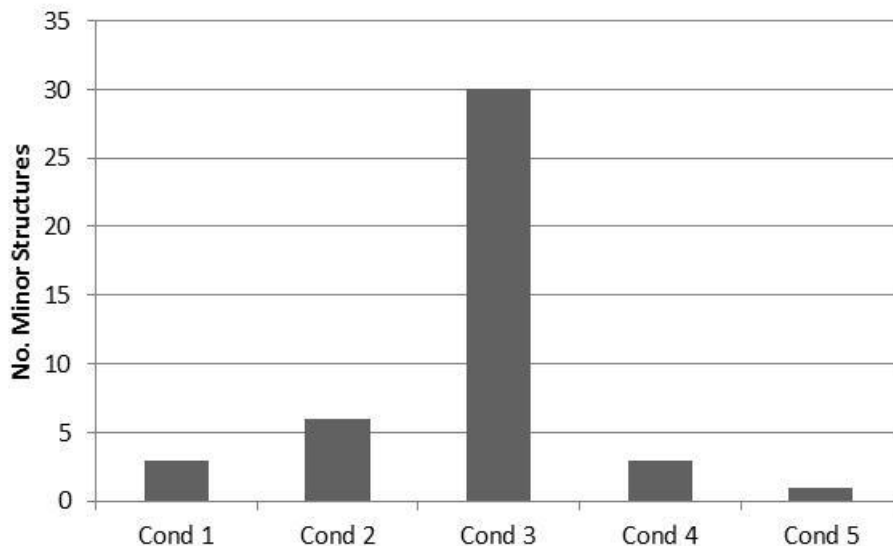
**Figure 5.3 Distribution of physical condition of major culverts as at 30 June 2013**

The one culvert that was identified as being in the ‘Critical’ zone is a sandstone arch culvert at The Bulwark. Several rehabilitation solutions were considered and during the 2012/2013 financial year, Council constructed suspended slabs over the culvert to arrest the deterioration caused by traffic loading.

**Condition Assessment for Minor Structures**

Minor structures are assessed in line with the general 0 – 5 condition rating. Council has established a description for each condition state depending on the material of the minor structure to ease and enable consistency of assessments. A table containing this description can be found in Section 0.

The figure below shows the number of structures in each condition.



**Figure 5.4 Condition distribution of minor structures**

As shown in the figure above, the majority of minor structures are in condition 3, which reflects a condition rating of 'moderate'. During the first round of inspection, these structures were mostly in condition 2. Most minor structures are small timber structures in parks and reserves, and have been assumed to have short useful life, e.g. 10 years for timber bridges. During the next round of inspection, comparison will be made with last inspection's data to validate the rate of deterioration and, if necessary, refine the assumptions.

#### 5.1.4. Asset valuations

Council values all assets at Fair Value. The assumptions and calculation methods associated with valuations are documented in Council's Asset Valuation Methodology. Valuations for the assets covered by this Plan are provided in Table 5.4.

**Table 5.4 Valuations for assets covered by this plan**

Asset type	Current replacement cost	Depreciated replacement cost (fair value)	2012/13 depreciation expense
All assets covered by this Plan	\$ 11,394 k	\$ 8,581 k	\$ 276 k

Indicators of Council's financial sustainability can be derived from fair value figures (reported in Table 5.5).

**Table 5.5 Financial sustainability indicators for assets covered by this Plan**

Indicator	Calculation method	Working	Result
Asset consumption	2012-2013 depreciation / depreciable amount * 100%	= \$276k / \$10,381k * 100%	2.7%
Asset renewal	2012-13 renewal spend / depreciable amount * 100%	= \$0 / \$10,831k * 100%	0%
Asset upgrade	2012-13 capital spend / depreciable amount * 100%	= \$0 / \$10,831k * 100%	0%

No renewal works were undertaken during the 2012/2013 financial year for bridge assets. All bridge funding had been used to carry out maintenance and repair works for two of the bridges. Due to the nature of works carried out on the bridges, renewal expenditure from year to year will vary significantly, unlike assets that can be measured in replacement unit rate. Each bridge is very different from the others, and renewal works on one component may mean other components have to be done at the same time.

Council's current strategy with bridge assets is to undertake rehabilitation works for bridges that have been marked as urgent repair during the condition inspection. The current funding level generally means these are more likely to be maintenance or repair works, rather than renewal works. In the long term, this is not sustainable as some bridges will eventually be due for renewal. In addition, from time to time, bridge funding may need to be set aside and rolled over to enable major renewal works be undertaken.

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## 5.2. Risk management plan

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An assessment of risks associated with service delivery from infrastructure assets has identified critical risks to Council. The risk assessment process is documented in the AMIS and identifies credible risks, likelihood of risk events occurring and consequences should the event occur.

As there is not a high quantity of major bridges and culverts, generally the BCN and CCN is used to prioritise works required at this time, along with recommendations given by structural engineers as to the most critical assets requiring works. Inspection regime for bridge assets are more rigorous, requiring specialised skills and carried out periodically by structural engineers.

Council will develop a more comprehensive Risk Management Plan as asset management practices become more advanced and the electronic asset management system is fully implemented. This rating will also be incorporated into Council's works prioritisation methodology.

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## 5.3. Expenditure plan

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Expenditure is calculated over a 20 year period based on current levels of expenditure and projections of funds required to meet target levels of service.

Two levels of funding are considered:

- (1) the base case, where expenditure follows current trends;
- (2) the sustainable case, where target levels of service are achieved and funding shortages may exist.

The types of expenditure covered include maintenance and operational, renewal, upgrade, new and disposal. These are defined in the AMIS. The method of predicting future expenditure to achieve target levels of service and the assumptions applied to modelling techniques are also explained in the AMIS.

All maintenance, renewal, upgrade and new work is carried out in accordance with relevant Australian Standards.

### 5.3.1. Maintenance and operational expenditure projections

Activities included as maintenance and operational expenditure are defined in the AMIS. The past *actual* maintenance expenditure (as opposed to the allocated maintenance budget) trend for the assets covered by this Plan is shown in Table 5.6 and does not include operational expenditure.

As mentioned previously in this plan, bridge assets were not allocated a separate funding until the 2010/2011 financial year. Works on bridges up until this time were often sourced from roads or footpath funding, depending on the bridge location. The first two years of funding were rolled over for works undertaken during 2012/2013.

**Table 5.6 Actual maintenance expenditure history**

Financial year	Maintenance expenditure
2010-2011	\$ 0
2011-2012	\$ 0
2012-2013	\$ 343 k

