



Road Pavements

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

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

1.1. What does council provide?

Roads are a vital element of the greater transport network, providing physical and social connectivity throughout all areas. The Roads Act 1993 establishes councils as the roads authority for all public roads within the area other than freeway, crown road, and other roads for which some other public authority such as the RMS has been designated as the roads authority.

Willoughby City Council is responsible for the care and control of approximately 211km of sealed roads, 12km of which are regional roads and the rest being local roads. The total replacement value of this road network is approximately \$163M.

1.2. What does it cost?

Council uses a pavement modelling software which has the capacity to store the information about the condition of Council's roads and determine the impacts of different budget scenarios.

An ideal budget strategy is determined by the Pavement Management System software to establish the lowest life cycle cost. This is then compared to the current funding level, which determines the life cycle expenditure. Modelling on road pavement assets indicates that the life cycle expenditure matches the life cycle cost, which is approximately \$4.8M p.a. and there is no life cycle gap. However, a number of assumptions have to be made during the modelling process, and some funding sources that have been used in the modelling are from grants and subsidies from State and Federal Government, which may vary from year to year and is not guaranteed indefinitely.

1.3. How do we measure performance?

Road pavements will be maintained at a safe and functional standard. Requests for improvements and faults are investigated and if appropriate, made safe and repaired in a timely manner as availability of budgets and resources allow. Maintenance works are generally prioritised and undertaken to minimise the risk of injury to the public. Inspections of road pavements are carried out regularly; detailed surveys are carried out every 3-4 years encompassing every street segment within Council's LGA.

1.4. What are the risks?

Risk management is embedded within the pavement improvement prioritisation process through the different intervention levels and treatment matrix for the different NAASRA classes. Roads with higher traffic count are considered as having higher risk profile and therefore maintained at a higher standard.

1.5. Community consultation

Community consultation specifically relating to asset management of road pavements and other asset classes was completed in 2013 as part of Council's community engagement strategy. Council also has a broad understanding of community expectations in the context of road pavements due to the regular direct contact between community members and Council.

Results from community consultation indicate that there is generally an agreement on the level of service between the community and Council's adopted strategy. The results of the consultation process have not caused any change in the way this asset class is assessed or the level at which intervention point is required.

1.6. What does the future hold?

Planning processes and budgeting for road pavements is the most long standing asset management initiative out of all the infrastructure asset class. Asset management principles have been in place and modelled using a dedicated pavement modelling software for approximately two decades. In addition, given the 80% community satisfaction rating on road pavement, it can safely be assumed that Council's current asset management strategy for road pavements would continue as planned.

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 total length of sealed road network in the Willoughby Local Government Area (LGA) is approximately 234km. 23km of this is classified as State Road & Freeways that are maintained by the Roads and Maritime Services (RMS) of New South Wales. This leaves Willoughby City Council with approximately 211km of sealed roads to maintain. Of this 211km, 12km are regional roads which Council is eligible for grant funding from the RMS.

The road network is divided into different National Association of Australian State Road Authorities (NAASRA) classes and different levels of service are designated for each class. e.g. on a regional road the pavement shall generally have a lower roughness value due to the higher design speeds expected of these roads compared to a local road where the design speeds are lower. Traffic volumes for the LGA have been analysed where data is available from Annual Average Daily Traffic (AADT) counts and upper and lower traffic volumes have been adopted for the different road classification as shown on the table below. These ranges may change over time as more information on traffic volumes is available.

These NAASRA Classes are used in the pavement modelling process. However, while a road may be technically classed as a regional road, if its volume is less than the AADT ranges listed below, it could be modelled as a different NAASRA class road.

Table 2.1 Description of NAASRA Class

NAASRA Class	Description	AADT Range
5	State road	
6	Regional	>14,500
7	Local: Distributor	6,500-14,500
8	Local: Residential collector	1,000-6,500
9	Local: Residential access	0-1,000

The length and proportion of roads in each class is shown in the figure below.

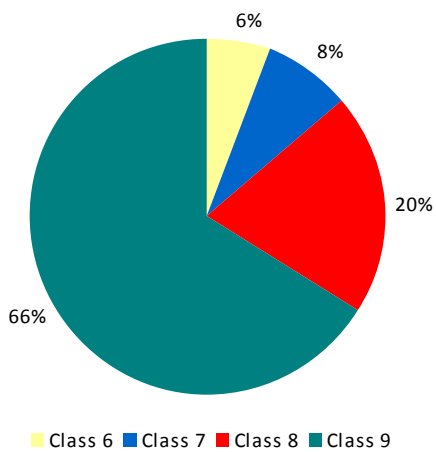


Figure 2.1 Length of roads in each NAASRA class in the Willoughby LGA (Total length 211 km)

The map below (Figure 2.2) shows the classification of the roads in Council's LGA

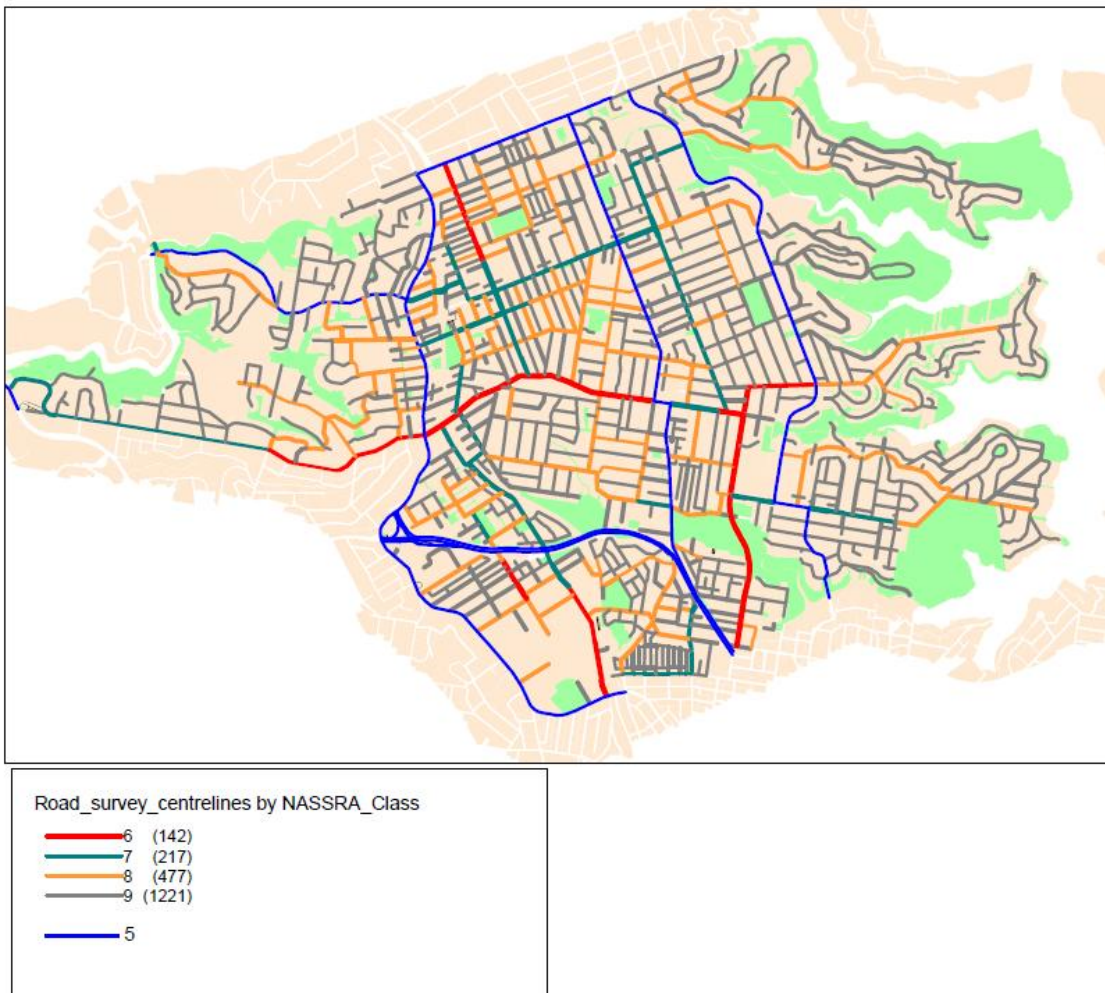


Figure 2.3 Map of Council's road network based on NAASRA classification

The majority of surface or the wearing course of the road pavements in the LGA is asphalt. A small proportion consists of an asphalt wearing course over a concrete pavement but in some instances, the concrete does not have an asphalt overlay. The figure below shows the locations of concrete pavements within Council's area.

In a number of cases, the pavement or base course that is below the wearing course may be constructed from concrete, however the majority of the pavements are generally granular (compacted gravel). There are some locations that have been constructed of full depth asphalt.

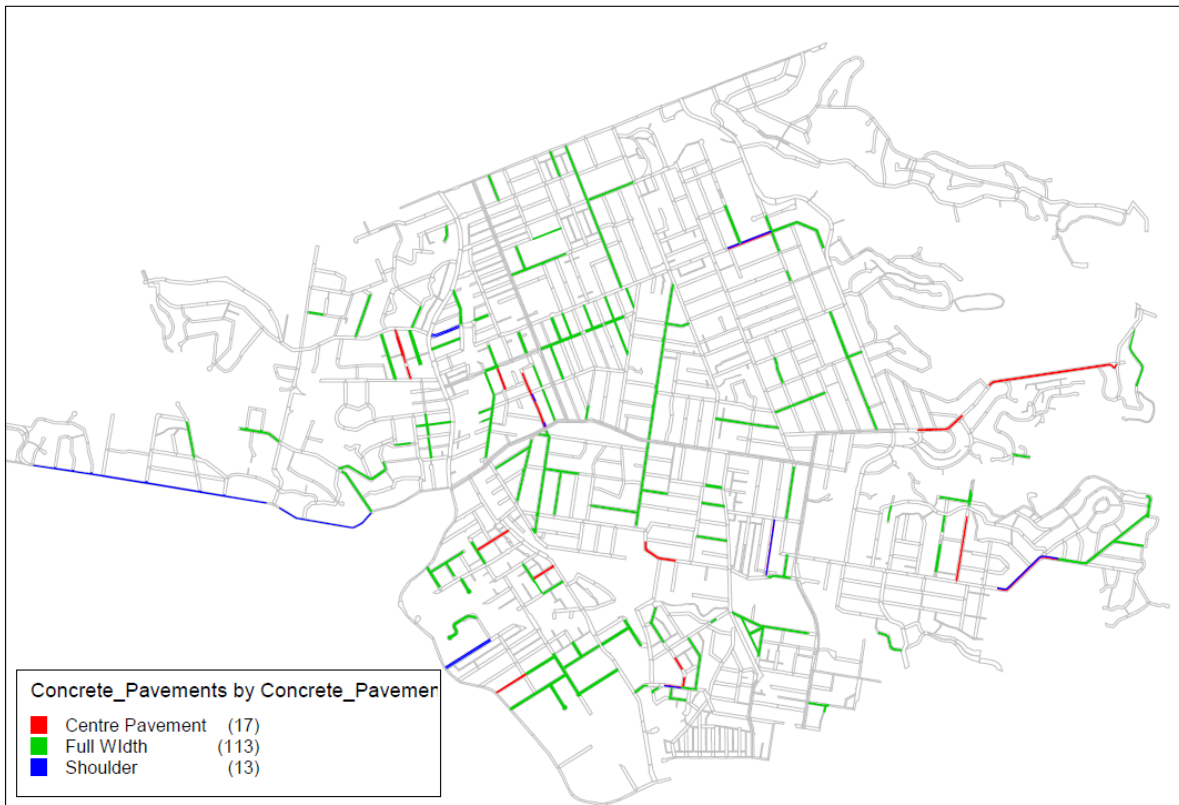


Figure 2.4 Location of Council's concrete pavements

The break-down of surface (wearing course) material within each NAASRA Class is shown in the graph below.

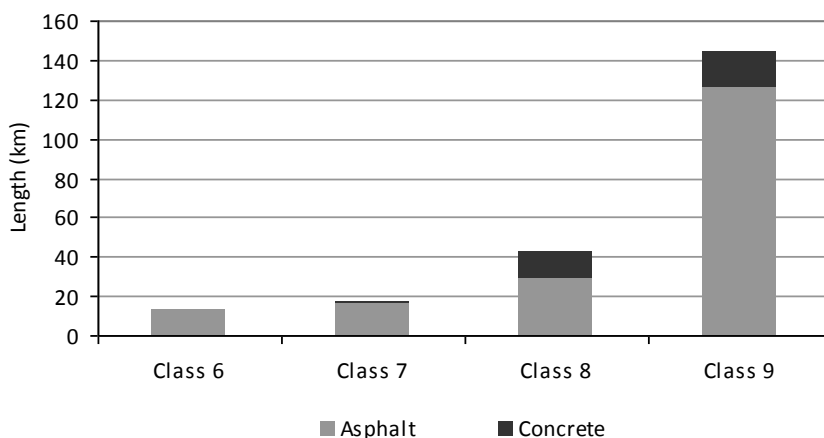


Figure 2.5 Council's road network by surface types and class

In accordance with DLG's requirement, road pavements are considered as complex assets, which are to be broken down further to its components: formation, pavement, and surface. Bitumen pavements consist of all three components, whereas concrete pavements will only have formation and pavement valued, as they are usually constructed of homogenous concrete.

The following table shows the replacement values of each component in Council's road network as at 30th June 2013. It should be noted that actual replacement of pavements may be higher than the values listed as there may be site specific constraints or major utility services that may require adjustment, upgrading or relocation in order for pavement improvement works to proceed.

Table 2.2 Assets covered by this plan

Asset category	Dimensions/quantity	Replacement value (\$millions)
Surface	1,351,151 sqm	\$ 30,213 k
Pavement	1,640,333 sqm	\$ 132,495 k
Formation	1,640,333 sqm	\$ 20,750 k
TOTAL		\$ 183,458 k

The replacement rates of the pavement components have allowed for items such as line marking, signage, traffic control, service relocations, and other works related to pavement rehabilitation.

This Plan specifically addresses road pavements only. Other assets within the road reserves are covered under different plans. Table 2.3 lays out responsibilities for those assets not covered by this Plan.

Table 2.3 Assets NOT covered by this plan.

Asset category	Plan covering asset category	Division/branch responsible
Footpaths in Road Reserves	Footpaths AMP	Engineering Branch
Kerb and gutter in road reserves	Kerb and gutter AMP	Engineering Branch
Bridges in road reserves	Bridges AMP	Engineering Branch
Drainage in road reserves	Stormwater Drainage AMP	Engineering Branch
Retaining walls in road reserves	Retaining Wall AMP	Engineering bBranch
Street furniture and street lighting	Miscellaneous Road Reserve AMP (works in progress)	Property Maintenance and Construction Branch
LATM devices	Miscellaneous Road Reserve AMP (works in progress)	Engineering Branch
Street trees and planter beds	Miscellaneous Road Reserve AMP (works in progress)	Open Space Branch

Key stakeholders in the preparation and implementation of this plan and their respective roles are listed in Table 2.4.

Table 2.4 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 & update, prioritisation of works.

Stakeholder	Role
Engineering Works Services Group	Planning, prioritisation, supervision, 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 2.5 along with the strategies for achieving those outcomes.

Table 2.5 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
4.1.1 Planning, maintenance and operation of infrastructure	Consider life cycle costs for all existing and proposed road works.
4.2.1 Increased use of active and public transport	Working with other government bodies and private sector for improved local and regional public transport
4.2.2 Balance traffic management	Maintain road pavements at safe and functional level to improve integration between transport modes, including public transport such as buses that operate on part of Council's road 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)

2.4. Core and advanced asset management

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 will improve assumptions relating to financial projections, but these data are not currently available. 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
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 utilise 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.

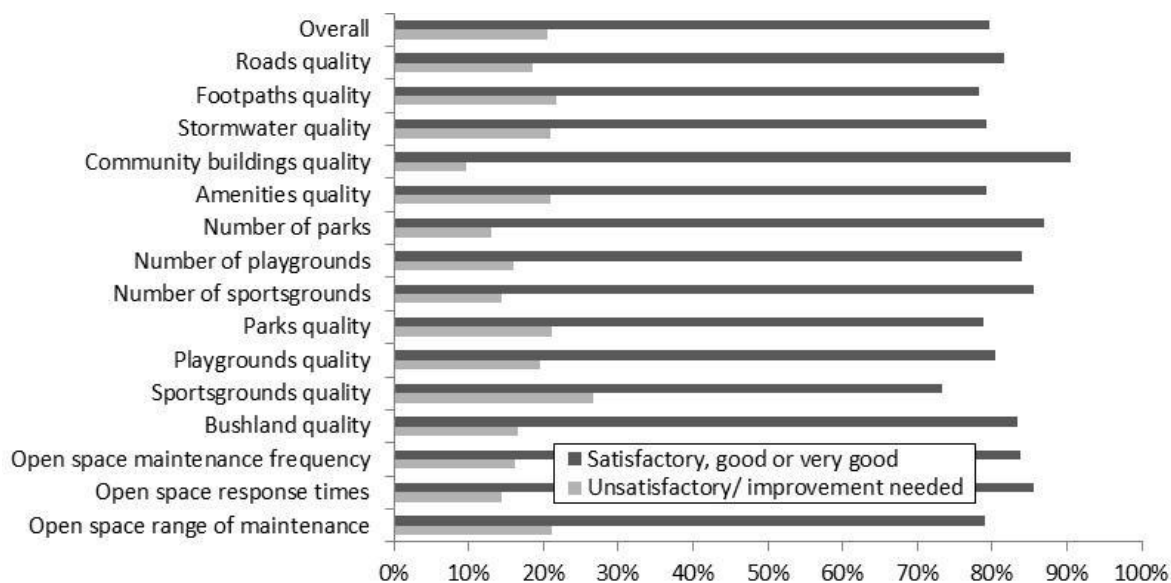


Figure 3.1 Levels of satisfaction with Council’s assets (100+ surveys completed in 2013)

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 the opportunity to become well informed about Council’s assets and asset management processes.

