CITY OF ARMADALE

AGENDA

OF **TECHNICAL SERVICES COMMITTEE** TO BE HELD IN THE **COMMITTEE ROOM**, ADMINISTRATION CENTRE, 7 ORCHARD AVENUE, ARMADALE ON **MONDAY, 6 SEPTEMBER 2021 AT 7.00PM.**

A meal will be served at 6:15 p.m.

PRESENT:

APOLOGIES: Cr G Nixon (Leave of Absence)
Cr K Busby (Leave of Absence)

OBSERVERS:

IN ATTENDANCE:

PUBLIC:

*"For details of Councillor Membership on this Committee, please refer to the City's website – **www.armadale.wa.gov.au/your council/councillors**."*

DISCLAIMER

The Disclaimer for protecting Councillors and staff from liability of information and advice given at Committee meetings to be read.

DECLARATION OF MEMBERS' INTERESTS

QUESTION TIME

Public Question Time is allocated for the asking of and responding to questions raised by members of the public.

Minimum time to be provided – 15 minutes (unless not required).

Policy and Management Practice EM 6 – Public Question Time has been adopted by Council to ensure the orderly conduct of Public Question time and a copy of this procedure can be found at http://www.armadale.wa.gov.au/PolicyManual.

It is also available in the public gallery.

The public's cooperation in this regard will be appreciated.

DEPUTATION

CONFIRMATION OF MINUTES

RECOMMEND

Minutes of the Technical Services Committee Meeting held on 2 August 2021 be confirmed.

ITEMS REFERRED FROM INFORMATION BULLETIN

If any of the items listed above require clarification or a report for a decision of Council, this item to be raised for discussion at this juncture.

CONTENTS

TECHNICAL SERVICES COMMITTEE

6 SEPTEMBER 2021

1.1 - APPLICATION TO CLEAR NATIVE VEGETATION - FORREST ROAD WIDENING PROJECT

WARD	:	ALL
FILE No.	:	M/301/21
DATE	:	29 April 2021
REF	:	AB/KB/DH/AO
RESPONSIBLE MANAGER	:	Executive Director Technical Services

In Brief:

- The City's Works Program includes a project to widen Forrest Road between Eighth Road and Ninth Road in Armadale.
- The environmental implications and a review of the applicable environmental regulation and licence requirements are presented in this report for Council's consideration.
- This report recommends that Council authorise the Chief Executive Officer to sign an Application to Clear Native Vegetation under the *Environmental Protection Act 1986* and to refer the proposal to the Department of Agriculture, Water and Environment for assessment under the *Environmental Protection and Biodiversity Conservation Act 1999*.

Tabled Items

Nil.

Decision Type

☐ **Legislative** The decision relates to general local government legislative functions such as adopting/changing local laws, town planning schemes, rates exemptions, City policies and delegations etc.

☒ **Executive** The decision relates to the direction setting and oversight role of Council.

☐ **Quasi-judicial** The decision directly affects a person's rights or interests and requires Councillors at the time of making the decision to adhere to the principles of natural justice.

Officer Interest Declaration

Nil.

Strategic Implications

The subject of this report has impact on the following objectives of the Strategic Community Plan 2020-2030:

2.1 Conservation and restoration of the natural environment

2.1.6 Protect soil and land resources throughout the City.

2.1.7 Biodiversity is managed to preserve and improve ecosystem health.

2.1.8 Facilitate the creation of partnerships and support strategies for the maintenance and enrichment of the natural environment.

Legal Implications

An assessment of legislative and regulatory requirements that are applicable to the proposed works is summarised below.

Federal legislation (matters of National Environmental Significance):

- *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act)

State legislation (significant proposals, proposals likely to have an impact of protected matters, clearing proposals):

- *Biodiversity Conservation Act 2016* (BC Act)
- *Environmental Protection Act 1986* (EP Act), Section 51 (Clearing of native vegetation)
- *Environmental Protection (Clearing of Native Vegetation) Regulations 2004*

Council Policy/Local Law Implications

Assessment of Policy/Local Law indicates that the following are applicable:

- *PLN 2.4 Landscape Feature and Tree Preservation* focuses on the retention of trees and landscape features that are deemed significant by the community and to advocate for environmental offset within the City's municipal boundary. Further the policy outlines the environmental offset to be located within the local suburb of development. Offset options are discussed later in the report.

Budget/Financial Implications

Provision has been made within the 2021/22 Budget and Long Term Financial Plan estimates for the expenditure associated with the clearing permit application cost, including the costs associated with the implementation of a successful application.

Consultation

- Intra Directorate.

BACKGROUND

The City's Works Program includes a road construction proposal for the widening of Forrest Road between Eighth Road and Ninth Road in Armadale (refer Attachment 1 - Forrest Road Survey Area). The proposed works necessitate the clearing of native vegetation.

The proposed improvements to Forrest Road are consistent with the road infrastructure required to accommodate the Wungong Redevelopment Area and specifically the traffic demands of the Wungong road network. Forrest Road is a key strategic link running east/west that connects Armadale and neighbouring suburbs to the Tonkin Highway and Armadale Road; both important major routes serving the Wungong area.

The Wungong Urban Water Project showcases best practice in sustainable urban development incorporating natural resource management, water sensitive design, integration of natural drainage systems, soil improvements and energy efficient housing and infrastructure. A focus of the project includes the implementation of improved surface water quality and ground water quality. The improvement of Urban Waterways include restoration along 6,400m of the Wungong River by altering a straight engineered section to a natural meandering low flow waterway that enhances environmental values.

Further improvements include the creation of new low flow Living Streams, south of Forrest Road Bridge (1,200m) and north of Neerigen Brook South (1,800m). The conversion of existing drains to living streams include:

- Neerigen Brook North (1,120m)
- Neerigen Brook South (3,050m)
- Brickworks Drain (1,650m)
- Berriga Main Drain (800m).

The project will provide a high quality living environment for up to 40,000 people with retail opportunities and integrated open space energising what has previously been a largely dormant metropolitan corridor.

A report was considered by Council on 22 March 2011 whereby Council acknowledged the requirement for a future road upgrade as part of the Wungong development. It was determined that opportunities be examined to avoid removal of trees where possible, however that ultimately the road upgrade may necessitate their removal and that St Francis Xavier School be notified of the removal.

The tender for Stage 1 of the Eighth Road project, the widening between Forrest Road and Gribble Avenue, has already been awarded and is to commence soon.

Stage 2 of the project was considered by Council in May 2021 and provides for the completion of the section of road linking the Eighth/Armadale Road intersection. Following completion of the City's works, the intersection is to be upgraded to a signalised intersection by Main Roads Western Australia (MRWA) during the 2022/23 financial year.

Stage 3, the subject of this report, provides for the completion of the section of road for which the City is responsible and links to the Forrest Road/Tonkin Highway intersection, which is a key route within the Wungong Urban Water Redevelopment Scheme managed by DevelopmentWA (DWA) and the Metropolitan Regional Road Group administered by MRWA.

This set of projects addresses the road capacity issues on the route and supports increased traffic volumes generated by additional population and commerce.

Consultant, 360 Environmental, was engaged in February 2021 to identify the environmental values (flora and fauna) associated within the Forrest Road reserve in order to determine the extent of environmental impact and relevant state and federal environmental legislation with which the City is required to comply.

360 Environmental was engaged to undertake a biological assessment of the entire road reserve and its comprising native vegetation. The proposed impact of the works has subsequently been determined based on an analysis of the values identified in the *360 Environmental Flora, Fauna and Black Cockatoo Assessment 2021* and detailed design clearing plans.

DETAILS OF PROPOSAL

The concept design of the Forrest Road widening project (between Eighth Road and Ninth Road) initially included a clearing requirement for 239 trees to accommodate a District Entry Road as identified in the Wungong Master Plan. The concept showed a dual traffic lane cross section separated by a three metre wide median island and cycle lanes either side. The necessity for a four lane dual carriageway is based on the forecast traffic volumes of Forrest Road as it supports the growth of the Wungong development area.

Although removal of vegetation was acknowledged by Council in March 2011, as part of the review to retain as many trees as possible, the design was amended to reduce the overall width including:

- A reduced median width to two metres
- Horizontal curve geometry reduced to the minimum radius to suit a design speed of 60km/hr
- Removal of cycle lanes and provision of a shared path on the northern verge
- Removal of the southern footpath (school side) from the design
- Removal of deceleration slip lanes to minor side roads.

The design amendments have provided an opportunity to retain the majority of south-east trees near St Francis Xavier School with the potential for a future footpath to be constructed within their lot, around the existing vegetation (refer Attachment 2 - Forrest Road Designs 2014-2021).

Further reduction of the median island width is not recommended as two metres is the minimum width required for the safe accommodation of signs, street lighting and pedestrian crossing protection. The road was aligned to the north into the cleared, developed side of Forrest Road as far as the minimum horizontal curve geometry allowed, using a reduced design speed (refer Table 1).

Table 1. Progression of design options for Forrest Road 2014-2021

YEAR	DESIGNER	DRAWING NO.	MEDIAN WIDTH	DESIGN COMMENT
2014	GHD	61-30224-C145 & C146	6m	Full land acquisition both sides
2021	COA	E20-176-SK1-03	3m	Land acquisition one side (school)
2021	COA	E20-176-SK1-03A	3m	No land acquisition Reduced design speed Reduced tree removal
2021	**COA**	**E20-176-SK4-01**	**2m**	No land acquisition Reduced design speed Remove cycle lanes Remove footpath (southern side) Remove deceleration slip lanes Reduced tree removal Reduced median width

As a result of the above measures being taken, 89 trees as opposed to 239 trees, are to be impacted by the proposed works. Of the 89 trees, six are exotic and 83 are native.