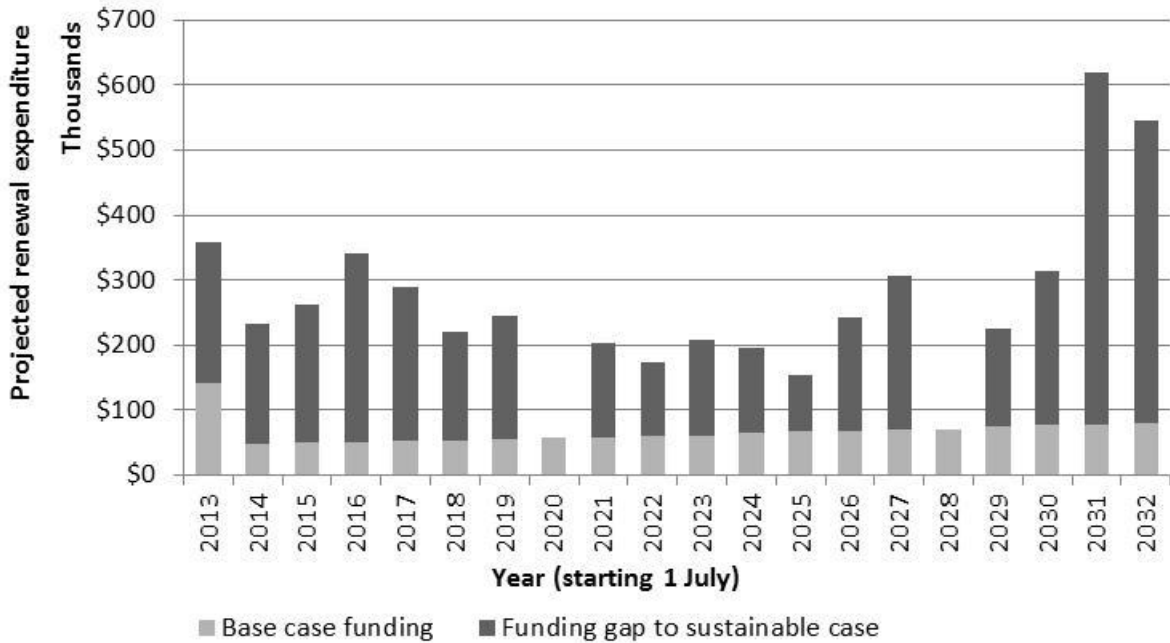
Annual maintenance expenditure is currently equivalent to 3% of the total replacement value reported in the financial reports. Currently Council does not have sufficient historical data to determine whether this funding level is adequate. Expenditure will be monitored and analysed in future years as data becomes available. However, it is worth noting that this maintenance expenditure has most likely been under estimated. Minor structures, for example, are mostly located within parks, reserves and bushland, and this has not taken into account the resources and time that have gone into maintaining the structures as it would have been included in the general maintenance funds of the parks, reserves or bushland.

Maintenance expenditure is expected to increase in line with increases to asset stock through upgrade and new capital works. There is no plan at this stage for new works for bridge assets, but rehabilitation options being considered for some of the bridges may involve upgrading. In order to be financially sustainable, maintenance expenditure should be maintained at least at the current level of total asset stock replacement value. The most current version of Council's Long Term Financial Plan has allocated the whole funding for bridge works as renewal works rather than maintenance, as there had been no bridge maintenance expenditure until the 2012/2013 financial year.

### **5.3.2. Renewal expenditure projections**

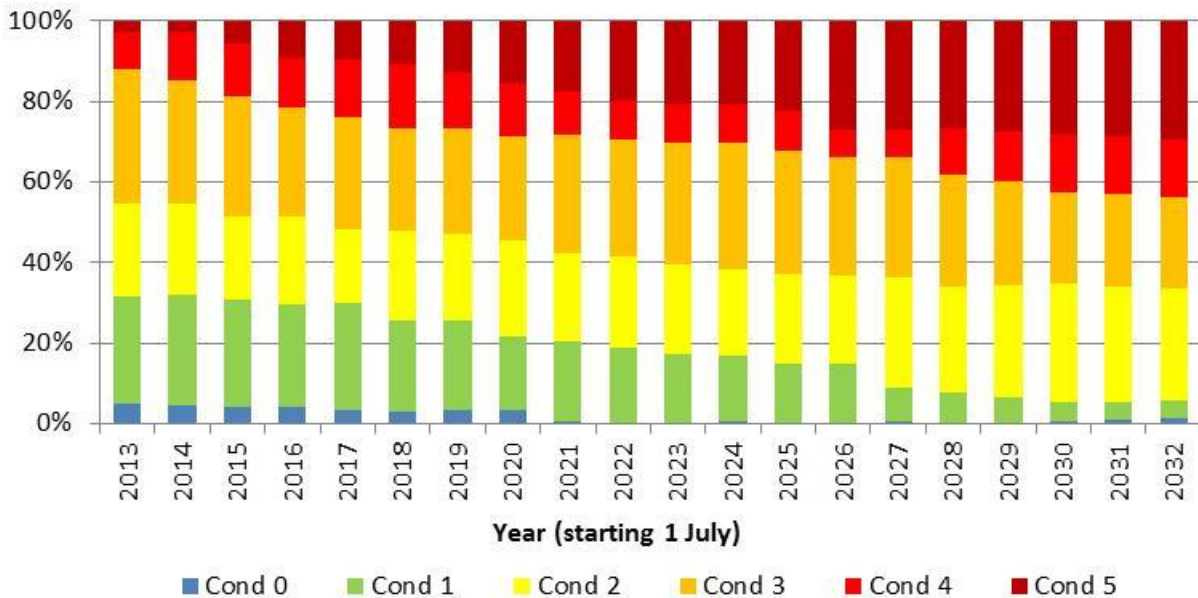
Renewal expenditure depends on levels of service and projections are calculated using modelling techniques and assumptions documented in the AMIS. There were a number of bridges that had been indicated as requiring works in the short term during the last round of inspection, but only the Bulwark sandstone culvert and the pedestrian bridge over Pacific Highway have had maintenance works carried out due to ownership issues and limitation of funding. Regardless of existing backlogs, additional renewal expenditure may be required in the future as a large number of assets reach their intervention point at the same time. Planning for these periods of intense expenditure is crucial. The modelling technique does have limitations which are also documented in the AMIS but still provides a good estimate of long term average funding requirements.

For the assets covered by this Plan, the cost of renewals is based on the replacement cost of the assets. In some cases, actual works may be higher if, for example, the component to be repaired cannot be accessed without also replacing another component. The difference between current funding levels (base case) and projected required renewal funding (sustainable case) is shown in Figure 5.5.



**Figure 5.5 Projected renewal expenditure under the base and sustainable cases.**

Where funding shortages mean that renewals cannot be completed in a timely fashion, the asset pool is expected to decline in condition overall. Figure 5.6 shows the expected degradation in the average condition of the asset pool, as well as the distribution of condition by replacement value. Due to the higher risk they carry, a badly deteriorated bridge may need to have its load limit reduced or even closed to traffic for safety reasons.



**Figure 5.6 Projected asset average condition and distribution under the base case funding**

Where renewal funding falls short of requirements, a prioritisation method is applied to ensure that the highest risk and highest priority assets are renewed first or, in the absence of high risk assets, renewals are carried out in the most financially efficient manner possible. As previously mentioned, prioritisation of bridge works is based on the physical condition of the bridges as well as recommendation from structural engineer during the level 2 inspection. In addition, when a structure is known to have inherently higher risk, such as the pedestrian bridge over a busy state road, this would also life the priority ranking of this structure.



Low cost renewal methods will be used wherever practical, however for bridge assets, in some cases a complete renewal work, and some cases upgrade, may end up being the option with the lowest lifecycle cost, in which case this may be the option that Council selects, depending on the available funding.

### **5.3.3. New and upgrade expenditure projections**

New or upgrade capital works are defined in the AMIS. For the assets covered by this Plan, there are no new works planned, however rehabilitation options for some of the existing bridges may involve an upgrade of the structure. The value of these upgrade works is yet to be determined.

It should be noted that, should new and upgrade expenditure adds to the asset stock, increases in maintenance and operational expenditure can be expected in conjunction with all capital projects.

### **5.3.4. Disposal plan**

Disposals are defined in the AMIS. There is currently no bridge asset that has been identified for disposal.

## 5.4. Summary of future costs

For each of the funding scenarios (base case and sustainable case) the total projected expenditure is displayed in Figure 5.7 and Figure 5.8.