Results from the community survey indicate that the community’s satisfaction level of the quality of road assets within Willoughby LGA is over 80%.

3.3. Target levels of service

Based on the results of the community engagement throughout 2013, target levels of service have been adopted by Council for assets covered by this Plan. These targets relate to the physical condition and appearance of assets, and drive renewal or rehabilitation programs. Findings from the survey specific to road pavements indicate that the community’s feedback corresponds to the intervention point set by Council.

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 3.2 in the next section.

3.4. Current levels of service

Indicators of quality, capacity, functionality and legislative compliance are taken into account when assessing levels of service. Some examples of these indicators and how they relate to level of service criteria for *maintenance response* are included in the table below.

Table 3.2 Target and current levels of service

Service criteria	Level of Service	Measurement Scale	Technical Performance Target	Current Performance
Quality	Physical condition	As per visual, laser and structural assessments.	To meet the target intervention level as described in section 3.4	Council's road network is considered to be in good to very good condition and is below the intervention levels.
	Aesthetic condition	Repairs are currently undertaken based on physical condition and risk. Aesthetic condition is not a factor in prioritising pavement works.	N/A	N/A
Quantity	Connectivity of road pavements	CSR requesting new road construction.	Adequate connectivity between properties and the road network.	CSR number reflects good performance.
Capacity	Appropriate to demand.	CSR related to road capacity.	Traffic is managed appropriately through various methods described in section 4.2	Minor number of CSR relating to traffic congestion.
Functionality	Fitness for purpose	Evidence of premature pavement failure	Pavements are appropriate for location, traffic type and volume.	Prioritisation of works through PMS addresses any known issues.
Responsiveness	Inspect, make-safe or repair	Response times and number of insurance claims received by Council	CSR related to road pavement damage will be attended to within 24 hours. If appropriate, works will be prioritised within allocated budgets. No insurance claims received by Council	Council receives approximately 2 low-value insurance claims per annum.
Heritage listing	Maintain heritage status	Y, N or N/A	Y	Y
Legislative compliance	Compliant	Y, N or N/A	Y	Y

Technical Levels of Service are the operational indicators or technical measures for performance monitoring that have been developed to ensure that an appropriate minimum community levels of service are met by Council. Council has also developed a set of technical measures based on the extent of pavement defects which are used as the technical levels of service for *planned maintenance* and *capital works thresholds and prioritisation*. These levels of service have a direct impact on the funding level required for managing the asset class. Naturally, a higher level of service requires higher expenditure.

The table below shows a brief description of these pavement defects. More details, including sample photos, are provided in Appendix A – Asset assessment manual.

Table 3.3 Pavement defects

Defects	Description	Measurement unit
Roughness	Irregularities in pavement surface affecting the vehicle ride quality.	NRM (NAASRA Roughness Meter)
Rutting	Longitudinal deformation in a wheel path.	millimetre
Fatigue Cracking	Interconnected cracks forming a series of small polygons resembling a crocodile hide, sometimes called crocodile cracking.	%

Defects	Description	Measurement unit
Environmental Cracking	Cracks running either longitudinally, transverse or diagonally along the road	%
Potholes	A steep sided or bowl shaped cavity extending into the pavement layers below the wearing course	%
Ravelling	A progressive disintegration of pavement surface by loss of both binder and aggregates.	%
Patching	A permanent pavement repair not encompassing a full lane width reconstruction	

These defects are measured and recorded through inspection which use a combination of three methods; visual survey, laser profilometry survey, and structural falling weight deflectometer (FWD) testing. More details on these methods can be found in section 11.

A set of intervention levels described in terms of the extent of the defects have been determined. This set of intervention levels are therefore essentially the adopted technical levels of service. It has been used in the modelling software to indicate the minimum condition when a treatment for the pavement may be triggered. These levels are set out in the following table. An average current condition from the last formal inspection has been shown to assist the interpretation of these levels. Note that the current network average for Willoughby reflects a good to very good level of service.

Table 3.4 Intervention Levels

Pavement Condition	Regional	Distributor	Residential Collector	Residential Access	Current Network Average
Roughness (NRM)	80	130	135	160	132
Rut Depth (mm)	8	8	12	12	2.4
Fatigue Cracking (%)	5	5	5	10	2.0
Environmental Cracking(%)	5	10	10	15	6.5
Potholes (%)	1	1	1	1	0.19
Ravelling (%)	20	30	30	40	7.2

Each year the pavement modelling system predicts the deteriorated condition of the pavement during the modelling process. The model uses classification and resolution matrices (see section 12) to recommend a treatment that is required in that particular year. Treatments are described in section 13.

In addition to formal inspections using these three methods, Council staff drive over portions of the road network each day as part of their works and would report possible failures of the road pavement and record them to ensure that they are acknowledged and planned for in a future works programs.

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, weather related damage, underground service utility damage, 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%¹. Employment is expected to increase by approximately 16,000 during the same period.

The table below shows in more details the projected population growth which may impact on service delivery in the future.

Table 4.1 Projected Population Growth in Willoughby LGA

Demand factor	2010	2030	% change
Population			
0 to 4 years	4,878	5,055	+3.6
5 to 11 years	5,519	6,010	+8.9
12 to 17 years	4,294	4,857	+13.1
18 to 24 years	6,330	7,249	+14.5
25 to 34 years	11,206	12,109	+8.1
35 to 49 years	16,467	17,252	+4.8
50 to 59 years	8,248	9,517	+15.4
60 to 69 years	5,773	7,195	+24.6
70 to 84 years	4,954	7,404	+49.5
85 and over years	1,462	1,532	+4.8
Total Population	69,133	78,181	+13.1

This growth forecast reflects on an increase in population and employment opportunities, which in turn indicates an increased demand for the service provided by the road network. However, as areas in Willoughby have largely been urbanised, there is often no options available to increase road capacities. This demand is therefore managed in other ways, which is discussed in more details in section 4.2 below.

¹ Willoughby City Council Population Forecasts (<http://forecast2.id.com.au/Default.aspx?id=234&pg=5000>)

4.2. Demand management plan

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

The increased population and employment opportunities associated with the growth forecast suggests that there will be an increased demand on the capacity of Willoughby's road network. However, simply providing new assets is not a plausible solution, since areas in Willoughby have largely been urbanised and there is often no physical space available to increase road capacities, e.g. adding an extra lane to a road. Tunnelling or flyovers and other similar physical solutions are costly and environmentally and visually inappropriate options and will not be considered at this time. There is also a belief by some traffic and transport practitioners that such measures would generate further traffic congestion and are short term solutions at best. Options to reduce single occupant car travel are more likely to have long term benefits.

Council has carried out micro simulation traffic modelling of the Chatswood CBD to develop traffic management options to facilitate access to the CBD and reduce problems associated with congestion. Further work to develop and refine options is currently being undertaken.

To date some opportunities have been identified for demand management, which are also in line with Willoughby's goals and strategies. For example, Council encourages more sustainable forms of transport by providing bike paths, free shuttle buses, through co-operation with car sharing schemes, adoption of parking pricing to regulate parking demand, and encourage more sustainable active transport. Council also undertakes significant work to promote and educate the community with regard to more sustainable transportation.

New developments may result in a change of vehicular volumes. An assessment of the existing pavement capacity and condition could be required as part of the application review, and as a result an upgrade of the road pavements fronting a development could be required as part of the conditions of consent of the development.

4.3. Changes in technology

Technology changes are forecast to affect the delivery of services covered by this plan as indicated in the table below.

Table 4.2 Changes in Technology and Forecast effect on Service Delivery

Technology Change	Effect on Service Delivery
Implementation of 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 allow a more pro-active approach in asset management. New technology may allow for improved accuracy and knowledge in data collection.
Changes in construction and material technology	Improved construction and/or material technology may extend the life of road pavement assets and may well result in more cost-efficient repair methods.

4.4. New assets from growth

New assets required to meet growth projections will be provided by Council or acquired from land developments when appropriate. Willoughby Council's LGA is a built up urban area, and therefore opportunities to construct new roads are rare.

Land to facilitate road widening may be required from developers at locations identified by Council as necessary to ease traffic congestion. Such practice is common although site constraints at times prevent such options to be considered.

Construction of new assets will require ongoing operational and maintenance funding, which will need to be identified and considered when developing forecasts of future budgets.

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

Willoughby City Council is responsible for the care and control of approximately 211km of sealed roads, 12km of which are regional roads and the rest being local roads. The total replacement value of this road network is approximately \$163M. For a summary of the dimensions and replacement cost of these assets refer to Table 2.2.

Data collection for the assets covered by this Plan has been completed but confidence in the data 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
Surface	95%	Detailed survey of pavement assets was carried out in 2008, and road pavement inventory generally does not change often in Willoughby LGA. Where a new road has been constructed, for example through new development, the new segment has been added to the asset stock. Condition data was collected thoroughly, although not all properties are known, such as seal age or pavement thickness.
Pavement	50%	
Formation	50%	

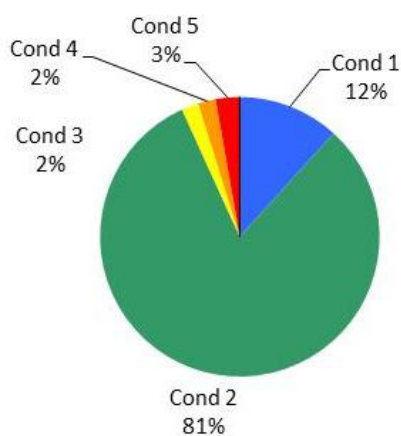
5.1.2. Asset capacity and performance

Council's services are generally provided to meet design standards or guidelines where these are available. Council is unaware of any asset under its control that does not comply with the adopted technical standards that were applicable at the time of construction.

5.1.3. Asset condition

The distribution of condition ratings amongst the assets covered by this Plan is shown in Figure 5.1. The data used was based on the condition survey carried out in 2008, continuous updating of pavement works carried out and an assumed deterioration rate. 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. The relationship between the defect measures and the 0-5 condition rating can be found in Appendix F – Interpreting defect criteria to 0-5 condition rating.

**Condition distribution - pavement
(flexible and rigid)**



**Condition distribution - surface
(flexible only)**

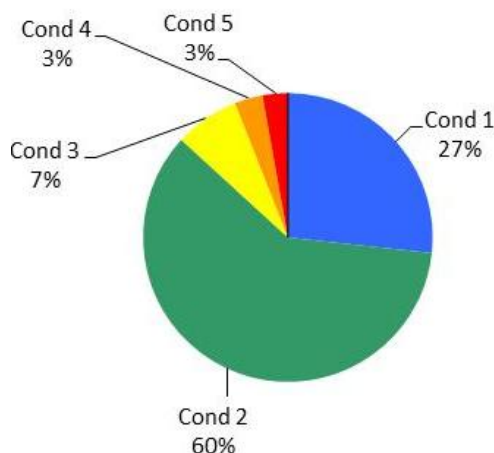


Figure 5.1 Distribution of physical condition ratings

On the whole, the pavement condition of Council’s road network is in a good to very good condition. The identification of ravelling, cracking, potholes and patching are good indicators of the condition of an aging pavement. In the case of Willoughby, both ravelling and cracking are at acceptable levels and are generally rare. There are therefore no areas of major concern with respect to the condition of Willoughby’s pavement. The level of roughness across all road classes is similar and is representative of a road network that is predominantly subject to low speeds and volumes. Similarly, rutting across the network is similarly very low.

For modelling purposes the road network has been divided into manageable segments of road pavement that are approximately 200m in length. Average condition data is reported on each segment of road.

The most recent inspection using the three methods of formal inspection was carried out in 2008. Based on that inspection, the condition of Council’s road network, measured in terms of these defects, has been determined. The average of these measures has been shown as part of Table 3.4 Intervention Levels, and is reproduced in the following table.

Table 5.2 Average Condition of Road Network Measured in Terms of Defect Types

Measure of Pavement Condition	Current Network Average
Roughness (NRM)	132
Rut Depth (mm)	2.4
Fatigue Cracking (%)	2.0
Environmental Cracking(%)	6.5
Potholes (%)	0.19
Ravelling (%)	7.2

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 5.3.

Table 5.3 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	\$ 162,708 k	\$ 109,072 k	\$ 3,163 k

Indicators of Council’s financial sustainability can be derived from fair value figures. These are reported in Table 5.4.

Table 5.4 Financial sustainability indicators for assets covered by this Plan

Indicator	Calculation method	Working	Result
Asset consumption	2012-2013 depreciation / depreciable amount * 100%	= \$3,163k / \$154,572k * 100%	2.0 %
Asset renewal	2012-13 renewal spend / depreciable amount * 100%	= \$1,609k / \$154,572k * 100%	1.0 %
Asset upgrade	2012-13 capital spend / depreciable amount * 100%	= \$0 / \$154,572k * 100%	0%

The ratios in the table above indicate that road pavement assets are currently being renewed only at half the rate at which it is being consumed, which is not sustainable in the long term. Despite the indicator ratios showing that renewal works are not keeping up with the consumption of the assets, feedback on the community engagement indicates that the community has 80% satisfaction rating in terms of road quality. Moreover, modelling in the Pavement Management System also shows that current base level funding is adequate to ensure financial sustainability. There are several possible reasons for this discrepancy between asset consumption and renewal:

- Incorrect classification of maintenance and renewal.
For road pavements, works are classified into maintenance and renewal based only on the type of works. For example, all deep mill and resheet works are renewals, and all heavy patching jobs are classified as maintenance. In reality, some heavy patching jobs are extensive enough that they cost more than the typical maintenance works, but they are not classified as renewal works because it did not include the whole segment of the roads.
- Difference in the perceived level of service
The technical intervention level set by Council is largely based on calculation and numerical measurements. On the other hand, from the community point of view, satisfaction is most likely based on personal experience, such as smoothness of roads, potholes on roads and the general quality of the ride.
- The useful life of road pavement is under estimated.
The surface component of the road pavement is estimated to have a useful life between 15 to 20 years, and the pavement component 60 years. An under-estimated useful life would significantly inflate the asset’s annual depreciation expense which in turn over estimate the asset consumption rate.

5.2. Risk management plan

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.

Risk management is embedded within the pavement prioritisation process through the different intervention levels and treatment matrix for the different NAASRA classes. Roads with higher traffic count are considered as having higher risk profile and therefore maintained at a higher standard.

5.3. Expenditure plan

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 the following standards and specifications:

- Willoughby City Council's Standard Specifications and Drawings
- Relevant Australian Standards
- Willoughby City Council's Development Control Plans
- Contemporary engineering practice

There are several funding sources for rehabilitation and maintenance of road pavements. Some of these funding is restricted as to the types of roads the funding can be used for, e.g. the RMS Regional Block Grant can only be used for specific projects on regional roads that have been identified as requiring work and submitted by Council the previous year and subsequently approved by the RMS.

Table 5.5 Funding sources for works relating to road pavements

Funding	Funding Source	FY 2013/2014 Budgeted amount (approx. \$ p.a.)*
PMS Program This funding source is the main source of funding for major road pavement works carried out by Council.	Council	\$1,552K
Road Pavement Administration The road pavement administration is generally used for day to day maintenance and preventative works.	Council	\$794K
RMS Regional Block Grant RMS provides block grants to councils as a contribution towards the cost of works on Regional Roads under the terms of the Block Grant Agreement. Block Grants may be spent on preservation, restoration and enhancement works to the extent provided for in the Block Grant Agreement.	RMS	\$101K

Funding	Funding Source	FY 2013/2014 Budgeted amount (approx. \$ p.a.)*
RMS Regional Block Grant – Supplementary The supplementary component of the block grant provides an equivalent level of funding to what each council received under the former 3x3 Council Determined Program.	RMS	\$57K
RMS REPAIR Program Grant RMS provides 50% contribution for works on regional roads through the REPAIR program to provide additional assistance to councils to undertake larger works of rehabilitation and development on regional roads. The main aim is to minimise the long term maintenance costs of these roads commensurate with their function and usage. Works funded under the REPAIR program is selected on a merit basis using point system. Council applies for the grant for specific proposed projects and the final determination on the grant lies with RMS.	RMS	Varies every year depending on proposed projects. For FY 2013/2014, \$0.
Bus Route Subsidy The RMS provides the Bus Route Subsidy to assist Councils to maintain bus routes.	RMS	\$53K
Roads to Recovery The Roads to Recovery program operates across Australia. Under current arrangements, each council is guaranteed a share of the total available funding. Councils nominate the projects to be funded. The program runs on a 4-year cycle. The maximum amount of funding that Willoughby City Council can receive is approximately \$1.3M over the defined 4-year period. The current period finishes ends in 2013/2014 financial year. The continuation of this program into the future depends on Federal Government longer term road funding decision.	Federal Department of Infrastructure and Transport	Varies every year depending on projects and grant. For FY 2013/2014, \$0.