The progression of design options and location of the proposed trees for removal can be viewed in Attachment 2.

The environmental values of the vegetation within the Forrest Road reserve have been assessed in accordance with biological survey methods and described in terms of legislative and policy frameworks for protection of native flora and fauna. For example, the assessment of environmental values and proposed impacts is often undertaken in the context of a ‘likelihood of occurrence’. This is to ensure the consideration of values that may not be physically observed during a survey but may still occur. The likelihood of occurrence criteria for flora and fauna is provided in Table 2 and is summarised in Table 3.

Table 2: Flora and fauna species likelihood of occurrence criteria

Rank	Criteria
Previously Recorded	The species has been previously recorded in the Survey Area
High (Likely to occur)	• There are existing records of the species in close proximity to the Survey Area (within 5 km), and for fauna has been recorded in the Survey Area in the last 15 years • The species is strongly linked to a specific habitat, which is present in the Survey Area; or • The species has more general habitat preferences, and suitable habitat is present.

Medium
(May occur)
	• There are existing records of the species from the locality (within 10 km), however
	  ○ The species is strongly linked to a specific habitat, of which only a small amount is present in the Survey Area; or
	  ○ The species has more general habitat preferences, but only some suitable habitat is present.
	• There is suitable habitat in the Survey Area, but the species is recorded infrequently in the locality.

Low (Unlikely to occur)	• The species is linked to a specific habitat, which is absent from the Survey Area; or • Suitable habitat is present, however there are no existing records of the species from the locality despite reasonable previous search effort in suitable habitat; or • There is some suitable habitat in the Survey Area, however the species is very infrequently recorded in the locality.

Table 3: Summary of environmental values and proposed impact – Forrest Road, Armadale

Environmental value	Summary of findings	Potential impact of proposal
Flora of conservation significance	No federal or state listed conservation significant species were identified within the survey area. Historical disturbance to the survey area that has resulted in its degradation means it is unlikely to support any conservation significant flora.	Nil
Vegetation of conservation significance	The vegetation observed within the Study Area does not correlate with any known Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) and is therefore not considered conservation significant.	Nil
Fauna of conservation significance	A flock of 100 individuals of conservation significant fauna species, the Forest Red Tailed Black Cockatoo (*Calyptorhynchus banksia naso*) were recorded moving around the survey area during the field survey. Based on the quantity and proximity of local records, and the presence of foraging and potential breeding and roosting habitat, three conservation significant species were considered to have a 'High Likelihood' to occur within the Survey area: Forest Red Tailed Black Cockatoo (*Calyptorhynchus banksia naso*), Carnaby's Cockatoo (*Calyptorhynchus latirostris*) and Baudin's Cockatoo *Calyptorhynchus baudinii*	See cell below with regard to Cockatoos
Potential Black Cockatoo Habitat (Foraging/ Roosting/Breeding)	Foraging (potential) – 1.43ha of 'Very High Quality' (score of 11) for Carnaby's cockatoo, Baudin's cockatoo, and Forest Red-tailed Black Cockatoo and 0.11ha of Medium quality habitat recorded.	Approximately 82 trees are proposed to be cleared or potentially impacted that were identified as having Black Cockatoo foraging value as shown in Attachment 3 - Potential Habitat Trees.
	Breeding (potential) – 117 trees identified within the Study Area were of a suitable size and species to support black cockatoo breeding with the most common species being marri (*Corymbia calophylla*). None of these were found to contain hollows.	26 trees are proposed to be cleared or impacted that were identified with DBH >500mm which support potential Roosting and Breeding trees. These are listed in Attachment 3.
	Roosting (potential) - Evidence of scat within the survey area, this may indicate roosting activity however may be due to foraging activity. A confirmed Forest Red-tailed Black Cockatoo roosting site occur 120m south of the survey area in a patch connected to the survey area.	Approximately 48 trees are proposed to be cleared or impacted that were identified as potential roosting trees. These are shown in Attachment 3.

Legislative Process for Approvals (Environmental Compliance)

The Forrest Road reserve is primarily landscaped verge with sections of large remnant trees. No threatened or priority listed flora was recorded and the vegetation was not analogous with any Threatened Ecological Communities (TECs) or Priority Ecological Communities (PECs) known to occur nearby.

The proposed clearing of 83 native trees, triggers the requirement for a Clearing Permit under the *Environmental Protection Act 1986 (Clearing of Native Vegetation) Regulations 2004* as issued by the Department of Water and Environmental Regulation (DWER).

Recorded sightings of Forest Red-tailed Black Cockatoos feeding within the road reserve, the presence of marri (*Corymbia calophylla*) and jarrah (*Eucalyptus marginata*) trees and the occurrence of trees described as suitable potential roosting or breeding trees (trees of a suitable diameter at breast height to develop a nest hollow over time) demonstrates the road reserve's value for black cockatoo species.

The proposed impact on 83 foraging trees has been evaluated with regard to the EPBC Act Referral Guidelines for black cockatoo species (Table 4). In accordance with the analysis, a referral of the proposal for assessment in accordance with the EPBC Act is recommended.

Table 4: Evaluation of the impact of the Forrest Road proposal against the EPBC Act Referral Guidelines for three threatened black cockatoo species. The uncertain referral category reflects a proposed change in referral requirements.

Impacts considered high risk/significant where a referral is recommended	**Impacts considered uncertain where a referral may be required**	**Summary of proposed impact of the Forrest Road clearing proposal**
Clearing of any known nesting tree (any existing tree where breeding has been recorded or suspected)		Nil.
Clearing or degradation of any part of a vegetation community known to contain breeding habitat (trees of species known to support breeding within the range of the species which either have suitable nest hollow are of a suitable diameter at breast height to develop a nest hollow over time)		89 trees identified within the Study Area boundary were of a suitable size and species to potentially support black cockatoo breeding and are proposed to be cleared. No trees currently have hollows which support breeding.
Clearing of more than 1ha of quality foraging habitat	The survey identified 1.54ha of foraging habitat. 1.43ha of very high quality.	83 with potential foraging value are proposed to be cleared. The total clearing area for these trees is more than 1ha.
Clearing or degradation (including pruning the top canopy) of a known night roosting site	Scat evident, this could indicate roosting activity, however may be due to foraging activity	A known Forest Red-tailed Black Cockatoo roosting site occurs 120m south of the DE, therefore it is likely the site is used for roosting.

Impacts considered high risk/significant where a referral is recommended	Impacts considered uncertain where a referral may be required	Summary of proposed impact of the Forrest Road clearing proposal
Creating a gap of greater than 4km between patches of black cockatoo habitat (breeding, foraging or roosting)		Although the Study Area is located within a highly urbanised local environment, it is in the vicinity of Forrestdale Lake Nature Reserve (~2.7km southwest) and other reserves exist within 5km eg. Armadale Settlers Common, Bungendore Park – Wungong Regional Park, Champion Lakes (Bush Forever 255 and 260), Jandakot Regional Park. It is highly likely that the surrounding region contains additional foraging habitat for black cockatoos. Although breeding site locations are confidential, Bird Life database suggests that it is highly likely Black Cockatoo breeding occurs within the surrounding area.

Construction and Environmental Management

A Construction Environmental Management Plan is proposed to be prepared to support the project works. This document will consider matters such as the reuse of large pieces of timber and hollows for environmental purposes elsewhere in the City, the management of fauna (ie.checking hollows prior to felling) and other relevant matters.

Environmental Offsets

The Department of Water and Environmental Regulation (the Department) are the regulating body who ultimately determine offset requirements however, as part of the City's application to the Department, the City is looking at options to apply a suitable offset ratio within the City's local municipality.

There are a number of habitat belts where offsets could be targeted. Some reserves identified as potential offset locations are as follows:

- Neerigen Brook
- Powell Reserve which is located immediately adjacent to the survey area and a known roosting site
- Fletcher Park
- Shipwreck Park.

OPTIONS

In relation to the proposal to clear native vegetation for the purpose of the construction of Forrest Road in Armadale between Eighth Road and Ninth Road, Council could consider the following options.

Option 1

Support the submission of an Application to Clear Native Vegetation under the *Environmental Protection Act 1986*, authorising the Chief Executive Officer to sign the permit application.

Option 2

Support the referral of the proposal under the *Environmental Protection Biodiversity Conservation Act*, authorising the Chief Executive Officer to sign the relevant documentation.

Option 3

Not support the administrative process for the clearing of native vegetation for this purpose. This option is not supported as this will not allow for the improvement of the road network in support of the growth of the Wungong area.

Options 1 and 2 are recommended as these options allow the Forrest Road project to progress towards construction, pending the relevant environmental approvals being obtained.

CONCLUSION

The widening of Forrest Road is included the City's Works Program. These works are likely to require the clearing of 89 trees. Of the 89 trees, 83 are native and therefore require a Clearing Permit under the EP Act.

As the proposal is also likely to have an impact on a matter of National Environmental Significance (namely on Black Cockatoo habitat), a referral under the EPBC Act is also required.

It is therefore recommended that Council authorise the Chief Executive Officer to sign the Application to Clear Native Vegetation under the *Environmental Protection Act 1986* and to refer the matter to the Department of Agriculture, Water and Environment for consideration under the EPBC Act.

