WARRNAMBOOL
CITY COUNCIL

Bridge asset management plan

Amendment Register:

Issue	Date	Details	Author
V0.01	May 2012	Draft developed from original Roads & Footpaths AMP	
V0.02	April 2013	Draft for comment	
V1.00	June 2014	Redraft to align with MAV STEP Brief AMP template some content deleted.	B. McDonald
V2.00	Sept 2015	Updated quantities and values	B. McDonald
V3.00	March 2017	Updated all sections	M. Stewart

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1 EXECUTIVE SUMMARY

Introduction

Warrnambool City Council manages a total of 50 road bridges, footbridges and major culverts which assist in creating a high level of connectivity throughout the municipality. Council recognises that like other infrastructure asset classes, the management of bridge and major culvert infrastructure must be conducted appropriately and responsibly. This plan is a means of outlining the asset management principles and processes such that Council may work towards a more sustainable system of management and delivery.

Bridge and Major Culvert Asset Summary:

Asset Category	Quantity	Average Condition 0(New)-10(Very Poor)	Replacement Value
Major Culverts	15	2.8 (Good)	$ 2,406,295
Footbridge	25	3.4 (Good)	$ 5,830,914
Road Bridge	10	4.1 (Average)	$ 23,707,382
Totals	50	3.42 (Good)	$ 31,944,591

Table 1: Asset Dimensions

Bridges and major culverts are defined as structures with a minimum span of 1.8m and a minimum waterway area of $3m^2$. Structures which are outside of this definition, alongside structures under the ownership and management of private parties, the adjoining municipality or road and rail authorities (VicRoads & VicTrack), are not included in this plan.

Council recognises a wide variety of community stakeholders in bridge and major culvert infrastructure; these include, but are not limited to pedestrians, lightweight private vehicle users, commercial and industrial mid-heavy vehicle users, cyclists, wheelchairs and prams.

Levels of Service

The service requirements for Council's bridge and major culvert infrastructure have been developed through the analysis of customer requests, the results from the community satisfaction survey (2016), legislative requirements, design guidelines and standards and requirements developed from the regional asset service project. Community consultation regarding the road and footpath network is planned to occur in late 2017. As a part of the engagement process, consideration will be given to including consultation on service levels and performance targets specific to bridge and major culvert infrastructure. To ensure the effectiveness of the consultation, inclusion of the respective risk and financial consequences to service level performance target amendments shall be ensured.

The service requirements identified form the basis for the community and technical levels of service provided in section 3.3. The community and technical levels of service are evaluated using performance measurements against targets of performance and hence resulting under-performing assets or procedures may be identified. In section 3.4 Council's service level performance is discussed including solutions and expectations for future service performance and monitoring.

Future Demand

The future demand upon Council's bridge and major culvert assets will be dependent on demographic, environmental, social, economic and technological developments. Table 14 ("Future Demand Forecast and Management") in section 4.1 provides a list of factors expected to influence the future demand in bridge and major culvert infrastructure, alongside their predicted effects and plans of management. The key points to consider, however, are summarised below:

- Natural Environment – Changes in the natural environment are predicted to have adverse effects on the structural condition of Councils road assets. Bridges and major culverts will experience an increase in flood damage, increased structural and foundation damage through increased geotechnical effects and more generally an accelerated degradation of materials and structures through increased temperature.
- Demographics – The population in Warrnambool is currently increasing at an average rate of 1.4% per annum (Warrnambool City-Wide Housing Strategy). The loading on bridge and major culvert assets is expected to increase proportionally to the rate of population growth.
- Heavy Vehicles – According to Freight Futures Victorian Freight Network Strategy, the freight task for the Warrnambool region is currently increasing at approximately 2.6% per annum. In line with this increase, bridge and major culvert infrastructure will be exposed to greater loads both cumulatively and individually as a result of higher mass vehicles.

Risk Management

The risk management section identifies risks that may affect the ongoing delivery of services from bridge and major culvert infrastructure and details the controls for managing such risks. During the process of identifying significant risks (refer to appendix 3 – Bridge and Major Culvert Risk Register), assets which present a high consequence of failure were highlighted as "critical assets" such that they may potentially receive greater consideration during the formulation of works programs, with respect to their overall risk rating. The critical assets identified are listed below.

Condition	Critical Asset	Risk Rating
A structure which is the only access to a dwelling or business for emergency services	Skuses Road Bridge	Medium
	Swinton Street Bridge	Low
	Hopkins Point Road Bridge	Low
A structure with a detour greater than 20km	Hopkins Point Road Bridge	Low
A structure located on a link road or footpath with high usage	Stanley Street Bridge (Merri River)	Medium
	Harris Street Bridge (Merri River)	Low
	Tooram Road Major Culvert	Low
	Wangoom Road Major Culvert (East of Wrights Rd)	Low
	Wollaston Road Bridge	Medium

Table 2: Critical Assets

Life Cycle Management Plan

Background Data

In July 2016, Moloney Asset Management Systems conducted a condition inspection of Council's bridge and major culvert assets. The scope of the project included condition assessments, works recommendations and load limit recommendations (where applicable). The data, projections and recommendations provided in this plan have been formulated in accordance with the results from this survey.

Key asset data facts:

- Council manages bridge and major culvert structures with a wide spread of ages, however over 50% of assets were constructed post 1990.
- A large number of structures are in good to very good condition; however there are a number of notable structures in poor condition.
- On average, Council's bridges and major culverts were found to be in good condition; however this figure has been influenced by newly acquired assets in excellent condition.
- Since the last audit (2012), the percent of assets with conditions warranting intervention has increased from below 2% to above 7%, a figure which is considered high by industry standards.
- The replacement value of the total asset base has increased since the previous audit, indicating increasing maintenance and renewal requirements.

Maintenance & Operations Plan

Council has adopted VicRoads three levels of inspection, which is detailed in "Road Structures Inspection Manual' - VicRoads, 2014. Following a routine maintenance or condition inspection, the defects identified are listed and ranked to produce a maintenance schedule. In addition, maintenance activities are also generated following the evaluation of customer requests. Defect priority and treatment selection is based upon considerations such as public safety, risk, required levels of service and the extent and severity of the defect.

During the recent condition inspection, maintenance works were identified and ranked to form the current maintenance schedule. The maintenance activities identified total to $103,000 of works. Given the current level of maintenance funding ($55,000 p.a.), the schedule forms a 2-year maintenance works program.

Bridge & Major Culvert Inspection Details:

Inspection Type	Inspection Details	Frequency
Routine Maintenance Inspection	A visual inspection for identifying routine maintenance issues and the potential requirement for further inspection. (refer to appendix 1 for the routine maintenance inspection form)	Annually/Following a significant event
Condition Inspection	A more detailed visual inspection to evaluate the structures condition at the component level. Condition inspections also provide the opportunity to identify required works and the potential need for detailed engineering inspections. (refer to appendix 2 for the condition inspection form).	Typically every 3 years
Detailed Engineering Inspection	A detailed structural inspection followed by structural analysis to identify potential structural issues, the load capacity, the in-service performance and any other information which may not be gathered via visual inspection.	As required

Table 3: Bridge and Major Culvert Inspection Overview

Asset Renewal Plan

Using the recent bridge condition assessment, a draft 15 year renewal program has been formulated (table 30). The program was structured with recourse to the condition rating assigned during the assessment, expected deterioration, treatment costs (where applicable) or alternatively the full replacement cost using updated unit rate values. Assuming that on average the annual renewal funding is $365,000 pa, the 15 year renewal program has a funding shortfall of approximately $570,000.

Approximately 7.6% of the total asset base is in a condition which warrants intervention, however, modelling with consideration for current funding suggests that this value shall reduce to below 6% within 15 years (disregarding new and upgrade project requirements and funding).

Creation/Acquisition/Upgrade Plan

Council is aware of the current difficulty in funding the existing road network, both maintenance and renewals, and therefore gives priority to renewal projects over the creation of new assets, or upgrading existing assets.

New and Upgrade programs may be identified from:

- A relevant Service Strategy,
- Current issues discussions,
- Under-capacity analysis,
- An assessment of future demand, and
- Risk assessments.

Provision of new or upgraded works fall into the following categories depending upon the extent and type of works:

- Council funded, or
- Developer funded as part of subdivisional development, or
- Contribution to the cost by either the developer and/or Council.

The table below outlines the details of the identified new and upgrade projects.

Project/Program Identified/source	Asset	Timing	Total Replacement Cost ($)[1]	Cost of Upgrade Component ($)
New structures	Bromfield Extension Road Bridge	To be confirmed	$0[2]	N/A
	Merri river Footbridges (x3)	To be confirmed	$0[2]	N/A
	Swinton St Footbridge	2018/19 - 2019/20	N/A	$175,000[3]
Poor capacity/functionality assets	Stanley Street Road Bridge	Upgrade is not currently programmed	$2,881,008	$559,283
Total New/Upgrade Cost				$ 734,283

Table 4: Identified new and upgrade projects

[1]: Total replacement cost is inclusive of the upgrade component cost.
[2]: The total cost of these projects shall be funded fully by external parties in accordance to the North of the Merri Development Contributions Plan, however current indicative costs suggest that the three footbridges in total shall cost $510,000.00 and the Bromfield St Road Bridge shall cost $1,525,568.00.
[3]: Given the lack of detailed costing having taken place at this moment, the cost provided is indicative only.

The following figure demonstrates the predicted effect on asset condition given the current level of funding and the required renewal projects.

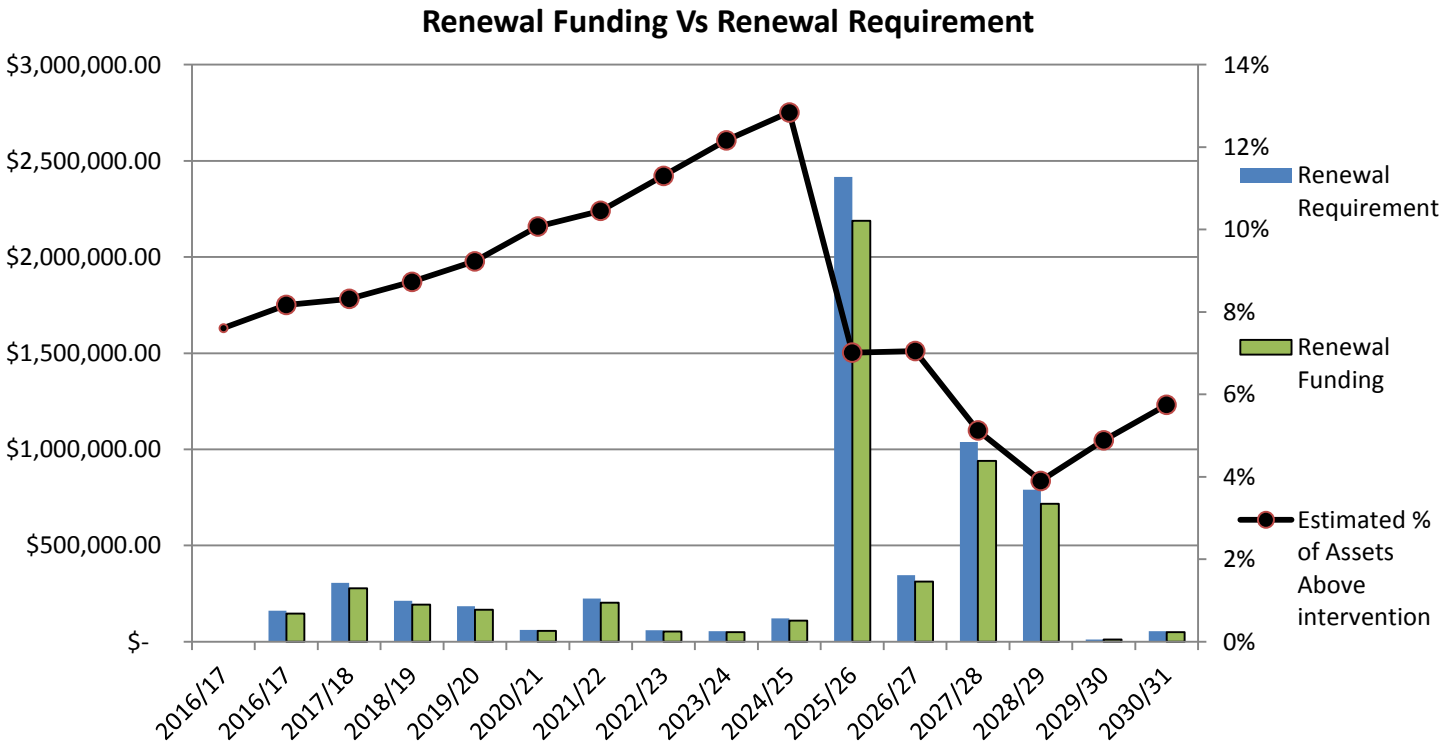

Figure 1: Renewal Funding Vs Renewal Requirement

Financial Plan

The table below provides a summary of the key financial parameters

Asset Description	Total Quantity	Average Asset Condition	Average Life (years)	Replacement Value	Written Down Value	Accumulated Depreciation	Annual Depreciation	Date of Condition Assessment
Bridges and Major Culverts	50	3.42 (Good)	81.0	$31,944,591	$19,065,049	$12,879,542	$324,512	July-16

Table 5: Bridge and Major Culvert Key Financial Parameters

Key funding facts:

- The 15 year renewal program includes $6,045,171 of works.
- Council is currently funding 91% of the 15 year renewal program.
- Council's 15 year renewal program funding shortfall is $570,171.
- Renewal funding meets the annual depreciation for the coming 15 year period.
- Given current renewal funding, the percentage of assets above intervention is predicted to reduce to below 6% in fifteen years' time.
- Council's backlog of works amounts to $2,432,809 (corresponding to 7.6% of the total asset base).
- Maintenance benchmarking demonstrates that Council's maintenance allocation of $55,000 is inadequate and that a value between $90,000 to $110,000 would be appropriate.
- Acquired assets shall increase the valuation of Council's bridges and major culverts by 8% over the coming 15 years.

Improvement Activities

The items listed below are the priority improvement actions identified during the development of this plan. Refer to the action plan (Appendix 4) for the full list of actions and further details.

- The current performance in each service level shall be re-evaluated or developed for monitoring capability. This shall also, therefore, provide an opportunity to develop a strategic plan for achieving the service level targets detailed within the plan.
- During the next community consultation on roads, some attention shall be directed towards the community's opinion on the current state of bridges and major culverts such that Council may test its assumptions and confirm or amend levels of service accordingly.
- With the goal of progressing towards an "advanced" approach to risk management, targeted, prioritised and planned responses to the identified hazards in the bridge and major culvert risk register shall be formulated.
- A system of digital reporting on level 1 inspections is required such that Council's asset management department can gain a rigorous understanding of the lower level issues which are identified during these assessments. In addition to this, the report template which is used for these inspections shall be reviewed and amended where necessary.
- A formal process shall be developed for identifying, evaluating and rationalising new and upgrade projects alongside the disposal of existing assets.

2 INTRODUCTION

2.1 Background

2.1.1 Purpose of this Plan

The Bridge asset management plan (AMP) is a means of structuring and outlining the processes and key elements required for effective management of Council's bridge and major culvert infrastructure. The plan combines management, financial, engineering and technical practices to ensure that the required service levels of bridges and major culverts are met by the most efficient means with consideration for Council's fiscal and resource limitations.

Specifically, the purpose of this plan is to:

- Give effect to asset management and strategic objectives as outlined in related documents
- Demonstrate responsible stewardship of bridge and major culvert infrastructure
- Manage the risks associated with the service delivery of bridges and major culverts
- Provide input into the long term financial planning for bridge and major culvert infrastructure
- Support community engagement to determine suitable service delivery requirements
- Optimise spending on bridge and major culvert infrastructure by taking a whole of life approach
- Guide the development of maintenance practices
- Drive continuous improvement

2.1.2 Asset Management Framework

This plan is part of Council's overall suite of asset management plans as described below:

- Asset Management Policy
    - Asset Management Strategy
        - Roads AMP
        - **Bridges AMP**
        - Buildings AMP
        - Pathways AMP
        - Drainage AMP
        - Sporting Facilities AMP
        - Open Space AMP
        - Information Communication Technologies AMP
        - Plant and Fleet AMP
        - Collections and Heritage AMP
        - Land AMP

2.1.3 Related Internal Plans & Strategies

This document supports the strategic objectives of related internal planning documents. The following documents are noted as having significant influence on the strategic direction of bridge and major culvert asset management:

- Municipal Road Management Plan
- Council Plan
- Growth Area Structure Plans
- Warrnambool Municipal Road Hierarchy Review and Traffic Management Plan
- Road User Plan
- Sustainable Transport Strategy
- North Warrnambool Flood Management Plan

2.1.4 Scope of this Plan

The Bridge asset management plan covers all those structures under Council's responsibility which are typically located either in the road reserve, or on footpaths in parks and recreation areas. Furthermore, the structure must conform to the following functional definitions of "Bridge" and "Major Culvert" provided by VicRoads.