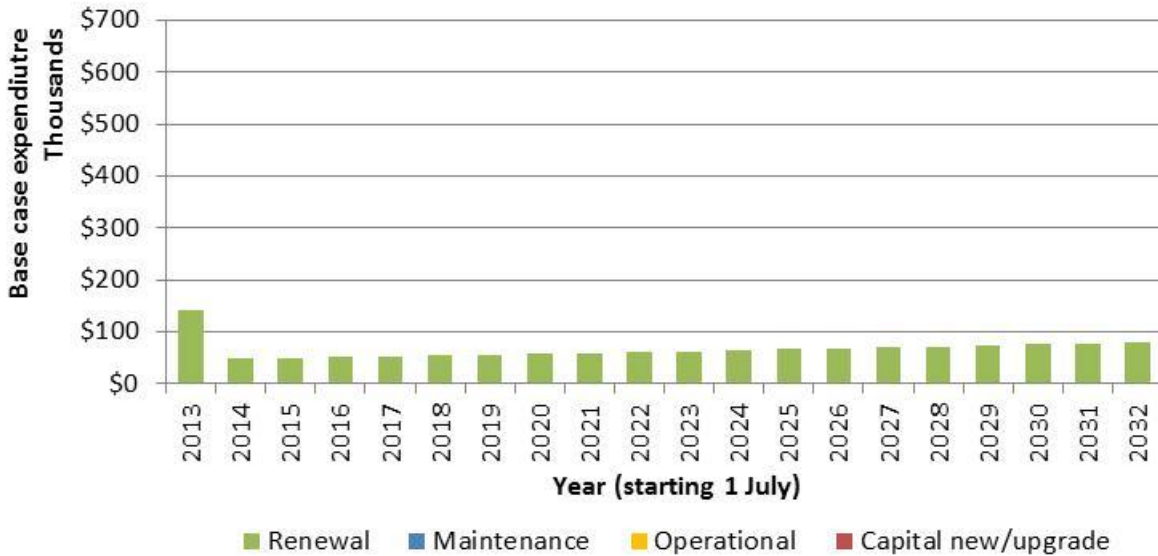


Figure 5.7 Projected 20 year asset expenditure under the base case

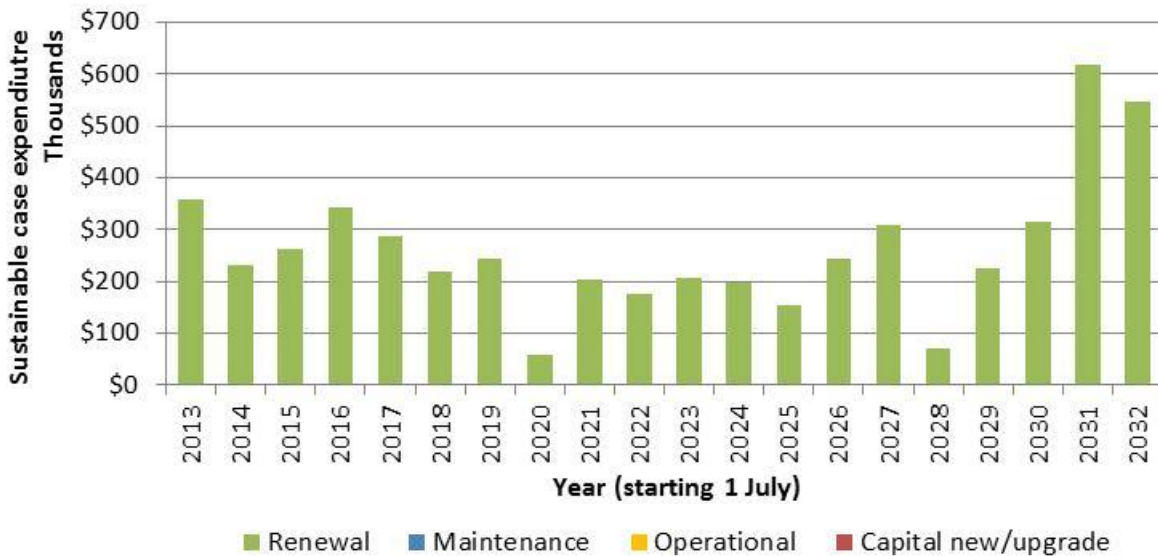


Figure 5.8 Projected 20 year asset expenditure under the sustainable case

As shown in the two figures above, the base case expenditure falls significantly short of the sustainable case. Base case funding for renewal works mean that Council is already facing a shortage of funds for the assets covered by this Plan. Over the 20 year period, this shortage amounts to a total of \$3.9M or an average of \$196,000 per year.

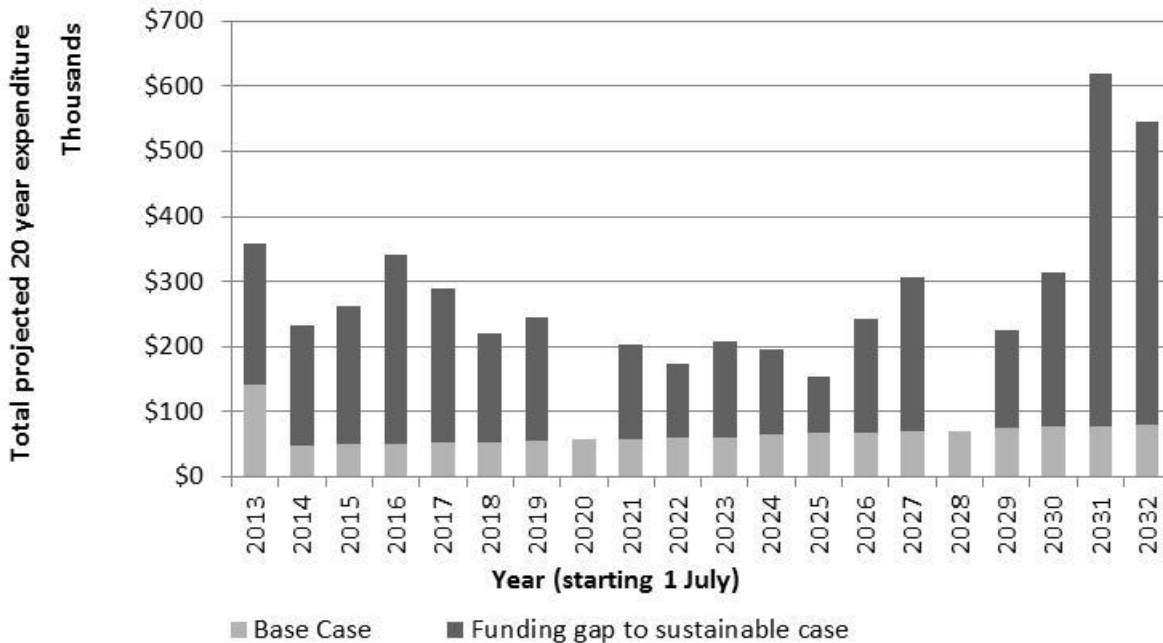
Note also that the expenditure pattern in the sustainable case fluctuates significantly from year to year as the financial model applies treatments to ALL assets that reach intervention level. In reality, funding generally changes at a constant rate, and therefore works may be deferred or brought forward to match the available funding. Some renewal works may also be better deferred to achieve economies of scale when combined with other works. These financial projections involve many assumptions, as detailed in the AMIS, and will be continually refined.

## 6. Financial summary

This section contains the financial requirements resulting from all the information presented in the previous sections of this asset management plan.

### 6.1. Financial statements and projections

Total projected expenditure under each of the two financial scenarios are presented on a single set of axes in Figure 6.1. Expenditure is not broken down into types.



**Figure 6.1 Projected 20 year expenditure for assets covered by this Plan**

For bridge assets this graph is the same as Figure 5.5, as 100% of the bridge funding plan has been allocated to renewal only.

Inflation has been applied at a rate of 3% per annum but no allowance for discount rates has been made.

### 6.2. Life cycle costs and sustainability

Life cycle cost is the average annual cost of meeting target service levels. Life cycle costs include periodic asset renewals and regular maintenance, and operational expenditure where relevant. Life cycle cost can be calculated on an individual asset basis, and the total compared to current levels of expenditure for an indicator of financial sustainability.