RECOMMEND

That Council:

1. **Authorise the Chief Executive Officer to sign a C1 Clearing Permit application for the widening of Forrest Road between Eighth Road and Ninth Road in Armadale to be submitted to the Department of Water and Environmental Regulation in accordance with the *Environmental Protection Act 1986*.**

2. **Authorise the Chief Executive Officer to sign the referral of the Forrest Road widening project to the Department of Agriculture, Water and Environment for assessment under the *Environmental Protection Biodiversity Conservation Act 1999*.**

ATTACHMENTS

1. Forrest Road Survey Area
2. Forrest Road Designs 2014-2021
3. Potential Habitat Trees

1.2 - CORPORATE GREENHOUSE ACTION PLAN

WARD	:	ALL
FILE No.	:	M/514/21
DATE	:	9 August 2021
REF	:	NB/LR/DH
RESPONSIBLE MANAGER	:	Executive Director Technical Services

In Brief:

- Underpinning the recommendations of the Plan is a gap analysis, completed in reference to a framework, recently released by WALGA.
- The Plan is entirely self funded as a result of future income generated by the Flaring Project and proposes to offset the carbon footprint of buildings and fleet in the period 2020/21 to 2029/30.
- This report recommends that Council endorse the 2020/21 to 2029/30 Corporate Greenhouse Action Plan.

Tabled Items

Nil.

Decision Type

☐ **Legislative**	The decision relates to general local government legislative functions such as adopting/changing local laws, town planning schemes, rates exemptions, City policies and delegations etc.
☐ **Executive**	The decision relates to the direction setting and oversight role of Council.
☐ **Quasi-judicial**	The decision directly affects a person's rights or interests and requires Councillors at the time of making the decision to adhere to the principles of natural justice.

Officer Interest Declaration

Nil.

Strategic Implications

The subject of this report has impact on the following objectives of the Strategic Community Plan 2020-2030:

2.1 Conservation and restoration of the natural environment

2.1.1 Sustainability initiatives are supported and implemented throughout the City.

2.1.4 Minimise corporate and community carbon footprints within the City of Armadale.

2.1.5 Minimise impacts on air quality throughout the City.

Legal Implications

General assessment of relevant legislation (eg *Local Government Act 1995*) has not revealed any restrictions.

Council Policy/Local Law Implications

The City's Strategic Environmental Commitment (ENG21), aligned to the Strategic Community Plan, includes the goal of "*Minimising the City's carbon footprint*".

Budget/Financial Implications

The financial implications of the recommendations of this report are entirely self funded. Additional entries into Long Term Financial Plan projections are necessitated to record both income and expense (which balance out). There is no requirement for additional municipal fund allocations.

Consultation

- Intra Directorate.

BACKGROUND

The first City of Armadale Corporate Greenhouse Action Plan (CGAP) covered the period 2008/09 to 2011/12. A subsequent report was produced for 2014/15 to 2019/20. This incorporated carbon reduction targets on a per capita basis, aligned to those set nationally by the federal government:

"19% per capita reduction in 2000 levels by 2020"

The target was achieved, primarily through carbon abatement activities and the purchase of offsets, accredited under the federally supported Climate Active scheme.

The expiry of the 2014/15 to 2019/20 Plan necessitates the production of a new CGAP (the Plan). The focus of this document is the mitigation of City of Armadale (the City) corporate emissions. The Plan is included as Attachment 1 and covers:

- International, national and state level carbon mitigation policy
- Western Australian Local government initiatives
- The duration of the new CGAP
- Current and projected emissions profiles
- A synopsis of current abatement projects and opportunities for improvement
- The development of carbon reduction targets
- An Offsets Strategy, addressing any residual emissions to the target.

The cost implications of future strategies are presented in the document, facilitating transparent decision-making.

Under the 2016 Paris Agreement (PA), Australia has committed to a 26 to 28% reduction in carbon emissions by 2030, relative to 2005 levels.

The Plan provides a synopsis of targets adopted by a cross section of both developing and developed countries. It also highlights targets adopted by the States of Australia and a significant sample of Local Governments in Western Australia. This provides context for the future and proposed actions of the City.

DETAILS OF PROPOSAL

Key features of the Plan are discussed below.

Duration of Plan

Under the PA, Australian carbon emission targets are set to be achieved in 2030. This milestone date is replicated by many countries and several Australian states.

Consequently, it is proposed that the term of the Plan is 2020/21 to 2029/30. This enables a clear indication of how the City's activities contribute towards national and international carbon reduction targets.

Emissions Profile

The starting point of the new Plan is the closing position of the last CGAP. In this sense, the previously reported carbon footprint of the City is highlighted as follows:

Table 1: Analysis of City Emissions in 2019/20

Emissions Component	Tonnes of Carbon Dioxide Equivalent (tCO_2-e)
Gross Waste Emissions	**52,887[1]**
Amounts Flared	(9,833)[1]
Net Waste Emissions	**43,055[1]**
Buildings	**4,366[2]**
Fleet	**132[2]**
Total	**47,553**

[1] Calculated using the Federal government Solid Waste Calculator
[2] Provided by carbon accounting software (third party)

The Plan uses the emissions categories of Waste, Buildings and Fleet as a basis for exploring carbon abatement opportunities.

Forecasting

Emissions generated by Waste, Buildings and Fleet are forecast to 2029/30. In each case, there is estimated to be a gradual increase. The figures for the final year of the Plan have been calculated as follows:

- Waste (58,342tCO_2-e)
- Buildings (5,414tCO_2-e)
- Fleet (259tCO_2-e)

This is based on a series of assumptions documented in the Plan.

For Buildings and Fleet, population growth is used as a proxy for the carbon footprint. Collectively, these account for 9% of the City's emissions.

The Hopkinson Road and Landfill Recycling Facility (the Landfill Site) accounts for 91% of the City's emissions profile and is about to enter a period of transition. In 2022, municipal waste will be diverted to the Avertas Waste to Energy Facility (WTEF) in Kwinana. Therefore, assumptions have been made around commercial contracts and the associated magnitude and type of waste.

The process followed, and supporting tools, used for Waste forecasts are consistent with that applied in the previous CGAP. This has been audited as part of submissions under the Climate Solutions Fund for the Landfill Flaring project.

As well as providing context for recommendations in the Plan, the forecasts provide a framework to quantify the level of abatement required for emissions targets. This may then be used as a basis for establishing the cost of meeting targets. This is discussed further below.

Carbon Accounting

WALGA has recently established a 'Carbon Accounting Group, consisting of LG members. The City has been added as a participant. The Terms of Reference include an objective to '*Establish an agreed guide as to what corporate carbon emission sources should be tracked by Local Governments*'.

The Group intends to formulate an accounting position on household waste diverted to the WTEF. This will guide the extent to which LGs incorporate carbon emissions into their profile (as a Scope 3 emission).

Avertas will receive the waste, in consideration for Local Government financial contributions. It is also possible that they will seek to register the combustion process as an abatement project (as it avoids CH_4 emissions). This may result in an additional income stream for the Kwinana site.

Avertas, therefore, receives a financial benefit for the service provided, at a cost to the LGs, including the City. From this perspective, it would be inequitable for the CoA to account for the carbon, and any potential related costs (e.g. mitigation through the purchase of offsets, or staff time in the preparation of carbon statements).

From this perspective, the 'carbon burden' should be matched with the revenue, and not borne by the City.

Gap Analysis

WALGA recently released a comprehensive list of actions with the capacity to reduce greenhouse gas emissions in Local Governments (the WALGA Action Planning Tool – 'WALGA Tool'). This was developed in collaboration with Ernst and Young, and a Local Government working group.

The list of 49 actions was considered as part of a multi-disciplinary internal workshop, and a gap analysis performed by City staff. This identified existing practices and opportunities for improvement. Additional actions were also suggested, above and beyond those included in the WALGA list.

The results are documented in Appendix 5 to the Plan. This analysis forms the basis of most of the twenty-four recommendations in the Plan.

City of Armadale Targets

The Plan considers potential emissions abatement targets that Council may or may not adopt. Here, emissions forecasts are compared to a number of reduction trajectories, reaching a defined emissions figure in 2029/30. These options include, but are not limited to, alignment with national targets under the Paris Agreement.

A Cost Benefit Analysis is performed on each option, highlighting potential budgetary requirements for each.

ANALYSIS

The key recommendations of the Plan are summarised as follows:

Policy/Strategic Documents

The WALGA Tool, referred to above, was issued in conjunction with the following templates:

1. Climate Change Declaration: Provides a clear statement that Local Governments accept the science of climate change and commit to adopting climate change adaptation and mitigation strategies.
2. Climate Emergency Declaration: Maybe adopted by Local Governments committed to taking urgent climate action and allocating resources accordingly. This involves rapidly scaling up mitigation and adaptation actions.
3. Corporate Adaptation Plan Template: This specifically focuses on identifying actions for Local Governments to manage climate risks, and adapt to the operational impacts of climate change.
4. Corporate Mitigation Action Plan: This identifies actions that Local Governments can take to reduce greenhouse gas emissions and help avoid future impacts of climate change.

The City has not endorsed a Climate Emergency Declaration but did sign a Climate Change Declaration in 2011, submitted to State Council. Given its age, the currency of this document needs to be reviewed, as does the potential for developing an Emergency Declaration.

The potential impacts of climate change are evaluated through the City's Risk Management Framework. Risks and mitigating controls are periodically evaluated by the Executive Leadership Team (ELT).

Nevertheless, it would be beneficial to conduct a review of the Climate Change Adaptation WALGA template and assess any potential implementation benefits. This is scheduled for completion in 2022/23.

Waste

Flaring Project and Income

<u>Existing Contract and Project Period</u>

The City is in a seven year contract with the Federal government. This is for the provision of 68,000 tonnes of carbon abatement. As previously reported, enough surplus credits have accrued to complete the contract. The City's Australian National Registration of Offset Unit (ANREU) account highlights the holding of 16,810tCO_2-e ACCUs. However, only 9,716tCO2-e are required to satisfy the contract, leaving a residual of 7,094tCO_2-e.