- Bridge - A structure with the primary purpose of carrying a roadway or pathway over an obstacle with a minimum span of 1.8m or a minimum waterway area of 3 m^2.

- Major Culvert - A structure with the primary purpose of providing a passageway beneath a road or a path, usually but not necessarily for stormwater, with a minimum span or diameter of 1.8m, or a minimum waterway area of 3 m^2.

Culverts outside of the definition above (minor culverts) are included as part of the Roads Asset Management Plan.

There are several structures within the road reserve that Council does not have responsibility to maintain. They are often a point of conflict with residents who have an expectation that Council will maintain them as they are within road reserves, parks and recreational areas. The assets which are not managed by council and hence not included in this plan are:

- Structures located on boundary roads allocated to the adjoining municipality. However, in some instances the agreements allow for cost sharing of specified capital works on the roads. Such works will only be carried out with prior agreement of the two municipalities concerned. Refer to the Boundary Agreement for full details.
- Structures on arterial roads (where Council is not designated as the responsible authority).
- Structures on roads not included under Councils Public Road Register
- Private vehicle crossings/driveways
- Floodways not classified as a 'major culvert'
- Structures on roads over irrigation and drainage channels, dams and aqueducts where the rural water authority is responsible (as the relevant infrastructure manager) to the limits of the structure
- Culverts provided for VicTrack infrastructure

2.1.5 Asset Components Included in the Plan

The following table lists the various asset components belonging to the asset groups described above whose management is governed via the processes and principles described in this document.

Asset Category	Asset Type	Asset Components/Elements Included
Bridges	Major Culverts	• Cell • End wall • Beaching
	Road Bridges	• Beams • Deck • Abutment • Piers • Bearing • Joint • Wingwall • Approach guard rail • Bridge guard rail
	Footbridges	

Table 6: Asset Components Covered by the Bridges and Major Culverts Asset Management

2.1.6 Asset Function

Council's bridge and major culvert infrastructure assist the overall road and footpath network to promote a high level of connectivity throughout the municipality. More specifically, the function and capacity of an individual asset will be largely dependent on the assets location on the road and footpath network. Each road and footpath are classified according to a functional hierarchy which is dependent on the type of traffic experienced, volume of traffic, specific function and potential risk.

2.1.7 Key Stakeholders in the Plan

2.1.7.1 External & Community Stakeholders

Stakeholder	Role in this Plan
Private vehicle operators	Customer
Pedestrians	Customer
Users of a range of miscellaneous smaller, lightweight vehicles: cyclists, wheel chairs, prams etc.	Customer
Industrial and commercial operators and other transport services	Customer
Public Transport services	Customer
School Bus services	Customer
Emergency Agencies (Police, Fire, Ambulance, VICSES)	Customer
Utilities (Water, sewerage, gas, electricity, telecommunications);	Other interested party
Road authorities (VicRoads, DELWP)	Other interested party
Glenelg Hopkins Catchment Management Authority	Other interested party
State & Federal government	Other interested party
Land Developers	Other interested party
Military (special use in times of conflict & emergency)	Other interested party
Road safety organisations	Other interested party
Council's Insurer	Other interested party

Table 7: External Stakeholders

2.1.8 Asset Responsibility

Service Managers

Service managers are responsible for the planning, controlling and directing of one or more of Council's services. Where a service portfolio includes bridge or major culvert assets, a service manager may hold one or more of the following responsibilities depending on the assets associated extent of delivery:

- Monitoring the risks associated with the respective asset/s
- Providing input into required service levels such as performance, safety, maintenance and aesthetics
- Understanding the service generated from the required asset/s
- Providing guidance on the asset/s future requirements
- Assisting in ensuring the performance of the asset/s meets service level performance targets
- Providing reports and metrics concerning the asset/s service performance

Council's services which include Bridges and Major Culverts within their service portfolio:

Service	Responsibility
Infrastructure Development and Projects	Manager of Infrastructure Services
Parks and Gardens – Botanical Gardens	Team Leader Trees and Botanics
Parks and Gardens – Lake Pertobe	Manager Recreation and Culture
General recreation	Manager Recreation and Culture

Table 8: Bridge and Major Culvert Service Managers

Asset Managers

Asset managers are responsible for planning for the delivery and longevity of assets required for Council's services. The asset manager of bridges and major culverts is the Coordinator of Assets and Developments, who is responsible for the following:

- Conducting asset inspections
- Ensuring adequate maintenance of assets
- Monitoring and developing asset service levels
- Meeting the agreed service level performance targets
- Collecting and managing asset data
- Developing asset renewal and upgrade programs
- Assisting service managers in planning for future demand and disposal

2.2 Goals & Objectives of Asset Ownership

2.2.1 Links to Organisation Vision, Mission, Goals & Objectives

Document	Section	Strategy/goal
Council Plan 2013-17 (amended)	1. Leading Regional City	Comply with the requirements of Council's Asset Management Plans
	2. A Sustainable City	Promote sustainable transport systems.
		Review and update Council's renewal funding model to ensure Council adequately funds asset replacement and maintenance while considering Council's risks.
	3. A Livable City	Implement the Municipal Road Safety Strategy
	4. A City of Growth	Deliver roads, drainage and community infrastructure commitments as outlined in structure plans for growth areas.
		Ensure infrastructure development, renewal and maintenance plans address current and forecast community needs.

Table 9: Links to Councils Vision & Objectives

3 LEVELS OF SERVICE

3.1 Community Engagement and Expectations

3.1.1 Background and Customer Engagement Undertaken

The following table details the sources and basis from which Council develops the service requirements and standards of bridge and major culvert infrastructure In lieu of targeted and substantial community consultation having taken place.

Audience/ Technique	Needs/comments/outcomes/issues
Community Satisfaction Survey (2016)	• The community indicated that the overall performance of local streets and footpaths is lower than the amount of importance that the community places on these services.
Customer Requests (2016)	Refer to table 11 (Customer Requests Review)
Service standards developed from design guidelines (General Service Standards)	• Access to the municipal road network by heavy vehicles to be limited to roads which are both reasonably necessary and classified as “link” or “Collector” on the road hierarchy (with exceptions for when accessing a site). • Minimal conflict between various road user groups/vehicle types (cars, trucks, motorcyclists, bicyclists, pedestrians, children and people with disabilities); • Suitable traffic control devices in dangerous locations especially where there is potential conflict between user groups (pedestrian crossings, road and street intersections); • Road surfaces that create minimal adverse noise conditions in residential areas, are smooth riding, accessible, safe in all the prevailing local weather conditions and free-draining; • All road structures (pavement base, surface, bridges, and traffic devices) to be maintained in a safe, workable condition.
Service requirements developed from the Regional Asset Service Project (MAV STEP)	• Require bridges to provide access to my property • Bridges should provide all weather access • Bridges do not have any load limits where heavy vehicle travel is required • Bridges should be wide enough for farm machinery • Bridges should be safe to use • Bridges should be well maintained • Bridges should be able to carry two-way traffic • Footbridges will be wide and accessible by wheelchair or pram

Table 10: Service Requirements and Community Engagement Results

Bridge and Major Culvert Customer Request Results

Table 11 summarises the results from reviewing and analysing the customer requests from the past four years in relation to bridges and major culverts.

Asset Type	Amount of Requests	Concern (ranked from highest to lowest request amount)
Bridges (Road and Pedestrian)	High Amount ↓ Low Amount	Material and structural deterioration
		Graffiti
		Surface ride-ability and slip resistance
		Access safety (fencing and handrails)
		Heavy vehicle usage
		Surface defects
		Vegetation intrusion
		Insufficient lighting
		Lack of aesthetic appeal
Major Culverts	High Amount ↓ Low Amount	Blockages
		Structural integrity
		Graffiti
		Surface defects
		Request for inspection
		Insufficient signage and marking

Table 11: Customer Requests Review

It is worth noting that the total amount of customer requests in regards to bridges and major culverts within the past four years was 37. Within the context of the total amount of requests concerned with Council managed infrastructure, this amount is considered low, as such it may be presumed that the required community levels of service are not substantially different from those being provided.

3.1.2 Community Service Level Outcomes

Asset Type	Customer Needs
Bridges	• Located to provide all-weather access to dwellings and properties • No unreasonable load restrictions on access • Bridges should be able to carry traffic safely and without impedance • Bridges should be well maintained
Footbridges	• Located to separate road use by vehicles and pedestrians • Safe to use in regards to signage, trip hazards, hand railing and lighting • Allows access by a wheelchair or pram
Major Culverts	• Structures should be free of blockages • Major Culverts should be well maintained • Major Culverts should be free of visible offensive graffiti

Table 12: Service Level Outcomes Derived from Community Demand

Note: Many of these needs (or slight variations) were identified as being applicable to all asset types, as such, this is reflected in the levels of service table (section 3.3)

3.1.3 Community Engagement Plan

Community consultation regarding the road and footpath network is planned to occur in late 2017. As a part of the engagement process, consideration will be given to including consultation on service levels and performance targets specific to bridge and major culvert infrastructure. To ensure the effectiveness of the consultation, inclusion of the respective risk and financial consequences to service level performance target amendments should be ensured.

3.2 Legislative Requirements

In addition to providing service standards which are at a level agreed with the community, Council must also formulate the service requirements of infrastructure with consideration for related codes of practice, standards and legislative requirements.

The following table details the codes of practice, standards and legislative requirements which have been taken into consideration in the development of bridge and major culvert service standards:

Reference	Description
Road Management Act (2004) (alongside associated Regulations and Codes of Practice)	In summary, the act: • Establishes a new statutory framework for the management of the road network which facilitates the coordination of the various uses of road reserves for roadways, pathways, infrastructure and similar purposes. • Establishes the general principles which apply to road management. • Provides for the role, functions and powers of a road authority. • Provides for the construction, inspection, maintenance and repair of public roads. • Sets out the road management functions of road authorities. • Sets out the road management functions of infrastructure managers and works managers in providing infrastructure or conducting works.
Local Government Act (1989)	Details the functions of Council in regards to the provision of services and facilities for the community as well as providing the legal framework for establishing and administering Councils.
Road Safety Act (1986)	Details the safety requirements relating to the use and operation of the road network.
Disability Discrimination Act (1992)	Details the liabilities for provisions of access for persons with disabilities.
Catchment and Land Protection Act (1994)	Sets the framework of management for catchments, including the functions and powers of Council.
Austroads Road Design Guidelines	Provides guidelines for design of roads, pedestrian and cyclist areas, drainage structures, ancillary areas and structures.
Australian Rainfall and Runoff	Provides the guidelines for flood estimation in design.
AS 5100 – Bridge Design	Details the guidelines and standards for design of all bridge structures.

Table 13: Legislative requirements

3.3 Community and Technical Levels of Service

Bridge and Major Culvert Service Levels						
Service Demands	**Service Indicator**	**Community Levels of Service**		**Technical Levels of Service**		
		Community Measure	**Community Target**	**Technical Measure**	**Current Performance**	**Technical Target**
Located to allow access during all typical weather events	Accessibility	Accessibility during all typical weather events.	The transport network including required structures remains serviceable during all typical weather events.	Trafficable surface levels in references to flood levels.	Currently 96% of road structures above the 20% Annual Exceedance Probability (AEP). Further investigation required to accurately understand the structures below the 1% AEP level.	100% of road structures above the 20% Annual Exceedance Probability. 100% of critical assets above the 1% AEP, except for where heritage status is the only driver for criticality.
No unreasonable load restrictions on access	Accessibility	Accessibility of required vehicles.	Structures are to allow access for all required vehicles.	Number of structures with a load limit below what is reasonably required.	Currently 98% of structures with either no load limit or a reasonable load limit.	100% of structures have either no load limit or a load limit outside of the functional scope of the asset
Structures should allow safe travel without impedance	Safety & Serviceability	Freedom and safety of travel.	All bridges should allow for safe travel without disturbance of the flow.	- Sight distance - Gradient - Trafficable width	Currently 98% of structures are adherent.	100% Adherence to relevant contemporary design standards and guidelines.
Structures should be provisioned sufficiently in regards to signage, lighting, hand/guard railing and surfacing.	Safety & Serviceability	Amount of accidents per year resulting from insufficient signage, lighting, hand/guard railing and surfacing.	No accidents per year resulting from insufficient signage, lighting, hand/guard railing and surfacing.	Level of adherence to relevant contemporary design standards and guidelines.	90% of structures are adherent.	100% Adherence to relevant contemporary design standards and guidelines.

Non-vehicular travel should be adequately separated from vehicular travel	Safety & Serviceability	Amount of structures which do not offer separation of vehicles and pedestrians (Including cyclists)	All structures should provide separate spaces for vehicular and pedestrian travel (including cyclists).	Level of adherence to relevant contemporary design standards and guidelines.	Currently 98% of assets provide sufficient and compliant separation of pedestrian and vehicular travel.	100% Adherence to relevant contemporary design standards and guidelines.
Pedestrian travel along the transport network should allow for access by wheelchairs and prams	Accessibility	Amount of structures along the transport network which do not allow sufficient access and mobility.	All structures along the transport network allow for full access and mobility.	Level of adherence to relevant contemporary design standards and guidelines on access and mobility.	86% of all structures are adherent.	100% adherence to relevant contemporary design standards and guidelines on access and mobility.
Structures should be well maintained	Safety & Aestheticism	Amount of notable defects on structures.	Structures should be free of notable defects.	Level of adherence to inspection regime and level of responsiveness to identified defects	Level of adherence is currently unknown. As such, developing monitoring procedures forms part of the improvement actions.	90% adherence to inspection regime and defect allocated response times. 100% adherence to routine maintenance inspections (compliance with RMP).
Structures should be cleared of blockages and debris within the waterway area	Safety & Serviceability	Amount of instances where a structures waterway area is blocked.	Structures should be consistently free of blockages.	Level of adherence to reactive and proactive inspection regime and level of responsiveness to blockages	Level of adherence is currently unknown. As such, developing monitoring procedures forms part of the improvement actions.	90% adherence to inspection regime and response time for the clearance of blockages. 100% adherence to routine maintenance inspections (compliance with RMP).

Table 14: Community and Technical Levels of Service

3.4 Service Level Consequences and Development Plan

The following table discusses the service level consequences of bridge and major culvert funding for the coming 15 years.

It's projected that Council's service level targets will not all be met during this period; however Council should make some progress in achieving them. Moving forward, future community engagement regarding road and pathway service demands shall assist in forming Council's direction in asset and service planning.

Service Level	Discussion
Structures are located to allow access during all typical weather events.	Consideration has been given to upgrading the Bromfield Street and Queens Road Major Culvert over Russel's Creek, it was concluded that upgrades would not provide a positive cost benefit outcome for the community at this time.
No unreasonable load restrictions on access.	The Stanley Street Road Bridge is programmed for pile rehabilitation works this financial year (2016/17), following the works, a detailed structural analysis shall be undertaken to gauge the increase in the structures load carrying capacity. At this time the load limit imposed on the structure may be amended in line with the structural improvements.
Structures should allow for two-way travel safely and without impedance.	In an attempt to address Stanley Street Road Bridges inadequate trafficable width an upgrade project was scoped and costed at approximately $2.9M. The project would be a full replacement and extension to address the structures poor condition, width inadequacy and load limit. An alternative and substantially cheaper treatment option was costed at $162,000. This treatment would address only the piles on the bridge (the component with the worst condition) and is estimated to prolong the structures life by 20 years. In the interest of sound financial management, the lower order treatment has been chosen in lieu of the more costly full replacement.
Structures should be provisioned sufficiently in regards to signage, lighting, hand/guard railing and surfacing.	A recent maintenance funding benchmarking analysis shows that Council allocates a relatively low amount of funding for bridge and major culvert maintenance. The analysis suggests that Council should be allocating between $90,000 pa to $110,000 pa. Council will not be able to achieve this service level target without increasing the maintenance funding from $55,000 pa to an amount which is consistent with the extent of structures that Council manages. Council has formulated a maintenance works program containing $103,000 of works which would address the structures failing this service level.
Non-vehicular travel should be adequately separated from vehicular travel.	Council shall meet its performance target in this service level once the Swinton Street Footbridge is constructed. This project is expected to go ahead in 2019/20.
Pedestrian travel along the transport network should allow for access by wheelchairs and prams.	Currently Council does not have a sufficient amount of funds to allow the upgrade of all non-compliant structures. Once non-compliant assets reach their natural end of life, consideration shall be given to the upgrade of these structures.
Structures should be well maintained.	Improvement of this service level shall be achieved by enabling performance monitoring (refer to the action plan).
Structures should be cleared of blockages and debris within the waterway area.	Improvement of this service level shall be achieved by enabling performance monitoring (refer to the action plan).