A gap between life cycle cost and current expenditure gives an indication of whether the community is currently paying their share of the assets being consumed. Life cycle costing will be refined with each reiteration of this Plan as more information is collected about asset inventories, treatment costs and asset degradation. Life cycle costs for the assets covered by this Plan are provided in **Error! Reference source not found.**

**Table 6.1 Life cycle cost analysis**

Life cycle cost (annual)	Life cycle expenditure (annual)	Life cycle gap
\$ 263k	\$ 67k	\$ 196k

Over 20 years, life cycle cost, which is the required funding in sustainable case, amounts to \$263,000 p.a. on average. On the other hand, the \$67,000 life cycle expenditure reflects the 20 year average of current funding, which is approximately \$150,000 for the 2013/2014 financial year, which then decreases to \$50,000 the following year with an increase of 3% thereafter. This results in life cycle gap of approximately \$196,000 per year, which means current level of service cannot be achieved.

This Plan is the key to addressing the life cycle gap because it provides guidance on future levels of service and resources required to provide those services.

### 6.3. Funding strategy

The information from this Plan, including funding gaps, feeds directly into Council's Long Term Financial Plan (LTFP). The LTFP should be consulted for all funding strategies.

### 6.4. Valuation forecasts

Asset replacement values will increase as additional assets are added to the asset stock. For bridge assets, increase of asset values are more likely to occur due to upgrade rather than new construction. Depreciation expense will vary according to the expenditure level, since depreciation patterns vary throughout the life cycle of assets. Fair value is expected to increase in line with additions to the new asset stock, but if assets are not renewed in a timely fashion the overall fair value is more likely to drop. Table 6.2 compares the current and projected total replacement cost, depreciation expense and written down value of all assets covered by this Plan under each of the two expenditure cases (base and sustainable).

**Table 6.2 Asset valuation forecasts under the base and sustainable cases**

Financial case	Year	Replacement cost	Annual depreciation expense	Written down value (fair value)
Base case	1	\$ 11,394 k	\$ 298 k	\$ 8,629 k
	20	\$ 11,394 k	\$ 129 k	\$ 5,596 k
Sustainable case	1	\$ 11,394 k	\$ 298 k	\$ 8,629 k
	20	\$ 11,394 k	\$ 227 k	\$ 8,135 k

As mentioned previously in section 6.2, there is a significant lifecycle gap for bridge assets. Base case funding falls significantly short of the sustainable case, and hence by the end of the 20 year period, many of the bridge assets are in poor condition, some even reaching their end of life as funding is inadequate for treatment to be applied, as reflected in the lower written down value by that stage.

### 6.5. Key assumptions made in financial forecasts

The broad assumptions applied to all asset classes in producing financial forecasts are described in the AMIS. Assumptions that relate specifically to this asset class are as follows:

- Repair or renewal work results in asset condition being restored to condition 1.
- Repair cost is based on the replacement cost of each component for major bridges and culvert, and replacement costs of the whole structure for minor structures.

- For modelling purposes we assume each component can be repaired independently. In reality one component may not be able to be repaired without affecting another component. Actual work programs will group components as required manually, as this logic is too complex to model.

Accuracy of future financial forecasts may be improved in future revisions of this asset management plan by the following actions:

- Continued revision of assumptions relating to valuations such as useful life, pattern of consumption and residual values.

## 7. Asset Management Practices

This section summarises Council's current asset management practices in terms of software systems and business processes. All information that applies to Council as a whole can be found in the AMIS. Only information relating specifically to the assets covered by this Plan is covered here.

### 7.1. Accounting/financial systems

Capital thresholds have been developed for most infrastructure assets to determine whether expenditure is classed as maintenance or capital. However, for bridge assets, whether a particular project falls into renewal, maintenance or upgrade is determined on a case by case basis, as each project tends to be unique and may be a combination of more than one type of works.

### 7.2. Asset management systems

Council is in the process of implementing Infor Public Sector Suite as its corporate asset management system. Details of Council-wide implementation, including integration with other Council systems, can be found in the AMIS.

The status of asset management system implementation for the assets covered by this Plan is near completion and accurate in terms of asset register. However, condition rating was based on inspections carried out approximately 3 years ago, and a new round of inspection is due to be carried out during the 2013/2014 financial year.

### 7.3. Information flow requirements and processes

The key information flows *into* this asset management plan are:

- Data from the asset register on size, age, value, condition, remaining life (see asset valuation methodology);
- Unit rates for treatments/replacements and asset consumption patterns (see asset valuation methodology)
- Adopted service levels (Section 3.3 of this Plan)
- Projections of various factors affecting future demand for services (Section 4.1 of this Plan)
- Available budgets from the long term financial plan
- Long term capital project planning
- Outputs from renewal modelling
- Data on new assets acquired by Council and future disposals

The key information flows *from* this asset management plan are:

- The works program
- The annual operational plan and budget
- The 4 year delivery program
- Required funding to address any renewal and maintenance gaps for the long term financial plan

### 7.4. Standards and guidelines

This Plan has been prepared under the Division of Local Government's Integrated Planning & Reporting Framework with guidance from the IPWEA International Infrastructure Management Manual.

## 8. Plan Improvement and Monitoring

This section deals with the improvement of this Plan and the management of assets covered by this Plan, including performance measures, an action plan for improvement and review procedures.

### 8.1. Performance measures

The effectiveness of this Plan can be measured in the following ways:

- Integration of the contents of this Plan with the other documents that constitute the Integrated Planning and Reporting Framework, particularly the Resourcing Strategy.
- The level of deviation from previously published capital works programs and budgets.
- Improvement in data confidence.

### 8.2. Action plan for improvement

Actions that can be undertaken to ensure this Plan is improved in the future are listed in Table 8.1

**Table 8.1 Action plan for improvement**

Task #	Task description
1	Revision for assumptions that have been used for valuations. For example, timber boardwalks may have shorter useful life due vandalism.
2	Conditions of bridges and culverts are shown in BCN and PCS as per the condition rating methodology. In the future, will "translate" this to 1-5 scale to make it comparable to Council's other assets

Improvement in Council-wide asset management practices, business processes, workflows and systems is detailed in the AMIS.

### 8.3. Monitoring and review procedures

This Plan will be reviewed in November and December annually during the preparation of the annual budget and amended to recognise any changes in levels of service and/or resources available to deliver those services as a result of financial decisions in the long term financial plan.

## 9. References

NSW DLG Integrated Planning and Reporting Manual

<http://www.dlg.nsw.gov.au/dlg/dlghome/Documents/Information/Intergrated%20Planning%20and%20Reportin%20Manual%20-%20March%202013.pdf>

Willoughby City Strategy 2013-2029

<http://www.willoughby.nsw.gov.au/Community/Community-Planning/Willoughby-City-Strategy/>

Willoughby City Council Delivery Program 2013-2017 and Operation Plan

<http://www.willoughby.nsw.gov.au/About-Council/Forms-Policies---Publications/delivery-program-and-operational-plan-2010-2014/>

Willoughby City Council Resourcing Strategy

<http://www.willoughby.nsw.gov.au/About-Council/Forms-Policies---Publications/resourcing-strategy/>



## 10. Appendix A – Maintenance and inspection program

Inspections are conducted in order to identify defects and monitor the condition of the structure, and attempt to predict the rate of deterioration of the structure over time.

There are three levels of inspections that are able to be carried out that vary from a basic visual inspection (Level 1) to a detailed engineering inspection (Level 3). Inspectors and inspection frequencies vary dependant on the type of structure and method of inspection carried out. Note that these are *target* inspection frequency, and ultimately actual frequency is subject to availability of budgets and resources. The following table outlines Council's inspection program, which has been sourced from *VicRoads Bridge Inspection Manual* but modified to suit Council's strategy.