The City may request that the Clean Energy Regulator draw the arrangement to a conclusion, triggering the transfer of 9,716 units from the City's ANREU account. The Manager Environmental Services and Executive Director Technical Services are the respective 'Initiator' and 'Approver' of transactions on the ANREU system (as approved by the previous CEO).

Despite contractual obligations being fulfilled, there is a requirement to produce a final Offset Report for 20 June 2020 to 13 December 2021 (the scheduled end date of the project).

This is likely to record that abatement of approximately 12,000 to 13,500 units has been generated over the final project period (eighteen months). This is above and beyond the requirements of the contract.

These units may be combined with residual holdings of 7,094tCO_2-e, resulting in a total of 19,000 to 20,500tCO_2-e. An option is to sell these on the Voluntary Market as a one off sale. The current spot price of carbon is $18.50. Following the application of a 15% contingency, to cover broker commission and market fluctuations, a price of $15.7 per unit is likely. Hence, they have an approximate value of $310,000, constituting additional unbudgeted income.

Future Project Options

The regulator has recently announced that all CSF Flaring projects may be extended by five years. For the City, this means a potential total life span of twelve and a half years. There are three possible approaches to the treatment of the project, summarised below and evaluated in detail in the Plan.

Table 2: Financial Summary of Options for the Flaring Project

Option	Explanation	Net Financial Impact $
1.	Extend the project – Sell City generated Australian Carbon Credit Units (ACCUs) on the Voluntary Market	666,890
2.	Extend the project – Do not sell City generated ACCUs and surrender credits to the Federal government	(105,000)*
3.	Do not extend the project – Account for flare abatement in-house	0

*relates to compliance costs

Of the alternatives, Option 1 creates a position of financial surplus. This puts the City in a position to potentially fund, or partially fund, the recommendations of the Plan.

The spot price of carbon is considered a conservative estimate. As 2030 approaches, the demand for ACCUs is likely to increase, as State and Local Government targets need to be achieved. This is likely to lead to an increase in price.

The Voluntary Market is proposed as a future sales avenue for carbon credits. This enables the City to sell as many or as few credits as it likes, at a time that suits. There is no risk of failing to achieve set contracted abatement quantities. The alternative is entering into a new contract with the Federal Government. In this scenario, Council will be obliged to provide fixed amounts at a specific point in time. This could provide to be a risky strategy, given the Landfill Site is in a period of transition. For this reason, the Voluntary Market is the preferred approach.

Waste Synopsis

The Plan recommends that the contract with the Federal Government be drawn to an early conclusion. It also proposes that surplus credits generated to date be sold on the Voluntary Market, with those generated in the last eighteen months of the project period. This approach will generate additional unbudgeted income of approximately $980,000 (the last payment will be received in 2028/29).

The continued expansion of Flaring infrastructure at the Landfill Site is also recommended. This will ensure continued carbon abatement, and also maximise revenue from the sale of credits.

Buildings

The City's Contestable sites (>50MwH) are currently supplied by renewable power. This comes at a premium and is approximately 15% more expensive than traditional energy sources.

WALGA is investigating the possibility of a bulk purchase of renewable energy. This will take the form of a Power Purchase Arrangement, scheduled to commence April 2022. It is hoped that this will introduce economies of scale. The City has provided energy use profiles to WALGA, to assist in setting procurement volumes. Suppliers may then use this to determine pricing.

A Memorandum of Understanding has been signed by the City's Chief Executive Officer, enabling participation in the quotation process. A chosen supplier will be selected by WALGA in October 2021. The CoA doesn't need to accept the preferred supplier or pricing on offer.

The Plan recommends that, at this point, a report be produced for Council to consider the commercial and environmental benefits of contracting with the preferred supplier.

Other recommendations include a solar feasibility study for the City's top 20 energy using sites, the implementation of a series of energy efficiency reviews, the deployment of a real-time energy monitoring system, and the development of a sustainable buildings policy.

Fleet

Aside from one vehicle, the City’s fleet is fuelled by traditional sources. There is an opportunity for an ongoing evaluation of alternative technologies and the benefits they may introduce. These include, for example, electric or hydrogen powered vehicles.

The Plan recommends that, at the appropriate juncture, the Assets team prepare a report for Council, incorporating a business case for the implementation of alternatively fuelled fleet vehicles.

Other

Most street lights in Australia are owned and operated by Distribution Network Service Providers. In Western Australia, this is Western Power.

There are 11,000 streetlights in the City, attracting a flat daily tariff. There is limited transparency over the components of this charge, particularly for electricity and maintenance costs. The City's lighting stock consists of inefficient, antiquated technology and there are environmental issues associated with disposal of mercury vapour lights.

The annual street lighting bill to the City is $2.2M, with no opportunity for contestability. Although not included in the City's carbon footprint, street lights in Armadale generate emissions of 4,118tCO_2-e.

In 2020, a Street Lighting Working Group was formed by the Cities of Albany, Armadale, Canning, Cockburn and Melville. The purpose is to implement, in partnership with Western Power, bulk changeover projects to replace old lights with LED smart ready lighting.

An indicative business case, provided by a third party consultant, was presented to Council in August 2020. This highlighted that a changeover project will cost in the region of $6.4M. This will reduce the cost of street lighting by $1.1M per annum, with a payback period in the order of six years. The carbon footprint associated with street lights will be halved.

The working group continues to liaise with Western Power to advance the project, and derive certainty over costs. The Plan recommends that a report be produced for the Council with a final business case when there is more certainty over costs.

Other recommendations include, but are not limited to, greater transparency over the use of the Revolving Energy Fund, the development of a Sustainable Procurement Policy and staff incentives for the demonstration of sustainable behaviours.

Cost

The implementation cost of recommendations around Policy/Strategy Development, Waste, Buildings, Fleet and Other is estimated at $145,000. The Plan proposes that this be funded through income from the Flaring Project. This leaves residual funds of $835,000.

Targets

In all scenarios, abatement activities are highly unlikely to meet the target. As a result, offsets will need to be purchased.

The table highlights two options for the purchase of offsets; 1) Those allowable under the Climate Active Scheme (probably sourced from overseas), or 2) Australian Carbon Credit Units. The former comes at a much lower price (estimated at $4 per t$CO_2$-e compared to $18.50).

For reference, income from the sale of surplus credits, credits generated over the last eighteen months of the project, and credits from the five-year extension are displayed at the top of the table. Costs associated with the Plan are also displayed.

This enables all financial aspects to be considered holistically. In this sense, income may be used to fund the recommendations of this Plan ($145,000), and the purchase of offsets. The table therefore also displays residual income or net costs after the purchase of offsets.

Table 3: Target Options and the Price of Offsets

Income/Cost Source			**$**
Surplus Credits and the Final Project Period (18 months)			**312,000**
Flaring Project Extension			**667,000**
Actions in CGAP			**(145,000)**
Residual Income			**834,000**
Target	**Rationale**	**Income, Cost of Offsets and Residual Amounts/(Cost)**	
		CA Scheme $	**ACCU's $**
1. Emissions at 2005 Levels by 2030	2005 is commonly used as a baseline year	**834,000** **(752,000)** **82,000**	**834,000** **(3,478,000)** **(2,644,000)**
2. 28% Reduction on 2005 Levels by 2030	Aligned to Australian National target	**834,000** **(972,000)** **138,000**	**834,000** **(4,497,000)** **(3,663,000)**
3. 45% Reduction on 2005 Levels by 2030	Based on IPCC publication *'Special Report 'Special Report - Global Warming of 1.5 Degrees C'* states that '(to limit)…*global warming to 1.5 degrees....Global net human-caused emissions of carbon dioxide would need to fall by about 45% from 2010 levels by 2030, reaching 'net zero' by 2050*	**834,000** **(1,106,000)** **(272,000)**	**834,000** **(5,116,000)** **(4,282,000)**
4. 75% Reduction on 2005 Levels by 2030	Based on announced Climate Council target	**834,000** **(1,342,000)** **(508,000)**	**834,000** **(6,208,000)** **(5,374,000)**
5. Zero emissions by 2030	Elimination of the City's carbon footprint	**834,000** **(1,539,000)** **(705,000)**	**834,000** **(7,119,000)** **(6,285,000)**
6. Offset Buildings and Fleet Only for 2020/21 to 2029/30	Many LGs with or without Landfill Sites only have targets in relation to Buildings and Fleet	**834,000** **(205,000)** **629,000**	**834,000** **(947,000)** **(113,000)**

In all cases, it is clear that the costs of ACCUs are price prohibitive. Hence, it is advantageous to the City to purchase offsets allowable under the Climate Active Scheme.

Evaluation of Targets

Option 6 is the preferred option in the report, as this assists in implementing a balanced and beneficial approach. This enables the recommendations of the Plan to be funded, in conjunction with offsets for Buildings and Fleet. The remaining $629,000 may then be used for energy efficiency/carbon mitigation projects in the City.

This approach may not eliminate as much carbon as the purchase of offsets, but still reduces the City's carbon footprint, assisting in stimulating the local economy, and providing ongoing reductions in operating costs. As highlighted above, it is possible that a retrofit of LED streetlights may be feasible at some point in the near future. An injection of $629,000 would represent 10% of the capital cost.

An approach to offsetting 100% of Building and Fleet emissions is above and beyond the aspirations of many Local Governments. Hence, through this approach, the City can consider itself a sector leader.

Finally, in order to be consistent with the State Government, the City should also adopt a target of net zero emissions by 2050. By this time, the Landfill Site is anticipated to be long closed. Buildings and Fleet will dominate emissions.

Budget Allocation Process

The City requires a mechanism to accumulate funds for the purchase of offsets and energy efficiency projects. An effective way to achieve this is through the creation of a Carbon Reserve. The Plan demonstrates that the reserve will always be cash positive, due to the initial influx of income in 2021/22, followed by regular deposits.