*All funding amounts are based on 2013/2014 financial year amounts. Grants and subsidies may vary from year to year and are not guaranteed to be available indefinitely.

In addition to the funding sources listed in the previous table, there are other funding dedicated to road and street signs, LATMs generally, roads safety program, development transport, and traffic facility safety audit. As works from these funding sources are not directly aimed at improving the pavement condition, but nevertheless related to the road network, they have been recognised in Council's Long Term Financial Plan, but have not been included in the 20-year modelling of the pavement rehabilitation and maintenance programs.

The assumed funding level that has been used in the 20-year rehabilitation and maintenance programs is shown in the table below. Note that funding under Road Pavement Administration has not been included, as most of it is currently administered towards *reactive maintenance* works, which cannot be predicted by the modelling software. The 20-year forecast is largely for rehabilitation and *planned maintenance* works.

Table 5.6 Funding level used in the 20-year rehabilitation and planned maintenance program

Financial Year	Local			Regional		
	Roads to Recovery Programme	PMS Program	RTA Bus Route Subsidy	RTA Regional Road Block Grant	RTA Regional Block Grant - Supplementary	RMS Purpose Proj (50% RMS)
2013/2014	0	1,551,500	53,000	100,900	56,600	175,000
2014/2015	300,000	1,568,000	53,000	103,900	41,000	180,250
2015/2016	300,000	1,585,046	53,000	103,900	41,000	185,658
2016/2017	300,000	1,632,599	54,590	107,020	42,230	191,227
2017/2018	300,000	1,681,570	56,230	110,230	43,500	196,964
2018/2019	309,000	1,732,017	57,917	113,537	44,805	202,873
2019/2020	318,270	1,783,978	59,654	116,943	46,149	208,959
2020/2021	327,818	1,837,497	61,444	120,451	47,534	215,228
2021/2022	337,653	1,892,622	63,287	124,065	48,960	221,685
2022/2023	347,782	1,949,401	65,186	127,787	50,428	228,335
2023/2024	358,216	2,007,883	67,142	131,620	51,941	235,185
2024/2025	368,962	2,068,119	69,156	135,569	53,500	242,241
2025/2026	380,031	2,130,163	71,230	139,636	55,104	249,508
2026/2027	391,432	2,194,067	73,367	143,825	56,758	256,993
2027/2028	403,175	2,259,889	75,568	148,140	58,460	264,703
2028/2029	415,270	2,327,686	77,835	152,584	60,214	272,644
2029/2030	427,728	2,397,517	80,171	157,162	62,021	280,824
2030/2031	440,560	2,469,442	82,576	161,876	63,881	289,248
2031/2032	453,777	2,543,526	85,053	166,733	65,798	297,926
2032/2033	467,390	2,619,831	87,605	171,735	67,772	306,864

An examination of the graph showing funding level indicates that the current funding level is adequate to address existing backlog of works in 20 years. This is done by comparing the current funding scenario with an unlimited budget scenario, taking into account CPI.

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 5.7 and does not include operational expenditure.

Table 5.7 Actual maintenance expenditure history

Financial year	Maintenance expenditure (\$ '000)	Comments
2006-2007	1,920	Includes maintenance and some renewal
2007-2008	1,930	Includes maintenance and some renewal
2008-2009	2,004	Includes maintenance and some renewal
2009-2010	2,781	Includes maintenance and some renewal
2010-2011	1,262	Maintenance only

Financial year	Maintenance expenditure (\$ '000)	Comments
2011-2012	1,476	Maintenance only
2012-2013	4,241	Change in Special Schedule 7 reporting method, includes: <ul style="list-style-type: none"> - Maintenance \$1,293k - Renewal \$1,339 k - Restorations \$1,610k

Note that the currently adopted capitalisation threshold for road pavement assets was not adopted until the 2010/2011 financial year. Up until this year, renewal and maintenance expenditures were not clearly distinguished and a lot of renewal works were included as maintenance. When the renewal works were separated out in 2010/2011, this caused a sharp decrease in maintenance expenditure that year.

In 2012/2013 financial year, for completeness of data, pavement restorations have also been included, which caused the figure to increase significantly. In the past, restoration expenditure has always stood apart from the other expenditure as restoration works were carried out outside the normal prioritisation method. However, Council recognises that these works have an impact on the pavement condition and, following that, the footpath works program in the following years and therefore should be included.

If we exclude the effect of restoration, the actual maintenance expenditure would have been \$1,339K renewal and \$1,293K maintenance, which is in line with the previous years' spending. Using this \$1,293K maintenance figure, i.e. excluding renewal and restoration effects, this means the annual maintenance expenditure is currently equivalent to 0.8% of the total replacement value reported in rks to proceed.

Table 2.2.

In the IPWEA NSW's Road Management Report: Road Asset Benchmarking Project 2010, surveys from 142 councils in NSW who responded showed the following:

Table 5.8 Maintenance cost / Replacement cost ratio - Road Assets Benchmarking Project 2010

Results from the Road Asset Benchmarking Project 2010 ²					Maintenance cost / Replacement cost ratio calculated
Asset class:	Replacement Cost (\$M)	Length (km)	Routine maintenance rate (\$/km/year)	Maintenance cost / year (\$ M/yr)	
Sealed Roads	34,364	13,433	3,916	52.6	N/A
Local Roads		62,521	2,943	184.0	
Regional Roads	34,364	75,954	6,859	236.6	0.7%

It was recognised in the survey that maintenance cost was one of the data with high variability in values, however the average of the total shows that annual maintenance expenditure for sealed roads is 0.7%, compared to Council's 0.8%. Council's maintenance expenditure would therefore seem to be at the appropriate level.

Maintenance expenditure is expected to increase in line with increases to asset stock through upgrade and new capital works. Due to the urban environment of Willoughby LGA, increase of asset stocks from road pavement is rare, although this may occur through, say, new development. From year to year, however, there is generally capital new works on other road related assets, such as street signs.

If there is an increase of asset stock, there will be a maintenance shortfall if maintenance budget is not increased to represent the 0.8% of total replacement value, as calculated above.) In order to be financially

² IPWEA (NSW) Roads & Transport Directorate, 2011, p.17-18

sustainable, maintenance expenditure needs to be maintained at least at 0.8% of total asset stock replacement value.

As mentioned previously, financial modelling for road pavement indicates that current funding is adequate to ensure sustainability of the maintenance for road pavements, and therefore there is no funding gap in both projected maintenance and renewal expenditure.

Forecast for maintenance expenditure is shown in Figure 5.2.

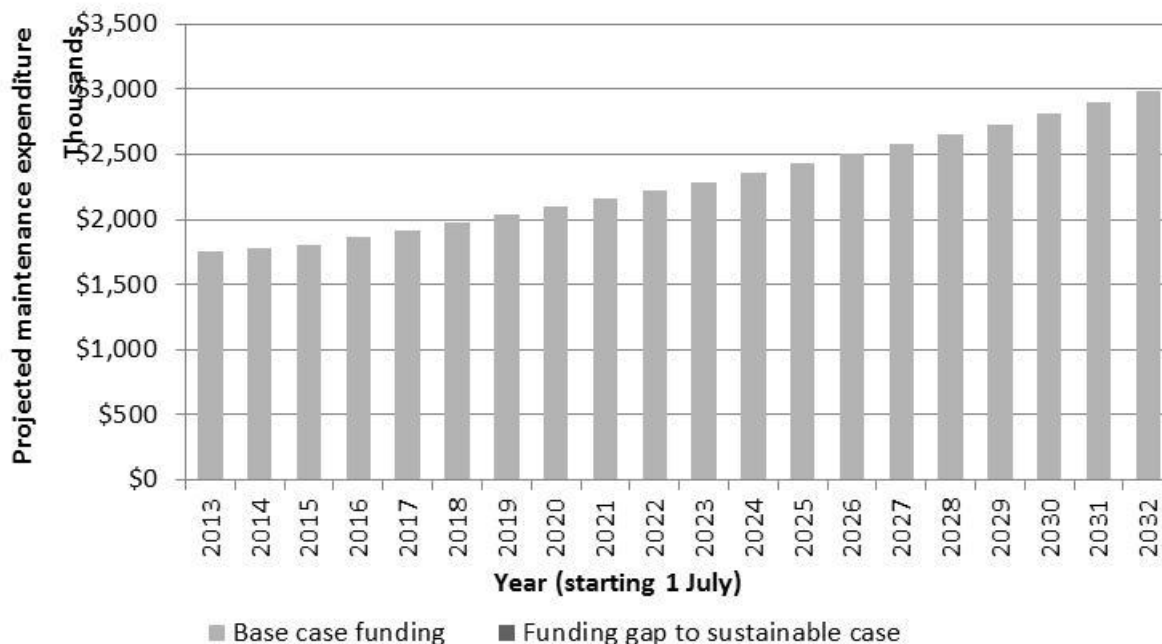


Figure 5.2 Projected maintenance expenditure under the base and sustainable cases.

Maintenance expenditure is also expected to increase as asset condition declines, however further data analysis is required to quantify this link between asset condition and maintenance expenditure.

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. Some of Council’s road pavements are currently at or beyond intervention level, however these will be addressed within the modelling period of 20 years. 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 pavements. As mentioned previously, modelling result from the Pavement Management System shows that the current funding levels (base case) is adequate for required renewal funding (sustainable case), and this is shown in Figure 5.3.

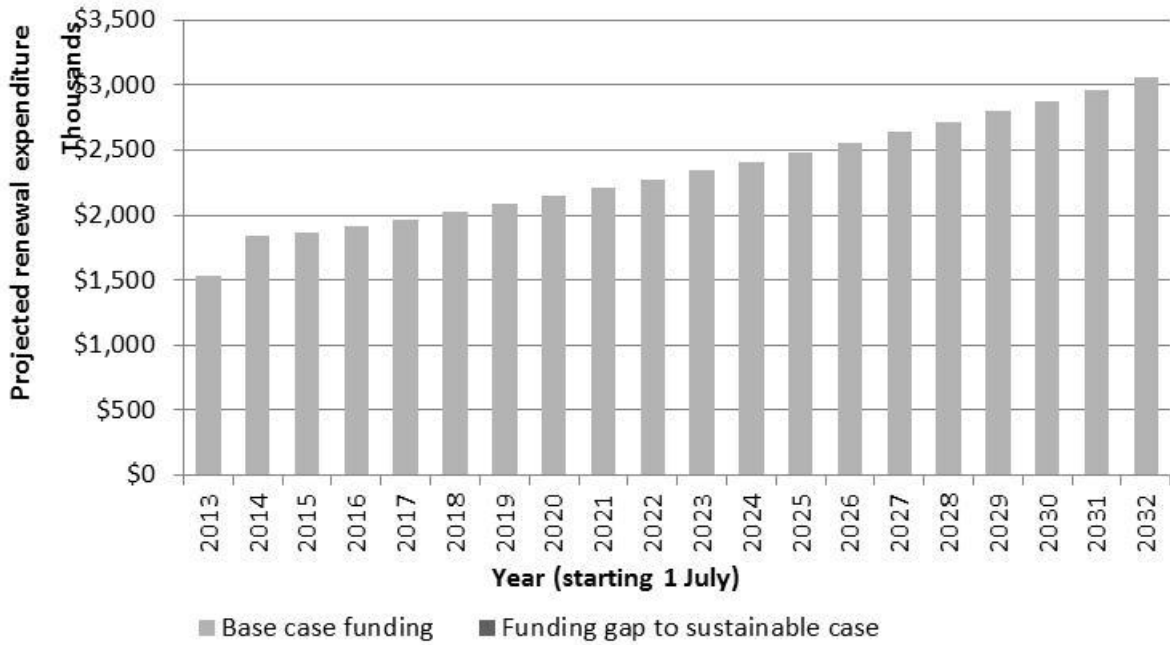


Figure 5.3 Projected renewal expenditure under the base and sustainable cases.

Where funding shortages mean that renewals cannot be completed in a timely fashion, the asset pool is expected to decline in condition overall. Figure 5.9 to Figure 5.8 shows the expected degradation in different measures of the condition of the local roads over the 20-year modelling period. Note that the majority of local roads are in NAASRA Class 9 and 8.

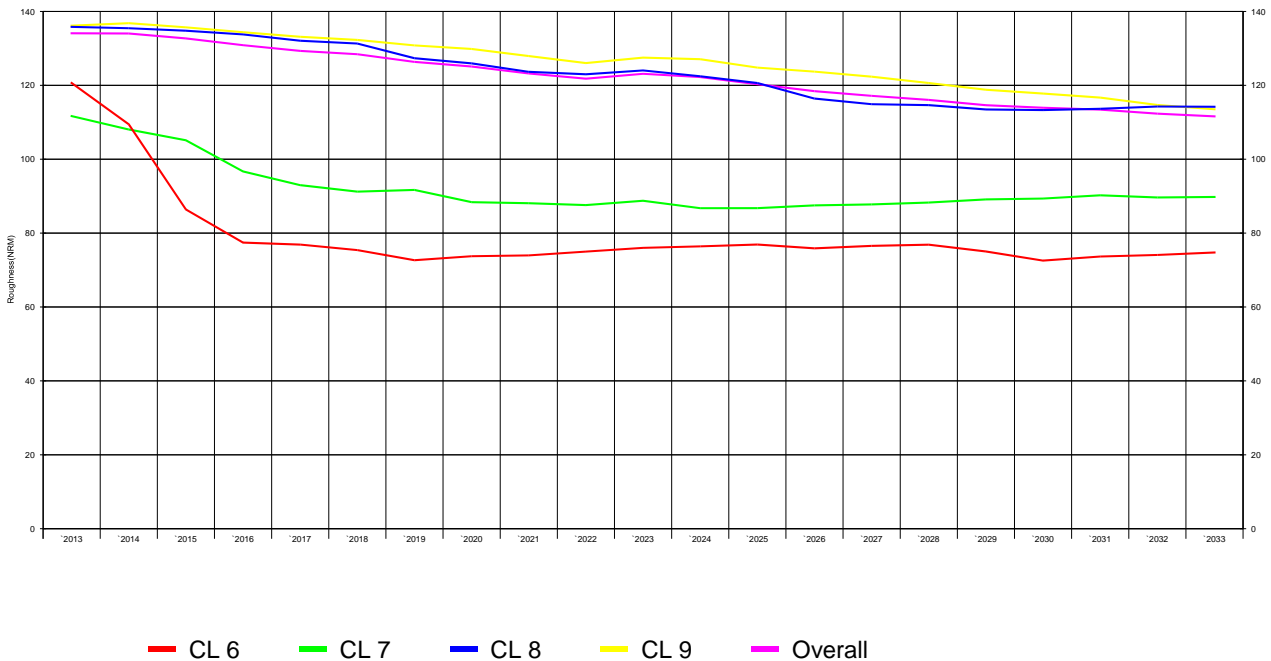


Figure 5.4 Roughness progression for local roads

Over 20 years roughness is improved and maintained across all NAASRA classes in the local roads.

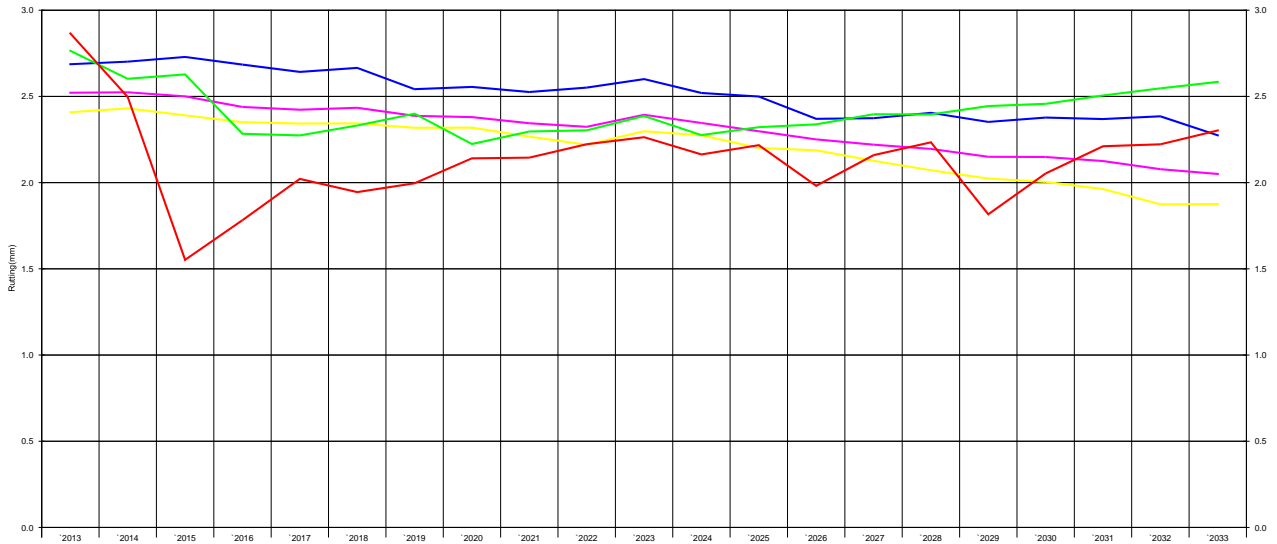


Figure 5.5 Rutting progression for local roads

Rutting in NAASRA Class 6 roads improved significantly before rising again, however it is then kept in check at roughly the same level. Rutting in other NAASRA class generally decreases over the 20 year period.