Table 15: Service Level Consequences and Discussion

4 FUTURE DEMAND

4.1 Demand Forecast and Management Plan

A crucial factor in planning for future community demands and technical requirements for infrastructure is to accurately understand how a wide variety of social, economic, environmental and technological changes will influence the operating environment. Furthermore, it is necessary to develop a plan to manage said changes appropriately. The following table lists various areas of potential change alongside their expected impacts and approach to management.

Factor	Description	Expected Impact	Management Plan
Natural Environment			
Climate Change	A notable risk is posed by climate change through increasing storm surges, sea level rise, increased ground and foundation movement, groundwater changes, temperature and solar radiation and frequency and intensity of extreme rainfall events.	Bridges and major culverts will experience an increase in flood damage, increased structural and foundation damage through increased geotechnical effects and more generally an accelerated degradation of materials and structures through increased temperature and solar radiation.	Continue to monitor developments in this space such that the projected climate change and effects on infrastructure may be estimated. Appropriate measures may then be taken to account for these effects in asset management practices, infrastructure planning and material and design standards.
Demographics and Land Use			
Increasing Dwelling Density	One of the recommendations of the Warrnambool City-Wide Housing Strategy is that housing densities should be expected to increase in many parts of Warrnambool.	Areas of increased housing density can be expected to have increased volumes of use on the Councils road and footpath network.	Monitor population and traffic count data in developing areas alongside continuing to developing works programs with consideration of zonal requirements.
Ageing Population	Population forecasting indicates there will be increases in all age groups between 2011 and 2026. The largest proportional increase (relative to population size) will be in the 60 to 79 (43%) and 20 to 39 age groups (20%) (Warrnambool City-Wide Housing Strategy).	With a large relative proportion of the population moving into the 60 to 79 age group an increased demand upon the pathway network (including footbridges) may be expected. In addition, increases in the 20-39 age group shall produce increases in demand on the road network.	Continue to monitor age trends with a focus on potential infrastructure effects, alongside continuing to gather traffic count data.
Population Changes	Population in Warrnambool is currently increasing at an average rate of 1.4% per annum (Warrnambool City-Wide Housing Strategy)	An increased load on bridge and major culvert assets can be expected proportional to the increase in population.	Monitor population and traffic count data alongside continuing to develop works programs with consideration of population trends.

Factor	Description	Expected Impact	Management Plan
Technology			
Technology Improvement Utilisation	Increases in available technology for the management, construction, design and maintenance of bridge and major culvert infrastructure.	Possible opportunities for cost savings across all fields involved in the service. Improvements in the structural integrity, life and aesthetics of bridge and major culvert infrastructure. Improvements in asset management capability and data analysis.	Continue to monitor developments in this space such that Council may adopt available new and improved technology in a timely manner with the vision of improving the operating environment of bridge and major culvert infrastructure delivery.
Vehicle Automation	It is predicted that from between 2020-2030 to 2040-2050 the amount of automated vehicles comprising the total vehicle traffic on road networks will increase from 1-4% to 30-50% according to the Victoria Transport Policy Institute (Autonomous Vehicle Implementation Predictions – *Implications for Transport Planning,* 2015)	Possible necessary improvements required for roadway infrastructure to enable autonomous vehicle technology.	Continue to monitor developments in this space and begin to identify areas in which Council will be expected to institute changes to the road network to allow for an effective and safe application of the technology.
Heavy Vehicles			
Increasing Legal Load Limits	In recent years, Container Transport Alliance Australia and other organisations have been advocating for increases in the legal load limits for heavy vehicles (notably an increase of 20% in 2015). Thus there is a reasonable expectation of increased load regimes at some point in the future.	Bridge and major culvert infrastructure will be exposed to greater loads in proportion to the load limit increases which can be expected to cause deterioration at rates larger than expected. The potential for substantial failure increasing in number across infrastructure that is currently insufficient to carry the required loads.	Work is currently being done to develop an official freight network through the municipality; to that end, increasing freight effects may be limited to certain areas such that planning may be more effective. Consideration will be given to possible increasing load limits when developing bridge and major culvert works programs.
Increasing Freight Task	Freight Futures suggests that freight volumes in the Warrnambool region are expected to increase from 30 million tonnes to 50 million tonnes from 2000 to 2020.	Bridge and major culvert infrastructure will be exposed to greater volumes of heavy vehicle traffic in proportion to the increase of the freight task which can be expected to cause deterioration at rates larger than expected.	Work is currently being done to develop an official freight network through the municipality; to that end, increasing freight effects may be limited to certain areas such that planning may be more effective.

Factor	Description	Expected Impact	Management Plan
Finance and Economics			
Unit Rate Cost Changes	Unit rate costs may potentially increase in rates which differ from those expected.	Changes in unit rates will effect Council's utilisation of renewal and capital expenditure.	Conduct annual review of unit rates including benchmarking, project reviews and industry research.
Economic effects on willingness to pay	Potential strengthening/weakening of the macro-economy could potentially affect the willingness to pay of the community	Shifting levels of willingness to pay within the community will create changes in service level demand.	Continual and progressive community engagement surrounding service level requirements and associated costs.

Table 16: Future Demand Forecast and Management

Refer to the action plan (Appendix 4) for a plan of progression and development of the management and control measures for the areas of impact.

5 RISK MANAGEMENT

5.1 Risk Identification

Event	Cause	Area of Impact	Controls
Collapse or damage to structure or road approach	• Overloading, oversize/injury • Poor structural condition • Lack of maintenance • Severe weather event • Waterway users	Public health & safety	• Condition survey undertaken and renewal works programmed. • Bridges assessed for load limits. • Maintenance inspection and works programming.
Bridge run-off accident	• Vehicle conflict • Obstruction (fallen limbs) • Surface condition (timber decks, road interface) • Inadequate drainage • Inadequate signage, delineation • Poor sight distance	Public health & safety	• Maintenance inspection and works programming. • Risk assessment of bridges and bridge guard rail renewal/upgrade.
Delays from bridge closure or diversions	• Bridge collapse • Bridgeworks • Load limits • Width restrictions • Flooding	Service Delivery Financial	Condition survey undertaken and renewal works programmed. Level of service for: • Load Limits • Flooding access
Pedestrian accident with road user	• No path present, walking on road • Inappropriate, missing signage • Inadequate protection • Inappropriate use	Public health & safety	• Level of service for provision of path appropriate for level of use. • Level of service for provision of footpath, and barriers appropriate for location and use.
Pedestrian fall	• Rough uneven surface • Inappropriate, missing signage • Slippery surface, water	Public health & safety	• Defect inspection frequency • Street lighting

Table 17: Risk Management

Refer to the Infrastructure Risk Register for Bridges and Major Culverts for more information (Appendix 3)

5.2 Asset Criticality

5.2.1 Critical Assets

Critical assets are those which would result in a high consequence of failure, as such, Council understands the importance of identifying critical bridges or major culverts, to the effect that maintenance, investigative and capital expenditure plans may be refined in light of critical areas.

The table below gives asset descriptions (along with the assets which fit the description) which hold in them the implication of high consequence of failure along with the appropriate actions that Council will make to minimise the risk of such failures occurring.

Description Assets with high consequence (Major or Catastrophic) of failure	**Area of Impact**	**Actions to Address**	**Critical Assets**
A structure that is the only access to a dwelling or business for emergency services	Customers & Community Public Health & Safety	Greater consideration in capital works programs	• Skuses Road Bridge • Swinton Street Bridge
A structure with a detour > 20km[1]	Customers & community	Greater consideration in capital works programs	• Hopkins Point Road Bridge (Hopkins River)
A structure located on a Link road or footpath with high usage.	Customers & Community	Greater consideration in capital works programs	Road Bridges and Major Culverts (Link Roads)[2]: • Hopkins Point Road Bridge (Hopkins River) • Stanley Street Bridge (Merri River) • Harris Street Bridge (Merri River) • Tooram Road Major Culvert • Wangoom Road Major Culvert (East of Wrights Road) • Wollaston Road Bridge Footbridges (Category 1 Footpaths): • Not currently applicable
Heritage Structures	Cultural and Historical Significance	Greater Consideration in capital works programs	• Wollaston Road Footbridge • Ziegler Parade Road Bridge • Stanley Street Road Bridge • Hopkins Point Road Bridge • Plummer's Hill Road Masonary Arch Culvert

Table 18: Asset Criticality

[1]: The detour value of 20km was chosen after concluding that this was both functionally unreasonable and potentially highly consequential in an emergency situation since a detour greater then 20km corresponded to a travel delay of approximately 20 minutes (under normal travel conditions).
[2]: Whilst the Ziegler parade Road Bridge is on a link road, it's inclusion as a critical asset has been withheld since Garabaldi Lane (in close proximity) acts as an adjacent means of access. As such, the consequence of stifled access has been deemed to be low.

6 LIFECYCLE MANAGEMENT PLAN

6.1 Background Data

6.1.1 Asset Quantities

Asset Component	Number	Deck Area (m^2)
Road Bridges	10	4,574 m^2
Footbridges	25	1,138 m^2
Major Culverts	15	736 m^2

Table 19: Asset Overview

Note: Quantities are correct only at the time of the development of this plan. Up to date information is obtained from the asset register. Quantities as of 29/07/2016

6.1.2 Asset Ages (Distribution of Construction Decade)

The following graph illustrates the distribution of construction decades within Council's bridges and major culverts. As shown, the majority of Council's assets were constructed within the past three decades.

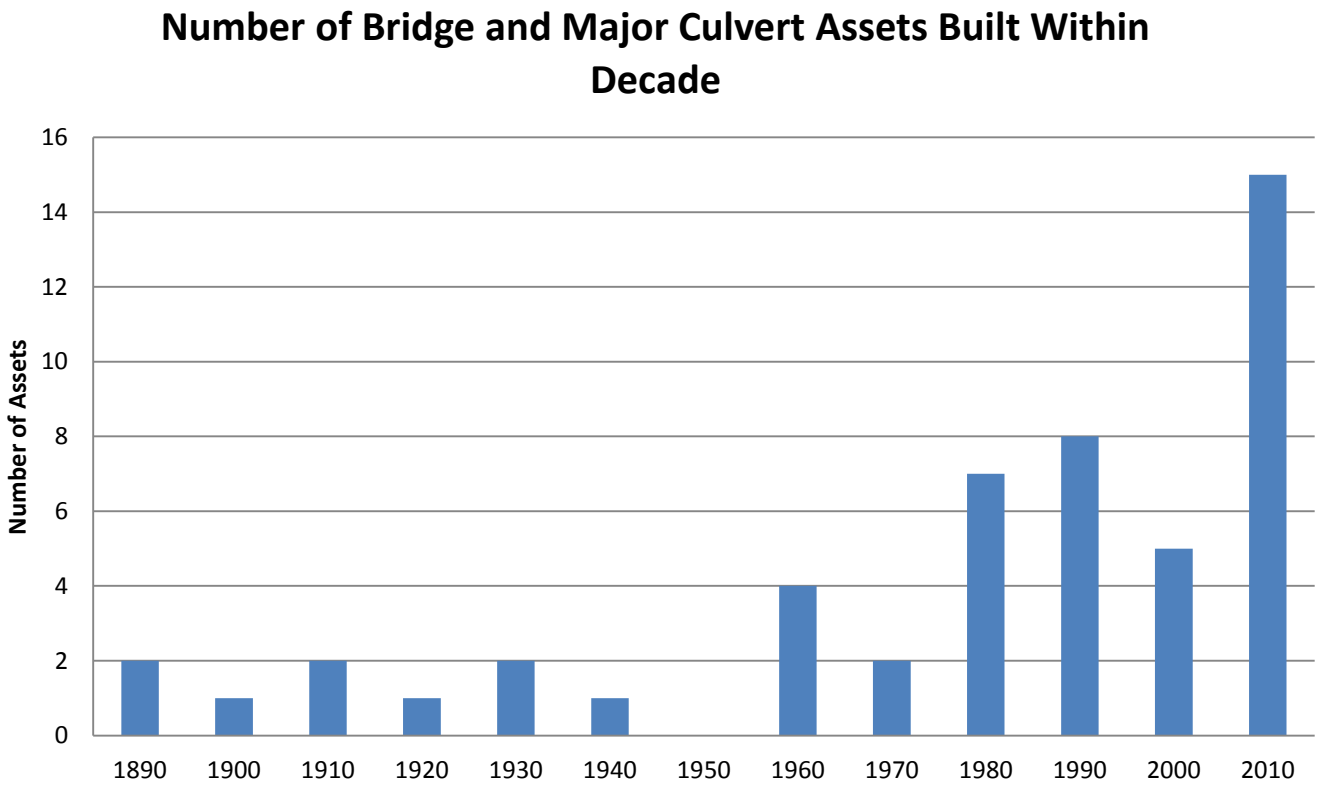

Figure 2: Asset Construction Decade Distribution

6.1.3 Current Issues

Issue	Comment
Recommendation for instituting a load limit upon various structures (MAMS survey July 2016)	• Wellington St Road Bridge (25t) • Daltons Rd Road Bridge (20t) • Skuses Rd Road Bridge (30t)
Management systems for controlling access to the network by over-weight / over-dimensional vehicles	A system of management is required to ensure adherence to instituted load limits given the exposure to risk generated from heavy vehicles accessing structures not suited to their access.
Structures identified for further investigation during MAMS survey July 2016.	• Viaduct Rd • Wollaston Rd Footbridge • Wollaston Rd Road Bridge • Harris St Road Bridge • Russell's Creek Footbridge 1 (Sth of Glenbane Ct)

Table 20: Current Issues

Note: Refer to the action plan for more information.

6.1.4 Asset Classification and Functional Hierarchy

Bridge and major culvert infrastructure is classified via their construction standard and location on the road and footpath functional hierarchy.

Classification by Design and Construction

Asset Group	Classification by Design Life	Classification by Construction
Major Culvert	Short Life	N/A
	Long Life	Masonry
		Precast Reinforced Concrete
		Steel
Road Bridge	Short Life	Full Timber Construction
		Reinforced Concrete with at least one major timber structural element
	Long Life	Masonry and Steel
		Full Reinforced Concrete
		Reinforced Concrete and Steel
Footbridge	Short Life	Footbridges of low construction standard
		Foot bridges of medium construction standard
	Long Life	Footbridges of high construction standard

Table 21: Classification by Design and Construction

Classification by Road and Footpath Functional Hierarchy

Classification	Description
Road Network	
Arterial	Arterial roads are the principle routes of movement to and from the municipality and are controlled and maintained by VicRoads.
Link	Links carry high volumes of traffic and are the principle routes for traffic flow in and around the municipality (including freight movement).
Collector	Collectors are streets which carry higher volumes of traffic; they connect accesses and access streets through and between neighbourhoods.
Access	Access streets provide local residential access where traffic is subservient, speed and volume of traffic are low and pedestrian and bicycle movements are facilitated.
Lane	Lanes carry local traffic and typically provide secondary access to properties with more than one road frontage
Footpath Network	
Category 1	CBD and those pathways within the vicinity of schools, hospitals and aged care centres
Category 2	Selected medium use pathways in prominent areas other than described above and routes to schools.
Category 3	Pathways in residential, commercial and industrial areas other than as described above.

Table 22: Classification by Road and Footpath Functional Hierarchy

6.1.5 Asset Capacity/Performance

Assets Under-Capacity

The following table lists the assets which are not meeting their service level requirements. The upgrade of these assets may now be investigated with the goal that the project would provide a positive cost-benefit outcome for the community.