**Table 10.1 Willoughby City Council's Bridge Inspection Program**

<b>Level 1: Routine Maintenance Inspections</b>	
Inspection frequency	Annually and immediately after floods and other natural disasters, accident and overload, or if there is threat to the safety of community and road users.
Inspector	Trained Council Staff or Contractor (resource-dependent)
Purpose of inspection	To check the general serviceability of the structure for the safety of users, and identify any emerging problems.
Scope of inspection	Inspection of approaches, waterway, deck/footway, substructure, superstructure and attached services to assess and report any significant visible signs of distress or unusual behaviour, including active scours or deck joint movements.
<b>Level 2: Bridge Condition Inspections</b>	
Inspection frequency	3-yearly or as required based on the Level 1 inspection.
Inspector	Structural Engineer or Level 2 certified inspector.
Purpose of inspection	To assess and rate the condition of a structure as a basis for assessing the effectiveness of past maintenance treatments, identifying current maintenance needs, modelling and forecasting future changes in condition and estimating future budget requirements.
Scope of inspection	Inspection of the principal bridge components and an assessment of condition using a standard condition rating system. Reporting the condition of principal bridge components and aggregate rating for the structure as a whole. Reviewing and updating bridge inventory data items as appropriate Identifying and programming defect treatment requirements. Requesting detailed bridge inspection if warranted by apparent rapid changes in structural condition and/or deterioration Recommending requirements for next inspection and nominating components for closer monitoring as appropriate. Recommending supplementary testing as appropriate.
<b>Level 3: Detailed Engineering Inspection</b>	
Inspection frequency	Conducted on as needed basis following results from Level 2 inspection
Inspector	Structural Engineer.
Purpose of inspection	To assess the structural condition and behaviour of a structure. To identify and quantify the current and projected deterioration of the structure. To assess appropriate management options.
Scope of inspection	Detailed inspection of all bridge components, including testing and analyses as necessary to supplement visual inspection. Reporting the condition, structural adequacy, evidence of distress, mode of deterioration, and projected deterioration. Recommendations of management actions and/or maintenance/rehabilitation treatment options.

## 11. Appendix B – Capital works program

This appendix lists all capital works projects identified in asset management plans for the five years beginning 2013/14. The types of works included are renewal of existing assets, upgrade of existing assets and purchase/construction of new assets. These are presented according to the two financial cases covered by the Long Term Financial Plan:

- **Base Case** – works that will almost certainly take place if funding continues at present levels
- **Sustainable case** – works that either could not be carried out, or would be carried out later than is ideal, without a special rate variation.

Whilst reviewing this list of works, it is very important to note that it does not represent a prescriptive capital works program. The proposed year of works is listed against each item based on current priorities. As asset degradation and use profiles can only ever be estimated rather than accurately predicted, it is likely that priorities will shift over time. Each proposed work will require on-site investigation before determining its final inclusion in the works program, and the condition of many assets will be reassessed in this financial year. This may result in considerable variation of proposed works, depending on actual asset degradation.

It is standard practice for Council staff to review such lists of Capital works at budget time each year, and often much more frequently for network assets such as footpaths. As such, this list should be considered an indicator of the *quantity* and *distribution* of works that are likely to be undertaken. The accuracy of these capital works programs decreases with each subsequent year. Nonetheless, long-term planning and identification of these projects is an essential part of ensuring that Council attains financial sustainability.

The following table provides the 5-year total expenditure for bridge asset works by ward. These have been compiled to provide an overview by ward.

**Table 11.1 Summary of capital works by ward**

Asset class	Ward	Projects total value over 5 years (Base case)	Additional projects value over 5 years (Sustainable case)
Bridges	West Ward	\$540,254	\$0
	Sailors Bay Ward	\$404,473	\$0
	Middle Harbour Ward	\$307,381	\$200,000
	Naremburn Ward	\$435,000	\$270,000

Works are presented in a tabular fashion by year. “Year 1” is the 2013/14 financial year, “Year 2” is the 14/15 financial year, and so on. All works listed for bridges (and other structures, including major culverts) involve the partial or complete renewal of the component indicated. Since renewal of certain components necessarily involves renewal of other, supporting or supported components, several items are likely to be brought forward in order to minimise costs and carry out works on individual structures simultaneously.

### 11.1. Base Case

Structure description	Component of structure	Value	Year	Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Retaining walls	\$ 100,000	1	Middle Harbour Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Embankments and fill	\$ 50,000	1	Middle Harbour Ward

Structure description	Component of structure	Value	Year	Ward
Timber bridge in H.C Park in Castle cove	Pedestrian bridge	\$ 1,800	1	Middle Harbour Ward
Timber bridge in H.C. Press Park in Castle Cove	Pedestrian bridge	\$ 2,070	1	Middle Harbour Ward
Timber bridge in H.C. Press Park in Castle Cove	Pedestrian bridge	\$ 2,376	1	Middle Harbour Ward
Masonry/ blockwork arch culvert with concrete base under Ruth St spanning main stormwater channel in Naremburn	Embankment	\$ 10,000	1	Naremburn Ward
Masonry/ concrete arch culvert under Dargan St spanning main stormwater channel in Naremburn. 2 layers of blockwork supporting masonry/ brick arch structure.	Embankment	\$ 20,000	1	Naremburn Ward
Timber bridge in Artarmon Reserve over Creek in Artarmon.	Beam or girders	\$ 15,000	1	Naremburn Ward
Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	Embankment	\$ 30,000	1	Sailors Bay Ward
Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	End Protection	\$ 30,000	1	Sailors Bay Ward
Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	Footing	\$ 30,000	1	Sailors Bay Ward
Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	Invert	\$ 30,000	1	Sailors Bay Ward
Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	Culvert	\$ 100,000	1	Sailors Bay Ward
Timber bridge at Outpost Rd, North bridge Bowling Club	Pedestrian bridge	\$ 4,500	1	Sailors Bay Ward
Bridge over Pacific Hwy near Victoria Ave	Canopy Framing	\$ 188,519	1	West Ward
Timber bridge in Coolaroo Reserve over creek in Chatswood.	Piers	\$ 15,000	1	West Ward
Box culvert under Fourth Ave spanning main stormwater channel in Willoughby. Concrete wall, masonry base.	Embankment	\$ 50,000	2	Middle Harbour Ward
Timber bridge in Harold Reid Reserve over creek in Middle Cove	Pedestrian bridge	\$ 2,208	2	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove	Pedestrian bridge	\$ 2,178	2	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Underside of deck	\$ 10,000	2	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Abutment	\$ 15,000	2	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Piers	\$ 10,000	2	Middle Harbour Ward

Structure description	Component of structure	Value	Year	Ward
Steel frame bridge with timber decking in Flat Rock Gully on bicycle track in Naremburn with cantilevering observation platform looking downstream.	Deck Surface	\$ 15,000	2	Naremburn Ward
Boardwalk in Flat Rock Gully off bike track in Northbridge	Suspended footpath	\$ 24,950	2	Sailors Bay Ward
Jetty structure at Northbridge Baths at end of Widgiewa Rd with concrete piers.	Joint seal	\$ 5,000	2	Sailors Bay Ward
Timber bridge in Clive Park over creek in Northbridge	Pedestrian bridge	\$ 2,592	2	Sailors Bay Ward
Timber bridge in Northbridge Park over creek in Northbridge	Pedestrian bridge	\$ 9,225	2	Sailors Bay Ward
Timber bridge in Warners Park off Eastern Valley Way in Northbridge	Pedestrian bridge	\$ 9,540	2	Sailors Bay Ward
Timber bridge in Watergate Reserve over creek in Castlecrag	Pedestrian bridge	\$ 6,840	2	Sailors Bay Ward
Timber bridge near Jack McLure Pl, Northbridge Bowling Club	Pedestrian bridge	\$ 14,333	2	Sailors Bay Ward
Timber bridge near The Barricade over creek adjacent to amphitheatre.	Underside of deck	\$ 5,000	2	Sailors Bay Ward
Timber bridge near The Barricade over creek adjacent to amphitheatre.	Deck Surface	\$ 5,000	2	Sailors Bay Ward
Timber footpath on The Bulwark over stormwater channel in Castlecrag	Suspended footpath	\$ 6,614	2	Sailors Bay Ward
Boardwalk adjacent to Lane Cove River near golf course in Lane Cove	Suspended footpath	\$ 5,180	2	West Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River near end of Hatfield St in Lane Cove	Suspended footpath	\$ 3,823	2	West Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River near end of Willandra St, Lane Cove	Suspended footpath	\$ 1,850	2	West Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	Suspended footpath	\$ 29,600	2	West Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	Suspended footpath	\$ 25,530	2	West Ward
Timber bridge in Blue Gum Park over creek in Chatswood	Pedestrian bridge	\$ 10,620	2	West Ward
Timber bridge in Coolaroo Reserve over creek in Chatswood.	Underside of deck	\$ 10,000	2	West Ward
Timber bridge in Mowbray Park over creek, Lane Cove.	Underside of deck	\$ 5,000	2	West Ward
Boardwalk linked by bridges in playground at Castle Cove Park	Suspended footpath	\$ 14,134	3	Middle Harbour Ward
Steel arch bridge in Muston Park over creek in Chatswood.	Underside of deck	\$ 10,000	3	Middle Harbour Ward
Steel arch bridge in Muston Park over creek in Chatswood.	Deck Surface	\$ 10,000	3	Middle Harbour Ward