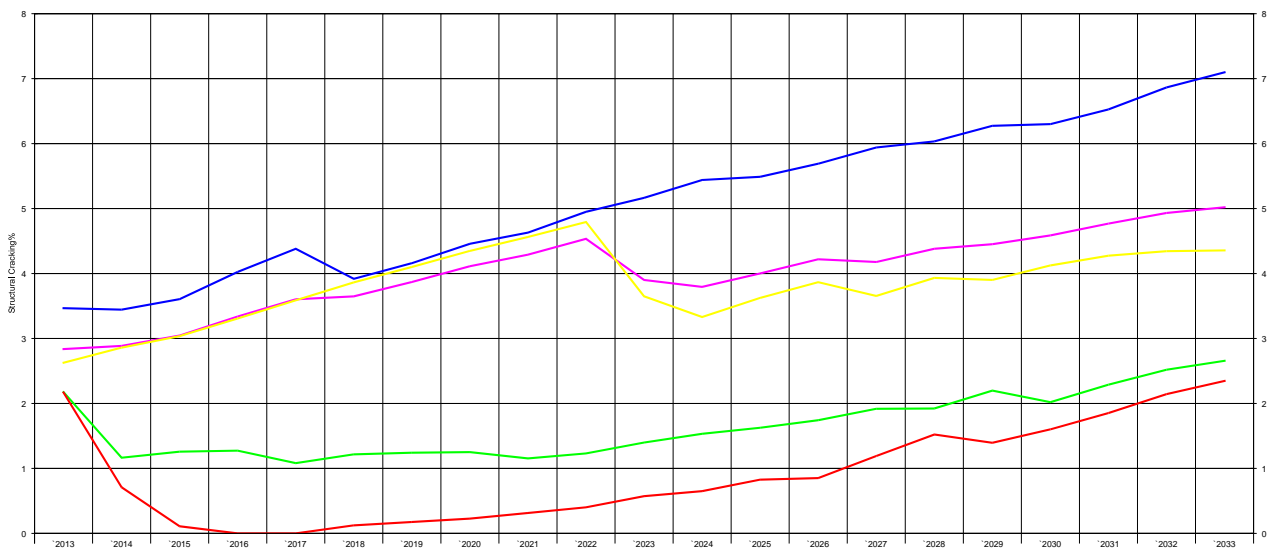


Figure 5.6 Structural cracking progression for local roads

— CL 6 — CL 7 — CL 8 — CL 9 — Overall

Similarly to the rutting progression, structural cracking in Class 6 local roads initially improved but then slowly increases again over time. Overall there is a slight increase in structural cracking over the 20 year period.

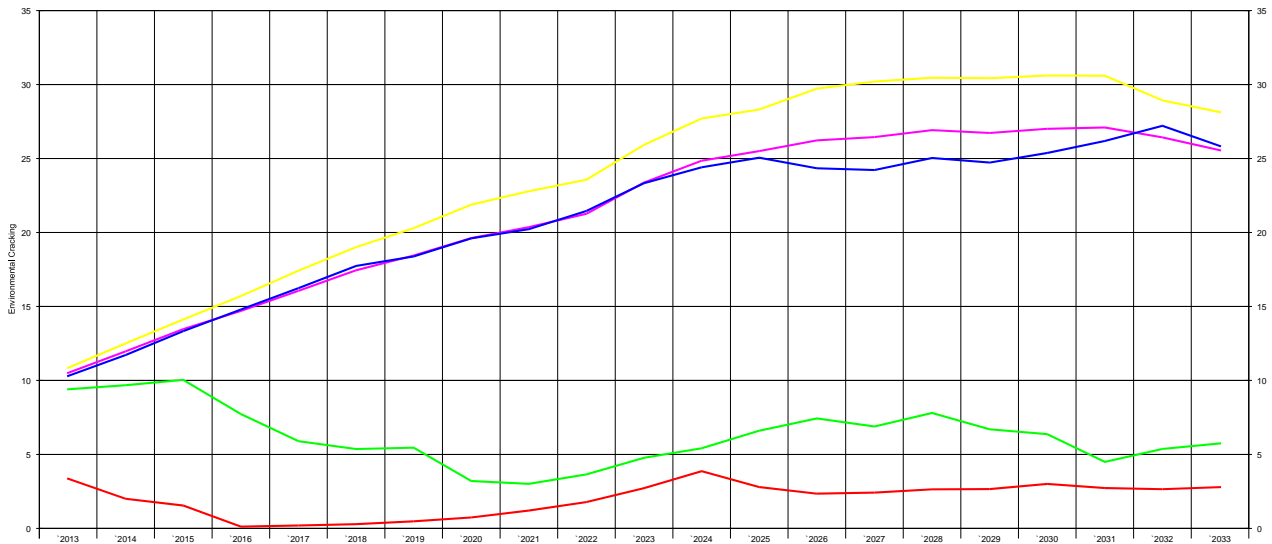


Figure 5.7 Environmental cracking progression for local roads

Environmental cracking is not a major concern for the Class 6 and Class 7 roads, however the majority of the local roads are in Class 8 and 9. In these latter classes, environmental steady increases for the first half of the modelling period but then is kept in check, most likely because of treatments being triggered.

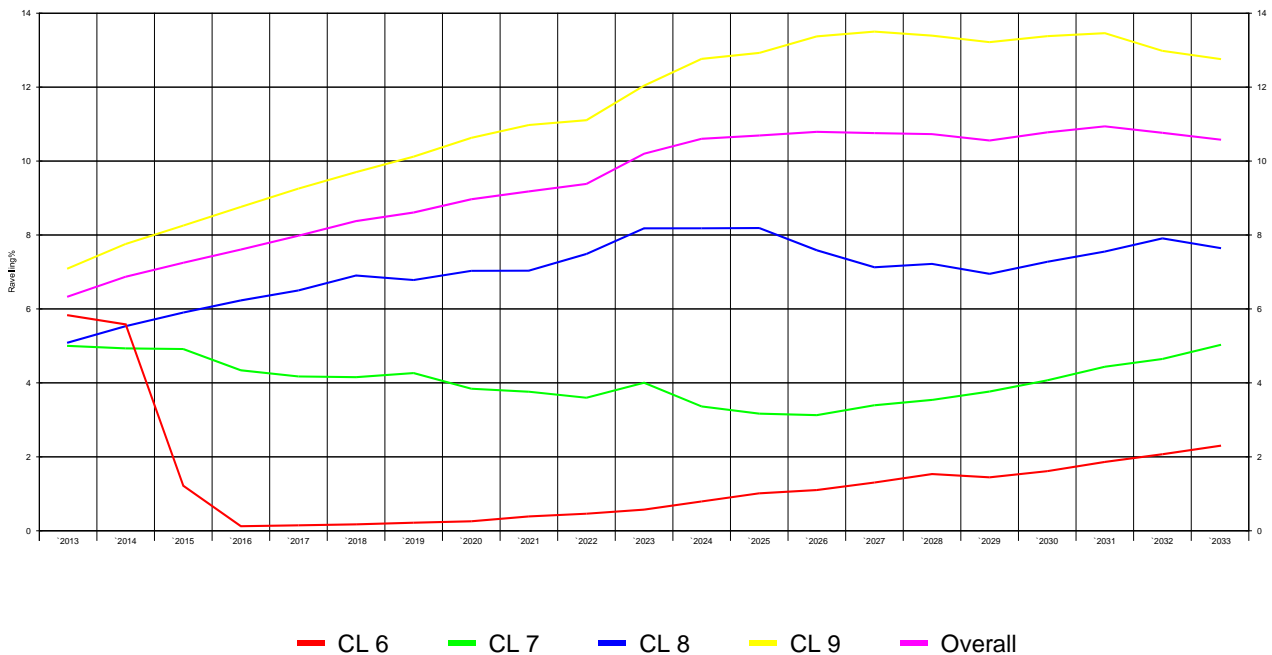


Figure 5.8 Ravelling progression for local roads

Despite the variation in trend between the different NAASRA classes, overall ravelling increases for the first half of the modelling period then levels out for the remaining period.

Figure 5.9 Projected asset average condition and distribution under the base case funding

The projection in the previous graphs is based on modelling with assumptions, such as the rate of progression of each defect type, the seal age, etc. Council’s engineers will continue to monitor the road network condition and compare it to the modelling assumptions to enable future forecasts to be refined. As information becomes available, the assumptions for the modelling will be revised and used as feedback to the software program, updating the model. This would have the effect of improving the accuracy of future projections.

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. Prioritisation in road pavements are based on matrices of modelling logic, the details of which can be found in section 12.

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, currently there are no plans for new and upgrade works of road pavements. Due to the urban environment of Willoughby LGA, construction of new roads rarely happens. However, there is annual expenditure on new works of road related assets, such as roads and street signs or Local Area Traffic Management Devices.

The total value of planned new and upgrade works for these other road related assets covered by this Plan is \$159k p.a., which is assumed to be the same for both levels of expenditure (base case and sustainable. There is therefore no difference between current funding levels (base case) and projected required capital funding (sustainable case) is shown in Figure 5.10.

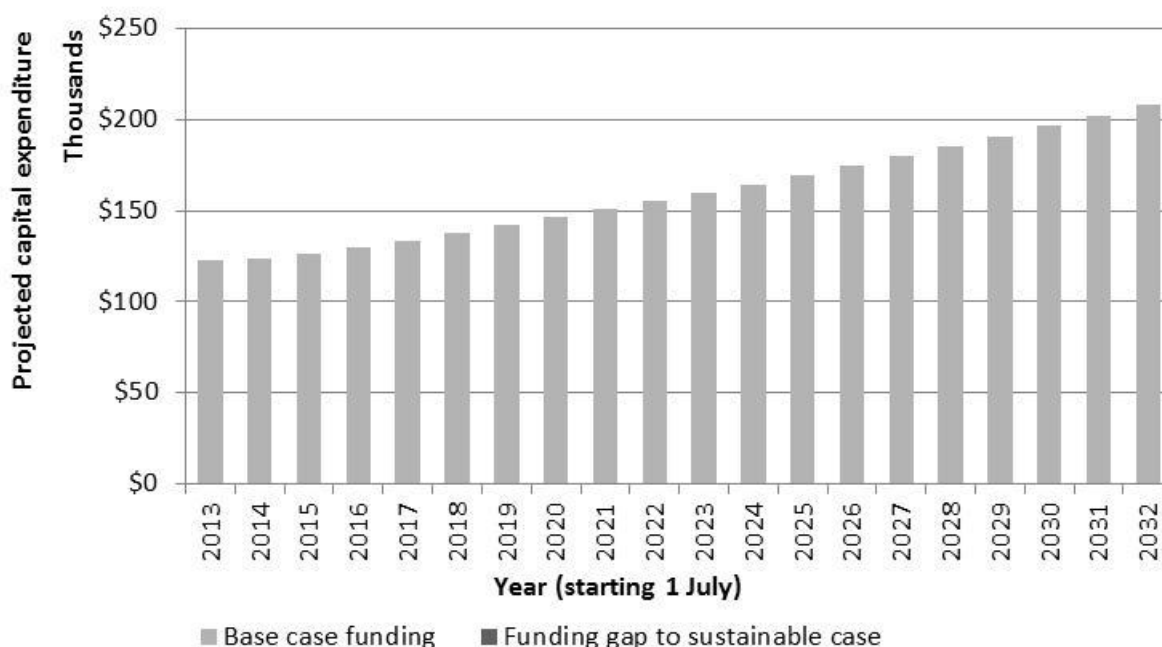


Figure 5.10 Projected capital expenditure under the base and sustainable case.

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

5.3.4. Disposal plan

Disposals are defined in the AMIS. Assets identified for possible decommissioning and disposal are shown in Table 5.9 below.

Table 5.9 Assets identified for disposal

Asset	Reason for disposal	Timing	Cash flow from disposal*
Road pavement of About Rd between Barton St and McMillan Rd	Acquisition by other government body	To be determined	To be determined

*Plus sign indicates a profit; negative sign indicates a cost to Council.

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 5.11. Base case funding for maintenance and renewal works mean that Council's current funding level is adequate for the assets covered by this Plan, and hence the sustainable case is the same as base case funding.

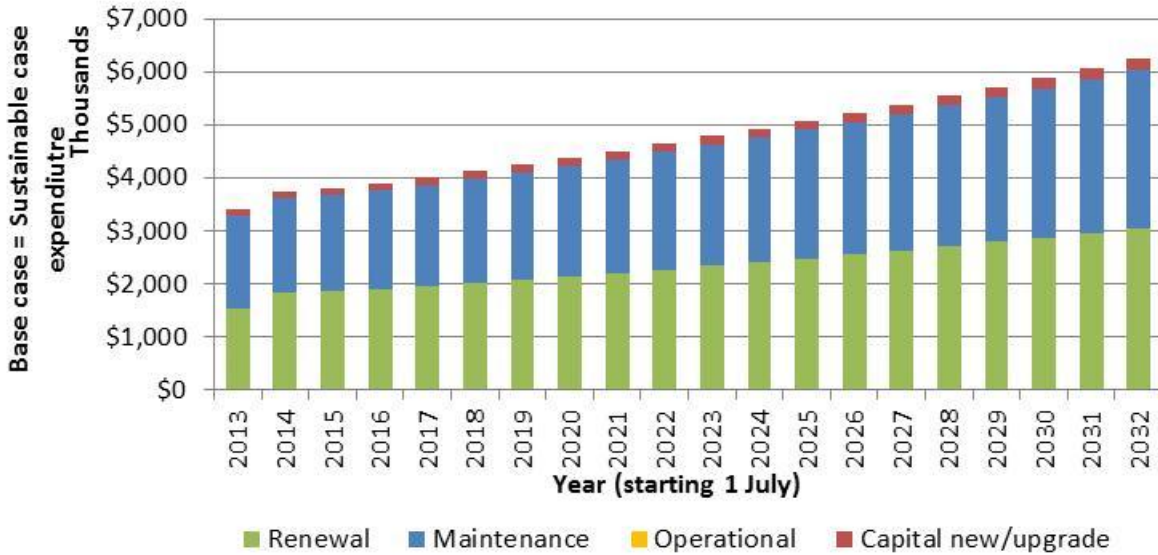


Figure 5.11 Projected 20 year asset expenditure under base case / sustainable case

Base case funding for maintenance and renewal works mean that Council's current funding level is adequate for the assets covered by this Plan, and hence the sustainable case is the same as base case funding. 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.

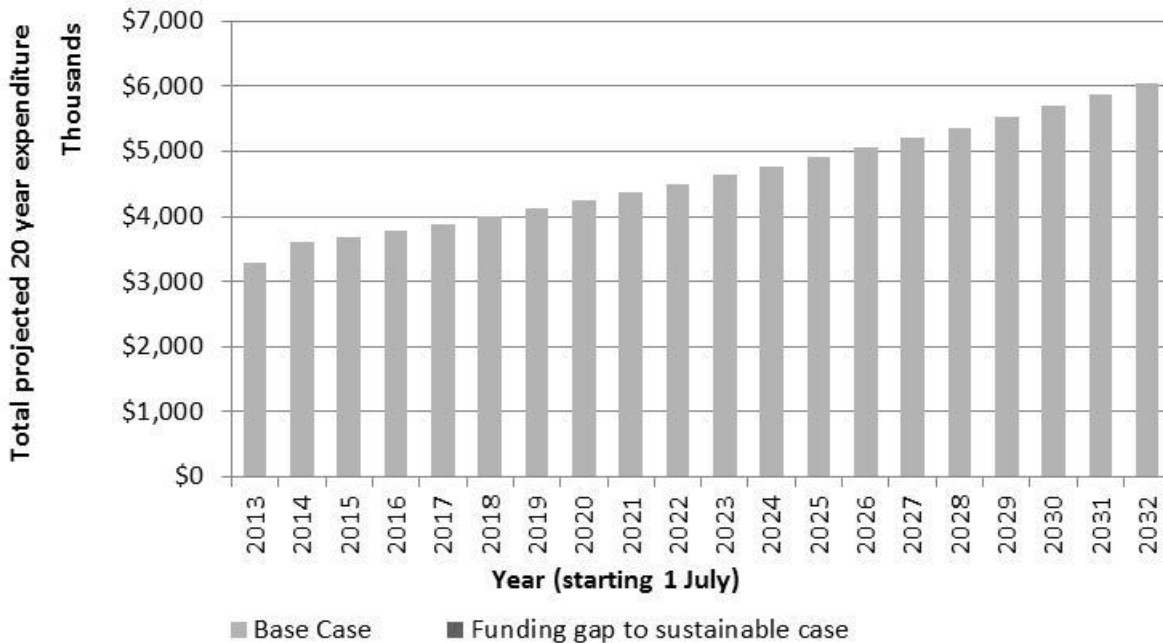


Figure 6.1 Projected 20 year expenditure for assets covered by this Plan

As shown and discussed previously, there is no funding gap for road pavement assets. 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 Table 6.1. For road pavements, as there is no funding gap, analysis shows that the life cycle expenditure matches the lifecycle cost.