Level of Service	Service Target Status	Assets Under-Capacity	Reasoning
Located to allow access during abnormal weather events	4% of assets under capacity. Further investigation required to accurately understand the structures below the 1% AEP level.	• Queens Road Major Culvert[1] • Bromfield Street Major Culvert[1]	These structures have been closed due to flooding during 20% AEP events.
No unreasonable load restrictions on access	2% of assets under capacity.	Stanley Street Road Bridge (20t)	Structure would be reasonably required for vehicles greater than 20t (waste vehicles).
Structures should allow for safe travel without impedance	2% of assets under capacity.	Stanley Street Road Bridge	Structure provides inadequate trafficable width for two way Travel on a link road (6m total).
Structures should be provisioned sufficiently in regards to signage, lighting, hand/guard railing and surfacing.	10% of assets under capacity.	• Wollaston Road Road Bridge • Wollaston Road Footbridge • Lake Pertobe Footbridge (6) • Lake Pertobe Footbridge (4) • Lake Pertobe Footbridge (5)	Structures have been found to be insufficient in one or more instances with regards to signage, lighting, hand/guard railing and surfacing.
Non-vehicular travel should be adequately separated from vehicular travel	2% of assets under capacity.	Swinton St Road Bridge	The Swinton Street crossing of the Merri River provides no travel space for non-vehicular movement, hence forcing travel to occur on the road.
Pedestrian travel along the transport network should allow for access by wheelchairs and prams	12% of assets are under capacity.	• Jubilee Park (Woodford) Footbridge (Merri river) • Lake Pertobe Footbridge (9) • Lake Pertobe Footbridge (4) • Lake Pertobe Footbridge (5) • Lake Pertobe Footbridge (6) • Ziegler Parade Road Bridges	One or more access and mobility issues with these structures gradients, approaches, surfaces, railings and widths have been identified.
Structures should be well maintained	Currently unknown	Not applicable (Refer to Appendix 4 – "Action Plan" for service level monitoring development plan)	N/A
Structures should be cleared of blockages and debris within the waterway area	Currently unknown	Not applicable (Refer to Appendix 4 – "Action Plan" for service level monitoring development plan)	N/A

Table 23: Assets Currently Under Capacity

[1] A cost-benefit analysis for the upgrade of Bromfield St and Queens Rd Major Culverts has revealed that there is a negative community benefit from upgrading these assets. This is since no property damage is expected from a 20% AEP event and there is multiple alternative routes for access. Thus, upgrading these assets is currently thought to not be necessary.

6.1.6 Asset Condition

Condition Rating

In accordance with the VicRoads Level 2 inspection procedure each structure is assessed at component, sub-component and element level (Council's inspection policy is further described in section 6.2.1).

The overall structure is assessed and rated with a score of 0 (new) to 10 (poor) taking into account certain criteria. In assessing the condition rating, the consultant may take into account a range of factors, including but not limited to:

- **Structural performance**
  - Loss of effective section (corrosion/spalling/rot/splitting)
  - Failure
  - Cracking
  - Fatigue
- **Structural integrity**
  - General wear and tear/ deterioration
  - Severity/ extent defects
  - Movement/ displacement/ subsidence/ deformation
- **Structural durability**
  - Water penetration
  - Exposure

Asset Condition Data

Asset Component	Previous Condition/Current Condition Survey Results 0(New)-10(Very Poor)			Comments/Trend
	2009	2012	2016	
Road Bridges	4.0 = Average Condition	4.4 = Average Condition	4.1 = Average Condition	***Stable***
Footbridges	3.7 = Good Condition	4.7 = Average Condition	3.4 = Good Condition	***Improving***
Major Culverts	5.7 = Average Condition	3.5 = Good Condition	2.8 = Good Condition	***Improving***
Average Condition	***4.5 = Average Condition***	***4.2 = Average Condition***	***3.4 = Good Condition***	***Improving***

Table 24: Asset Condition Data

Note: Newly acquired assets will contribute to an improved average condition alongside the renewal of existing assets.

Asset Age and Condition Profile

The figure below is based on Moloney's 2016 condition survey data; refer to the Conquest Asset Management System for current data. The wide spread of age/condition values demonstrates how the standard of construction influences the deterioration of an infrastructural asset. For example, the Russel's Creek footbridge (1) is a low standard timber footbridge which has deteriorated to a condition of 6/10 within 14 years, whereas Plummer's Hill Road Masonry Culvert has only deteriorated to a condition of 3/10 in 116 years.

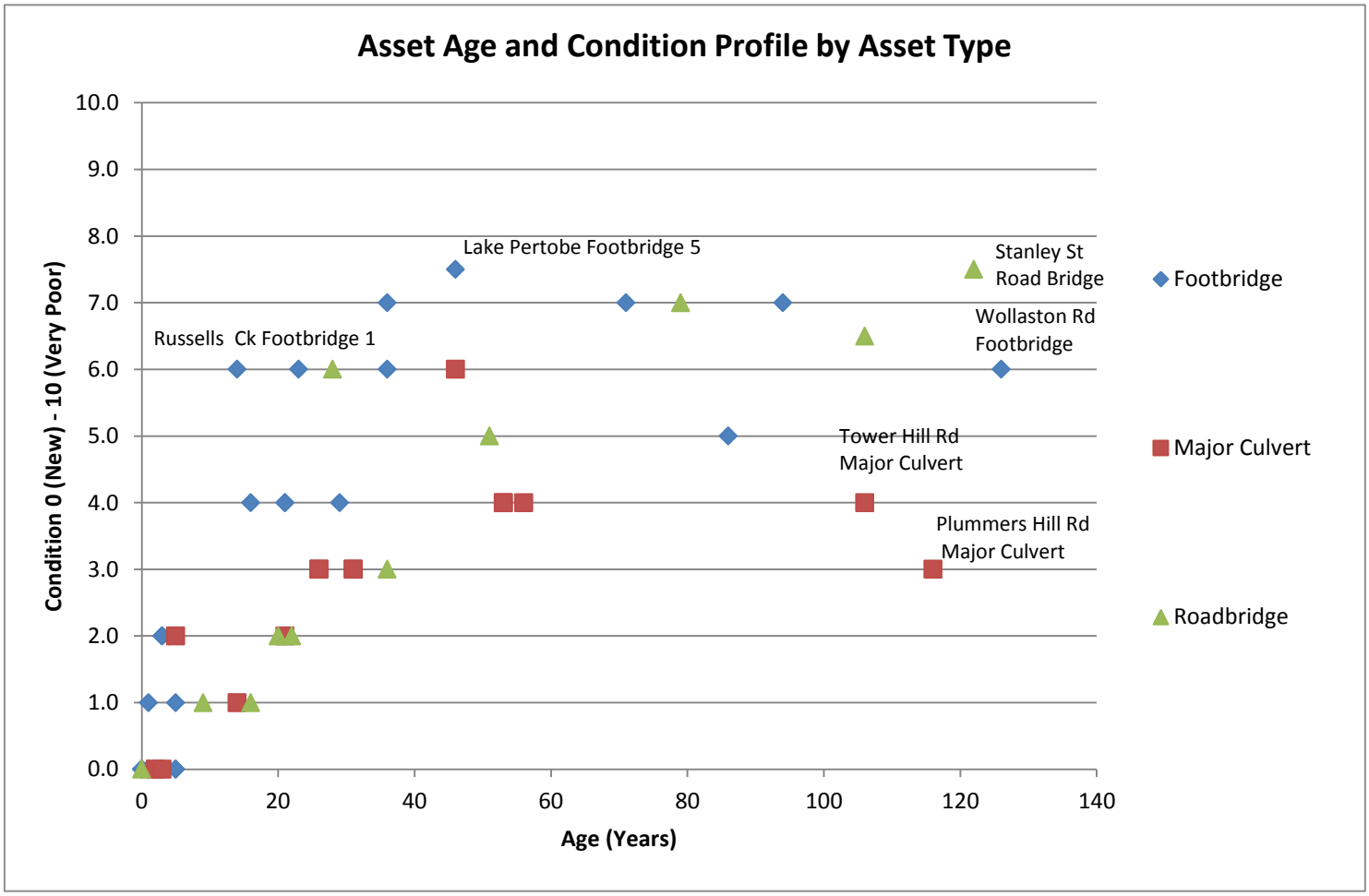

Figure 3: Asset Age and Condition Profile

6.1.7 Asset Valuations and Useful Lives

Table 24 summarises the valuations of each bridge and major culvert construction type. The formulation of these values is derived from the replacement project costing of each individual asset, alongside their respective condition and useful lives.

BRIDGE/CULVERT TYPE	TOTAL VALUATION					
	Replacement Value	Written Down	Accumulated Depreciation	Annual Depreciation	Asset Type Physical Life (years)	Asset Type % of Value
Bridge - Masonry and steel construction	$ 345,384.00	$ 64,759.50	$ 280,624.50	$ 2,302.56	150	1.08%
Bridge - Full reinforced concrete construction	$ 15,954,284.00	$ 11,915,686.86	$ 4,038,597.14	$ 127,634.27	125	49.94%
Bridge - Steel and/or reinforced concrete design	$ 3,818,880.00	$ 2,162,862.00	$ 1,656,018.00	$ 30,551.04	125	11.95%
Bridge - Reinforced concrete with at least one major structural timber element.	$ 1,267,110.00	$ 402,333.75	$ 864,776.25	$ 18,101.57	70	3.97%
Bridge - Timber design	$ 2,321,724.00	$ 145,107.75	$ 2,176,616.25	$ 33,167.49	70	7.27%
Major culvert - Precast reinforced concrete box units	$ 142,085.00	$ 78,501.25	$ 63,583.75	$ 1,776.06	80	0.44%
Major culvert – Precast reinforced concrete units	$ 1,214,159.00	$ 1,068,323.75	$ 145,835.25	$ 12,141.59	100	3.80%
Major culvert - Masonry construction	$ 60,793.00	$ 37,995.63	$ 22,797.37	$ 303.97	200	0.19%
Major culvert - Precast RC pipe culverts	$ 989,258.00	$ 592,172.00	$ 397,086.00	$ 12,365.73	80	3.10%
Major culvert – Steel culvert (corrugated galvanised)	$ 0	$ 0	$ 0	$ 0	80	0%
Footbridge – High level design	$ 3,902,418.00	$ 1,288,257.75	$ 2,614,160.25	$ 39,024.18	100	12.22%
Footbridge - Medium level design	$ 1,285,447.00	$ 975,679.38	$ 309,767.62	$ 25,708.94	50	4.02%
Footbridge - Low level design	$ 643,049.00	$ 333,369.38	$ 309,679.62	$ 21,434.97	30	2.02%
Totals	$ 31,944,591.00	$ 19,065,049.00	$ 12,879,542.00	$ 324,512.36	N/A	100 %

Table 25: Current Asset Valuation

Note: Values are correct only at the time of the development of this plan. Up to date information is obtained from the asset register. Values as of 30 June 2016

Assumptions in the Valuation Process

- Structures will deteriorate with respect to their estimated “physical life” and require replacement; upon reaching the end of the structures estimated “useful life”;
- Structures of the same class/construction standard will deteriorate at the same rate;
- Unit rates for renewal are reflective of industry construction rates.

6.1.8 Historical Valuation Trend

ASSET TYPE	YEAR OF VALUATION	TOTAL VALUATION					
		Replacement Value $	Change from last Valuation %	Written Down $	Change from last Valuation %	Accumulated Depreciation $	Annual Depreciation $
	2009	$ 9,249,128.00	N/A	$ 7,047,006.20	N/A	$ 2,202,121.80	$ 79,725.92
Road Bridges	**2012**	$ 9,284,128.00	0%	$ 6,463,287.76	-8%	$ 2,820,840.24	$ 80,013.42
	2016	$ 23,707,382.00	+155%	$ 14,690,749.86	+127%	$ 9,016,632.14	$ 211,756.93
	2009	$ 1,039,840.00	N/A	$ 446,345.60	N/A	$ 593,494.40	$ 12,642.95
Footbridges	**2012**	$ 1,241,328.00	+19%	$ 483,693.41	+8%	$ 757,634.59	$ 16,095.31
	2016	$ 5,830,914.00	+370%	$ 2,597,306.50	+437%	$ 3,233,607.50	$ 86,168.09
	2009	$ 1,296,240.00	N/A	$ 843,623.50	N/A	$ 452,616.50	$ 16,031.96
Major Culverts	**2012**	$ 1,372,120.00	+5%	$ 821,128.82	-3%	$ 550,991.18	$ 16,785.04
	2016	$ 2,406,295.00	+75%	$ 1,776,992.63	+116%	$ 629,302.37	$ 26,587.35

Table 26: Historical Valuation Trend

Valuation Trends

It is clear that a substantial change in valuation has occurred between the two most recent surveys, the reason for this is twofold:

- The 2016 survey includes a total increase of 22 structures which were either built after 2012 or are being recognised as bridges or major culverts for the first time.
- The replacement rates for bridges and major culverts were updated for the 2016 survey to better reflect the current costs associated with replacement, thus providing a greater capability in planning.

6.1.9 Historical Asset Consumption/Renewal

Annual Consumption & Renewal (% of asset value)	Year		
	2009	2012	2016
Asset Consumption $(\frac{Asset\ Depreciation}{Replacement\ Value})$	0.94%	0.95%	1.02%
Asset Renewal $(\frac{Renewal\ expenditure}{Replacement\ Value})$	0.82%	1.60%	1.15%
Amount of Asset Depreciation Funded	87.64%	168.30%	113.09%

Table 27: Historical Asset Consumption/Renewal Rates

Although annual asset consumption has been slightly rising over this seven year period (due to the construction of relatively lower life footbridges), average asset renewal expenditure has increased dramatically from 2009 to 2012. The reason for this is two-fold; firstly, the previous level of expenditure on bridge renewal was inadequate in meeting the required renewal demand. Secondly, this shortfall in funding had the effect of accumulating a significant backlog of renewal works to be completed. The current renewal expenditure is beginning to slowly address this backlog of works, which is presently comprised of many large scale projects (refer to table 29), whilst attempting to address the annual asset depreciation.

6.2 Maintenance & Operations Plan

6.2.1 Maintenance/Condition Inspections

Council has adopted three levels of inspections derived from the VicRoads Road Structures Inspection Manual - April 2011:

- Routine Maintenance Inspection.
- Condition Inspection.
- Detailed Engineering Inspection and Analysis.

Routine Maintenance Inspection

Routine maintenance inspections are undertaken once every year for the entire bridge and major culvert network. The general serviceability of the structure for the safety of road users is checked, and any problems are identified. This type of inspection will also include checking the signage, approaches, waterways, vandalism, graffiti and all visible structural components.

Structures will also be subject to a routine maintenance inspection following a major accident or environmental event which would warrant concern regarding the structures serviceability and condition. In addition to this, structures with relatively high risk ratings and/or components warranting further interrogation will be referred to an alternative inspection regime, which shall take into consideration the structures condition and criticality (refer to appendix 5).

All data obtained from the routine maintenance inspection is to be recorded on the Bridge Inspection Form included in the Appendices.

Condition Inspection

Condition inspections are carried out typically every 3 years or as required based on the results on the results of a routine maintenance inspection. Condition inspections are currently carried out by Council's Civil Engineer or contractors with proven experience and qualifications.

The performance of critical structures against their previous survey results are checked by council staff with suitable bridge design and/or construction experience on a more frequent basis given their higher risk status.

Engineering Inspection & Analysis

A detailed engineering inspection involves a combination of field inspection and theoretical analysis to more accurately assess the structural performance of the bridge or major culvert. Detailed engineering inspections typically will be conducted by qualified contractor given the significant resources required.

A detailed engineering inspection will be conducted as required following a routine maintenance or condition inspection.

Current Inspection Schedule

Asset Category	Inspection Type	Inspection Output	Frequency	Responsibility
Bridges & Major Culverts	Routine Maintenance Inspection	Refer to Bridge Maintenance Inspection Form (Appendix 1)	Annually/According to the alternative asset inspection regime (Appendix 5)/Following a significant event	Coordinator Asset Management and Development
	Condition Inspection	Refer to Bridge Condition Inspection Form (Appendix 2)	Typically every 3 years	Coordinator Asset Management and Development
	Detailed Engineering Inspection	Detailed field inspection report and structural analysis.	As recommended from a routine maintenance or condition inspection.	Coordinator Asset Management and Development

Table 28: Current Inspection Schedule

6.2.2 Maintenance Works Formulation

Following a routine maintenance, condition or detailed engineering inspection, the defects identified which require maintenance are listed and ranked to produce a maintenance schedule. In addition, maintenance activities are generated reactively following the evaluation of customer requests. Maintenance activities are completed with regard to the Maintenance Work Practices Manual – Road Reserves (2009). The priority and details of response for defects are calculated based upon considerations such as public safety, risk, required levels of service and the extent and severity of the defect.

6.2.3 Current Maintenance Works Schedule

As a result of the recent condition assessment (July 2016) of Bridges and Major Culverts completed by Moloney Asset Management Systems, a list of proposed maintenance works (refer to the figure below) was generated and forms the basis of the maintenance schedule for the present financial year (2016-2017).