Structure description	Component of structure	Value	Year	Ward
Timber bridge in H.C. Press Park in Castle Cove	Pedestrian bridge	\$ 7,215	3	Middle Harbour Ward
Timber bridge in North Arm Reserve over Creek in Castle Cove	Pedestrian bridge	\$ 3,240	3	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove	Pedestrian bridge	\$ 2,160	3	Middle Harbour Ward
Masonry/ concrete arch culvert under Dargan St spanning main stormwater channel in Naremburn. 2 layers of blockwork supporting masonry/ brick arch structure.	Culvert	\$ 100,000	3	Naremburn Ward
Timber bridge in Artarmon Reserve over Creek in Artarmon.	Embankments and fill	\$ 15,000	3	Naremburn Ward
Timber bridge in Artarmon Reserve over Creek in Artarmon.	Deck Surface	\$ 10,000	3	Naremburn Ward
Timber bridge in Watergate Reserve over creek in Castlecrag	Pedestrian bridge	\$ 4,131	3	Sailors Bay Ward
Timber bridge near Jack McLure Pl, Northbridge Bowling Club	Pedestrian bridge	\$ 6,999	3	Sailors Bay Ward
Timber bridge near Jack McLure Pl, Northbridge Bowling Club	Pedestrian bridge	\$ 7,042	3	Sailors Bay Ward
Timber bridge near The Barricade over creek adjacent to amphitheatre.	Embankments and fill	\$ 5,000	3	Sailors Bay Ward
Timber bridge near The Barricade over creek adjacent to amphitheatre.	Beam or girders	\$ 10,000	3	Sailors Bay Ward
Timber footpath on The Bulwark over stormwater channel in Castlecrag	Suspended footpath	\$ 4,718	3	Sailors Bay Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River in Lane Cove	Suspended footpath	\$ 35,520	3	West Ward
Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	Suspended footpath	\$ 51,060	3	West Ward
Timber bridge in Mowbray Park over creek in Lane Cove	Pedestrian bridge	\$ 10,350	3	West Ward
Timber bridge in Mowbray Park over creek, Lane Cove.	Beam or girders	\$ 10,000	3	West Ward
Timber stairs in Mowbray Park in Lane Cove	Suspended stairways	\$ 18,415	3	West Ward
Box culvert under Fourth Ave spanning main stormwater channel in Willoughby. Concrete wall, masonry base.	Culvert	\$ 100,000	4	Middle Harbour Ward
Steel arch bridge in Muston Park over creek in Chatswood.	Railings	\$ 15,000	4	Middle Harbour Ward
Steel arch bridge in Muston Park over creek in Chatswood.	Deck	\$ 10,000	4	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Footpath	\$ 10,000	4	Middle Harbour Ward

Structure description	Component of structure	Value	Year	Ward
Box culvert under Burra Rd spanning stormwater channel in Artarmon. Masonry walls and base, concrete wall.	Culvert	\$ 80,000	4	Naremburn Ward
Masonry/ concrete arch culvert under Mitchell St spanning main stormwater channel in Naremburn	Culvert	\$ 100,000	4	Naremburn Ward
Timber bridge in Artarmon Reserve over Creek in Artarmon.	Railings	\$ 10,000	4	Naremburn Ward
Boardwalk in Flat Rock Gully off bike track in Northbridge	Suspended footpath	\$ 27,991	4	Sailors Bay Ward
Timber bridge in Coolaroo Reserve over creek in Chatswood.	Railings	\$ 10,000	4	West Ward
Timber bridge in Coolaroo Reserve over creek in Chatswood.	Deck Surface	\$ 10,000	4	West Ward
Steel arch bridge in Muston Park over creek in Chatswood.	Long/ cross decking	\$ 10,000	5	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Deck Surface	\$ 10,000	5	Middle Harbour Ward
Timber bridge in North Arm Reserve over creek in Middle Cove.	Crossheads (not integral)	\$ 10,000	5	Middle Harbour Ward
Box culvert under Burra Rd spanning stormwater channel in Artarmon. Masonry walls and base, concrete wall.	Embankment	\$ 20,000	5	Naremburn Ward
Masonry/ concrete arch culvert under Dargan St spanning main stormwater channel in Naremburn. 2 layers of blockwork supporting masonry/ brick arch structure.	End Protection	\$ 40,000	5	Naremburn Ward
Jetty structure at Northbridge Baths at end of Widgiewa Rd with concrete piers.	Bearings (Elastomeric)	\$ 20,000	5	Sailors Bay Ward
Timber bridge near The Barricade over creek adjacent to amphitheatre.	Abutment	\$ 5,000	5	Sailors Bay Ward
Boardwalk adjacent to Lane Cove River near golf course in Lane Cove	Suspended footpath	\$ 3,453	5	West Ward
Boardwalk in Mowbray Park behind athletics field	Suspended footpath	\$ 86,333	5	West Ward
Timber bridge in Mowbray Park over creek, Lane Cove.	Deck Surface	\$ 5,000	5	West Ward
Timber bridge in Mowbray Park over creek, Lane Cove.	Piers	\$ 5,000	5	West Ward

## 11.2. Sustainable Case

Structure description	Component of structure	Value	Year	Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Footpath	\$30,000	2	Middle Harbour Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Kerbs	\$10,000	2	Middle Harbour Ward

<b>Structure description</b>	<b>Component of structure</b>	<b>Value</b>	<b>Year</b>	<b>Ward</b>
Concrete and steel composite bridge on Herbert St over railway at St Leonards.	Joint seal	\$20,000	2	Naremburn Ward
Concrete bridge with metal railings off southern end of Waters Rd over creek in Talus Reserve, Naremburn.	Railings	\$10,000	2	Naremburn Ward
Concrete bridge on Artarmon Rd over Artarmon Reserve bike track in Artarmon with pedestrian walkway.	Kerbs	\$10,000	3	Naremburn Ward
Concrete bridge with metal railings off southern end of Waters Rd over creek in Talus Reserve, Naremburn.	Embankments and fill	\$20,000	3	Naremburn Ward
Timber bridge adjacent to Artarmon Oval over creek in Artarmon.	Abutment	\$20,000	3	Naremburn Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Parapets	\$60,000	4	Middle Harbour Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Underside of deck	\$50,000	4	Middle Harbour Ward
Concrete bridge on Artarmon Rd over Artarmon Reserve bike track in Artarmon with pedestrian walkway.	Footpath	\$10,000	4	Naremburn Ward
Suspended concrete deck between 15/15A Herbert St and bridge over railway, St Leonards	Kerbs	\$10,000	4	Naremburn Ward
Timber bridge adjacent to Artarmon Oval over creek in Artarmon.	Embankments and fill	\$15,000	4	Naremburn Ward
Concrete bridge at Lower Gibbes St over Scotts Ck in Chatswood.	Guard rails	\$50,000	5	Middle Harbour Ward
Concrete and steel composite bridge on Herbert St over railway at St Leonards.	Railings	\$100,000	5	Naremburn Ward
Suspended concrete deck between 15/15A Herbert St and bridge over railway, St Leonards	Footpath	\$50,000	5	Naremburn Ward
Timber bridge adjacent to Artarmon Oval over creek in Artarmon.	Deck Surface	\$5,000	5	Naremburn Ward

## 12. Appendix C - Asset assessment manual

Condition assessment of major bridges is based on the *VicRoads 2004 Bridge Inspection Manual*.