Table 6.1 Life cycle cost analysis

Life cycle cost (annual)	Life cycle expenditure (annual)	Life cycle gap
\$ 4,788 k	\$ 4,788	\$ 0

According to the IPWEA NSW's *Road Management Report: Road Assets Benchmarking Project 2010*, there is a \$510m p.a. funding gap between lifecycle cost and lifecycle expenditure for sealed road assets (combined local and regional) for all 142 responding councils³. The following table enables a comparison to be made between Willoughby City Council and other councils' life cycle cost and expenditure. Note that Willoughby is included in the 142 councils.

Table 6.2 Comparing LCC and LCE of WCC and other councils

Asset class: Sealed Roads only	Willoughby City Council	142 responding NSW councils
Replacement cost (\$M)	162.8	36,784 ⁴
Life cycle cost (\$M)	4.8	1,064 (= 185 Regional + 879 Local) ⁴
Life cycle expenditure (\$M)	4.8	554 (= 123 Regional + 431 Local)
Length (km)	211	75,954 ⁵
Life cycle cost / Replacement Cost	2.9%	3.1%
Life cycle expenditure / Replacement Cost	2.9%	1.5%

The analysis in the table above shows that life cycle cost relative to replacement cost is slightly lower for Willoughby compared to all 142 responding councils. Also, looking at life cycle expenditure, total expenditure on sealed roads for all 142 councils is only 1.5% of the replacement cost value, whereas Willoughby spends 2.9%. This would explain why there is such a significant funding gap for road pavement works for all councils in NSW, but in Willoughby there is no lifecycle gap. It may also indicate that the level of service in Willoughby is above the norm for pavements as indicated in the survey.

This Plan is the key to addressing life cycle gap, if there is any, 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. As iterated previously, it is rare for road pavement stocks to increase in Willoughby's LGA which has largely urban environment that has been built up. However there are likely other new road related assets such as roads and street signs and Local Area Traffic Management Devices.

³ IPWEA (NSW) Roads & Transport Directorate, , 2011, p.9

⁴ as above, p.6

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 concurrently with additions to the new asset stock, but if assets are not renewed as indicated in the modelling, the overall fair value is more likely to drop.

As pavement uses separate modelling software, forecast values are not as easily retrieved and therefore projected replacement costs, fair value and depreciation expense cannot be shown until further analysis is carried out. However, as total asset stock is not expected to increase, the replacement costs would stay the same.

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:

- Different treatments have different effects on the condition of the pavement. For example, a crack sealing treatment will only reset the value of environmental cracking, heavy patching will reset the structural cracking, whereas a deep mill and resheet work will reset all the conditions. Effects of this treatment has been built into the pavement modelling software.
- Repair cost is based on the treatment type and the NAASRA class. For example, works on higher NAASRA class roads would generally cost more due to the additional traffic control, different pavement thickness to cater for higher road capacity, etc.
- 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.
- Comparison with IPART cost benchmarking which is due to be published during the 2013/2014 financial year and making adjustments as necessary
- Comparison with other Councils and discussions in Asset Management forums, bearing in mind that factors like useful life, residual values and replacement costs may vary from Council to Council depending on the location and renewal policy of each one.
- Cost indexing should be compared to *NSW Local Road Construction Cost Forecasts 2012-2022* published by the IPWEA (NSW) Roads and Transport Directorate, rather than straight 3%

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

Thresholds have been developed for the assets covered by this Plan to determine whether expenditure is classed as maintenance or capital. Details of this information are held in Council's asset valuation methodology. For pavement works, in principle the type of works is what determines whether it is a renewal or maintenance expenditure.

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 is accurate for the purpose of an asset register. Works carried out throughout the year is added into the pavement modelling software at the end of each financial year by Engineering Assets team to update the condition data. A new round of data collection will be carried out in 2013/2014 or 2014/2015 depending on availability of budgets and resources.

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

Business processes in relation to the assets covered by this Plan are continually being improved.

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	Officer Responsible	Resources required
1.	The pavement modelling system assumes a default date for seal age for a major portion of the network. This information is not available on two thirds of the network. Continued updating of this information will improve the accuracy of the modelling output.	Engineering	Staff
2.	Continued monitoring of the pavement condition to verify the accuracy of the key assumptions in the pavement modelling program to improve the forecast.	Engineering	Budget for surveying, staff
3.	Create handheld electronic data entry form to allow condition to be updated and recorded by staff in the field.		
4.	Continue to update records in the pavement management system, including seal dates and AADT data.	Engineering	Staff
5.	Integration with Long Term Financial Plan by applying the assumed portion of renewal/maintenance work for each funding source.	Engineering	Staff
6.	Incorporate an increase in treatment cost in PARMMS modelling software	Engineering	External consultant

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


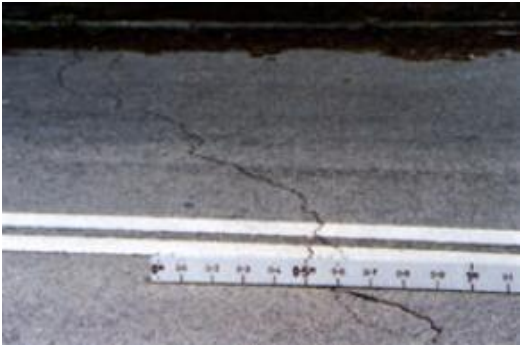

<http://www.willoughby.nsw.gov.au/About-Council/Forms-Policies---Publications/resourcing-strategy/>




IPWEA (NSW) Roads & Transport Directorate, *Road Management Report: Road Asset Benchmarking Project 2010*, 2011

10. Appendix A – Asset assessment manual

The pavement condition is determined by visual survey, laser profilometry survey and structural FWD testing, identifying the following defects:

Table 10.1 Defects identified in pavement condition assessment

Visual Survey		
Defect	Photos	Measurement
<p>Fatigue cracking (Structural Cracking)</p> <p>Interconnected cracks forming a series of small polygons resembling a crocodile hide, sometimes called crocodile cracking.</p>		<p>Area affected (%)</p>
<p>Environmental cracking</p> <p>Cracks running either longitudinally, transverse or diagonally along the road</p>		<p>Area affected (%)</p>
<p>Potholes</p> <p>A steep sided or bowl shaped cavity extending into the pavement layers below the wearing course</p>		<p>Area affected (%)</p>

<p>Ravelling</p> <p>A progressive disintegration of pavement surface by loss of both binder and aggregates.</p>		<p>Area affected (%)</p>
<p>Irregular patching</p> <p>An irregularly shaped path, usually small and a temporary repair of a pothole by cold mix asphalt</p>		<p>Area affected (%)</p>
<p>Heavy patching</p> <p>A permanent pavement repair, usually straight edged, not encompassing a full lane width reconstruction</p>		<p>Area affected (%)</p>
<p>Laser profilometry survey</p>		
<p>Defect</p>	<p>Photos</p>	<p>Measurement</p>
<p>Roughness</p> <p>Irregularities in pavement surface affecting the vehicle ride quality. A measure of serviceability.</p>	<p>N/A</p>	<p>Pavement transverse and longitudinal profile (NRM (NAASRA Roughness Meter) Counts)</p>
<p>Rutting</p> <p>Longitudinal deformation in a wheel path.</p>		<p>Pavement transverse profile used to calculate rut depth (mm)</p>

Structural testing	
Defect	Measurement
Structural deficiency	Deflection and curvature of the deflection bowl measured during the FWD test. Subgrade California Bearing Ratio (CBR) (%).

11. Appendix B – Inspection Method

Condition survey on the sealed road network is undertaken by consultants on behalf of Council on a regular basis and includes:

Visual condition assessment

A visual survey is conducted by collecting imagery from cameras mounted on a travelling vehicle and which records video footage to enable the pavement condition to be assessed.



Figure 11.1 Visual survey⁵

The visual condition assessment determines the extent and severity of the surface defects, including:

- Fatigue cracking
- Environmental cracking
- Potholes
- Ravelling
- Irregular patching
- Heavy patching

For more information on these defects, see the previous section on Condition Assessment.

Laser profilometry survey

This survey measures the profile of the pavement using lasers attached to a travelling vehicle, which is then used to calculate the roughness and rutting.



Figure 11.2 Host Vehicle Where the Laser Profilograph is Installed⁶

⁵ http://www.pavement.com.au/visual_surveys.html

⁶ <http://www.pavement.com.au/Laser-Profilograph.html>

Structural assessment

Structural assessment has been carried out on more than half of Council’s road network using the Falling Weight Deflectometer (FWD) test. This test determines the pavement’s characteristics and reaction to traffic loading.



Figure 11.3 Falling Weight Deflectometer Unit⁷

It should be noted that newer technology has become available since the last pavement survey carried on Council’s roads which enables pavement layer thicknesses and homogeneity to be determined using ground penetrating radar technology. The advent of high definition video recording and the increase in computer processing power now allows higher quality video footage to be recorded during visual surveys. This information will allow the accuracy of the data and reliability of the modelling result to be improved.

Each year Council updates AADT traffic data in the model and applies works that were carried out over the past financial year to adjust condition data within the model.

The data on the pavement condition is analysed and incorporated into the PARMMS® Road Manager Pavement Management System to develop a pavement management strategy for the Council’s road network. The objective of this strategy is to ensure the pavement network retains full functionality now and into the future.

The frequency of these inspections depends on the type of assessment and the NAASRA Class of the roads and available budget. The current pavement strategy aims for inspection frequency as summarized below, however inspection would ultimately depend on the availability of budgets and resources at the time.

Table 11.1 Target frequency of condition assessments of Council's road network

NAASRA Class	Visual survey	Laser profilometry survey	Structural FWD testing
6	Every 4 years	Every 4 years	Every 7 years
7	Every 4 years	Every 4 years	Every 7 years
8	Every 4 years	Every 4 years	Every 7 years
9	Every 4 years	Every 4 years	Every 7 years

⁷ http://www.pavement.com.au/Structural_Testing.html

12. Appendix C – Classification Matrix and Resolution matrix

Table 12.1 Classification matrix

ROUGHNESS (NRM)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 80	No Treatment	No Treatment	No Treatment	No Treatment
80 - 130	Redesign	No Treatment	No Treatment	No Treatment
130 - 135	Redesign	Redesign	No Treatment	No Treatment
135 - 160	Redesign	Redesign	Redesign	No Treatment
160 - 250	Redesign	Redesign	Redesign	Redesign
250 - 300	Reconstruction	Reconstruction	Redesign	Redesign
300 - 350	Reconstruction	Reconstruction	Reconstruction	Redesign
>350	Reconstruction	Reconstruction	Reconstruction	Reconstruction

RUT DEPTH (mm)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 8	No Treatment	No Treatment	No Treatment	No Treatment
8 - 12	Redesign	Redesign	No Treatment	No Treatment
12 - 20	Redesign	Redesign	Redesign	Redesign
> 20	Reconstruction	Reconstruction	Reconstruction	Reconstruction

ENVIRONMENTAL CRACKING (%)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 5	No Treatment	No Treatment	No Treatment	No Treatment
5 - 10	Crack Sealing	No Treatment	No Treatment	No Treatment
10 - 15	Crack Sealing	Crack Sealing	Crack Sealing	No Treatment
15 - 20	Redesign	Crack Sealing	Crack Sealing	Crack Sealing
20 - 25	Redesign	Redesign	Crack Sealing	Crack Sealing
25 - 30	Redesign	Redesign	Redesign	Crack Sealing
> 30	Redesign	Redesign	Redesign	Redesign

STRUCTURAL CRACKING (%)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 5	No Treatment	No Treatment	No Treatment	No Treatment
5 - 10	Heavy Patching	Heavy Patching	Heavy Patching	No Treatment
10 - 20	Heavy Patching	Heavy Patching	Heavy Patching	Heavy Patching
20 - 30	Redesign	Redesign	Heavy Patching	Heavy Patching
> 30	Redesign	Redesign	Redesign	Redesign

POTHoles (%)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 1	No Treatment	No Treatment	No Treatment	No Treatment
1 - 5	Pothole Patching	Pothole Patching	Pothole Patching	Pothole Patching
5 - 10	Heavy Patching	Heavy Patching	Heavy Patching	Pothole Patching
10 - 15	Heavy Patching	Heavy Patching	Heavy Patching	Heavy Patching
> 15	Redesign	Redesign	Redesign	Redesign

RAVELLING (%)	NAASRA CLASS 6	NAASRA CLASS 7	NAASRA CLASS 8	NAASRA CLASS 9
0 - 20	No Treatment	No Treatment	No Treatment	No Treatment
20 - 30	Resurface	No Treatment	No Treatment	No Treatment
30 - 40	Resurface	Resurface	Resurface	No Treatment
40 - 60	Resurface	Resurface	Resurface	Resurface
> 60	Resurface	Resurface	Resurface	Resurface

Table 12.2 Resolution Matrix

Prepared on 31st July 2008

NAASRA Class	Treatment Classification	Surface Type	AC Overlay Thickness	Roughness	Structural Cracking	Min Seal Age	Treatment Number	Treatment	Associated Treatment		
6	No Treatment						2	No Treatment			
	Crack Sealing						5	Crack Sealing	1		
	Pothole Patching						6	Pothole Patching	2		
	Heavy Patching						7	Heavy Patching	2		
	Resurface	AC					< Min	2	No Treatment		
							> Min	8	40mm AC Overlay		
	Redesign	AC	AC	< 50	< 80			< 5	2	No Treatment	
								> Min	10	40mm Mill & Resheet	3
								5 - 20	7	Heavy Patching	2
								20 - 50	10	40mm Mill & Resheet	3
								> 50	11	Deep Lift Mill & Replace	4
								> 50	11	Deep Lift Mill & Replace	4
					80 - 150	< 5	2	No Treatment			
						> Min	10	40mm Mill & Resheet	3		
						5 - 10	7	Heavy Patching	2		
						10 - 50	10	40mm Mill & Resheet	3		
						> 50	11	Deep Lift Mill & Replace	4		
						> 50	11	Deep Lift Mill & Replace	4		
					150 - 200	< 50	10	40mm Mill & Resheet	3		
						> 50	11	Deep Lift Mill & Replace	4		
						> 200	11	Deep Lift Mill & Replace	4		
						> 200	11	Deep Lift Mill & Replace	4		
						> 200	11	Deep Lift Mill & Replace	4		
						> 200	11	Deep Lift Mill & Replace	4		
	50 - 100	11	Deep Lift Mill & Replace	4							
	> 100	17	Reconstruct AC	5							
	Concrete	Concrete						< 20	2	No Treatment	
								20 - 30	13	Conc Slab Replacement	
								30 - 40	14	Conc Slab Replacement	
								> 40	15	Conc Slab Replacement	
< 20								12	Slab Jacking		
20 - 30								13	Conc Slab Replacement		
30 - 40								14	Conc Slab Replacement		
> 40								15	Conc Slab Replacement		
> 40								15	Conc Slab Replacement		
> 40								15	Conc Slab Replacement		
Reconstruction	AC						17	Reconstruct AC	5		
	Concrete						< 20	12	Slab Jacking		
							20 - 30	13	Conc Slab Replacement		
							30 - 40	14	Conc Slab Replacement		
							> 40	15	Conc Slab Replacement		

Associated Treatment Notes

1. Cracking sealing is associated with this treatment
2. Crack Sealing and patching is associated with this treatment
3. Heavy and pothole patching is associated with this treatment
4. An additional 50mm of asphalt thickness is provided due to milling of pavement
5. 200mm minimum reconstruction thickness
6. 300mm minimum reconstruction thickness

Minimum Seal Lives

15 years for Asphalt

NAASRA Class	Treatment Classification	Surface Type	AC Overlay Thickness	Roughness	Structural Cracking	Min Seal Age	Treatment Number	Treatment	Associated Treatment		
7	No Treatment						2	No Treatment			
	Crack Sealing						5	Crack Sealing	1		
	Pothole Patching						6	Pothole Patching	2		
	Heavy Patching						7	Heavy Patching	2		
	Resurface	AC					< Min	2	No Treatment		
							> Min	8	40mm AC Overlay		
		Concrete						2	No Treatment		
	Redesign	AC	< 50	< 130	< 5		< Min	2	No Treatment		
					5 - 20		> Min	10	40mm Mill & Resheet	3	
					20 - 50			7	Heavy Patching	2	
					> 50			10	40mm Mill & Resheet	3	
									11	Deep Lift Mill & Replace	4
				130 - 180	< 5				2	No Treatment	
					5 - 10				7	Heavy Patching	2
					10 - 50				10	40mm Mill & Resheet	3
			> 50					11	Deep Lift Mill & Replace	4	
			180 - 220	< 50				10	40mm Mill & Resheet	3	
				> 50				11	Deep Lift Mill & Replace	4	
				> 50				11	Deep Lift Mill & Replace	4	
				> 50				11	Deep Lift Mill & Replace	4	
			50 - 100						11	Deep Lift Mill & Replace	4
			> 100						17	Reconstruct AC	5
			Concrete		< 220	< 20				2	No Treatment
	20 - 30							13	Conc Slab Replacement		
	30 - 40							14	Conc Slab Replacement		
	> 40							15	Conc Slab Replacement		
	> 220	< 20						12	Slab Jacking		
		20 - 30						13	Conc Slab Replacement		
30 - 40							14	Conc Slab Replacement			
> 40							15	Conc Slab Replacement			
Reconstruction	AC						17	Reconstruct AC	5		
							12	Slab Jacking			
Concrete							20 - 30	13	Conc Slab Replacement		
							30 - 40	14	Conc Slab Replacement		
							> 40	15	Conc Slab Replacement		
							> 40	15	Conc Slab Replacement		