BRIDGE GENERAL DETAILS

ROAD NAME	REFERENCE CHAINAGE 00 AT	Insp Cond 0-10	Sub Asset	DESCRIPTION OF EXISTING ASSET	DETAILS OF PROPOSED ASSET WORKS		
					Deg Urg 0-10	Est. Cost $	DESCRIPTION OF PROPOSED WORKS
Lake Pertobe Res F/B 5	Nth of Pertobe Rd	**7.5**	Hand Rail	2 No Steel wire ropes with drop chains at 900 cts	**10**	2,000	Reduce gap in Handrails - If bridge remains in service
Harris St Road Bridge	at McDonalds St	**2.0**	Stringer	7 No 500 Deep x 1700 wide precast RC T-Beams - Very extensive and severe cracking underneath	**10**	8,000	Investigate reason for severe cracking of RC T-Beam underneath
Lake Pertobe Res F/B 4	Nth of Pertobe Rd	**6.0**	Hand Rail	Single 90 x 45 Timber rail on Diagonal Cross braced frame	**9**	1,000	Reduce gap in Handrails - If bridge remains in service
Lake Pertobe Res F/B 6	Nth of Pertobe Rd	**7.0**	Hand Rail	Single 100 Dia Timber rail on timber posts with cross bracing	**8**	800	Reduce gap in Handrails - If bridge remains in service
Russells Ck F/B 1	Sth of Glenbane Ct	**6.0**	Other No1	NP	**8**	3,000	Investigate repair - Replacement options
Lake Pertobe Res F/B 1	Nth of Pertobe Rd	**2.0**	Stringer	2 No 600 x 130 Laminated timber arch beams on main span - Early signs of delamination	**8**	2,500	Provide protective coating to laminated timber main beams
Lake Pertobe Res F/B 2	Nth of Pertobe Rd	**0.0**	Stringer	2 No 585 x 140 Laminated timber arch beams with 190 x 50 HWD beams at 450 Cts on approach spans	**8**	2,500	Provide protective coating to laminated timber main beams
Lake Pertobe Res F/B 3	Nth of Pertobe Rd	**1.0**	Stringer	2 No 600 x 130 Laminated timber arch beams at 1500 cts on main span	**8**	2,000	Provide protective coating to laminated timber main beams
Russells Ck F/B 2	East of Dunlea Ct & Moonal Sts Inters	**4.0**	Deck	In 2 Layers 25 x 150 Treated Pine on top of older rotten Hardwood deck	**7**	3,000	Provide protective coating to timber deck and Handrails
Wollaston Rd Road Bridge	Mortlake Rd	**5.0**	Deck	Cast in Place RC deck slab over Steel U-Beams - Very extensive Cracking and Weathering and high deflection under load	**7**	8,000	Investigate the need to strengthen the RC deck
Mortlake Rd F/B West Side	Nth of Moor St	**6.0**	Hand Rail	2 No 50 mm Dia Water pipe rails on pipe posts at 1650 Cts	**7**	1,200	Repair handrail and reduce gap
Russells Ck F/B 1	Sth of Glenbane Ct	**6.0**	Hand Rail	Single 90 x 45 Top rail with Large spaced diagonal Bracing in fills - Very extensive rotting	**7**	4,000	Repair and paint - preserve handrail and reduce gap
Wollaston Rd foot Bridge	Mortlake Rd	**6.0**	Other No1	2 No Timber Trusses supported on steel cables also acting as handrails - Extensive rot in timbers	**7**	10,000	Undertake investigations into the most appropriate method to preserve and repair the major timber components of the bridge
Skuses Rd	Dallimores Rd	**3.0**	Signs	NP	**7**	1,500	Place 4 No Chevron and 2 No Narrow Bridge signs
Viaduct Rd	Stanley St	**7.0**	Stringer	Single Cast in Place RC Tee Beam approx 700 Deep - Very extensive Cracking and Spalling	**7**	10,000	Investigate concrete repair options and if this is consisered to be a viable rehabilitation consideration

Figure 4: Current Maintenance works Schedule

6.2.4 Standards and Specifications

Maintenance activities are undertaken to a standard that returns the asset to a safe, useable, fit for purpose condition and must be in compliance with the standards described in section 6.3.4.

6.2.5 Maintenance Funding

Maintenance activities listed in the general ledger are:

Activity	Account	Budget
Routine Inspection & Maintenance	228000-1234	$55,000
Total		**$55,000**

Table 29: Maintenance Funding

Council's annual maintenance allocation has been found to be insufficient in treating Council's assets optimally. A benchmarking analysis revealed that a more appropriate level of funding for bridge and major culvert maintenance would be between $90,000 to $110,000.

6.3 Renewal Plan

Renewal works are undertaken generally when an asset has reached the end of its service life, and restoring the structure to its original capacity remains appropriate given the present and projected service requirements. Renewal works may be identified at the component or sub-component level (renewal of elements is generally considered maintenance) during routine maintenance, condition or detailed engineering inspections or following the evaluation of customer requests. Condition assessments, however, typically form the basis for the bridge renewal program. The priority ranking of renewal projects is justified by recourse to the assets performance, condition, associated risks and the economic efficiency of renewal.

Whilst council's bridge and major culvert infrastructure has experienced a general improvement in condition since the previous survey in 2012, it is clear that there still exists a significant backlog of bridges with conditions which warrant consideration for renewal/replacement (Table 29).

Large value individual assets such as road bridges and some major buildings may be unable to be effectively funded in any single year as the average renewal amount contains part of the asset over a number of years. The actual renewal profile of high cost assets has large peaks in renewal requirement and some years where very little renewal is required.

Draft 15 year Renewal Program

BRIDGE/CULVERT DETAILS				TOTAL VALUATION		PROGRAM
Road Name	Location	Asset Type	Asset Condition	Replacement Value	Cumulative Replacement Value	Year of Replacement
Stanley Street	Pertobe Road	RB	**7.5**	$161,500.00 (Partial Replacement)	$161,500.00	2016/17
Jubilee Park (Woodford)	North of the end of Victoria Street	FB	**10**	$206,338.00	$367,838.00	2017/18
Wollaston Road Footbridge	McGennan Street	FB	**6**	$100,000.00 (Partial Replacement)	$467,838.00	2017/18
Lake Pertobe Reserve F/B 5	North of Pertobe Road	FB	**7.5**	$112,292.00	$580,130.00	2018/19
Ziegler Parade	Princes Highway	RB	**7**	$100,000.00 (Rehabilitation works)	$680,130.00	2018/19
Stephens Street	Denman Drive	FB	**7**	$183,924.00	$864,054.00	2019/20
Lake Pertobe Reserve F/B 6	North of Pertobe Road	FB	**7**	$61,579.00	$925,633.00	2020/21
Russells Creek F/B 1	South of Glenbane Court	FB	**6**	$224,640.00	$1,150,273.00	2021/22
Mortlake Rd F/B West Side	North of Moore Street	FB	**6**	$58,968.00	$1,209,241.00	2022/23
Carrolls Road	East of Tooram Road	MC	**6**	$55,177.00	$1,264,418.00	2023/24
Lake Pertobe Reserve F/B 4	North of Pertobe Road	FB	**6**	$90,558.00	$1,354,976.00	2024/25
Jubilee Park (Allansford)	Riverbank Walk	FB	**4**	$30,885.00	$1,385,861.00	2024/25
Ziegler Parade	Princes Highway	RB	**7**	$2,416,354.00	$3,802,215.00	2025/26
Daltons Road	Ardlie Road	RB	**6.5**	$345,384.00	$4,147,599.00	2026/27
Wellington Street Road Bridge	McGennan Street	RB	**6**	$1,038,960.00	$5,186,559.00	2027/28
Viaduct Rd	Stanley Street	FB	**7**	$791,154.00	$5,977,713.00	2028/29
Lake Pertobe F/B 9	West of Maze	FB	**4**	$12,000.00	$5,989,713.00	2029/30
Russells Creek F/B 3	East of Wares & South of Whites	FB	**4**	$55,458.00	$6,045,171.00	2030/31

Table 30: Draft 15 Year Renewal program

It should be noted that individual replacement costs may not necessarily be equal to the actual project cost of replacement due to the long list of variables, the required activities and the agreed scope of a renewal project (multiple of these assets are likely to require replacement or rehabilitation of specific components only). Considering these points, as individual projects are fully costed amendments to the renewal plan, including generated service level and risk consequences, may need to be undertaken.

6.3.1 Renewal Requirement

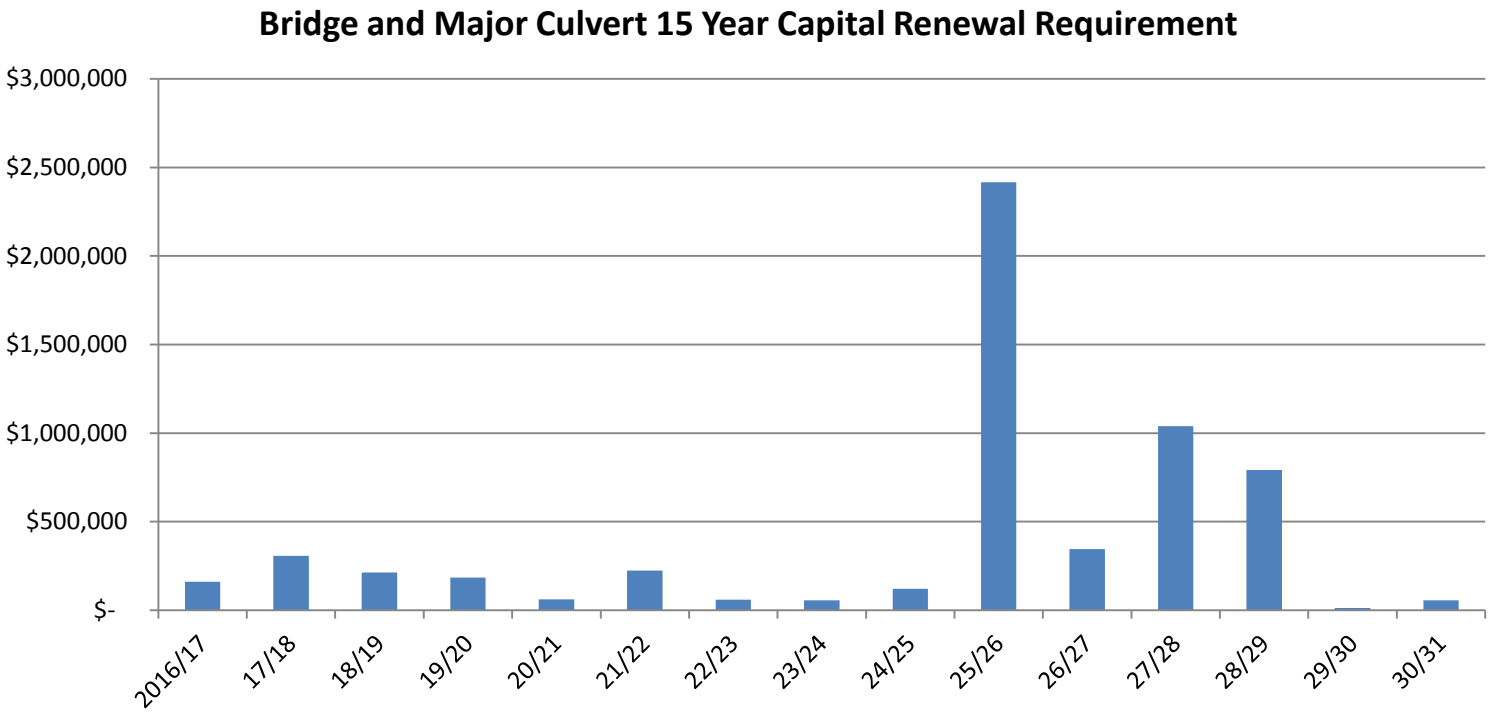

Figure 5: Annual Renewal Expenditure Requirement

6.3.2 Basis for Future Renewal Costs

The following unit rate values have been developed from a recent valuation (December 2016) of all Council's bridges and major culverts. The valuation was triggered in response to renewal project estimates substantially differing from previous unit rate values. As such, the updated figures below are thought to accurately represent industry renewal rates.

Code	Description	Replace rate ($/m^2)
B/M/S	Bridges with masonry and steel construction	$6,055.00
B/RC(/S)	Bridge of reinforced concrete (may contain steel components)	$5,393.00
B/RC/T	Bridge of reinforced concrete with a major timber component	$5,393.00
B/T	Bridge of timber construction	$5,393.00
C/M	Masonry culvert all sizes	$5,477.00
C/PIPE	Precast RCP culverts of any size	$3,901.00
C/S	Steel culvert - corrugated galv. plated steel culverts of any size	N/A[1]
F/HIGH	All Footbridges of high construction standard	$3,855.00
F/MED	All Footbridges of medium construction standard	$3,572.00
F/LOW	All Footbridges of low construction standard	$3,254.00

Table 31: Asset Renewal Rates

[1]: Council currently manages 0 steel culverts.

6.3.3 Renewal Funding

Historic Renewal Funding

Year	Expenditure
2015-2016	$366,548.00
2014-2015	$33,266.00
2013-2014	$693,699.00
Average	***≈ $365,000.00***

Table 32: Historic Renewal Expenditure

The averaged figure above shall be used as the basis for an indicative amount of funding over the next 15 years for the purpose of renewal gap calculation and deterioration modelling.

6.3.4 Renewal Gap

Figure 5 illustrates the cumulative total renewal gap for all bridge and major culvert Infrastructure, which is the difference in actual expenditure and the required expenditure for asset components over intervention.

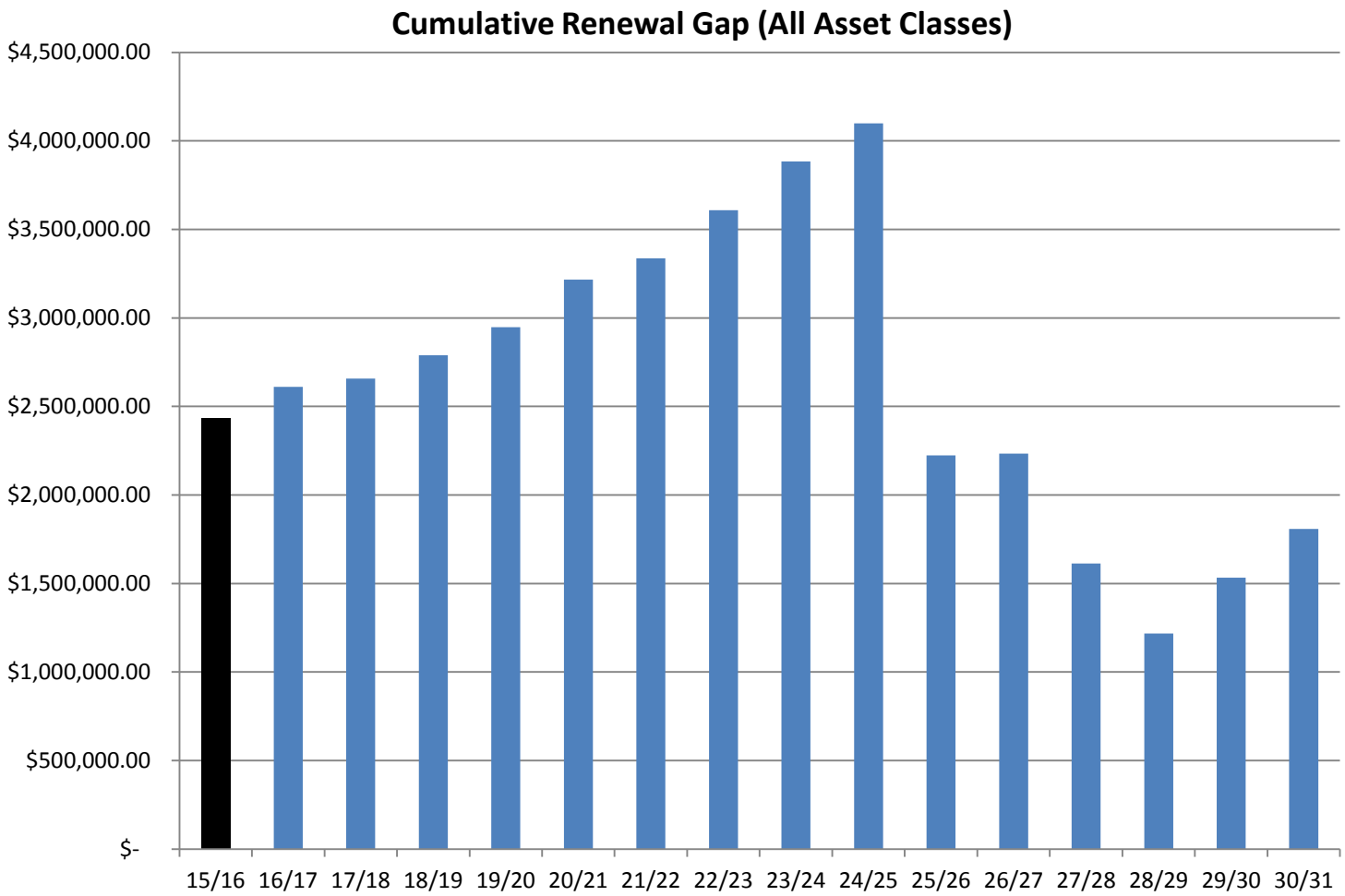

Figure 6: Cumulative Renewal Gap (Bridges and Major Culverts)

6.3.5 Standards and Specifications

Waterway design shall be completed in accordance with *Guide to Road Design Part 5: Drainage design* (Austroads, 2013). Bridge design shall be completed in accordance to Austroads *Guide to Bridge Technology* (2009) and Australian Standards 5100. In addition, the specifications of design should also be in accordance with the requirements of the Infrastructure Design Manual (2015).