Condition assessment for major culverts is carried out using the methodology described in the publication: *An Asset Management Approach for Drainage Infrastructure & Culverts – Midwest Regional University Transportation Centre*.






Condition assessment for minor structures is developed mainly based on local experience in the council, and is shown below.







Condition	General	Concrete	Stone/Brick Masonary	Timber	Steel
1	Good condition. Little or no deterioration.	Looks new and in excellent condition. .	Looks new and in very good condition	Looks new and in excellent condition.	Looks new and in excellent condition.
2	Fair condition. Minor deterioration	Fine cracking (0.1-0.3mm) May have minor spalls but no corrosion staining in the cracks.	Fine cracking (0.1-0.3mm), Minor spalling. NO any joint erosion or dislocation.	Minor decay. Connections are tight, no corrosion.	Spot corrosion may be present. Connections are tight, no corrosion.
3	Moderate condition. Advancing deterioration with minor loss of section. No short-term expectation of issues but indicators of medium term concern.	Medium cracking (0.3-0.7mm) Isolated spalling	Medium cracking (0.3-0.7mm) Isolated spalling and eroded joints. Isolated mortar loss from joints.	Moderate decay. Large splits, checks, some delamination. Loose connections due to timber decay, and/or steel component corrosion. Vegetation starting to encroach on the boardwalk.	Medium corrosion, slight loss of section Paint has completely failed. Connections may be loose with some corrosion.
4	Poor condition. Advanced deterioration with loss of effective section. Concerns over safety and usability.	Heavy cracking (>0.7mm) Heavy spalling	Heavy cracking (>0.7mm) Heavy spalling. Heavy erosion of joints and surface. Bulges and dislocation of Stone/Brick.	Severe splitting. Some cracking and split along the joints of beams. Loose connections Boardwalk heavily encroached by vegetation, difficult to pass through.	Heavy corrosion, obvious loss of section Connections are loose and protective coatings have gone completely.
5	At intervention point. If remedial action is not taken immediately, structure will need to be closed or decommissioned.				







Each minor structure is assigned a condition rating ranging from 1 to 5 as shown above.





## 13. Appendix D – Willoughby City Council’s Bridge Assets



1.0 MAJOR BRIDGES			
1.1 ROAD BRIDGES			
1	Structure_No	STRBR-002	
	Description and Location	Concrete bridge at Lower Gibbest St over Scotts Creek in Chatswood.	
	Maintenance_Resp	Willoughby City Council	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	53.7	
2	Structure_No	STRBR-004	
	Description and Location	Concrete bridge on Artarmon Rd over Artarmon Reserve bike track in Artarmon with pedestrian walkway.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	46.3	
3	Structure_No	STRBR-005	
	Description and Location	Timber bridge adjacent to Artarmon Oval over creek in Artarmon.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	50.7	
4	Structure_No	STRBR-008	
	Description and Location	Concrete and steel composite bridge on Herbert St over railway at St Leonards.	
	Maintenance_Resp	Willoughby City Council (Engineering) during defect period	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	34.5	
5	Structure_No	STRBR-022	
	Description and Location	Concrete bridge on Lady Game Drive over Blue Gum Creek.	
	Maintenance_Resp	Willoughby City Council and Ku-ring-gai Council	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	31.9	


1.2 PEDESTRIAN BRIDGES			
1	Structure_No	STRBR-003	
	Description and Location	Concrete bridge with metal railings off southern end of Waters Rd over creek in Talus Reserve, Naremburn.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	46.7	
2	Structure_No	STRBR-007	
	Description and Location	Steel bridge on Park Rd within an existing arch structure under Willoughby Rd.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	36.7	
3	Structure_No	STRBR-009	
	Description and Location	Steel arch bridge in Muston Park over creek in Chatswood.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	46.5	
4	Structure_No	STRBR-010	
	Description and Location	Steel frame bridge with timber decking in Flat Rock Gully on bicycle track in Naremburn with cantilevering observation platform looking downstream.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	35.5	
5	Structure_No	STRBR-011	
	Description and Location	Bridge and pontoon in Mowbray Park behind athletics field over part of the Lane Cove River.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	41.8	
6	Structure_No	STRBR-012	
	Description and Location	Timber bridge in Coolaroo Reserve over creek in Chatswood.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	53.6	




7	Structure_No	STRBR-013	
	Description and Location	Timber bridge in North Arm Reserve over creek in Middle Cove.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	57.2	
8	Structure_No	STRBR-014	
	Description and Location	Timber bridge near The Barricade over creek adjacent to amphitheatre.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	50.0	
9	Structure_No	STRBR-015	
	Description and Location	Timber bridge in Artarmon Reserve over Creek in Artarmon.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	53.6	
10	Structure_No	STRBR-016	
	Description and Location	Timber bridge in Mowbray Park over creek, Lane Cove.	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	48.8	
11	Structure_No	STRBR-017	
	Description and Location	Concrete ramp supported by blockwork connecting into roof of building in Naremburn Park	
	Maintenance_Resp	Willoughby City Council (Property)	
	Traffic	Pedestrian	
	Structure_Type	Ramp	
	BCN as of June 2011	38.4	
12	Structure_No	STRBR-019	
	Description and Location	Jetty structure at Northbridge Baths at end of Widgiewa Rd with concrete piers.	
	Maintenance_Resp	Willoughby City Council (Property)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	BCN as of June 2013	56.3	





13	Structure_No	STRBR-035	N/A
	Description and Location	Pedestrian bridge over Pacific Hwy near Victoria Avenue	
	Maintenance_Resp	Willoughby City Council	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	BCN as of June 2013	31.9	






1.3 SUSPENDED DECK			
1	Structure_No	STRBR-006	
	Description and Location	Suspended concrete deck between 15/15A Herbert St and bridge over railway, St Leonards	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Suspended deck	
	BCN as of June 2013	34.9	
2	Structure_No	STRBR-018	
	Description and Location	2-level amphi-theatre near The Barricade.	
	Maintenance_Resp	Willoughby City Council (Property)	
	Traffic	Pedestrian	
	Structure_Type	Suspended deck	
	BCN as of June 2011	40.6	

1.4 RAMP			
1	Structure_No	STRBR-020	
	Description and Location	Concrete ramp leading to building at Gore Hill Oval	
	Maintenance_Resp	Willoughby City Council (Property)	
	Traffic	Pedestrian	
	Structure_Type	Ramp	
	BCN as of June 2011	29.6	
2	Structure_No	STRBR-021	
	Description and Location	Concrete ramp leading to building at Gore Hill Oval	
	Maintenance_Resp	Willoughby City Council (Property)	
	Traffic	Pedestrian	
	Structure_Type	Ramp	
	BCN as of June 2011	29.9	






2.0 MAJOR CULVERTS			
2.1 Pedestrian Culverts			
1	Structure_No	STRCL-004	
	Description and Location	Pedestrian underpass under Flat Rock Drive in Naremburn	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Culvert - Pedestrian	
	Performance Score	1.5	