Limitations

It should be noted that the financial analysis presented is predicated on several assumptions. These have been 'de-risked' wherever possible, ensuring a conservative approach is taken. It is imperative that variables in the analysis are continuously monitored, and periodically updated financial forecasts prepared.

This will provide an indication of funds available for energy efficiency projects, and also give assurance on the achievement of the objectives of this Plan. Updates can be provided through the Environmental Services bi-annual report to Council.

OPTIONS

Option 1

That Council endorses 2020/21 to 2029/30 Corporate Greenhouse Action Plan without modification.

Option 2

That Council seeks modifications to the 2020/21 to 2029/30 Corporate Greenhouse Action Plan prior to endorsement.

Option 1 is recommended.

CONCLUSION

A new Corporate Greenhouse Action Plan is due for renewal, after the conclusion of the 2014/15 to 2019/20 Plan. The new iteration is proposed to run till 2029/30, aligning the City's actions to those to be delivered internationally.

A gap analysis has been performed on the City's operations, after the release of a guiding WALGA template. This has been produced by a Local Government Working Group, in conjunction with Ernst and Young, and has spawned a number of improvement actions for the City.

There is an opportunity for the City to sell surplus credits, generated by the Flaring Project, and also extend the project by a further five years. This will generate additional unbudgeted revenue of circa $1M, after compliance costs. This can fund the recommendations of the Plan ($145,000).

A number of carbon mitigation targets are considered in the document. A balanced approach has been selected that ensures that the City remains a leader in carbon mitigation, limits the amount of money spent on offsets, and maximises the amount that may be reinvested in local projects. This means that, of the income received, $205,000 is spent on offsets, leaving $629,000 to be invested in carbon mitigation projects in the City.

A thorough gap analysis has been performed, providing opportunities for improvement in the City. A measured approach has been taken towards the selection of a carbon mitigation target, and the Plan is self funded. A separate report regarding the disposal of carbon credits as per *Recommendation 6* of the Plan, will be provided in the near future.

Accordingly, Option 1 is recommended.

RECOMMEND

1. **That Council endorse the 2020/21 to 2029/30 Corporate Greenhouse Action Plan.**

2. **Pursuant to Section 6.11(1) of the *Local Government Act 1995*, establishes a Carbon Credits Reserve Account for the purpose of setting aside funds from the sale of Australian Carbon Credit Units to fund future carbon mitigation initiatives.**

ATTACHMENTS

1.⇩ Corporate Greenhouse Action Plan 2020/21 to 2029/30

1.3 - LED STREETLIGHTING PROJECT - UPDATE

WARD	:	ALL
FILE No.	:	M/524/21
DATE	:	13 August 2021
REF	:	NB/DH
RESPONSIBLE MANAGER	:	Executive Director Technical Services

In Brief:

- The LED Streetlighting Project has been progressed by the Streetlighting Working Group, through lobbying by other member Councils and the development of a new Business case.
- The Business case re-affirms the messages from previous iterations, with a payback period ranging from 5.5 to 7 years for the City.

  Uncertainties remain in relation to project implementation, mainly around the treatment of the Regulated Asset Base charge.
- Recommend that Council note the contents of this update report on the LED Streetlighting project.

Tabled Items

Nil.

Decision Type

☐ **Legislative**	The decision relates to general local government legislative functions such as adopting/changing local laws, town planning schemes, rates exemptions, City policies and delegations etc.
☒ **Executive**	The decision relates to the direction setting and oversight role of Council.
☐ **Quasi-judicial**	The decision directly affects a person's rights or interests and requires Councillors at the time of making the decision to adhere to the principles of natural justice.

Officer Interest Declaration

Nil.

Strategic Implications

The subject of this report has impact on the following objectives of the Strategic Community Plan 2020-2030:

2.1 Conservation and restoration of the natural environment

2.1.4 Minimise corporate and community carbon footprints within the City of Armadale.

- Implement the Actions of the City's corporate Greenhouse Action Plan

Legal Implications

General assessment of relevant legislation (eg. *Local Government Act 1995*) has not revealed any restrictions.

Council Policy/Local Law Implications

The City's Strategic Environmental Commitment (ENG21), aligned to the Strategic Community Plan, includes the goal of "*Minimising the City's carbon footprint*".

Budget/Financial Implications

There are no financial implications associated with the recommendation of this report.

Consultation

- Intra Directorate.

BACKGROUND

Most street lighting in Australia is managed by Distribution Network Service Providers (DNSPs). The DNSP in Western Australia is Western Power, who own and operate the system.

There are 11,000 streetlights in the City of Armadale, attracting a daily flat tariff charge from Western Power. There is limited transparency over the tariff, specifically the constituent components of electricity charges and maintenance costs. The lighting stock largely consists of antiquated technology that is not energy efficient. In addition, there may be environmental issues associated with disposal of mercury vapour lights.

The annual street lighting bill to the City is $2.2M. There are no opportunities to seek alternative pricing options. Street lighting energy supply is not contestable in Western Australia.

Synergy, the State Government's '*Gentailer'* (electricity generator and retailer) provides the monthly invoice, comprising a daily tariff (Z tariff) for each streetlight. The tariff comprises two components being electricity consumed and network charges.

Synergy retain a component of the payment to cover electricity used and regulatory return on capital; and remit the balance to Western Power to cover network charges, maintenance, depreciation and regulated return on capital.

As previously reported, a Street Lighting Working Group (SLWG) has been formed, incorporating the Cities of Cockburn, Melville, Armadale, Canning and Albany. The objectives of the group are to propose bulk street light changeovers to Western Power.

The Cities constitute 47,000 of the 275,000 Western Power controlled streetlights on the grid and the project is being badged as a Super-Trial. The working group, led by the Cities of Cockburn and Melville, has been attempting to engage Western Power to modernise its fleet of luminaires for some time.

Australia is poised to ratify the Minimata Convention banning the import of mercury. This is relevant in that 54% of the streetlights are Mercury Vapour (MV). It is evident that the future replacement of MV lights will be problematic due to worldwide manufacturing increasingly catering for LED lights.

The drivers of the trial are the modernisation of the streetlight luminaire fleet, the substantial improvement in sustainability of the modern LED network and consequential reductions in power consumption and greenhouse gas emissions, as well as the financial benefits of shifting to lower tariffs, which will self fund the transition over a period of years.

Council approval was provided in August 2020 for City officers to attend the SLWG (T36/8/20 refers):

"1. Authorise City officers to continue to attend the Street Lighting Working Group to further investigate a bulk changeover project and enhance the level of certainty over the LED Street Lighting Business Case before presentation to a future meeting of Council.

2. Include the LED Street Lighting project in the City's Advocacy Strategy."

The report was also prompted by the preparation of a business case by a consultant, to identify potential financial benefits of an LED bulk retrofit. The results of the study are summarised below, as reported to Council.

Table 1: Results of Business Case

Project Component	Result
Capital Cost	$6.4M
Annual Electricity Saving	$1.145M
Payback Period	5.6 Years

The purpose of this report is to provide an update on the activities of the SLWG and highlight the key features of a refreshed business case (see below) to replace the City's streetlights.

DETAILS OF PROPOSAL

The Cities of Cockburn and Melville have taken a leadership role on the project over the last six months, across a number of fronts. A synopsis of the current state of play is discussed below.

Business Case

On behalf of the five Councils, a financial model has been developed by Australia's pre-eminent streetlighting consultancy firm, Ironbark Sustainability (Attachment 1). The resultant report considers the participating Councils as a collective, covering the replacement of 47,000 luminaires (the City has 11,000). It concludes that the payback period will be from 5 to 6.3 years.

Subsequently, the City of Albany undertook a peer review using Sage Engineering. This supported the financial outcomes presented in the business case for the Super-Trial.

The model is able to be split into the individual local governments. The results for the City are discussed below in the Analysis section.

The Cities of Cockburn and Melville have led on the negotiations over the base price of the luminaire, given it is based on the pricing of Western Power's ad hoc replacement program of 2/3,000 luminaires per annum, versus the volumes within the Super Trial. The SLWG believes there could be additional savings of between 5-10% on the luminaire program, based on bulk purchasing agreements.

The ongoing tariffs included in the business case include a discount, given that members of the SLWG would be funding the capital purchase of new luminaires. This has been mandated by the Economic Regulatory Authority.

Project Approvals

The Cities of Cockburn and Melville have presented reports to Council on the project. This has resulted in the allocation of capital funds for project delivery. Key features of the business cases and funding mechanisms are highlighted below.

Table 2: Cockburn and Melville Business Case Summary

Project Component	Cockburn	Melville
Net Cost	$6.3m	$6.4m
Grant Funds	$3.7m (LCRI)	$Nil
Payback Period	6.25 Years	8 Years
Delivery Timescale	1 Year	2 Financial Years
Funding	Internal Loan – Land Sales	Land and Property Reserve

In the case of the City of Cockburn, project timescales are very constrained, in order to meet deadlines associated with stimulus funding. In both cases, funding of the project is being enabled by use of internal reserves.

Project Advocacy

The partner local governments have advocated for the financial, environmental and social benefits of the project to Western Power, Departmental and Ministerial representatives. There remains a number of matters to be resolved by the various stakeholders/partners before any firm commitments are made. These matters are raised in this report.

Western Power

There is strong support within Western Power (WP) for the implementation of the project. Local governments can now request, through WP's Client Portal, for LED retrofit trials to be implemented. In addition, they are gearing up for bulk changeover projects from the 2022/23 financial year. WP are also hopeful to be part of the solution for the treatment of the Regulated Asset Base Charge (see below).