6.4 Asset Creation/Acquisition/Upgrade Plan

Council is aware of the current difficulty in funding the existing road network, both maintenance and renewals, and therefore endeavors to prioritise renewal projects over the creation of new assets, or upgrading existing assets.

Provision of new or upgraded works fall into the following categories depending upon the extent and type of works:

- Council funded, or
- Developer funded as part of subdivisional development, or
- Contribution to the cost by either the developer and/or Council.

Where possible, developers of new subdivisions are required, as part of the development approvals process, to provide the basic road infrastructure to the standard appropriate for that development.

In addition, as Council acquires new assets through the subdivision development process it is important that the consequential costs are established and allowed for in future budgets. Costs of maintaining these assets should be funded by rate income from the properties within the development.

It is not reasonable to expect that these costs will be absorbed into existing budgets without an increase. To do so is to effectively reduce the current levels of service to some or all of the municipal area.

New and Upgrade programs may be identified from:

- A relevant Service Strategy,
- Current issues discussions,
- Under-capacity/function analysis,
- An assessment of future demand, and
- Risk assessments.

6.4.1 Required Future New and Upgrade Projects

The table below outlines the details of the identified new and upgrade projects:

Project/Program Identified/source	Asset	Timing	Total Replacement Cost ($)[1]	Cost of New/Upgrade Component ($)
New structures	Bromfield Extension Road Bridge	To be confirmed	$0[2]	N/A
	Merri river Footbridges (x3)	To be confirmed	$0[2]	N/A
	Swinton St Footbridge	2018/19 - 2019/20	N/A	$175,000[3]
Poor capacity/functionality assets	Stanley Street Road Bridge	Upgrade is not currently programmed	$2,881,008	$559,283
Total New/Upgrade Cost				$ 734,283

Table 32: Identified new and upgrade projects

[1]: Total replacement cost is inclusive of the upgrade component cost.
[2]: The total cost of these projects shall be funded fully by external parties in accordance to the North of the Merri Development Contributions Plan, however current indicative costs suggest that the three footbridges in total shall cost $510,000.00 and the Bromfield St Road Bridge shall cost $1,525,568.00.
[3]: Given the lack of detailed costing having taken place at this moment, the cost provided is indicative only.

6.4.2 Standards and Specifications

The standards and specification of design for new assets shall be in accordance with those documented in section 6.3.4.

6.5 Disposal Plan

In order to achieve a holistic approach for infrastructure financial sustainability, Council must ensure that resources are not spent on maintaining or renewing assets which no longer serve a genuine community demand. Disposal of assets, therefore, serves as a tool for achieving optimal use of the available resources. Generally speaking, most road bridges, footbridges and major culverts are considered to be essential to the connectivity of Warrnambool's road and footpath network, therefore demand for disposals is usually low.

The disposal of bridge and major culvert infrastructure may occur under the following conditions:

- A request is made by the community which is approved by council;
- Following a study of demand, it is demonstrated that an asset receives low or no usage and thus continual expenditure on maintaining the asset is not justified; or
- An asset is handed over to a private interest or other authority.

Council owns and manages a number of bridges and major culverts which have unconfirmed service requirements. There is a potential for disposal to be a solution in these cases if the confirmed service demands are sufficiently minimal for disposal to provide a positive financial result. Structures which require investigation into the ongoing service requirements are:

- Ziegler Parade Road Bridge
- Stephens Street Footbridge

7 FINANCIAL PLAN

7.1 Current Financial Position

7.1.1 Current Asset Valuations

The tables below present a summary of the overall asset quantities and valuations of Council's bridges and major culverts. Annual depreciation should be regarded as an accounting figure which may vary from the actual renewal demand annually. As such, Council's actual expenditure on renewal will vary from year to year based upon annual renewal liability.

Latest Survey Valuations

Asset Description	Total Quantity	Weighted Av. Asset Condition	Av. Asset Life in Years	Replacement Value	Written Down Value	Accumulated Depreciation	Annual Depreciation	Date of Condition Assessment
Bridges and Major Culverts	50	3.42 (Good)	81.0	$31,944,591	$19,065,049	$12,879,542	$324,512	July-16

Table 33: Current Asset Valuations

7.1.2 Current Levels of Renewal Expenditure and Depreciation

Current Renewal Expenditure vs. Average Long-term Demand

Present total Annual Capital Renewal Expenditure	Annual Depreciation or Average Long-term Annual Demand	% of Annual Depreciation Being Met	% of Renewal Requirement funded
$365,000	$324,512	113.09%	91.06%

Table 34: Current Renewal Expenditure vs. Average Long-term Demand

NB: The annual depreciation is a long-term figure whereas the present annual renewal expenditure is a short term indicative figure, as such, the "% of annual depreciation being met" is expected to be dynamic over the short term as large scale projects are required/not-required.

7.2 Financial Forecasting

The renewal demand is currently a relatively high figure considering the general good condition of bridge and major culvert assets. Figure 7 shows the predicted effect of the current renewal expenditure ($365,000 pa) on the amount of assets above the intervention level. If Council maintains its current spending on renewal, the proportion of assets above intervention will rise from 7.6% to over 12% in the next 9 years. Following the completion of some large renewal projects in the concluding 5 years of the coming 15 year period, this figure is predicted to fall to below 4% and conclude below 6%.

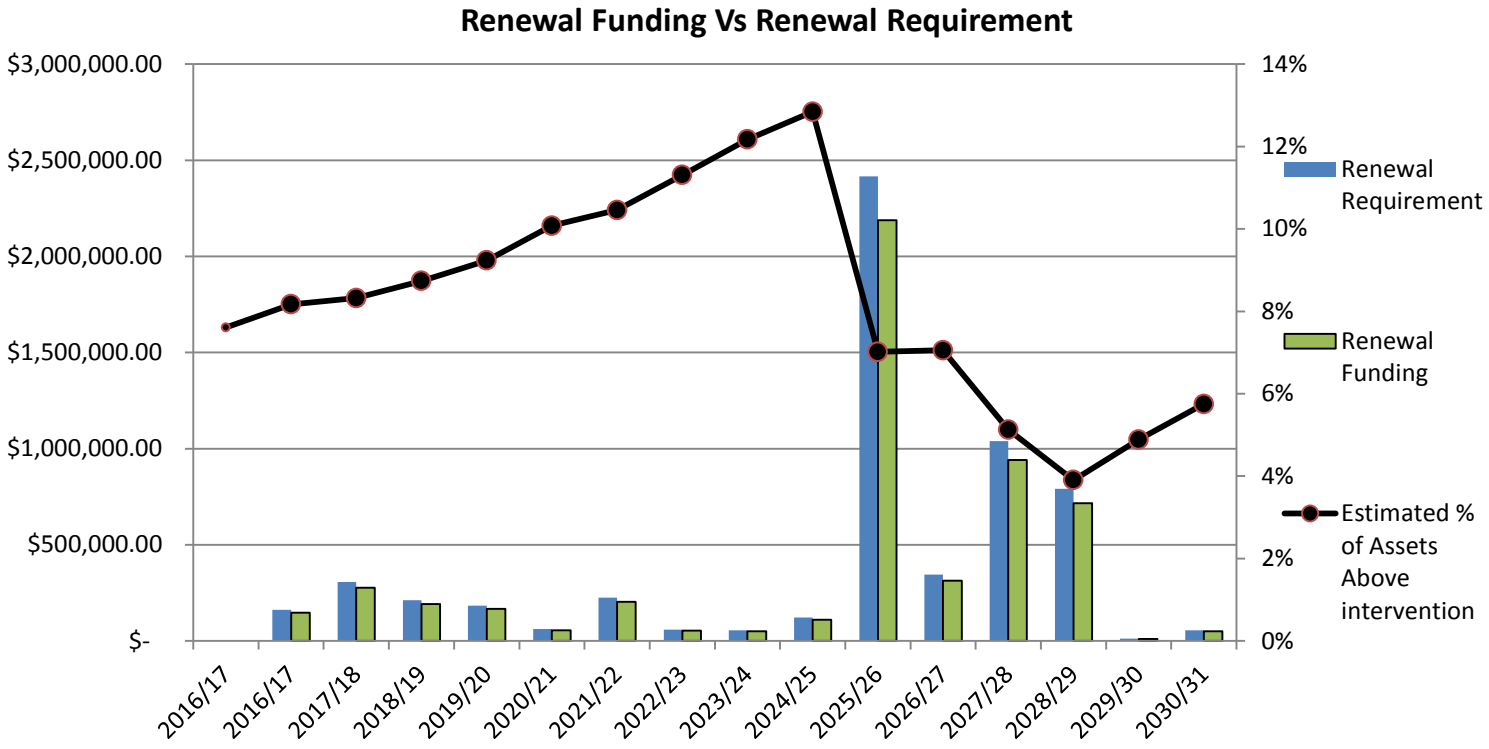

Figure 7: Renewal Funding Vs Renewal Requirement

The projects constituting Councils current renewal gap are programmed within the figure above through distributing the backlog renewal projects throughout the 15 years, some of the renewal gap shall be addressed via component replacement or rehabilitation (where deemed acceptable). The year with the largest renewal requirement corresponds to the full replacement of the Ziegler Parade Road Bridge.

7.3 Funding Strategy

Bridge and major culvert works expenditure is funded from the following sources:

- Rates
- Federal and State Government Grants

The total replacement cost of Council's Bridges and Major Culverts has increased significantly since 2009 (as illustrated in section 6.1.8). This increase in the asset base corresponds with a higher maintenance demand though with stagnant levels of annual funding for maintenance Council may expect both higher rates of structural deterioration and faltering levels of service generally. A recent maintenance unit rate and funding benchmarking analysis suggests that appropriate levels of funding would be within the range of $90,000 - $110,000 ($55,000 being the present level of annual maintenance funding).

Bridge and major culvert annual asset renewal requirements will tend to vary significantly. As a result of this, the funding requirements in many years shall be greater than the indicative amount of actual funding. In response Council shall effectively manage the funds from years where actual funding is greater than the renewal requirements such that periods with large renewal requirements may still be funded.

7.4 Valuation Forecasts

Figure 8 details that the total valuation of bridge and major culvert assets will increase by approximately 8% over the coming 15 years due to acquired assets. The inclusion of these assets into Councils management brings forth additional operational/maintenance and renewal requirements proportional to the total increase in valuation, as such future levels of funding should have consideration for the increasing asset base, as well as potential influencing market forces. Presently speaking, Council has limited knowledge of bridge and major culvert assets which are to be acquired post 2024/25. As this information becomes available it shall be included within this plan.

Total Valuation Forecasting

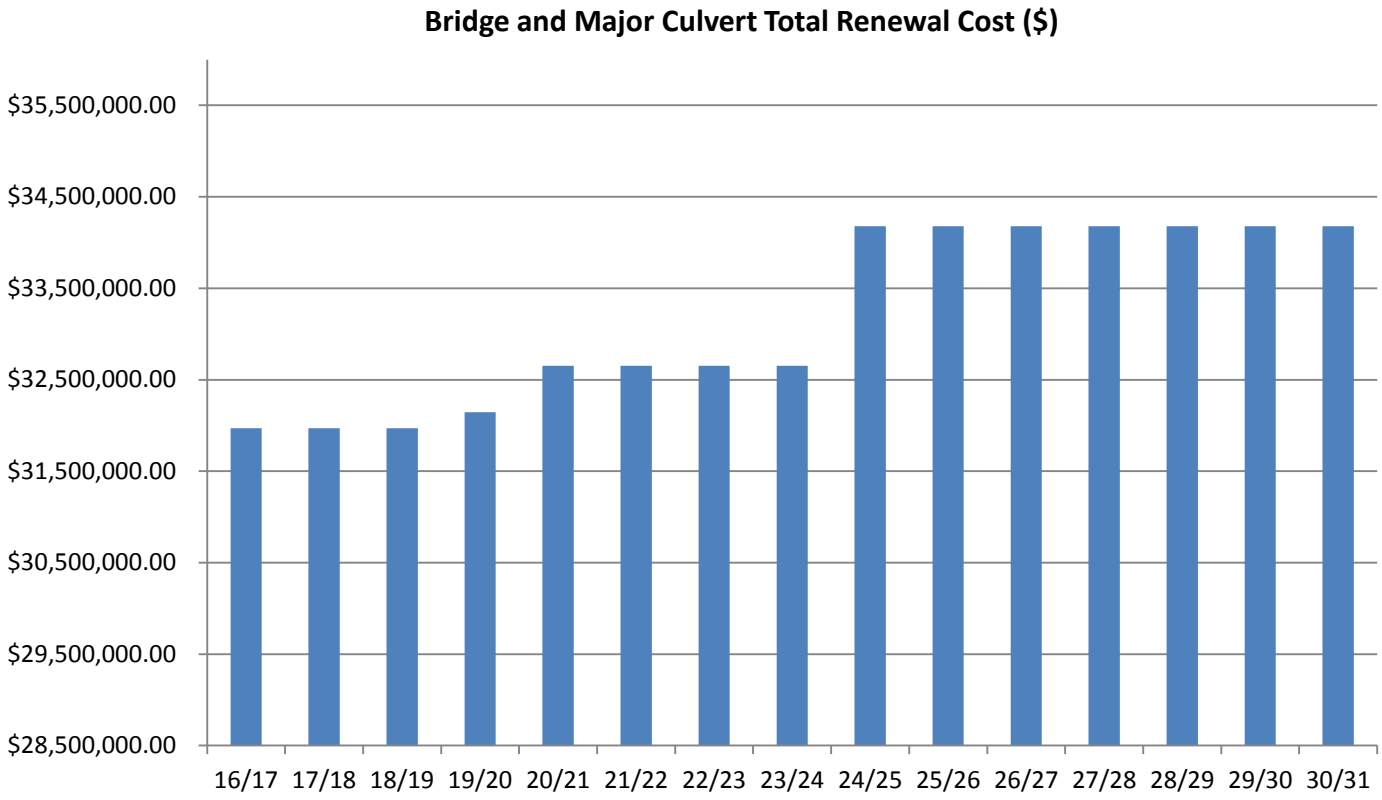

Figure 8: Forecasted Asset Valuation

7.5 Key Assumptions Made in Financial Forecasting

The key assumptions made in conducting the financial forecast for bridge and major culvert assets are:

- Structures will deteriorate with respect to their estimated “physical life” and require replacement upon reaching the end of the structures estimated “useful life”;
- Structures of the same class/construction standard will deteriorate at the same rate;
- Annual funding of $365,000 for renewal is a valid future figure;
- Present service level requirements shall remain reasonably consistent; and
- Unit rates for renewal are reflective of actual present industry construction rates.

8 ASSET MANAGEMENT PRACTICES

8.1 Asset Management Systems

The conquest asset management system contains the asset register for road bridges, footbridges, major culverts and all assets generally. The register currently contains fields regarding the structures location, description, dimensions, condition, function, capacity, replacement cost, written down value, useful life, construction date and more. Conquest has the capacity for integration with Councils Geographical Information System (MapInfo), as such; all bridge and major culvert assets have been mapped.

8.2 Information flow

The key input information for this asset management plan is:

- Related Council strategies which guide the provision of new assets and the management of existing assets;
- Asset data; including condition, age and cost values;
- Typical asset useful lives and unit rate costs for different construction standards;
- Projections and modelling of renewal requirements;
- Documented service levels;
- Future demand projections and factors affecting future demand;
- Forecasted works programs.