2.1 Culverts			
1	Structure_No	STRCL-005	
	Description and Location	Masonry/ blockwork arch culvert with concrete base under Ruth St spanning main stormwater channel in Naremburn	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Arch culvert	
	Performance Score	2.6	
2	Structure_No	STRCL-006	
	Description and Location	Masonry/ concrete arch culvert under Dargan St spanning main stormwater channel in Naremburn.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Arch culvert	
	Performance Score	2.8	
3	Structure_No	STRCL-007	
	Description and Location	Masonry/ concrete arch culvert under Mitchell St spanning main stormwater channel in Naremburn	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Arch culvert	
	Performance Score	2.5	





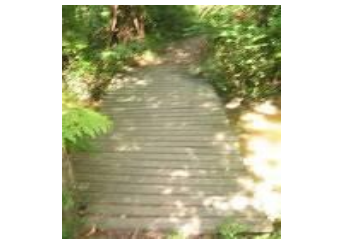
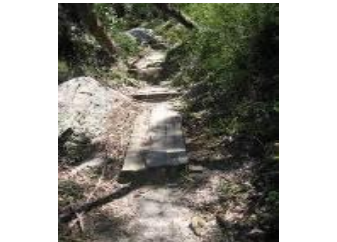
4	Structure_No	STRCL-008	
	Description and Location	Sandstone arch culvert under The Bulwark spanning stormwater channel in Castlecrag.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Arch culvert	
	Performance Score	4.1	
5	Structure_No	STRCL-009	
	Description and Location	Box culvert under Fourth Ave spanning main stormwater channel in Willoughby.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Box Culvert	
	Performance Score	2.6	
6	Structure_No	STRCL-010	
	Description and Location	Box culvert under Burra Rd spanning stormwater channel in Artarmon.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Box Culvert	
	Performance Score	2.8	
7	Structure_No	STRMI-014	
	Description and Location	Box culvert under and along Evans Ln, Nareburn. Brick walls, concrete invert.	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Vehicle, bicycle, pedestrian	
	Structure_Type	Box Culvert	
	Condition June 2013	2.5	


3.0 MINOR STRUCTURES			
3.1 Pedestrian bridges			
1	Structure_No	STRMI-001	
	Description and Location	Timber and steel bridge in Flat Rock Gully on bicycle track in Naremburn	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	2.2	
2	Structure_No	STRMI-002	
	Description and Location	Timber and steel bridge in Hallstrom Park on bicycle track in Willoughby	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	2.2	
3	Structure_No	STRMI-003	
	Description and Location	Timber and steel bridge in Hallstrom Park on bicycle track in Willoughby	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	2.2	
4	Structure_No	STRMI-004	
	Description and Location	Timber and steel bridge in Hallstrom Park on bicycle track in Willoughby	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.2	
5	Structure_No	STRMI-016	
	Description and Location	Timber bridge near Jack McLure Pl, Northbridge Bowling Club	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	









6	Structure_No	STRMI-017	
	Description and Location	Timber bridge near Jack McLure Pl, Northbridge Bowling Club	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
7	Structure_No	STRMI-018	
	Description and Location	Timber bridge near Jack McLure Pl, Northbridge Bowling Club	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
8	Structure_No	STRMI-019	
	Description and Location	Timber ridge at Outpost Rd, Northbridge Bowling Club	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	4.0	
9	Structure_No	STRMI-027	
	Description and Location	Timber bridge in Mowbray Park over creek in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
10	Structure_No	STRMI-030	
	Description and Location	Timber bridge in Blue Gum Park over creek in Chatswood	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	






11	Structure_No	STRMI-031	
	Description and Location	Timber bridge in H.C. Press Park in Castle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	5.0	
12	Structure_No	STRMI-032	
	Description and Location	Timber bridge in H.C. Press Park in Castle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
13	Structure_No	STRMI-033	
	Description and Location	Timber bridge in North Arm Reserve over creek in Middle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
14	Structure_No	STRMI-034	
	Description and Location	Timber bridge in North Arm Reserve over creek in Middle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
15	Structure_No	STRMI-035	
	Description and Location	Timber bridge in Harold Reid Reserve over creek in Middle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	





16	Structure_No	STRMI-036	
	Description and Location	Timber bridge in Watergate Reserve over creek in Castlecrag	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
17	Structure_No	STRMI-037	
	Description and Location	Timber bridge in Watergate Reserve over creek in Castlecrag	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
18	Structure_No	STRMI-038	
	Description and Location	Timber bridge in Warners Park off Eastern Valley Way in Northbridge	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
19	Structure_No	STRMI-039	
	Description and Location	Timber bridge in Clive Park over creek in Northbridge	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
20	Structure_No	STRMI-040	
	Description and Location	Timber bridge in Northbridge Park over creek in Northbridge	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
21	Structure_No	STRMI-044	
	Description and Location	Timber bridge in H.C. Press Park in Castle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	4.0	





22	Structure_No	STRMI-045	
	Description and Location	Timber bridge in North Arm Reserve over Creek in Castle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	3.0	
23	Structure_No	STRMI-048	
	Description and Location	Timber bridge in H.C. Park Castle Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Bridge	
	Condition as of June 2013	4.0	

3.2 Ramp			
1	Structure_No	STRMI-012	
	Description and Location	Concrete ramp on Smith Rd	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Bicycle, pedestrian	
	Structure_Type	Ramp	
	Condition as of June 2013	2.3	

3.4 Suspended footpath			
1	Structure_No	STRMI-010	
	Description and Location	Timber footpath on The Bulwark over stormwater channel in Castlecrag	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
2	Structure_No	STRMI-011	
	Description and Location	Timber footpath on The Bulwark over stormwater channel in Castlecrag	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
3	Structure_No	STRMI-020	
	Description and Location	Boardwalk in Flat Rock Gully off bike track in Northbridge	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
4	Structure_No	STRMI-021	
	Description and Location	Boardwalk in Flat Rock Gully off bike track in Northbridge	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
5	Structure_No	STRMI-022	
	Description and Location	Boardwalk in Mowbray Park behind athletics field	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	

6	Structure_No	STRMI-024	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
7	Structure_No	STRMI-025	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
8	Structure_No	STRMI-026	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River, Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
9	Structure_No	STRMI-028	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River near end of Willandra St, Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
10	Structure_No	STRMI-029	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River near end of Hatfield St in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	

11	Structure_No	STRMI-042	
	Description and Location	Boardwalk in Mowbray Park adjacent to Lane Cove River in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
12	Structure_No	STRMI-043	
	Description and Location	Boardwalk adjacent to Lane Cove River near golf course in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	2.0	
13	Structure_No	STRMI-046	
	Description and Location	Boardwalk adjacent to Lane Cove River near golf course in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	
14	Structure_No	STRMI-047	
	Description and Location	Boardwalk linked by bridges in playground at Castle Cove Park	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended footpath	
	Condition as of June 2013	3.0	

<b>3.5 Suspended stairways</b>			
1	Structure_No	STRMI-006	
	Description and Location	Steel stairs near Eastern Valley Way adjacent to main stormwater channel in Chatswood	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Suspended stairway	
	Condition as of June 2013	1.1	
2	Structure_No	STRMI-007	
	Description and Location	Steel stairs at end of The Lee in Castlecrag	
	Maintenance_Resp	Willoughby City Council (Engineering)	
	Traffic	Pedestrian	
	Structure_Type	Suspended stairway	
	Condition as of June 2013	2.2	
3	Structure_No	STRMI-023	
	Description and Location	Timber stairs in Mowbray Park in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended stairway	
	Condition as of June 2013	3.0	
4	Structure_No	STRMI-041	
	Description and Location	Timber stairs in Mowbray Park over creek in Lane Cove	
	Maintenance_Resp	Willoughby City Council (Open Space)	
	Traffic	Pedestrian	
	Structure_Type	Suspended stairway	
	Condition as of June 2013	1.0	