Uncertainties

State Government Approval

At this point in time, the main impediment to progressing the project business case remains obtaining the support and approval of the Minister for Energy. At this level, there is a belief that Local Governments should be made to pay the Regulated Asset Base Charge (explained below). The SLWG disagrees with this position. Western Power have communicated a desire to find a solution to this issue.

The Regulated Asset Base Charge

Discussions with Western Power have suggested that the residual (or 'un-depreciated') cost of existing luminaires may be passed on to project proponents as a capital charge. This is known as the Regulated Asset Base (RAB) charge. In the City of Armadale's case, this is estimated at $1.1M. The SLWG believes this is unfair, as participants have been paying depreciation on these assets, through the tariff, over the last 50 or so years. In addition, many lights do not function properly. If a resolution is not reached, then member Councils may need to pay the RAB in order to proceed, and the refreshed business case identifies these costs.

Tariff

Western Power and Synergy both have published tariffs in relation to new LED streetlights. However, there appears to be a significant difference between the two in relation to the energy charge component. Here, the margin applied by Synergy is perceived to be excessive and lacks transparency. Again, it is the view of the SLWG that this should be modified.

Smart Enabled

Within the business case, it is assumed that any new lights will be smart enabled. This means that they can be used for a number of purposes; traffic monitoring, Wi-Fi access, noise monitoring, etc.

Currently, streetlight tariffs are charged at a daily rate. However, the technology enables lights to be centrally controlled and dimmed when not required. In conjunction with the installation of meters, this provides the opportunity for further savings by local governments.

They will only pay for the electricity that they use and have recorded. This opens up the possibility of streetlighting electricity becoming a contestable supply, subject to a competitive process.

There is uncertainty over the extent to which local governments will be given access to the data and functionality. However, officers at the City have been recently approached by Western Power to indicate an appetite for contributing to any initial ICT investment. This will be considered by the Western Power Executive in September.

Bulk Discount

It is hoped that any published capital cost of installation will be reduced due to economies of scale across the five local governments. However, the extent to which this may be the case is unclear.

ANALYSIS

City of Armadale Business Case

The Ironbark Business case has been used to calculate project statistics for the City. It has been used for a number of scenarios associated with some of the uncertainties highlighted above.

Table 3: City of Armadale Project Statistics

Project Scenario	Net Present Value	Capital Cost	Payback Period
Includes Smart Enabled (SED) and Regulated Asset Base Cost (RAB)	$10.4M	$7.9M	7 years
5% Discount + SED + RAB	$10.7M	$7.5M	6.75 years
10% Discount + SED + RAB	$11M	$7.2M	6.5 years
Include SED but no RAB	$11.3M	$6.8M	6.1 years
5% Discount + SED + No RAB	$11.6M	$6.4M	5.75 years
10% Discount + SED + No RAB	$11.9M	$6.1M	5.5 years

*RAB = Regulated Asset Base (see 'Uncertainties' section above)
*SED = Smart Enabled Device (see 'Uncertainties' section above)

The annual saving on electricity bills is projected at $1.1M in each case. Hence, even in a worst case scenario, the payback period is attractive at 7 years. This has the opportunity to improve, if the RAB and cost of smart ICT is removed. Bulk discounts will improve the situation further, in conjunction with any reduction in the Synergy tariff.

Greenhouse gas emissions associated with streetlights (4,000tCO_2-e) will reduce by approximately 50%. This is a significant reduction and is comparable to approximately half of the City's carbon footprint associated with the City's building portfolio.

For every year that the project is not initiated, the City is missing out on a potential saving of potentially $1.1M. This, in the context of an asset that will pay for itself in, at most, seven years and will last for at least 15 years.

Nevertheless, the treatment of the Regulated Asset Base charge remains an issue.

CONCLUSION

As part of the Street Lighting Working Group, the City has continued to progress the LED Streetlighting Project. Lobbying has taken place by other member Councils within the broader group, with discussions held with Local Members, the Minister for Energy and Western Power officers.

A consultant produced business case, peer reviewed by a third party, reaffirms that the project boasts attractive payback periods for the City and annual electricity savings of $1.1M.

The Cities of Cockburn and Melville have their retrofit projects approved by Council, with funds allocated from reserves.

There are remaining uncertainties associated with the project but clarity around these are only likely to make the business case more attractive. However, the key remaining impediment to progress is the treatment of the Regulated Asset Base Charge. Consequently, the City is not yet in a position to implement the project.

RECOMMEND

That Council note the contents of this update report on the LED Streetlighting project.

ATTACHMENTS

1.⇩ Perth Southern Metropolitan and Regional WA LED Street Lighting Business Case

COUNCILLORS' ITEMS

Nil

EXECUTIVE DIRECTOR TECHNICAL SERVICES REPORT

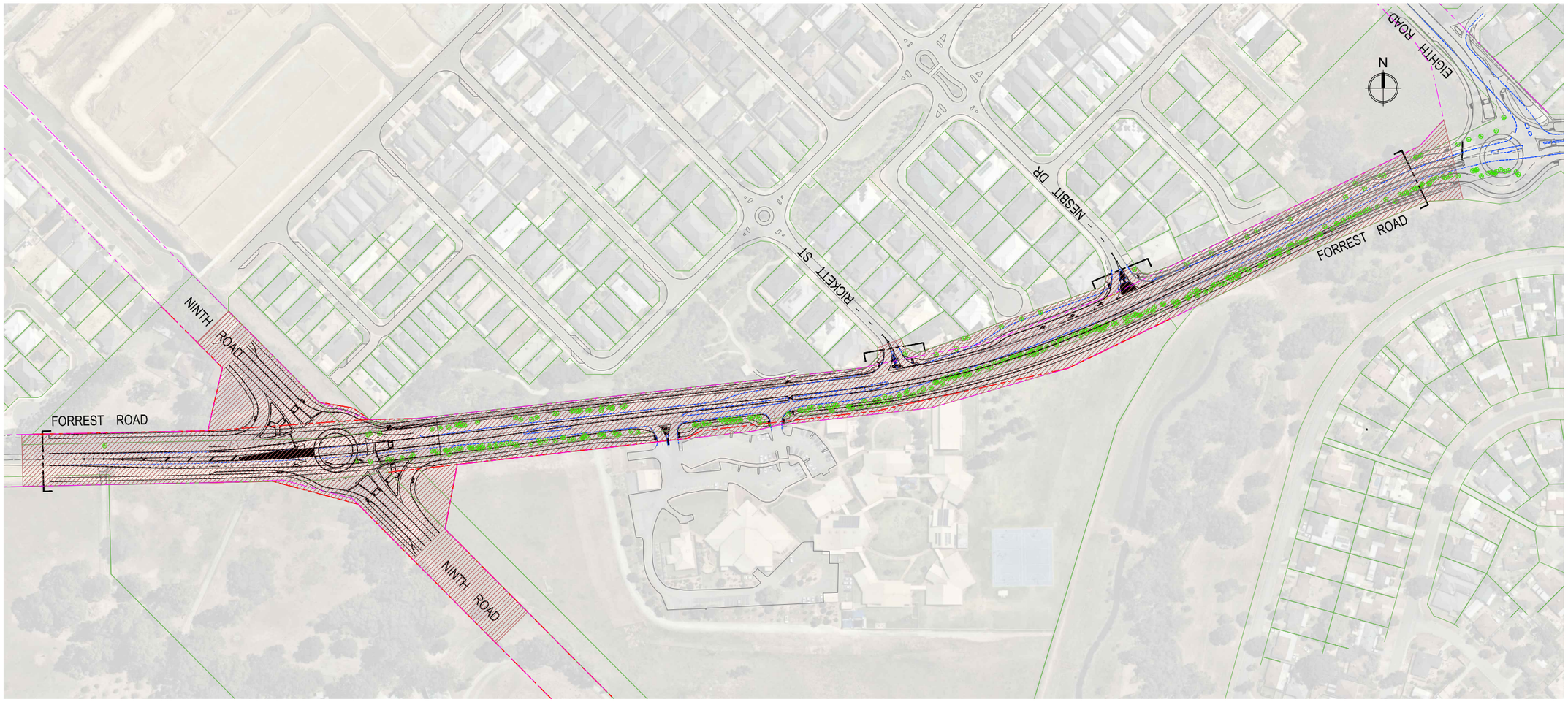
Nil

MEETING DECLARED CLOSED AT _____

TECHNICAL SERVICES COMMITTEE

SUMMARY OF ATTACHMENTS

6 SEPTEMBER 2021



PLAN VIEW

SCALE 1 : 1250

LEGEND

- EIGHTH ROAD STAGE 1 DESIGN
- NEW SEMI MOUNTABLE KERB
- MOUNTABLE KERB
- EXISTING KERB
- EXISTING CADASTRE
- NEW CADASTRE
- DESIGN BATTER LINE
- EXISTING KERB/SEAL REMOVAL
- EXISTING FOOTPATH REMOVAL
- EXISTING TREE / VEGETATION
- PROPOSED VEGETATION CLEARING AREA 9600m²

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V:\ENGINEERING & DESIGN DEPARTMENT\DESIGN DEPARTMENT_DESIGN PROJECTS\2020 DESIGNS\Forrest Road (Eighth Rd - Ninth Road)\3. Civil 3D - Working Folder\E20-176-SK1.dwg