The key output information from this asset management plan is:

- Forecasted medium and long term renewal expenditure requirements to meet renewal demand.
- 15 year proposed renewal expenditure profile alongside the renewal demand and cost implications of the profile.
- A clear definition of the current value, type, service levels and condition concerning bridge and major culvert assets, which enables the community and stakeholders to participate in balancing service levels with the available resources.
- The activities identified for the improvement of this plan and the overall management of bridge and major culvert assets.

8.3 Standards & Guidelines

- Infrastructure Design Manual (2015)
- Standard Specifications for Roadworks & Bridgeworks – VicRoads 1993
- Road Structures Inspection Manual – VicRoads April 2011
- Bridge Maintenance Repair & Strengthening Guidelines – VicRoads 2001
- Local Road Bridge Management Manual – ARRB 2000
- Traffic Engineering Manual – Volume 2, Signs & Markings – VicRoads 2001
- AS 5100 Bridge Design – Australian Standards 2007
- Guide to Bridge Technology – Austroads 2009
- Guide to Road Design Part 5: Drainage Design – Austroads 2013
- IPWEA International Infrastructure Management Manual 2015

9 PLAN IMPROVEMENT AND MONITORING

9.1 Improvement Actions

Levels of Service

- The current performance in each service level shall be re-evaluated or developed for monitoring capability. This shall also, therefore, provide an opportunity to develop a strategic plan for achieving the service level targets detailed within the plan.
- During the next community consultation on roads, directing attention towards the community's opinion on the current state of bridges and major culverts should be considered such that Council may confirm or amend levels of service accordingly.

Future Demand

- It was noted during the development of the future demand for Bridges and major culverts in Warrnambool that many of the expected areas of impact lack reliable figures from which an effective management plan may be developed. It would be useful to use this information to develop various scenarios of future demand and their respective implications.
- An extensive evaluation of the service requirements of Ziegler Parade Road Bridge is required. The structure is in poor condition and is fit for intervention. The extent of works, however, must be formulated with regard to the future service demands of this structure. Possible solutions may range from disposal, partial replacement, partial rehabilitation, full replacement and full replacement and upgrade.

Risk Management

- With the goal of progressing towards an "advanced" approach to risk management, targeted, prioritised and planned responses to the identified hazards in the bridge and major culvert risk register shall be formulated.
- The process for managing critical assets shall be formally developed with respect to various management approaches, asset risk ratings and asset life-cycle.

Life Cycle Management Plan

- A system of digital reporting on routine maintenance inspections is required such that Council's asset management department can gain a rigorous understanding of the lower level issues which are identified during these assessments. In addition to this, the report template which is used for these inspections shall be reviewed and amended where necessary.
- A formal process shall be developed for identifying, evaluating and rationalizing new, upgrade projects alongside the disposal of existing assets.

9.2 Monitoring and Review Procedures

The Bridge asset management plan is a dynamic document, as such regular review of this document is required so that the plan remains relevant and in accordance with asset management best practice. It is planned that this document shall be reviewed annually, in accordance with Councils asset management strategy.

Following a network wide condition inspection, a substantial review and revision shall take place to reflect the change in asset knowledge. The review of the plan shall reflect changes in the condition of bridge and major culverts, disposed and created assets, new technologies effecting management and service delivery, community requirements and funding. Additionally, following any formal community engagement relating to Bridge Infrastructure, a review of the service levels and service level consequences within this document shall be undertaken.

10 REFERENCES

- VicRoads Road Structures Inspection Manual - April 2011
- IPWEA International Infrastructure Management Manual 2015
- Autonomous Vehicle Implementation Predictions – *Implications for Transport Planning,* 2015
- Road Structures Inspection Manual – VicRoads April 2011

11 APPENDICES

- 1 – Routine Maintenance Inspection Form
- 2 – Condition Inspection Form
- 3 – Bridge and Major Culvert Risk Register
- 4 – Bridge and Major Culvert Asset Management Action Plan
- 5 – Alternative Asset Inspection Regime
- 6 – Bridge and Major Culvert Asset Register
- 7 – Bridges and Major Culverts Managed by Other Authorities

11.1 Routine Maintenance Inspection Form

Bridge Name:	Location on map:
Bridge ID No.:	
Road No/Name:	
Inspector:	
Inspection Date:	

TASK		CHECKED	NEEDS REPAIR	LEVEL 2 INSPECTION REQUIRED	NOTES
Cleaning & Clearing	Clean deck, footway, expansion joints				
	Clean scuppers & down-pipes				
	Clean superstructure of dirt build-up				
	Clean substructure of dirt build-up				
	Clear vegetation in or around bridge				
Running or wearing surface	Repair asphalt/granular surface				
	Replace running planks				
	Repair wearing surface				
Minor repairs or painting	Repair spalled post/parapets				
	Repair or tightening railing				
	Painting railing				
Stream maintenance	Drainage approaches				
	Embankments				
	Remove debris in and around bridge				
	Minor scour repairs				
Signs & bridge furniture maintenance	Replace bridge signs				
	Replace bridge markings				
	Additional signs required				
	Install/replace bridge ID plate				
Vandalism repair	Removal of graffiti				
	Repairs needed due to vandalism				

Wind speed:	Wind direction:	Poison:
COMMENTS		

11.2 Condition Inspection Form

Bridge Name:	**Warrnambool City Council**
Bridge ID No:	**Location on Map:**
Road No/Road Name:	**km from/to:**
Crossing:	
Inspection Date:	**Inspected By:**

Number of Spans:	**Type and Number of Beams:**
Type of Piers:	**Type of Abutments:**
Foundation:	**Movement:**

Original Structure ☐ Widening Left ☐ Widening Right ☐

COMPONENT	**TYPE**					**Cond 1**	**Cond 2**	**Cond 3**	**Cond 4**
On Deck									
Road Approaches	Bumpy	Bitumen							
Footpath	Bitumen	Concrete	Timber						
Deck	Concrete	PC*	Steel	Timber					
Arch	Steel								
Arch hangers	Steel								
Kerbs	Concrete	Timber							
Parapets	Concrete	Steel	Timber	Masonry					
Railings	Concrete	Steel	Timber						
Guard Rails	Concrete	Steel	Timber						
Expansion Joint	Steel								
Joint Seal									
Abutment									
Abutment	Concrete	Timber	Masonry						
Wing walls	Concrete	Timber	Masonry						
Retaining Walls	Concrete	Timber	Masonry						
Embankments and Fill	Piled	Stone	Gabions	Rip-Rap					
Superstructures									
Underside of Deck	Concrete	PC*	Steel	Timber					
Beam or Girders	Concrete	PC*	Steel	Timber					
Cross beams/floor beams	Steel	Timber							
Long/cross decking	Timber								
Trusses	Steel	Timber							
Bracings	Steel	Timber							
Diaphragms	Steel	Concrete							
Cables and Hangars	Steel								
Spandral or Barrel Arch	Concrete	Steel							
Side Walls of Arch	Concrete	Steel							
Substructures									
Crossheads (not integral**)	Concrete	PC	Steel	Timber					
Crossheads (integral**)	Concrete								
Piers	Concrete	Steel	Timber						
Pile Cap	Concrete								
Piles	Concrete	Steel	Timber						
Bearings									
Bearings									
Bearing pedestals/pads	Concrete								

*PC = Prestressed or Post-tensioned Concrete; **integral with superstructure; ***Conditions 1-4 represent 'good' to 'severely damaged'

Inspectors General View of Bridge Condition: Good Fair Poor (please circle one)

11.3 Bridge and Major Culvert Risk Register

RISK IDENTIFICATION							RISK ANALYSIS			
Risk No.	**Asset at Risk**	**What can happen?**	**When can it occur?**	**Possible cause**	**Existing controls**	**Is risk credible?**	**Likelihood**	**Consequences**	**Risk rating**	**Action required**
1	Bridges and Major Culverts	Collapse or damage to structure or road approach	Anytime now	Overloading structure	Condition and load limit assessments	Yes	Unlikely	Major	Medium	Planned action required
2	Bridges and Major Culverts	Collapse or damage to structure or road approach	Anytime now	Poor current structural condition	Condition assessments and renewal works programming	Yes	Unlikely	Major	Medium	Planned action required
3	Bridges and Major Culverts	Collapse or damage to structure or road approach	Anytime now	Lack of maintenance	Level 1 maintenance inspections and works programming	No	N/A	N/A	N/A	N/A
4	Bridges and Major Culverts	Collapse or damage to structure or road approach	Anytime now	Severe weather event	Level 1 inspections required following a significant event	Yes	Likely	Major	High	Prioritised action required
5	Bridges and Major Culverts	Collapse or damage to structure or road approach	Anytime now	Waterway users	Nil	No	N/A	N/A	N/A	N/A
6	Bridges and Major Culverts	Delays from bridge closure or diversion	Anytime now	Bridge Collapse	Condition assessments and renewal works programming	Yes	Rare	Major	Medium	Prioritised action required
7	Bridges and Major Culverts	Delays from bridge closure or diversion	Anytime now	Bridgeworks	Works planning	Yes	Possible	Minor	Medium	Planned action required

RISK IDENTIFICATION							RISK ANALYSIS			
Risk No.	**Asset at Risk**	**What can happen?**	**When can it occur?**	**Possible cause**	**Existing controls**	**Is risk credible?**	**Likelihood**	**Consequences**	**Risk rating**	**Action required**
8	Bridges and Major Culverts	Delays from bridge closure or diversion	Anytime now	Load Limits	Renewal/ Upgrade planning	Yes	Almost certain	Minor	High	Prioritised action required
9	Bridges and Major Culverts	Delays from bridge closure or diversion	Anytime now	Width Restrictions	Design standards	No	N/A	N/A	N/A	N/A
10	Bridges and Major Culverts	Delays from bridge closure or diversion	Anytime now	Flooding	Nil	Yes	Likely	Moderate	High	Prioritised action required
11	Bridges and Major Culverts	Pedestrian accident with road user	Anytime now	No separation of pedestrian and vehicular travel	Renewal/ Upgrade planning	Yes	Rare	Moderate	Medium	Planned action required
12	Bridges and Major Culverts	Pedestrian accident with road user	Anytime now	Inappropriate or missing signage	Level 1 maintenance inspections and works programming	No	N/A	N/A	N/A	N/A
13	Bridges and Major Culverts	Pedestrian accident with road user	Anytime now	inadequate or inappropriate guard rail provisions	Level 1 maintenance inspections and works programming	Yes	Rare	Minor	Low	Manage by routine procedures
14	Bridges and Major Culverts	Pedestrian accident with road user	Anytime now	Poor sight distance	Design standards	Yes	Unlikely	Moderate	Medium	Planned action required
15	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	Vehicle conflict	Design standards & inspections	Yes	Unlikely	Major	Medium	Planned action required

RISK IDENTIFICATION							RISK ANALYSIS			
Risk No.	**Asset at Risk**	**What can happen?**	**When can it occur?**	**Possible cause**	**Existing controls**	**Is risk credible?**	**Likelihood**	**Consequences**	**Risk rating**	**Action required**
16	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	Road obstruction	Level 1 bridge inspections & customer request actioning	Yes	Unlikely	Major	Medium	Planned action required
17	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	Surface condition	Routine defect inspections and maintenance works	No	N/A	N/A	N/A	N/A
18	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	Inadequate drainage	Level 1 bridge inspections & customer request actioning	Yes	Unlikely	Major	Medium	Planned action required
19	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	inadequate signage and/ or delineation	Level 1 bridge inspections & customer request actioning	Yes	Unlikely	Major	Medium	Planned action required
20	Bridges and Major Culverts	Vehicular accident causing injury and/or structural damage	Anytime now	Poor sight distance	Design standards	Yes	Unlikely	Major	Medium	Planned action required

11.4 Action Plan

Related Section/Topic	Action	Responsible Officer	Timeline
Levels of Service – Community Engagement	During the road management plan review consultation period, consideration shall be given for the inclusion of consulting on the service level targets for bridges and major culverts.	Assets Planning Officer	During the consultation period for the RMP review
Levels of Service – Current Performance	For each level of service, the performance measures shall be re-evaluated and the monitoring procedures currently absent shall be developed. Once this is done, a subsequent plan shall be developed targeting those levels of service in which the performance targets are currently not being met. The plan may include but not limited to, amending levels of service, changes in operations and maintenance policy and capital works planning.	Assets Planning Officer	Prior to the annual review
Future Demand – Natural Environment	For each environmental change anticipated which shall impact on the life of bridge and major culvert infrastructure, research shall be conducted on the projected quantifiable change. Once these values have been sourced, subsequent research shall take place on the formulaic relationships between environmental conditions and specific infrastructural life. Once this research is completed, an accurate value for the expected environmental impact shall be calculated and thus an effective and targeted management plan may be developed.	Assets Planning Officer	Prior to the annual review
Future Demand – Demographics and Land Use	Further work shall be completed to quantify the total effect resulting from demographic and land use developments. The results of these developments are represented through the characteristics of travel throughout the network, as well as the total traffic loading. Once an accurate predicted total change is produced, implications for the road hierarchy and design standards shall be identified.	Assets Planning Officer	Prior to the annual review
Future Demand – Technology	Given the expected increase in automated vehicles on roads over the coming decades, the consequences of loading and requirements in technology shall be sourced and planned for.	Assets Planning Officer	Prior to the annual review
	Improvements in technology which may increase the efficiency and sustainability of the management and delivery of bridge and major culvert infrastructure (and council infrastructure generally) shall be actively identified and applied where practical.	All staff either directly involved in the management of assets or in fields affecting the management of assets.	Regularly (as required)

Related Section/Topic	Action	Responsible Officer	Timeline
Future Demand – Heavy Vehicle Loading and Freight Task	Once the finalised freight network is adopted, the structures affected by the continual increase in the freight task shall be identified and assessed for any potential structural issues that may ensue from the increasing load. Plans for each structure may then be developed. The potential for increasing load limits shall be evaluated and planned for when necessary.	Assets Planning Officer	Prior to the annual review
Future Demand – Finance and Economics	The macro-economic effects of willingness to pay shall be measured through changes in service level demands (assuming that consequences of service level change are effectively demonstrated). During the community engagement on the road and footpath network, this phenomenon shall be measured and planned for in conjunction with unrelated service level changes. The predicted changes in unit rate cost shall be sourced through industry research literature and by the analysis of the local change in previous years.	Assets Planning Officer	Prior to the annual review
Risk Management – Hazard Responses	For each hazard with a risk rating of high or very high, options for mitigating the risks shall be developed including the cost, time and residual risk of each option. Once a list of options has been developed for each hazard, they may be compared and ranked to formulate a plan of risk management for those hazards which present unacceptable risk.	Assets Planning Officer	Prior to the annual review
Risk Management – Critical Asset Priority	A formal system of managing the priority of critical assets shall be developed. There is various approaches to achieving this end, the most appropriate shall be decided on during the development of the system. Prioritising critical assets must, however, have respect for the overall risk rating for the individual structures.	Assets Planning Officer	Prior to the annual review
Life Cycle Management – Level 1 Inspections	To improve the current approach for recording the results from a level 1 bridge assessment, the process and outputs of the existing system shall be reviewed. Following this review, the assessment template shall be modified where and if required. A process shall then be devised for recording the results in the Conquest asset information system.	Assets Planning Officer & Assets Officer	Prior to the annual review