Associated Treatment Notes

1. Cracking sealing is associated with this treatment
2. Crack Sealing and patching is associated with this treatment
3. Heavy and pothole patching is associated with this treatment
4. An additional 50mm of asphalt thickness is provided due to milling of pavement
5. 200mm minimum reconstruction thickness
6. 300mm minimum reconstruction thickness

Minimum Seal Lives

15 years for Asphalt

NAASRA Class	Treatment Classification	Surface Type	AC Overlay Thickness	Roughness	Structural Cracking	Min Seal Age	Treatment Number	Treatment	Associated Treatment	
8	No Treatment						2	No Treatment		
	Crack Sealing						5	Crack Sealing	1	
	Pothole Patching						6	Pothole Patching	2	
	Heavy Patching						7	Heavy Patching	2	
	Resurface		AC				< Min	2	No Treatment	
			Concrete				> Min	8	40mm AC Overlay	
	Redesign		AC	< 50	< 135	< 5	< Min	2	No Treatment	
						5 - 20	> Min	10	40mm Mill & Resheet	3
						20 - 50		7	Heavy Patching	2
						> 50		10	40mm Mill & Resheet	3
						> 50		11	Deep Lift Mill & Replace	4
					135 - 200	< 5		2	No Treatment	
						5 - 10		7	Heavy Patching	2
						10 - 50		10	40mm Mill & Resheet	3
						> 50		11	Deep Lift Mill & Replace	4
						> 50		10	40mm Mill & Resheet	3
					200 - 250	< 50		10	40mm Mill & Resheet	3
						> 50		11	Deep Lift Mill & Replace	4
						> 50		11	Deep Lift Mill & Replace	4
					> 250		11	Deep Lift Mill & Replace	4	
					50 - 100		11	Deep Lift Mill & Replace	4	
					> 100		16	Reconstruct UB	6	
					Concrete				< 250	< 20
	20 - 30		13	Conc Slab Replacement						
	30 - 40		14	Conc Slab Replacement						
	> 40		15	Conc Slab Replacement						
	> 250	< 20		12					Slab Jacking	
20 - 30			13	Conc Slab Replacement						
30 - 40			14	Conc Slab Replacement						
> 40			15	Conc Slab Replacement						
> 40			15	Conc Slab Replacement						
Reconstruction		AC			< 20		16	Reconstruct UB	6	
					20 - 30		12	Slab Jacking		
					30 - 40		13	Conc Slab Replacement		
					> 40		14	Conc Slab Replacement		
					> 40		15	Conc Slab Replacement		
Concrete					< 20		12	Slab Jacking		
					20 - 30		13	Conc Slab Replacement		
					30 - 40		14	Conc Slab Replacement		
					> 40		14	Conc Slab Replacement		
					> 40		15	Conc Slab Replacement		

Associated Treatment Notes

1. Cracking sealing is associated with this treatment
2. Crack Sealing and patching is associated with this treatment
3. Heavy and pothole patching is associated with this treatment
4. An additional 50mm of asphalt thickness is provided due to milling of pavement
5. 200mm minimum reconstruction thickness
6. 300mm minimum reconstruction thickness

Minimum Seal Lives

15 years for Asphalt

NAASRA Class	Treatment Classification	Surface Type	AC Overlay Thickness	Roughness	Structural Cracking	Min Seal Age	Treatment Number	Treatment	Associated Treatment			
9	No Treatment						2	No Treatment				
	Crack Sealing						5	Crack Sealing	1			
	Pothole Patching						6	Pothole Patching	2			
	Heavy Patching						7	Heavy Patching	2			
	Resurface	AC					< Min	2	No Treatment			
							> Min	8	40mm AC Overlay			
		Concrete						2	No Treatment			
	Redesign	AC	< 50	< 160	< 5		< Min	2	No Treatment			
					5 - 20		> Min	10	40mm Mill & Resheet	3		
					20 - 50			7	Heavy Patching	2		
					> 50			10	40mm Mill & Resheet	3		
					> 50			11	Deep Lift Mill & Replace	4		
					> 50			11	Deep Lift Mill & Replace	4		
				160 - 220	< 5					2	No Treatment	
					5 - 10					7	Heavy Patching	2
					10 - 50					10	40mm Mill & Resheet	3
					> 50					11	Deep Lift Mill & Replace	4
					> 50					10	40mm Mill & Resheet	3
					> 50					11	Deep Lift Mill & Replace	4
				220 - 300	< 50					10	40mm Mill & Resheet	3
					> 50					11	Deep Lift Mill & Replace	4
					> 50					11	Deep Lift Mill & Replace	4
					> 50					11	Deep Lift Mill & Replace	4
					> 50					11	Deep Lift Mill & Replace	4
					> 50					11	Deep Lift Mill & Replace	4
	50 - 100							11	Deep Lift Mill & Replace	4		
								16	Reconstruct UB	6		
	Concrete	Concrete	> 100	< 300	< 20			2	No Treatment			
20 - 30							13	Conc Slab Replacement				
30 - 40							14	Conc Slab Replacement				
> 40							15	Conc Slab Replacement				
> 40							12	Slab Jacking				
> 40							13	Conc Slab Replacement				
> 300				20 - 30					13	Conc Slab Replacement		
				30 - 40					14	Conc Slab Replacement		
				> 40					14	Conc Slab Replacement		
				> 40					15	Conc Slab Replacement		
				> 40					15	Conc Slab Replacement		
				> 40					15	Conc Slab Replacement		
Reconstruction	AC						16	Reconstruct UB	6			
							12	Slab Jacking				
							13	Conc Slab Replacement				
							14	Conc Slab Replacement				
							14	Conc Slab Replacement				
							15	Conc Slab Replacement				
Concrete	Concrete						12	Slab Jacking				
							13	Conc Slab Replacement				
							14	Conc Slab Replacement				
							14	Conc Slab Replacement				
							15	Conc Slab Replacement				
							15	Conc Slab Replacement				

Associated Treatment Notes

1. Cracking sealing is associated with this treatment
2. Crack Sealing and patching is associated with this treatment
3. Heavy and pothole patching is associated with this treatment
4. An additional 50mm of asphalt thickness is provided due to milling of pavement
5. 200mm minimum reconstruction thickness
6. 300mm minimum reconstruction thickness

Minimum Seal Lives

15 years for Asphalt

13. Appendix D – Treatments

The following table list the types of treatments appropriate and applicable to rectify the pavement defects identified in Section 10. These are broken down by the types of works.

Table 13.1 Treatments

Types of Works	Treatment	Description
Preventative	Routine / Patrol maintenance	Routine maintenance involves work such as pothole repairs and clearing of drainage that is carried out during a patrol of the road network or in response to customer requests.
	Crack sealing	Sealing of cracks to waterproof the pavement surface and reduce the ingress of moisture into the pavement to extend the useful pavement life.
	Pothole patching	Repair of potholes to provide a safe pavement surface and reduce the moisture ingress into the pavement.
	Heavy patching	Repair of pavement affected by structural cracking to reduce the ingress of moisture leading to more significant failures.
Rehabilitation	AC overlay	Used to improve the general ride and safety characteristics of the pavement. This treatment may improve in structural capacity. A minimum thickness of 40mm applies to this treatment.
	Mill and resheet	Used to improve the general ride and safety characteristics of the pavement. The existing pavement is profiled to allow the pavement to remain at the existing level after the treatment and therefore the existing drainage capacity of the pavement is retained. This treatment utilises a minimum of 40mm of AC.
	Deep mill and resheet	Used to improve the structural capacity and the ride and safety characteristics of the pavement. The existing pavement is profiled to allow the pavement to remain at the existing level after the treatment and therefore the existing drainage capacity of the pavement is retained. This treatment utilises a minimum of 90mm of AC.
	Slab jacking	Used to improve the general ride characteristics of the pavement by injecting a grouting mix to raise and correct differences in the levels between concrete slabs and stabilises rocking slabs.
Reconstruction	Reconstruction UB	Reconstruction with unbound granular material with a new asphalt surface overlaying the granular material. This treatment is used when the existing pavement is in a poor structural condition and the roughness is higher than will be tolerated. This treatment utilises a minimum reconstruction thickness of 300mm.
	Reconstruction AC	Reconstruction with full depth asphalt pavement directly over the subgrade and remaining granular material. This treatment is used when the existing pavement is in a poor structural condition and the roughness is higher than will be tolerated. This treatment utilises a minimum reconstruction thickness of 200mm.
	Concrete slab replacement	Replacement of concrete slabs with jointed reinforced concrete. This treatment is used when the existing concrete pavement is in a poor structural condition and the roughness is higher than will be tolerated.

In addition to the above, utility service authorities often excavate road pavements which will generally cause the road pavement to fail at an accelerated rate. Additionally service ruptures under the road pavement such as water mains will also reduce the strength of the pavement. Utility services are to provide funding to Council to restore the road pavement. Concerns arise when utility services request to undertake their own repairs as they may be substandard and will generally not provide a warranty for the life of the pavement for the works undertaken.

14. Appendix F – Interpreting defect criteria to 0-5 condition rating

Road pavement components consist of formation, pavement and surface. Formation is not condition rated as it falls under bulk earthworks which is non-depreciable. For pavement and surface, the 0-5 condition rating depends on different factors of defect criteria, which is a result of collaboration between Council staff and external consultants. Each defect criteria returns a 0-5 rating, and for each segment, the condition rating is taken as the worst of the relevant criteria.

The following two tables show the relationship between each defect criteria and the 0-5 condition rating for pavement and surface.

Table 14.1 0-5 Condition Rating for Pavements

NASSRA Class	Cond	Structural Cracking (%)	Rutting (mm)	Flexible Roughness (NRM)	Structural Deficiency(%)
6	0	0 - 1	0 - 1	0 - 10	0 - 0.1
	1	1 - 2	1 - 3	10 - 20	0.1 - 20
	2	2 - 5	3 - 8	20 - 160	20 - 45
	3	5 - 10	8 - 12	160 - 180	45 - 60
	4	10 - 30	12 - 20	180 - 200	60 - 70
	5	30 - 100	20 - 999	200 - 999	70 - 999
7	0	0 - 1	0 - 1	0 - 20	0 - 0.1
	1	1 - 2	1 - 4	20 - 50	0.1 - 20
	2	2 - 5	4 - 8	50 - 180	20 - 50
	3	5 - 15	8 - 12	180 - 210	50 - 60
	4	15 - 30	12 - 20	210 - 240	60 - 70
	5	30 - 100	20 - 999	240 - 999	70 - 999
8	0	0 - 1	0 - 1	0 - 30	0 - 0.1
	1	1 - 2	1 - 8	30 - 70	0.1 - 20
	2	2 - 5	8 - 12	70 - 220	20 - 50
	3	5 - 20	12 - 16	220 - 240	50 - 60
	4	20 - 30	16 - 20	240 - 280	60 - 70
	5	30 - 100	20 - 999	280 - 999	70 - 999
9	0	0 - 1	0 - 1	0 - 40	0 - 0.1
	1	1 - 5	1 - 8	40 - 90	0.1 - 20
	2	5 - 10	8 - 12	90 - 270	20 - 50
	3	10 - 25	12 - 16	270 - 310	50 - 60
	4	25 - 30	16 - 20	310 - 350	60 - 70
	5	30 - 100	20 - 999	350 - 999	70 - 999

Table 14.2 0-5 Condition Rating for Surface

NASSRA Class	Cond	Structural Cracking (%)	Environmental Cracking (%)	Ravelling (%)
6	0	0 - 1	0 - 1	0 - 1
	1	1 - 2	1 - 5	1 - 5
	2	2 - 5	5 - 30	5 - 10
	3	5 - 10	30 - 35	10 - 15
	4	10 - 30	35 - 40	15 - 20
	5	30 - 100	40 - 999	20 - 999
7	0	0 - 1	0 - 1	0 - 1
	1	1 - 2	1 - 5	1 - 10
	2	2 - 5	5 - 30	10 - 15
	3	5 - 15	30 - 35	15 - 20
	4	15 - 30	35 - 40	20 - 30
	5	30 - 100	40 - 999	30 - 999
8	0	0 - 1	0 - 1	0 - 1
	1	1 - 2	1 - 5	1 - 10
	2	2 - 5	5 - 30	10 - 15
	3	5 - 20	30 - 35	15 - 20
	4	20 - 30	35 - 40	20 - 30
	5	30 - 100	40 - 999	30 - 999
9	0	0 - 1	0 - 1	0 - 1
	1	1 - 5	1 - 5	1 - 10
	2	5 - 10	5 - 30	10 - 20
	3	10 - 25	30 - 35	20 - 30
	4	25 - 30	35 - 40	30 - 40
	5	30 - 100	40 - 999	40 - 999

15. Appendix G – Capital Works

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 road pavement works by ward. These have been compiled to provide an overview by ward.

Table 15.1 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)
Roads	West Ward	\$1,632,825	\$0
	Sailors Bay Ward	\$2,230,988	\$0
	Middle Harbour Ward	\$2,139,715	\$0
	Naremburn Ward	\$2,122,499	\$0

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.

15.1. Base Case

The table below shows the list of capital works program produced by the Pavement Management System.

Table 15.2 Capital works program produced by the Pavement Management System

Street	Works	Ward	Year	\$
Albert Ave	Concrete slab replacement	Middle Harbour Ward	1	\$27,148
Ann St	Heavy patching	Middle Harbour Ward	1	\$18,796
Archer St	Heavy patching	Middle Harbour Ward	1	\$5,816
Archer St	Mill & resheet	Middle Harbour Ward	1	\$54,320
Ashley St	Deep mill & resheet	Middle Harbour Ward	1	\$30,052

Street	Works	Ward	Year	\$
Cammaray Rd	Mill & resheet	Middle Harbour Ward	1	\$36,734
Glenroy Ave	Mill & resheet	Middle Harbour Ward	1	\$10,014
Harold Reid Reserve Road	Mill & resheet	Middle Harbour Ward	1	\$50,027
Hercules St	Heavy patching	Middle Harbour Ward	1	\$7,798
High St	Heavy patching	Middle Harbour Ward	1	\$6,596
Kendall Rd	Heavy patching	Middle Harbour Ward	1	\$24,881
Mills L	Mill & resheet	Middle Harbour Ward	1	\$35,392
Neerim Rd	Heavy patching	Middle Harbour Ward	1	\$22,700
Padulla Pl	Mill & resheet	Middle Harbour Ward	1	\$7,272
Stan St	Heavy patching	Middle Harbour Ward	1	\$29,356
Stan St	Mill & resheet	Middle Harbour Ward	1	\$23,575
Stanley St	Pothole patching	Middle Harbour Ward	1	\$31,603
Victoria Ave	Deep mill & resheet	Middle Harbour Ward	1	\$10,720
Victoria Ave	Heavy patching	Middle Harbour Ward	1	\$17,860
Victoria Ave	Mill & resheet	Middle Harbour Ward	1	\$3,626
Victoria Ave	Pothole patching	Middle Harbour Ward	1	\$7,277
Artarmon Rd	Heavy patching	Naremburn Ward	1	\$133,900
Artarmon Rd	Mill & resheet	Naremburn Ward	1	\$62,980
Brand St	Mill & resheet	Naremburn Ward	1	\$11,508
Burra Rd	Mill & resheet	Naremburn Ward	1	\$6,292
Christie St	Deep mill & resheet	Naremburn Ward	1	\$28,251
Dalleys Rd	Heavy patching	Naremburn Ward	1	\$3,313
Elizabeth St	Heavy patching	Naremburn Ward	1	\$9,481
Glenmore St	Mill & resheet	Naremburn Ward	1	\$31,699
Hamilton Av	Mill & resheet	Naremburn Ward	1	\$3,594
Hampden Rd	Heavy patching	Naremburn Ward	1	\$21,000
Hampden Rd	Mill & resheet	Naremburn Ward	1	\$11,339
Herbert St	Deep mill & resheet	Naremburn Ward	1	\$24,587
Herbert St	Heavy patching	Naremburn Ward	1	\$46,172
Northcote St	Heavy patching	Naremburn Ward	1	\$71,768
Onyx Rd	Heavy patching	Naremburn Ward	1	\$8,811
Reserve Rd	Heavy patching	Naremburn Ward	1	\$27,592
Reserve Rd	Mill & resheet	Naremburn Ward	1	\$20,437
Sawyer Ln	Heavy patching	Naremburn Ward	1	\$24,147
Smith Rd	Heavy patching	Naremburn Ward	1	\$30,597
Wheatleigh St	Mill & resheet	Naremburn Ward	1	\$9,860
Keary St	Mill & resheet	Sailors Bay Ward	1	\$5,232
Minimbah Rd	Mill & resheet	Sailors Bay Ward	1	\$11,496
Minnamurra Rd	Heavy patching	Sailors Bay Ward	1	\$23,734
Pendey St	Slab jacking	Sailors Bay Ward	1	\$14,493
Sailors Bay Rd	Heavy patching	Sailors Bay Ward	1	\$1,079
Sailors Bay Rd	Mill & resheet	Sailors Bay Ward	1	\$8,186