No	Date	Revision	By	Approved
A	03/09/20	ISSUED FOR INFORMATION	BV	V.B

Amendments

Scale: AS SHOWN
Datum: AHD Grid: PCG94
Surveyed Date

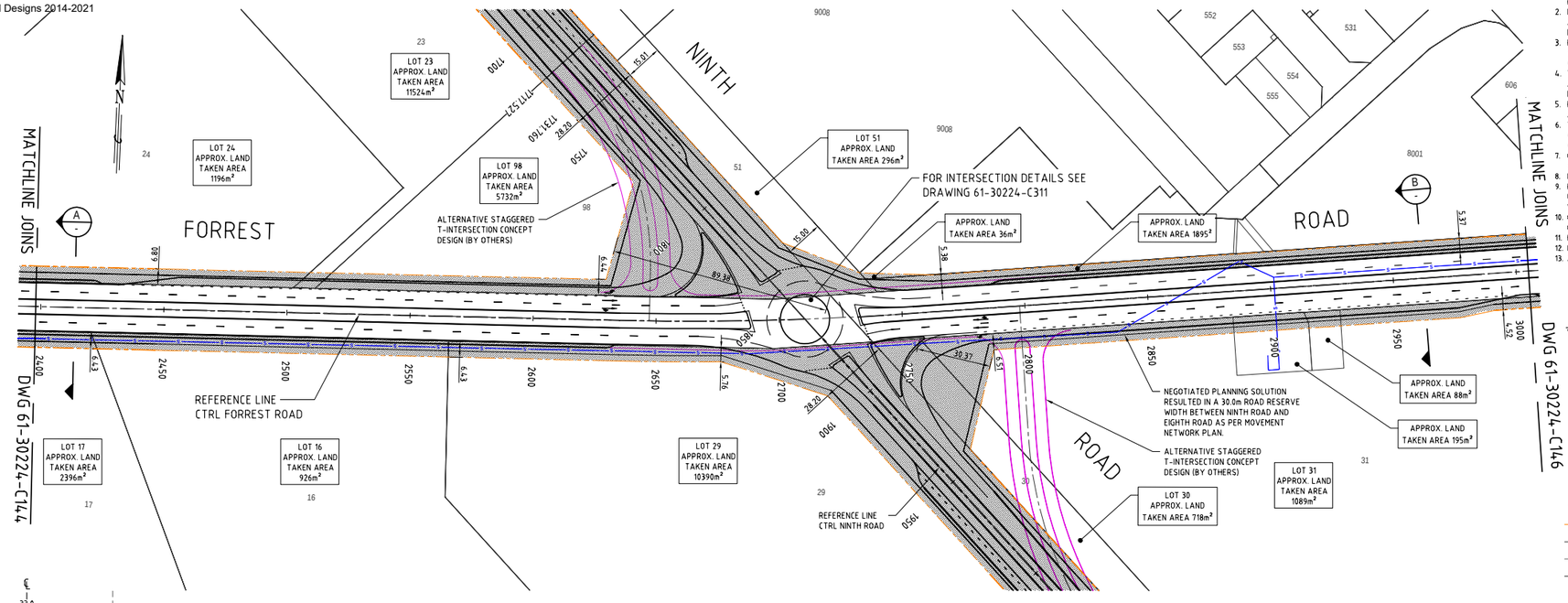
CITY OF Armadale
7 ORCHARD AVENUE, ARMADALE, WA 6112

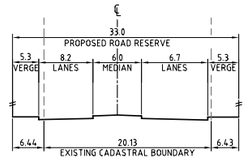
Drawn: BV	Date: 03/09/20	Signed:
Designed: BV	Date: 03/09/20	Signed:
Checked: V.B	Date: 03/09/20	Signed:
Manager Engineering & Design:		Signed:

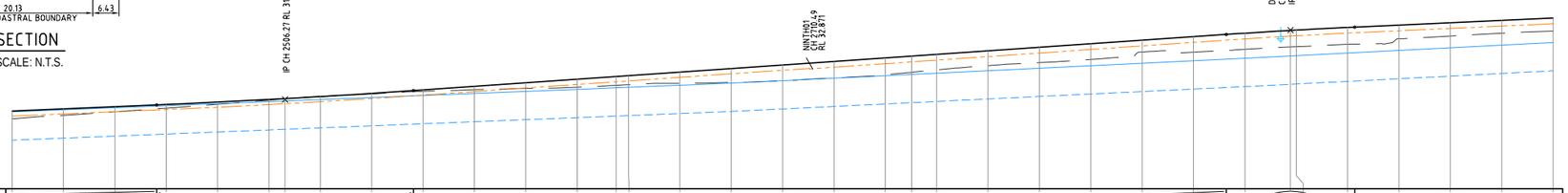
Project: FORREST ROAD - HAYNES
EIGHTH ROAD TO NINTH ROAD

Title: VEGETATION CLEARING AREA

PC No:	
CM9 No:	
Sheet No:	1 of 1
Revision No:	A
DWG No:	E20-176-SK1







2014 Design - 61-30224-C145 & C146
6m median width with full land acquisition both sides of road

Attachment 2: Forest Road Designs 2014-2021

NOTES:

1. THIS DRAWING SET SHOULD BE READ IN CONJUNCTION WITH GHD'S PRELIMINARY ROAD DESIGN REPORT.
2. INTERSECTION TREATMENTS ARE INDICATIVE ONLY AND ARE SUBJECT TO AMENDMENT FOLLOWING REVISED TRAFFIC MODELLING AND PRELIMINARY INTERSECTION DESIGN.
3. ROAD RESERVE TRUNCATIONS AT INTERSECTIONS ARE BASED ON THE STOPPING INTERSECTION SIGHT DISTANCE PROVIDED UNDER AUSTROADS GUIDANCE AND MAY CHANGE FOLLOWING PRELIMINARY DESIGN.
4. TRUNCATION REQUIREMENTS AROUND ROAD CURVES AND INTERSECTIONS ARE INDICATIVE ONLY AT THIS STAGE, AND WILL BE CONFIRMED ONCE INTERSECTION DESIGN IS AGREED WITH COA AND MRA.
5. ROAD RESERVE WIDENING TO ACCOMMODATE TURN POCKETS IS BASED ON ADDITIONAL 3.5m WIDTH PER LANE.
6. TURNING POCKET LENGTHS ARE BASED ON MODELLED VEHICLE STORAGE CAPACITIES AND DECELERATION LENGTH GUIDANCE FROM AUSTROADS AND MAY CHANGE FOLLOWING PRELIMINARY DESIGN.
7. ONLY APPROXIMATE LOCATIONS OF MAJOR TRANSMISSION GRADE SERVICES ARE SHOWN. THESE SHOULD BE PHYSICALLY VERIFIED PRIOR TO CONSTRUCTION.
8. DISTRIBUTION GRADE SERVICES ARE NOT SHOWN ON THESE DRAWINGS.
9. ROAD RESERVE WIDTHS ARE BASED ON FORECAST TRAFFIC VOLUMES GENERATED UNDER AN INCREASED TOTAL OF APPROXIMATELY 18,000 DWELLINGS WITHIN THE WUNGONG URBAN WATER REDEVELOPMENT AREA.
10. ON-STREET CAR PARKING BAYS ARE NOT SHOWN AND ARE TO BE DESIGNED BY OTHERS.
11. FOR TYPICAL CROSS SECTIONS REFER TO DRAWING NO. 61-30224-C401.
12. DRAWINGS TO BE PRINTED IN COLOUR.
13. ALL DIMENSIONS ARE IN METRES U.N.O.

LEGEND - PLAN

— — —	PROPOSED ROAD RESERVE
— - — - —	PROPOSED ROAD CENTRE LINE
———	EXISTING CADASTRAL BOUNDARY
— · — · —	DESIGN BY OTHERS
22	LOT NUMBER
🟩	ENVIRONMENTALLY SENSITIVE AREA
▨	CCW/ FORESHORE BUFFER
▨	ABORIGINAL HERITAGE SITE
▨	LAND TAKE AREA

LEGEND - PROFILE

⌖	100 YEAR FLOOD LEVEL
+	DESIGN LEVEL BASED ON SURFACE WATER DESIGN CRITERIA
———	DESIGN LEVEL BASED ON GROUNDWATER DESIGN CRITERIA
— — —	GROUND WATER LEVEL (AAMGL)

MAJOR SERVICES

—O/H—	EXISTING OVERHEAD POWER
—S—	EXISTING SEWER
—G—	EXISTING GAS
—W—	EXISTING WATER
—W—	EXISTING WATER (SURVEYED)
—S—	PROPOSED SEWER MAIN
◉	EXISTING 132kV OVERHEAD POWER POLE

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WARNING
SERVICES AND CADASTRAL BOUNDARY LOCATIONS SHOWN ARE ONLY INDICATIVE AND MUST NOT BE USED FOR EXCAVATION. THE "ONE CALL 1100" SYSTEM SHALL BE USED TO OBTAIN ACCURATE SERVICE LOCATIONS.