Related Section/Topic	Action	Responsible Officer	Timeline
Life Cycle Management – Useful Life Values	Bridge and major culvert condition and replacement data shall be evaluated against the current useful life values to estimate the conjunction/disjunction between the actual and projected useful life of each construction type. Once the performance data has been evaluated, design literature and other regional council documents shall be researched to conclude on potential amendments to useful life values.	Assets Planning Officer	Prior to the annual review
Life Cycle Management – Planning for Disposals	A plan for the disposal of bridge and major culvert assets (with the potential of extending the plan to cover all civil infrastructure) shall be developed. The plan should have regard for the service provided, the current demand upon the asset, the future demand which shall effect the asset, the condition rating, the risk exposure, the replacement cost and the ongoing maintenance and operational costs.	Assets Planning Officer:	Prior to the annual review
Life Cycle Management – Planning for New and Upgrade Projects	A detailed process shall be developed for rationalising of new and upgrade projects. This process should make inclusion for evaluating an assets service performance, condition, operational and maintenance costs, replacement and upgrade costs as well as the current and future demand.	Assets Planning Officer:	Prior to the annual review
Stanley Street Road Bridge structural assessment (post pile rehabilitation)	The Stanley Street Road Bridge currently is limited for access by vehicles below 20t in mass. The load carrying capacity of the structure is limited by the deteriorating piles. Following pile rehabilitation works, a structural analysis of the bridge shall be undertaken to determine whether the imposed load limit may be amended.	Manager Infrastructure Development and Projects	Action completed within 2 months of completion of works.
Access risk assessments of non-compliant bridges	Risk and service assessments shall be undertaken on structures which provide non-compliant access. These assessments shall be timed for when a structure has reached an end of life condition.	Coordinator Asset Management and Development	Prior to the replacement of the respective structure
Load limit investigations (structural analysis)	The most recent condition assessment (July 2016) identified a number of structures which may potentially require a load limit. Investigation into the load carrying capacity of the following structures is thus required: • Wellington Street Road Bridge • Daltons Road Road Bridge • Skuses Road Road Bridge	Manager Infrastructure Development and Projects	Prior to the next bridges condition assessment
Load limit management and enforcement	The ongoing structural integrity of the Ziegler Parade Road Bridge and the Stanley Street Road Bridge shall be ensured, in part, through adherence to the imposed load limits. Potential methods shall be investigated to gauge the level of adherence to the load limits, alongside potential methods for enforcement where and if due.	Manager Infrastructure Development and Projects	Prior to the annual review

Related Section/Topic	Action	Responsible Officer	Timeline
Investigation of defect causes and repair options	Further investigation is required into the causes and options for repair of various defects in the following structures: • Viaduct Road Footbridge • Wollaston Road Road Bridge • Wollaston Road Footbridge • Harris Street Road Bridge • Russel's Creek Footbridge (South of Glenbane)	Coordinator Asset Management and Development	Prior to the annual review
Investigation into critical structures which are below the 1% AEP	Current flood modelling has been deemed inconclusive as to the accuracy of Road Bridge flood levels. Further investigation shall be undertaken to confirm which critical structures are below the 1% AEP.	Assets Planning Officer	Prior to the annual review
Asset service requirements investigation	The Ziegler Parade Road Bridge and the Stephens Street Footbridge are in poor condition and are required for works within the next 15 years. The scope of these works, however, shall need to depend on the service requirements for these structures, which are currently unconfirmed. Therefore, an investigation shall be undertaken to confirm the future service demands of these structures.	Assets Planning Officer	Prior to the programmed replacement of the respective structure

11.5 Alternative Asset Inspection Regime

Asset	Level 1 Inspection Regime	Level 2 Inspection Regime	Level 3 Inspection Regime	Condition Rating	Comments and Key Considerations
Stanley Street Road Bridge	Bi-annually	Every 3 years	As required	7.5	Sub-structure has a considerable amount of rot causing a loss of structural capability.
Stephens Street Footbridge	Bi-annually	Every 3 years	As required	7.0	Abutments have rotated considerably and a pile has visibly settled by a significant amount. Beams have large cracking and corrosion.
Viaduct Road Footbridge	Bi-annually	Every 3 years	As required	7.0	Piers and columns have large amount of cracking and spalling. Reinforcement has corroded considerably.
Ziegler Parade Road Bridge	Bi-annually	Every 3 years	As required	7.0	Extreme spalling on longitudinal beams, piers and cross-beams. Reinforcement extensively exposed in multiple locations.
Daltons Road Road Bridge	Bi-annually	Every 3 years	As required	6.5	Cracking present in the deck. Stone abutments are cracking and damaged in multiple locations.
Wellington Street Road Bridge	Bi-annually	Every 3 years	As required	6.0	Recent replacement of deck segment and extension of steel beams. Steel beams beginning to corrode and timber sub-structure rotting.
Wollaston Road Footbridge	Bi-annually	Every 3 years	As required	6.0	Deck and handrails are extensively rotted. On the heritage register.

11.6 Bridge and Major Culvert Asset Register

BRIDGE LOCATION DETAIL											
ROAD NAME	LOCATION in m	REFERENCE CHAINAGE 00 AT	STREAM NAME	Bridge or Major Culvert	Total Width m	Total Length m	Deck Area m^2	Construction Standard	Condition 0-10	Construction Date M/Y	**GENERAL DESCRIPTION**
Boston Dr Reserve	20	Boston Drive	N/A	Footbridge	3.0	3.6	10.8	Footbridge Low Standard	**0.0**	2011	Small Decorative footbridge that is not needed as a water crossing
Botanic Gardens Warrnambool	40	South of Botanic Rd	N/A	Footbridge	1.7	19.0	32.3	Footbridge High Standard	**5.0**	1930	Ornamental stone and RC arch bridge in Botanic Gardens
Daltons Rd	20	Ardlie Rd	Russells Ck	Footbridge	2.5	20.2	50.5	Footbridge High Standard	**0.0**	2016	Large 3 span high construction standard footbridge with laminated timber main beams
G.G. Payne Reserve: stormwater outlet	30	West of The Esplanade	N/A	Footbridge	1.2	2.4	2.88	Footbridge Medium Standard	**2.0**	2012	Twin cell 1200 x 600 Precast RC bow culverts as pedestrian footbridge
Goodwin Ave	10	Cleveland St	N/A	Footbridge	2.2	3.5	7.7	Footbridge Low Standard	**0.0**	2011	Small footbridge across drain in middle of road
Jubilee Park (Allansford): River bank walking trail	200	East of Jubilee Park Rd	N/A	Footbridge	3.0	8.1	24.3	Footbridge Low Standard	**4.0**	2000	Three span timber footbridge of all timber construction
Jubilee Park (Woodford)	50	West of Park Car Park	Merri River	Footbridge	2.6	18.9	49.14	Footbridge Low Standard	**1.0**	2011	Large 5 span footbridge
Jubilee Park (Woodford)	130	North of the end of Victoria St	Merri River	Footbridge	1.5	38.9	58.35	Footbridge Medium Standard	**0.0**	2015	Long timber footbridge with some steel members

Lake Pertobe Reserve Footbridge 9	20	West of Maze	N/A	Footbridge	1.6	4.8	7.68	Footbridge Low Standard	**4.0**	1995	Small 3 span low construction standard Timber Arch type footbridge
Lake Pertobe Reserve Footbridge 1	100	North of Pertobe Rd	N/A	Footbridge	2.8	34.3	96.04	Footbridge Medium Standard	**2.0**	2013	Full Timber footbridge with Laminated timber main beams
Lake Pertobe Reserve Footbridge 2	160	North of Pertobe Rd	N/A	Footbridge	2.8	24.4	68.32	Footbridge Medium Standard	**0.0**	2015	Full Timber footbridge with Laminated timber main beams
Lake Pertobe Reserve Footbridge 3	120	North of Pertobe Rd	N/A	Footbridge	2.8	20.7	57.96	Footbridge Medium Standard	**1.0**	2015	Full Timber footbridge with Laminated timber main beams
Lake Pertobe Reserve Footbridge 4	110	North of Pertobe Rd	N/A	Footbridge	1.5	16.7	25.05	Footbridge Low Standard	**6.0**	1980	Full Timber footbridge Within Lake Pertobe Reserve with laminated arch main beams
Lake Pertobe Reserve Footbridge 5	120	North of Pertobe Rd	N/A	Footbridge	1.5	20.6	30.9	Footbridge Low Standard	**7.5**	1970	Timber suspension bridge in Lake Pertobe Reserve with two short approach spans and one large suspension span
Lake Pertobe Reserve Footbridge 6	160	North of Pertobe Rd	N/A	Footbridge	1.8	9.5	17.1	Footbridge Low Standard	**7.0**	1980	Full Timber Triple span footbridge Within Lake Pertobe Reserve
Mortlake Rd Footbridge East Side	80	North of Moore St	Russells Ck	Footbridge	2.5	8.1	20.25	Footbridge High Standard	**0.0**	2016	Abutments only in place at time of inspection in July 2016
Mortlake Rd Footbridge West Side	80	North of Moore St	Russells Ck	Footbridge	1.7	9.5	15.675	Footbridge High Standard	**6.0**	1993	Single span large timber footbridge
Russells Ck Footbridge 1	95	South of Glenbane Ct	Russells Ck	Footbridge	2.5	24.8	62	Footbridge Medium Standard	**6.0**	2002	Large 7 span timber footbridge of medium construction Standard
Russells Ck Footbridge 2	100	East of Dunlea Ct & Moonal Sts Intersection	Russells Ck	Footbridge	2.3	17.2	39.56	Footbridge High Standard	**4.0**	1987	Large single span Footbridge of high construction standard
Russells Ck Footbridge 3	50	East of Wares and 70 South of Whites	Russells Ck	Footbridge	2.4	6.2	14.88	Footbridge Medium Standard	**4.0**	1995	Timber footbridge with inadequate main beam

St James Park	70	Wollaston Rd Suspension Bridge	N/A	Footbridge	2.8	4.2	11.76	Footbridge Low Standard	**2.0**	2013	Small Full timber Footbridge within a reserve
Stephens St	20	Denman Dr	Merri River	Footbridge	1.4	30.0	42	Footbridge High Standard	**7.0**	1922	Large old RC footbridge in very poor condition
Viaduct Rd	330	Stanley St	Merri River	Footbridge	2.4	76.2	179.07	Footbridge High Standard	**7.0**	1945	Large high profile footbridge with RC sub structure and Timber deck
Wellington St Footbridge	75	McGennan Street	Merri River	Footbridge	2.5	22.4	56	Footbridge High Standard	**0.0**	2015	Large single span high construction standard Foot Bridge
Wollaston Rd Footbridge	440	Mortlake Rd	Merri River	Footbridge	4.2	37.6	157.92	Footbridge High Standard	**6.0**	1890	Very old single span historic suspension bridge now used as footbridge
Aberline Rd	100	Whites Rd	Russells Ck	Major Culvert	11.2	8.2	91.84	Precast RC Crown Units	**0.0**	2014	5 Cell Slab Linked 1500 x 1500 Precast RC Crown Units
Bromfield St	70	North of Barbers Lane	Russells Ck	Major Culvert	13.8	3.1	42.78	Precast RC Pipe	**4.0**	1970	Six cell 600 Diameter Precast RC Pipes
Carrolls Road	75	East of Tooram Rd	N/A	Major Culvert	8.3	1.1	9.13	Reinforced Concrete and Steel Culvert	**6.0**	1970	Single cell 1100 Diameter Corrugated Galvanised Steel Culvert
Garden St	210	North of Moore St	Russells Ck	Major Culvert	18.9	4.8	90.72	Precast RC Pipe	**4.0**	1960	Four Cell 1200 Diameter Precast RC Pipes
Horne Rd	200	North of Rodgers Road	Russells Ck	Major Culvert	14.7	12.5	183.75	Precast RC Crown Units	**0.0**	2014	Four cell 3000 x 1500 Precast RC Slab Linked crown units
Lake Pertobe Pedestrian Underpass	20	East of Maze and under Pertobe Rd	N/A	Major Culvert	21.1	3.0	63.3	Precast RC Crown Units	**3.0**	1985	Single cell 3080 x 2600 Precast RC Crown unit as pedestrian underpass
Plumbers Hill Rd	210	Bridge Rd	N/A	Major Culvert	11.1	1.0	11.1	Masonry Culvert	**3.0**	1900	900 x 1500 Old Dressed Stone Arch Culvert - Extended in 2011

Plumbers Hill Rd	710	Bridge Rd	Yarp Turk Ck	Major Culvert	12.5	2.4	30	Precast RC Pipe	**2.0**	2011	Twin Cell 1200 Diameter Precast RC Pipe
Queens Road	120	North of Botanic Rd	Russells Ck	Major Culvert	20.0	2.4	48	Precast RC Pipe	**4.0**	1963	Twin Cell 1200 Diameter RC Pipes with cast in Place RC deck slab both sides as pedestrian extensions
Skuses Rd (215m east of Dallimores Rd)	215	East of Dallimores Rd)	N/A	Major Culvert	16.4	0.9	14.76	Precast RC Pipe	**2.0**	1995	Single cell 900 Diameter Precast RC Pipe
Tooram Rd	550	Zeigler Parade	N/A	Major Culvert	11.1	2.1	23.31	Precast RC Pipe	**1.0**	2002	Single Cell 2100 Diameter Precast RC Pipe
Tower Hill Rd	270	East of Conns Lane	N/A	Major Culvert	13.8	1.2	16.56	Precast RC Crown Units	**4.0**	1910	Old Stone arch culvert with 1200 x 900 RC Box culvert extensions both sides
Wangoom Rd	260	East of Wrights Rd	N/A	Major Culvert	14.5	1.8	26.1	Precast RC Crown Units	**3.0**	1985	Twin Cell 900 x 900 ,Precast Arc Box culverts
Whites Rd	135	Aberline Rd	Russells Ck	Major Culvert	22.2	1.4	31.08	Precast RC Crown Units	**3.0**	1990	Single Cell 1350 Diameter Precast RC Pipe
Whites Rd	450	Aberline Rd	Russells Ck	Major Culvert	22.5	2.4	54	Precast RC Pipe	**3.0**	1990	Twin Cell 1200 Diameter Precast RC Pipe Culvert
Daltons Rd	20	Ardlie Rd	Russells Ck	Road Bridge	9.2	6.2	57.04	B/M/S	**6.5**	1910	Old stone Abutment single span bridge extended around 1970
Harris St Road Bridge	10	at McDonalds St	Merri River	Road Bridge	11.6	33.8	392.08	Full Reinforced Concrete	**2.0**	1995	Large 3 Span full RC Road Bridge
Hopkins Point Rd	30	Hickford Pde	Hopkins River	Road Bridge	14.5	168.4	2441.8	Full Reinforced Concrete	**1.0**	2000	Large 11 span full RC Road Bridge - With cantilevered Ped. Walkways attached both sides
Skuses Rd	500	Dallimores Rd	N/A	Road Bridge	5.8	9.5	55.1	Reinforced Concrete and Timber	**3.0**	1980	Single span road bridge with timber deck

Stanley St Road Bridge	30	Pertobe Rd	Merri River	Road Bridge	8.5	35.5	301.75	Timber Construction	**7.5**	1900	Large 5 Span full Timber Road Bridge - Foundations being the weakest link does not warrant works – Replace
Swinton St Road Bridge	830	Kennedy Street	Merri River	Road Bridge	9.2	21.5	197.8	Reinforced Concrete and Steel	**2.0**	1994	Large 2 Span RC bridge with Steel Stringers
Wares Rd	90	Whites Road	Russells Ck	Road Bridge	10.8	12.6	136.08	Reinforced Concrete and Steel	**1.0**	1995	Large single span RC road bridge with Steel stringers
Wellington St Road Bridge	75	McGennan Street	Merri River	Road Bridge	8.1	22.2	179.82	Reinforced Concrete and Timber	**6.0**	1950	Old 3 Span road bridge with some major timber components
Wollaston Rd Road Bridge	440	Mortlake Rd	Merri River	Road Bridge	9.0	46.5	418.5	Reinforced Concrete and Steel	**5.0**	1965	Large 3 Span RC Road Bridge with steel Stringers
Ziegler Pde	80	Princess Hwy	Hopkins River	Road Bridge	7.7	51.2	394.24	Full Reinforced Concrete	**7.0**	1937	Large old 6 Span RC Road Bridge on bluestone foundations

11.7 Bridges and Major Culverts Managed by Other Authorities

Assets not Included in this Plan

Asset Location	Asset Type	Responsible Authority
Mortlake Road (Botanic – Rosyln) (Steel Single Cell)	Major Culvert	VicRoads
Mortlake Road (Botanic – Rosyln) (Twin-Cell RC)	Major Culvert	VicRoads
Princes Highway (Garabaldi – Allansford-Wangoom)	Road Bridge	VicRoads
Princes Highway (Illowa – Esplanade)	Road Bridge	VicRoads
Princes Highway (Drummond – Lindsay)	Road Bridge	VicRoads
Princes Highway (Illowa – Esplanade)	Major Culvert	VicRoads
Princes highway (Staffords – Jubilee Park Rd)	Major Culvert	VicRoads
Princes Highway (Staffords – Aitken)	Major Culvert	VicRoads
Pertobe Road (Merri – Surf Club)	Road Bridge	VicTrack
McMeekin Road (Albert – Koroit)	Road Bridge	VicTrack
Bostock Road (Gladstone – Maxwell)	Road Bridge	VicTrack
Hopkins Point Road (Kinnear - Tooram)	Major Culvert	Glenelg Hopkins Catchment Management Authority
Buckleys Rd (Dallimores – Hugh)	Major Culvert	Glenelg Hopkins Catchment Management Authority