Street	Works	Ward	Year	\$
Sailors Bay Rd	Reconst ac 200mm	Sailors Bay Ward	1	\$9,191
Small St	Mill & resheet	Sailors Bay Ward	1	\$2,484
Widgiewa Rd	Mill & resheet	Sailors Bay Ward	1	\$21,360
Anderson St	Heavy patching	West Ward	1	\$65,865
Anderson St	Mill & resheet	West Ward	1	\$9,991
Archer St	Heavy patching	West Ward	1	\$8,652
Dalrymple Ave	Heavy patching	West Ward	1	\$15,803
Dalrymple Ave	Mill & resheet	West Ward	1	\$23,656
De Villiers Av	Heavy patching	West Ward	1	\$12,261
Eddy Rd	Heavy patching	West Ward	1	\$5,558
Edgar St	Slab jacking	West Ward	1	\$29,084
Goodchap Rd	Deep mill & resheet	West Ward	1	\$103,781
Goodchap Rd	Heavy patching	West Ward	1	\$3,523
Goodchap Rd	Mill & resheet	West Ward	1	\$20,178
Lone Pine Ave	Deep mill & resheet	West Ward	1	\$20,857
Victoria Ave	Deep mill & resheet	West Ward	1	\$27,568
Violet St	Mill & resheet	West Ward	1	\$38,032
Zinnia Ln	Deep mill & resheet	West Ward	1	\$17,210
Archer St	Mill & resheet	Middle Harbour Ward	2	\$13,468
Archer St	Reconst ac 200mm	Middle Harbour Ward	2	\$14,540
Ashley St	Heavy patching	Middle Harbour Ward	2	\$2,952
Baldry St	Mill & resheet	Middle Harbour Ward	2	\$3,040
Barcoo St	Heavy patching	Middle Harbour Ward	2	\$2,439
Broomham Ln	Heavy patching	Middle Harbour Ward	2	\$7,642
Castle Cove Dr	Heavy patching	Middle Harbour Ward	2	\$27,236
Church St	Pothole patching	Middle Harbour Ward	2	\$7,310
Clanwilliam St	Heavy patching	Middle Harbour Ward	2	\$5,521
Crick St	Deep mill & resheet	Middle Harbour Ward	2	\$8,208
Deepwater Rd	Mill & resheet	Middle Harbour Ward	2	\$20,825
Denawen Ave	Heavy patching	Middle Harbour Ward	2	\$10,838
Gibbes St	Mill & resheet	Middle Harbour Ward	2	\$12,895
Hercules St	Heavy patching	Middle Harbour Ward	2	\$3,990
Johnson St	Mill & resheet	Middle Harbour Ward	2	\$7,328
Macquarie St	Slab jacking	Middle Harbour Ward	2	\$10,568
Malvern Av	Heavy patching	Middle Harbour Ward	2	\$8,071
Malvern Av	Pothole patching	Middle Harbour Ward	2	\$18,486
Neerim Rd	Heavy patching	Middle Harbour Ward	2	\$23,861
Neridah St	Heavy patching	Middle Harbour Ward	2	\$9,943
Nicholson St	Mill & resheet	Middle Harbour Ward	2	\$7,092
Pindari Av	Mill & resheet	Middle Harbour Ward	2	\$111,766
Rembrandt Dr	Heavy patching	Middle Harbour Ward	2	\$14,574
Rosebridge Ave	Heavy patching	Middle Harbour Ward	2	\$28,532

Street	Works	Ward	Year	\$
Spearman St	Deep mill & resheet	Middle Harbour Ward	2	\$30,064
Spearman St	Mill & resheet	Middle Harbour Ward	2	\$3,962
Spring Pl	Heavy patching	Middle Harbour Ward	2	\$4,841
Victoria Ave	Heavy patching	Middle Harbour Ward	2	\$27,628
Warrane Rd	Mill & resheet	Middle Harbour Ward	2	\$4,066
William St	Mill & resheet	Middle Harbour Ward	2	\$21,325
William St E	Mill & resheet	Middle Harbour Ward	2	\$15,990
Artarmon Rd	Heavy patching	Naremburn Ward	2	\$18,390
Artarmon Rd	Mill & resheet	Naremburn Ward	2	\$5,183
Bongalong St	Heavy patching	Naremburn Ward	2	\$10,899
Burra Rd	Deep mill & resheet	Naremburn Ward	2	\$6,786
Crowley Ln	Deep mill & resheet	Naremburn Ward	2	\$7,084
Dalleys Rd	Mill & resheet	Naremburn Ward	2	\$21,787
Dodds St	Heavy patching	Naremburn Ward	2	\$9,715
Evans L	Mill & resheet	Naremburn Ward	2	\$12,773
Hampden Ln	Mill & resheet	Naremburn Ward	2	\$13,473
Herbert St	Deep mill & resheet	Naremburn Ward	2	\$4,115
Herbert St	Heavy patching	Naremburn Ward	2	\$5,564
Herbert St	Mill & resheet	Naremburn Ward	2	\$3,128
John Allen Ln	Heavy patching	Naremburn Ward	2	\$37,459
Moonbria St	Deep mill & resheet	Naremburn Ward	2	\$26,209
Northcote St	Heavy patching	Naremburn Ward	2	\$73,070
Olive L	Mill & resheet	Naremburn Ward	2	\$8,128
Piper Ln	Heavy patching	Naremburn Ward	2	\$4,784
Quiamong Rd	Mill & resheet	Naremburn Ward	2	\$3,628
Reserve Rd	Deep mill & resheet	Naremburn Ward	2	\$16,864
Reserve Rd	Heavy patching	Naremburn Ward	2	\$22,413
Reserve Rd	Mill & resheet	Naremburn Ward	2	\$5,818
Robert St	Mill & resheet	Naremburn Ward	2	\$51,501
Ross Ln	Mill & resheet	Naremburn Ward	2	\$6,897
Smith Rd	Heavy patching	Naremburn Ward	2	\$5,361
Taylor Ln	Heavy patching	Naremburn Ward	2	\$16,067
Waters Rd	Heavy patching	Naremburn Ward	2	\$17,126
Clifton Av	Mill & resheet	Sailors Bay Ward	2	\$16,781
Dalmeny Rd	Mill & resheet	Sailors Bay Ward	2	\$5,027
Eaton St	Heavy patching	Sailors Bay Ward	2	\$2,238
Edinburgh Rd	Deep mill & resheet	Sailors Bay Ward	2	\$5,006
Elliott Ln	Heavy patching	Sailors Bay Ward	2	\$77,417
Euroka St (Dalkeith To No.34)	Mill & resheet	Sailors Bay Ward	2	\$5,987
Fry St	Heavy patching	Sailors Bay Ward	2	\$26,106
Fry St	Pothole patching	Sailors Bay Ward	2	\$5,477
High St	Deep mill & resheet	Sailors Bay Ward	2	\$193,560

Street	Works	Ward	Year	\$
High St	Mill & resheet	Sailors Bay Ward	2	\$979
Holland St	Heavy patching	Sailors Bay Ward	2	\$14,267
Kameruka Rd	Heavy patching	Sailors Bay Ward	2	\$20,229
Keary St	Heavy patching	Sailors Bay Ward	2	\$25,388
Laurel St	Mill & resheet	Sailors Bay Ward	2	\$3,290
Laurel St	Reconst ac 200mm	Sailors Bay Ward	2	\$4,830
Marlborough Rd	Heavy patching	Sailors Bay Ward	2	\$10,176
Minimbah Rd	Mill & resheet	Sailors Bay Ward	2	\$14,419
Neeworra Rd	Deep mill & resheet	Sailors Bay Ward	2	\$4,262
Patton Ln	Heavy patching	Sailors Bay Ward	2	\$19,235
Pendey St	Slab jacking	Sailors Bay Ward	2	\$6,913
Penkivil St	Slab jacking	Sailors Bay Ward	2	\$8,026
Prentice L	Heavy patching	Sailors Bay Ward	2	\$11,777
Ranelagh Cr	Deep mill & resheet	Sailors Bay Ward	2	\$17,773
Small St	Heavy patching	Sailors Bay Ward	2	\$23,178
Small St	Slab jacking	Sailors Bay Ward	2	\$11,430
Stanley St	Pothole patching	Sailors Bay Ward	2	\$8,433
Sunnyside Cr	Mill & resheet	Sailors Bay Ward	2	\$6,646
The Citadel	Mill & resheet	Sailors Bay Ward	2	\$7,829
The Postern	Mill & resheet	Sailors Bay Ward	2	\$1,065
Tulloh St	Mill & resheet	Sailors Bay Ward	2	\$454
Weemala Rd	Mill & resheet	Sailors Bay Ward	2	\$1,805
Woonona Rd	Mill & resheet	Sailors Bay Ward	2	\$44,911
Anderson St S	Mill & resheet	West Ward	2	\$3,208
Anglo St	Mill & resheet	West Ward	2	\$8,466
Archer St	Mill & resheet	West Ward	2	\$8,489
Beresford Av	Mill & resheet	West Ward	2	\$959
Claude St	Heavy patching	West Ward	2	\$1,220
Colwell Cr	Mill & resheet	West Ward	2	\$15,831
Erskine St	Heavy patching	West Ward	2	\$6,035
Johnson St	Heavy patching	West Ward	2	\$2,161
Johnson St	Mill & resheet	West Ward	2	\$17,533
Johnson St	Pothole patching	West Ward	2	\$26,716
Mcintosh St	Heavy patching	West Ward	2	\$27,301
Moola Pde	Heavy patching	West Ward	2	\$4,121
Nichols Ln	Mill & resheet	West Ward	2	\$7,298
Orchard Rd	Mill & resheet	West Ward	2	\$10,408
Parkside L	Mill & resheet	West Ward	2	\$15,903
Peckham Av	Mill & resheet	West Ward	2	\$8,849
Sutherland Rd	Mill & resheet	West Ward	2	\$36,972
Thomas Ln	Heavy patching	West Ward	2	\$15,115
Thomas St	Heavy patching	West Ward	2	\$553

Street	Works	Ward	Year	\$
Victoria Ave	Mill & resheet	West Ward	2	\$11,772
Western Wy	Heavy patching	West Ward	2	\$2,127
Whitton Rd	Heavy patching	West Ward	2	\$5,470
Willandra St	Heavy patching	West Ward	2	\$11,864
Archer St	Mill & resheet	Middle Harbour Ward	3	\$7,143
Bertram St	Mill & resheet	Middle Harbour Ward	3	\$44,653
Bottlebrush Ln	Mill & resheet	Middle Harbour Ward	3	\$4,813
Boundary St	Heavy patching	Middle Harbour Ward	3	\$19,192
Cherry Pl	Heavy patching	Middle Harbour Ward	3	\$33,138
Crick St	Deep mill & resheet	Middle Harbour Ward	3	\$2,355
Darling St	Mill & resheet	Middle Harbour Ward	3	\$21,824
Gibbes St	Heavy patching	Middle Harbour Ward	3	\$15,131
Gibbes St	Mill & resheet	Middle Harbour Ward	3	\$50,553
High St	Mill & resheet	Middle Harbour Ward	3	\$4,522
High St	Pothole patching	Middle Harbour Ward	3	\$12,842
Lamette St	Deep mill & resheet	Middle Harbour Ward	3	\$8,577
Mein Ln	Heavy patching	Middle Harbour Ward	3	\$7,939
Milton St	Mill & resheet	Middle Harbour Ward	3	\$16,919
Power Ln	Heavy patching	Middle Harbour Ward	3	\$17,801
Robert St	Mill & resheet	Middle Harbour Ward	3	\$19,556
Robinson St	Mill & resheet	Middle Harbour Ward	3	\$6,452
Royal St	Reconst ac 200mm	Middle Harbour Ward	3	\$33,745
Spearman St	Mill & resheet	Middle Harbour Ward	3	\$24,396
Stirling L	Mill & resheet	Middle Harbour Ward	3	\$35,589
Victoria Ave	Crack sealing	Middle Harbour Ward	3	\$67,874
Victoria Ave	Mill & resheet	Middle Harbour Ward	3	\$22,128
William St	Mill & resheet	Middle Harbour Ward	3	\$8,976
William St E	Mill & resheet	Middle Harbour Ward	3	\$4,781
Willis Rd	Mill & resheet	Middle Harbour Ward	3	\$1,578
Artarmon Rd	Mill & resheet	Naremburn Ward	3	\$25,260
Ashers Ln	Heavy patching	Naremburn Ward	3	\$114,511
Broughton Rd	Mill & resheet	Naremburn Ward	3	\$6,617
Burra Rd	Deep mill & resheet	Naremburn Ward	3	\$11,766
Butchers Ln	Mill & resheet	Naremburn Ward	3	\$14,269
Christie St	Mill & resheet	Naremburn Ward	3	\$12,521
Clarendon St	Mill & resheet	Naremburn Ward	3	\$14,131
Cleland Rd	Heavy patching	Naremburn Ward	3	\$26,811
Dalleys Rd	Mill & resheet	Naremburn Ward	3	\$7,123
Elizabeth St	Crack sealing	Naremburn Ward	3	\$39,803
Elizabeth St	Mill & resheet	Naremburn Ward	3	\$11,704
Eric Rd	Mill & resheet	Naremburn Ward	3	\$16,707
Francis St	Heavy patching	Naremburn Ward	3	\$5,663

Street	Works	Ward	Year	\$
Garage Ln	Heavy patching	Naremburn Ward	3	\$92,831
Gaza St	Mill & resheet	Naremburn Ward	3	\$9,029
Hampden Ln	Mill & resheet	Naremburn Ward	3	\$18,985
Hampden Rd	Crack sealing	Naremburn Ward	3	\$20,834
Hampden Rd	Mill & resheet	Naremburn Ward	3	\$77
Harden Rd	Mill & resheet	Naremburn Ward	3	\$16,393
Henry Ln	Mill & resheet	Naremburn Ward	3	\$17,255
Herbert St	Mill & resheet	Naremburn Ward	3	\$13,549
Lane W94	Heavy patching	Naremburn Ward	3	\$113
Mitchell St	Heavy patching	Naremburn Ward	3	\$2,050
Pyrl Rd	Mill & resheet	Naremburn Ward	3	\$52,078
Reserve Rd	Mill & resheet	Naremburn Ward	3	\$4,789
Ryan Ln	Heavy patching	Naremburn Ward	3	\$10,408
Aubrey Rd	Deep mill & resheet	Sailors Bay Ward	3	\$21,585
Brothers Av	Heavy patching	Sailors Bay Ward	3	\$4,471
Clanwilliam St	Mill & resheet	Sailors Bay Ward	3	\$3,980
Coates Ln	Mill & resheet	Sailors Bay Ward	3	\$17,708
Edinburgh Rd	Mill & resheet	Sailors Bay Ward	3	\$7,330
Euroka St (Dalkeith To No.34)	Mill & resheet	Sailors Bay Ward	3	\$14,738
Frenchs Rd	Mill & resheet	Sailors Bay Ward	3	\$55,789
Hector Rd	Mill & resheet	Sailors Bay Ward	3	\$11,719
Minimbah Rd	Mill & resheet	Sailors Bay Ward	3	\$17,305
Nathan Ln	Mill & resheet	Sailors Bay Ward	3	\$176
Patton Ln	Heavy patching	Sailors Bay Ward	3	\$22,096
Roche L	Heavy patching	Sailors Bay Ward	3	\$1,594
Sailors Bay Rd	Crack sealing	Sailors Bay Ward	3	\$10,937
Sailors Bay Rd	Heavy patching	Sailors Bay Ward	3	\$11,975
Sailors Bay Rd	Mill & resheet	Sailors Bay Ward	3	\$12,564
Sunnyside Cr	Heavy patching	Sailors Bay Ward	3	\$1,562
Sunnyside Cr	Mill & resheet	Sailors Bay Ward	3	\$13,446
The Bulwark	Deep mill & resheet	Sailors Bay Ward	3	\$126
The Bulwark	Mill & resheet	Sailors Bay Ward	3	\$49,604
The Citadel	Mill & resheet	Sailors Bay Ward	3	\$23,774
Tulloh St	Mill & resheet	Sailors Bay Ward	3	\$18,840
Weetawaa Rd	Mill & resheet	Sailors Bay Ward	3	\$17,355
Clarke St	Mill & resheet	West Ward	3	\$1,645
Davies St	Mill & resheet	West Ward	3	\$54
Devonshire St	Heavy patching	West Ward	3	\$2,499
Fullers Rd	Deep mill & resheet	West Ward	3	\$5,275
Goodchap Rd	Mill & resheet	West Ward	3	\$29,119
Gordon Av	Mill & resheet	West Ward	3	\$3,682
Hawthorn Ave	Mill & resheet	West Ward	3	\$22,912

Street	Works	Ward	Year	\$
Help St	Crack sealing	West Ward	3	\$22,932
Iris Ln	Mill & resheet	West Ward	3	\$13,519
Johnson St	Mill & resheet	West Ward	3	\$23,444
Melrose St	Mill & resheet	West Ward	3	\$77,281
Sutherland Rd	Mill & resheet	West Ward	3	\$3,217
Thomas St	Heavy patching	West Ward	3	\$8,641
Victoria Ave	Mill & resheet	West Ward	3	\$4,036
View Ln	Mill & resheet	West Ward	3	\$19,131
View St	Heavy patching	West Ward	3	\$13,773
Wattle Ln	Mill & resheet	West Ward	3	\$1,616
West Pde	Heavy patching	West Ward	3	\$3,443
Zinnia Ln	Mill & resheet	West Ward	3	\$9,250
Albert Ave	Concrete slab replacement	Middle Harbour Ward	4	\$23,440
Cammaray Rd	Heavy patching	Middle Harbour Ward	4	\$9,929
Eastern Valley Way Access 1	Heavy patching	Middle Harbour Ward	4	\$5,905
George Brain Ln	Heavy patching	Middle Harbour Ward	4	\$27,105
Haig St	Mill & resheet	Middle Harbour Ward	4	\$17,574
Headland Rd	Mill & resheet	Middle Harbour Ward	4	\$24,278
High St	Mill & resheet	Middle Harbour Ward	4	\$9,158
Stan St	Deep mill & resheet	Middle Harbour Ward	4	\$22,469
Victoria Ave	Heavy patching	Middle Harbour Ward	4	\$15,955
Victoria Ave	Mill & resheet	Middle Harbour Ward	4	\$957
William St	Deep mill & resheet	Middle Harbour Ward	4	\$7,544
William St	Mill & resheet	Middle Harbour Ward	4	\$3,553
Broughton Rd	Mill & resheet	Naremburn Ward	4	\$12,936
Campbell St	Slab jacking	Naremburn Ward	4	\$122,537
Chandos St	Heavy patching	Naremburn Ward	4	\$12,192
Chelmsford Av	Mill & resheet	Naremburn Ward	4	\$39,992
Christie St	Mill & resheet	Naremburn Ward	4	\$23,030
Clarendon St	Mill & resheet	Naremburn Ward	4	\$22,177
Crowley Ln	Mill & resheet	Naremburn Ward	4	\$19,334
Dalleys Rd	Mill & resheet	Naremburn Ward	4	\$21,660
Darvall St	Deep mill & resheet	Naremburn Ward	4	\$5,865
Elizabeth St	Heavy patching	Naremburn Ward	4	\$9,100
Grafton Ave	Mill & resheet	Naremburn Ward	4	\$13,259
Hampden Rd	Mill & resheet	Naremburn Ward	4	\$15,016
Moonbria St	Deep mill & resheet	Naremburn Ward	4	\$18,905
Northcote St	Mill & resheet	Naremburn Ward	4	\$17,043
Plunkett St	Heavy patching	Naremburn Ward	4	\$8,257
Quiamong Rd	Mill & resheet	Naremburn Ward	4	\$4,464
Reserve Rd	Mill & resheet	Naremburn Ward	4	\$45,725
Ryan Ln	Mill & resheet	Naremburn Ward	4	\$4,874

Street	Works	Ward	Year	\$
Smith Rd	Mill & resheet	Naremburn Ward	4	\$17,789
Weedon Rd	Heavy patching	Naremburn Ward	4	\$3,101
Aubrey Rd	Deep mill & resheet	Sailors Bay Ward	4	\$12,466
Cheyne Walk	Mill & resheet	Sailors Bay Ward	4	\$31,152
Clanwilliam St	Mill & resheet	Sailors Bay Ward	4	\$25,627
Coolawin Rd	Mill & resheet	Sailors Bay Ward	4	\$7,088
Dalmeny Rd	Mill & resheet	Sailors Bay Ward	4	\$4,488
Edinburgh Rd	Mill & resheet	Sailors Bay Ward	4	\$21,158
Foundation Place	Heavy patching	Sailors Bay Ward	4	\$41,365
Frenchs Rd	Mill & resheet	Sailors Bay Ward	4	\$19,353
Fry St	Heavy patching	Sailors Bay Ward	4	\$21,404
Gorman St	Slab jacking	Sailors Bay Ward	4	\$11,641
Mabel St	Heavy patching	Sailors Bay Ward	4	\$56,709
Marlborough Rd	Mill & resheet	Sailors Bay Ward	4	\$2,216
Minimbah Rd	Heavy patching	Sailors Bay Ward	4	\$19,553
Minnamurra Rd	Mill & resheet	Sailors Bay Ward	4	\$26,071
Patton Ln	Mill & resheet	Sailors Bay Ward	4	\$18,863
Sailors Bay Rd	Heavy patching	Sailors Bay Ward	4	\$23,519
Sailors Bay Rd	Pothole patching	Sailors Bay Ward	4	\$13,107
Salisbury Ln	Heavy patching	Sailors Bay Ward	4	\$8,647
Small St	Mill & resheet	Sailors Bay Ward	4	\$3,445
Sortie Port	Mill & resheet	Sailors Bay Ward	4	\$30,605
Stanley St	Heavy patching	Sailors Bay Ward	4	\$59,158
Sunnyside Cr	Mill & resheet	Sailors Bay Ward	4	\$5,815
The Battlement	Mill & resheet	Sailors Bay Ward	4	\$21,121
The Outpost	Heavy patching	Sailors Bay Ward	4	\$4,121
The Parapet	Mill & resheet	Sailors Bay Ward	4	\$7,723
The Rampart	Mill & resheet	Sailors Bay Ward	4	\$14,093
Tycannah Rd	Deep mill & resheet	Sailors Bay Ward	4	\$7,332
Upper Minimbah Rd	Mill & resheet	Sailors Bay Ward	4	\$24,879
Widgiewa Rd	Mill & resheet	Sailors Bay Ward	4	\$24,982
Anderson St	Mill & resheet	West Ward	4	\$9,643
Anderson St S	Mill & resheet	West Ward	4	\$3,262
Anglo St	Heavy patching	West Ward	4	\$1,930
Centennial Ave	Mill & resheet	West Ward	4	\$4,312
Dulwich Rd	Heavy patching	West Ward	4	\$34,197
Endeavour St	Heavy patching	West Ward	4	\$6,929
Fitzsimmons Av	Deep mill & resheet	West Ward	4	\$20,911
Freeman Rd	Mill & resheet	West Ward	4	\$12,149
Goodchap Rd	Deep mill & resheet	West Ward	4	\$13,529
Goodchap Rd	Mill & resheet	West Ward	4	\$6,705
Greville St	Mill & resheet	West Ward	4	\$6,336

Street	Works	Ward	Year	\$
Help St	Heavy patching	West Ward	4	\$128,044
Ivy St	Mill & resheet	West Ward	4	\$21,317
Jenkins St (Lower Cariageway)	Heavy patching	West Ward	4	\$45,700
Kirk St	Heavy patching	West Ward	4	\$7,541
Macartney Ave	Mill & resheet	West Ward	4	\$16,426
Mcintosh St	Mill & resheet	West Ward	4	\$1,781
Melrose St	Mill & resheet	West Ward	4	\$44,612
Sharland Ave	Heavy patching	West Ward	4	\$1,515
View St	Heavy patching	West Ward	4	\$7,058
Violet St	Heavy patching	West Ward	4	\$31,489
Wyvern Av	Mill & resheet	West Ward	4	\$6,964
Albert Ave	Heavy patching	Middle Harbour Ward	5	\$11,618
Ann St	Heavy patching	Middle Harbour Ward	5	\$23,464
Ann St	Mill & resheet	Middle Harbour Ward	5	\$11,316
Archer St	Mill & resheet	Middle Harbour Ward	5	\$4,333
Ashley St	Deep mill & resheet	Middle Harbour Ward	5	\$30,143
Ashley St	Heavy patching	Middle Harbour Ward	5	\$14,050
Cammaray Rd	Heavy patching	Middle Harbour Ward	5	\$31,432
Castle Cove Dr	Heavy patching	Middle Harbour Ward	5	\$11,831
Darling St	Heavy patching	Middle Harbour Ward	5	\$6,084
Deepwater Rd	Heavy patching	Middle Harbour Ward	5	\$14,139
First Ave	Mill & resheet	Middle Harbour Ward	5	\$6,627
George Brain Ln	Mill & resheet	Middle Harbour Ward	5	\$10,478
Greenfield Ave	Heavy patching	Middle Harbour Ward	5	\$20,977
Headland Rd	Heavy patching	Middle Harbour Ward	5	\$16,443
Hercules St	Heavy patching	Middle Harbour Ward	5	\$76
High St	Heavy patching	Middle Harbour Ward	5	\$16,096
High St	Mill & resheet	Middle Harbour Ward	5	\$5,428
Holly St	Heavy patching	Middle Harbour Ward	5	\$25,318
Johnson St	Heavy patching	Middle Harbour Ward	5	\$23,580
Kendall Rd	Heavy patching	Middle Harbour Ward	5	\$2,203
Nicholson St	Mill & resheet	Middle Harbour Ward	5	\$12,036
Robinson St	Heavy patching	Middle Harbour Ward	5	\$12,956
Rosebridge Ave	Mill & resheet	Middle Harbour Ward	5	\$3,159
Stanley St	Deep mill & resheet	Middle Harbour Ward	5	\$5,625
Tyneside Ave	Heavy patching	Middle Harbour Ward	5	\$9,206
Victoria Ave	Heavy patching	Middle Harbour Ward	5	\$7,111
Warrane Rd	Mill & resheet	Middle Harbour Ward	5	\$22,816
Artarmon Rd	Heavy patching	Naremburn Ward	5	\$1,573
Broughton Rd	Heavy patching	Naremburn Ward	5	\$7,196
Buller Rd	Heavy patching	Naremburn Ward	5	\$20,824

Street	Works	Ward	Year	\$
Chandos St	Mill & resheet	Naremburn Ward	5	\$87
Dalleys Rd	Mill & resheet	Naremburn Ward	5	\$5,295
Darvall St	Mill & resheet	Naremburn Ward	5	\$10,435
Dodds St	Heavy patching	Naremburn Ward	5	\$6,012
Furnedge Ln	Heavy patching	Naremburn Ward	5	\$7,047
Garland Rd	Slab jacking	Naremburn Ward	5	\$17,206
Hamilton Av	Mill & resheet	Naremburn Ward	5	\$6,799
Hampden Rd	Mill & resheet	Naremburn Ward	5	\$10,709
Hawkins St	Heavy patching	Naremburn Ward	5	\$12,036
Henry Ln	Heavy patching	Naremburn Ward	5	\$26,810
Herbert St	Mill & resheet	Naremburn Ward	5	\$4,344
Hotham Pde	Heavy patching	Naremburn Ward	5	\$23,902
Jersey Rd	Heavy patching	Naremburn Ward	5	\$8,544
Kershaw Ln	Heavy patching	Naremburn Ward	5	\$3,029
Market St	Heavy patching	Naremburn Ward	5	\$14,030
Northcote St	Mill & resheet	Naremburn Ward	5	\$9,733
Park Rd	Heavy patching	Naremburn Ward	5	\$22,871
Park Rd	Mill & resheet	Naremburn Ward	5	\$2,351
Plunkett St	Mill & resheet	Naremburn Ward	5	\$21,087
Reserve Rd	Deep mill & resheet	Naremburn Ward	5	\$2,471
Robert St	Heavy patching	Naremburn Ward	5	\$4,276
Rohan St	Heavy patching	Naremburn Ward	5	\$5,047
Taylor Ln	Mill & resheet	Naremburn Ward	5	\$11,833
Thomson Ave	Heavy patching	Naremburn Ward	5	\$2,965
Tindale Rd	Heavy patching	Naremburn Ward	5	\$11,049
Aubrey Rd	Deep mill & resheet	Sailors Bay Ward	5	\$14,278
Byora Cr	Deep mill & resheet	Sailors Bay Ward	5	\$8,319
Church St	Heavy patching	Sailors Bay Ward	5	\$12,183
Edinburgh Rd	Heavy patching	Sailors Bay Ward	5	\$3,589
Frenchs Rd	Pothole patching	Sailors Bay Ward	5	\$27,617
Kameruka Rd	Heavy patching	Sailors Bay Ward	5	\$5,390
Kameruka Rd	Mill & resheet	Sailors Bay Ward	5	\$3,395
Keary St	Heavy patching	Sailors Bay Ward	5	\$10,663
Laurel St	Deep mill & resheet	Sailors Bay Ward	5	\$25,420
Laurel St	Heavy patching	Sailors Bay Ward	5	\$6,128
Lincoln Ave	Heavy patching	Sailors Bay Ward	5	\$7,365
Linden Way	Heavy patching	Sailors Bay Ward	5	\$3,338
Minimbah Rd	Mill & resheet	Sailors Bay Ward	5	\$18,837
Minnamurra Rd	Mill & resheet	Sailors Bay Ward	5	\$2,318
Miowera Rd	Mill & resheet	Sailors Bay Ward	5	\$3,542
Neeworra Rd	Heavy patching	Sailors Bay Ward	5	\$14,850
Sailors Bay Rd	Crack sealing	Sailors Bay Ward	5	\$841

Street	Works	Ward	Year	\$
Sailors Bay Rd	Heavy patching	Sailors Bay Ward	5	\$1,856
Salisbury Ln	Mill & resheet	Sailors Bay Ward	5	\$6,787
Small St	Heavy patching	Sailors Bay Ward	5	\$14,385
Sortie Port	Heavy patching	Sailors Bay Ward	5	\$35,439
Sugarloaf Cr	Mill & resheet	Sailors Bay Ward	5	\$12,378
Sunnyside Cr	Mill & resheet	Sailors Bay Ward	5	\$7,334
The Barbette	Heavy patching	Sailors Bay Ward	5	\$3,425
The Bulwark	Heavy patching	Sailors Bay Ward	5	\$3,804
The Outpost	Mill & resheet	Sailors Bay Ward	5	\$3,630
The Parapet	Heavy patching	Sailors Bay Ward	5	\$13,212
The Postern	Mill & resheet	Sailors Bay Ward	5	\$2,718
The Scarp	Mill & resheet	Sailors Bay Ward	5	\$10,354
Wyalong St	Heavy patching	Sailors Bay Ward	5	\$25,512
Anglo St	Heavy patching	West Ward	5	\$5,634
Archer St	Mill & resheet	West Ward	5	\$19,684
Avian Cr	Heavy patching	West Ward	5	\$5,288
Beaconsfield Rd	Pothole patching	West Ward	5	\$5,473
Centennial Ave	Reconst ac 200mm	West Ward	5	\$3,773
Claude St	Heavy patching	West Ward	5	\$63,365
Coolaroo Rd	Mill & resheet	West Ward	5	\$3,629
Dalrymple Ave	Heavy patching	West Ward	5	\$8,742
Dalrymple Ave	Mill & resheet	West Ward	5	\$17,310
De Villiers Av	Mill & resheet	West Ward	5	\$5,510
Dulwich Rd	Deep mill & resheet	West Ward	5	\$17,979
Dulwich Rd	Mill & resheet	West Ward	5	\$7,041
Eddy Rd	Mill & resheet	West Ward	5	\$20,942
Endeavour St	Mill & resheet	West Ward	5	\$18,086
Fehon Rd	Heavy patching	West Ward	5	\$18,688
Fullers Rd	Heavy patching	West Ward	5	\$3,928
Fullers Rd	Pothole patching	West Ward	5	\$2,720
Goodchap Rd	Mill & resheet	West Ward	5	\$31,990
Gordon Av	Heavy patching	West Ward	5	\$3,374
Greenlands Rd	Heavy patching	West Ward	5	\$2,643
Greville St	Heavy patching	West Ward	5	\$3,352
Help St	Crack sealing	West Ward	5	\$13,889
Help St	Slab jacking	West Ward	5	\$8,296
Johnson St	Heavy patching	West Ward	5	\$10,658
Kirk St	Mill & resheet	West Ward	5	\$2,535
Lone Pine Ave	Heavy patching	West Ward	5	\$16,615
Louise Av	Mill & resheet	West Ward	5	\$33,656
Moola Pde	Heavy patching	West Ward	5	\$28,114
Oliver Rd	Heavy patching	West Ward	5	\$8,705

Street	Works	Ward	Year	\$
Oliver Rd	Mill & resheet	West Ward	5	\$12,990
Orchard Rd	Heavy patching	West Ward	5	\$5,909
Park Av	Heavy patching	West Ward	5	\$11,955
Pearl Ave	Heavy patching	West Ward	5	\$641
Pearl Ave	Mill & resheet	West Ward	5	\$5,091
Peckham Av	Heavy patching	West Ward	5	\$15,797
Peckham Av	Mill & resheet	West Ward	5	\$27,147
Sharland Ave	Mill & resheet	West Ward	5	\$453
Sylvia St	Mill & resheet	West Ward	5	\$8,281
Thomas St	Heavy patching	West Ward	5	\$5,140
View Ln	Mill & resheet	West Ward	5	\$5,032
View St	Heavy patching	West Ward	5	\$3,806
View St	Mill & resheet	West Ward	5	\$3,679
Violet St	Mill & resheet	West Ward	5	\$109,710

15.2. Sustainable Case

No additional works are required under the sustainable case for roads. Capital works planning and budgeting for road pavements has been based on a mature and technical modelling process for several years, and is expected to be sufficient.