VERTICAL ALIGNMENT	L=562.9m G=0.42%			K=369.3 L=100m						L=316.49m G=0.69%	
HORIZONTAL ALIGNMENT	L=247.07m										
BOUNDARY LEVEL (BOTH SIDES)	30.823	30.906	30.99	31.074	31.165	31.267	31.302	31.38	31.504	31.638	31.776
EXISTING SURVEY	30.72	30.85	30.99	31.13	31.28	31.44	31.49	31.58	31.69	31.78	31.84
EXISTING LIDAR											
LEVEL DIFFERENCE CUT - / FILL +	0.31	0.26	0.20	0.14	0.08	0.03	0.01	-0.00	0.02	0.06	0.13
DESIGN SURFACE LEVEL	31.023	31.106	31.190	31.274	31.365	31.467	31.502	31.580	31.704	31.838	31.976
CHAINAGE	2400.00	2420.00	2440.00	2460.00	2480.00	2500.00	2506.27	2520.00	2540.00	2560.00	2580.00

VERTICAL ALIGNMENT											
HORIZONTAL ALIGNMENT			L=115.08m R=-1250.00m							L=294.21m	
BOUNDARY LEVEL (BOTH SIDES)	31.914	32.052	32.157	32.19	32.328	32.466	32.604	32.722	32.86	32.931	32.998
EXISTING SURVEY	31.90	31.95	32.02	32.04	32.10	32.13	32.20	32.30	32.43	32.52	32.62
EXISTING LIDAR											
LEVEL DIFFERENCE CUT - / FILL +	0.22	0.31	0.34	0.35	0.43	0.54	0.61	0.64	0.65	0.63	0.60
DESIGN SURFACE LEVEL	32.114	32.252	32.357	32.390	32.528	32.666	32.804	32.942	33.080	33.151	33.218
CHAINAGE	2600.00	2620.00	2635.18	2640.00	2660.00	2680.00	2700.00	2720.00	2740.00	2750.26	2760.00

VERTICAL ALIGNMENT						K=211.01 L=50m			L=560.8m G=0.45%				
HORIZONTAL ALIGNMENT													
BOUNDARY LEVEL (BOTH SIDES)	33.136	33.274	33.412	33.55	33.688	33.824	33.933	33.946	34.049	34.139	34.23	34.32	34.411
EXISTING SURVEY	32.78	32.90	33.02	33.31	33.30	33.42	33.51	33.52	33.61	33.83	33.94	34.04	34.13
EXISTING LIDAR													
LEVEL DIFFERENCE CUT - / FILL +	0.57	0.59	0.61	0.46	0.60	0.63	0.64	0.65	0.65	0.53	0.51	0.50	0.50
DESIGN SURFACE LEVEL	33.356	33.494	33.632	33.770	33.908	34.044	34.153	34.166	34.269	34.359	34.450	34.540	34.631
CHAINAGE	2780.00	2800.00	2820.00	2840.00	2860.00	2880.00	2897.76	2900.00	2920.00	2940.00	2960.00	2980.00	3000.00

PROFILE
SCALE H1:1000 V1:100

NOT FOR CONSTRUCTION

No.	Revision	Drawn	Job Manager	Project Director	Date
D	ISSUED FOR FINAL SUBMISSION	SJD	NA	AW	24.02.16
C	ISSUED FOR STAKEHOLDER COMMENTS	RA	NA	AW	29.07.15
B	ISSUED FOR HORIZONTAL ROAD DESIGN REVIEW	JS	NA	AW	21.11.14
A1	AMENDED TO REFLECT COMMENTS FROM MRA AND COA	JS	NA	AW	19.08.14

GHD House, 239 Adelaide Tce Perth WA 6004
PO Box Y3106 Perth WA 6832 Australia
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E permail@ghd.com.au **W** www.ghd.com

CITY OF Armadale

Metropolitan Redevelopment Authority

ORCHARD AVENUE
ARMADALE

LOCKED BAG No. 2
ARMADALE
W.A. 6112

TELEPHONE:
9399-0111

FACSIMILE:
9399-0184

SCALE
1:1000 @ A1
20 0 20 40
METRES

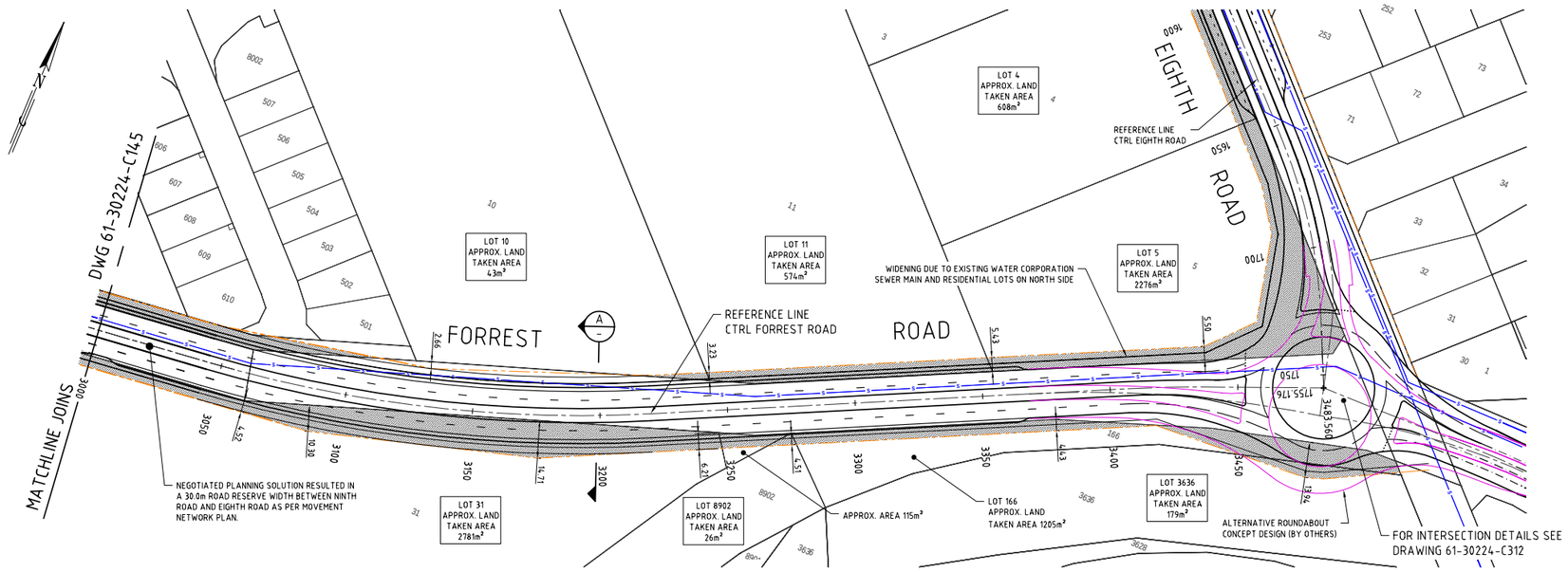
SURVEYED - -
DESIGNED J. GUDSELL 12.05.14
DRAWN J. SCHMECHTIG 15.05.14
CHECKED N. AHMED 21.11.14

ACCOUNT NO. -
APPROVED A. WILMOT

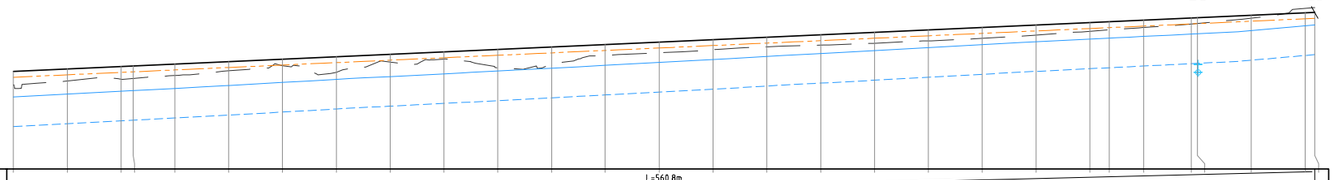
WUNGONG URBAN WATER
PRELIMINARY ROAD DESIGN
PLAN & PROFILE
FORREST ROAD

CAD FILE 61-30224-C145.dwg
DRAWING STATUS PRELIMINARY
SHEET 05 of 06
PLAN No. -
AMENDMENT D

2014 Design - 61-30224-C145 & C146
6m median width with full land acquisition both sides of road



PLAN
SCALE 1:1000



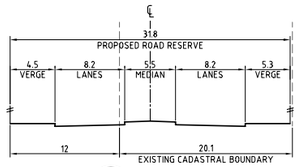
DATUM RL. 31.00

VERTICAL ALIGNMENT	L=560.8m G=0.45%																													
HORIZONTAL ALIGNMENT	L=294.21m			L=175.34m R=-520.00m								L=187.38m											L=30.50m R=500.00m		L=45.86m					
BOUNDARY LEVEL (BOTH SIDES)	34.411	34.502	34.592	34.612	34.683	34.773	34.864	34.954	35.045	35.135	35.226	35.317	35.406	35.498	35.588	35.679	35.769	35.86	35.95	36.041	36.132	36.222	36.255	36.313	36.393	36.403	36.494	36.584		
EXISTING SURVEY	34.13	34.27	34.34	34.37	34.47	34.65	34.84	34.60	34.97	35.09	34.76	34.90	35.22	35.32	35.43	35.54	35.61	35.67	35.76	35.86	35.97	36.12	36.18	36.26	36.39	36.41	36.61	36.97	37.00	
EXISTING LIDAR																														
LEVEL DIFFERENCE CUT - / FILL +	0.50	0.45	0.47	0.47	0.43	0.34	0.24	0.58	0.29	0.27	0.68	0.64	0.41	0.40	0.38	0.36	0.38	0.41	0.41	0.40	0.38	0.32	0.30	0.27	0.23	0.21	0.11	-0.17	-0.19	
DESIGN SURFACE LEVEL	34.831	34.722	34.812	34.832	34.903	34.993	35.084	35.174	35.265	35.355	35.446	35.537	35.626	35.718	35.808	35.899	35.989	36.080	36.170	36.261	36.352	36.442	36.475	36.533	36.613	36.623	36.714	36.804	36.807	
CHAINAGE	3000.00	3020.00	3040.00	3044.47	3060.00	3080.00	3100.00	3120.00	3140.00	3160.00	3180.00	3200.00	3219.82	3240.00	3260.00	3280.00	3300.00	3320.00	3340.00	3360.00	3380.00	3400.00	3407.19	3420.00	3437.70	3440.00	3460.00	3480.00	3483.56	

PROFILE
SCALE H1:1000 V1:100

NOTES:

1. THIS DRAWING SET SHOULD BE READ IN CONJUNCTION WITH GHD'S PRELIMINARY ROAD DESIGN REPORT.
2. INTERSECTION TREATMENTS ARE INDICATIVE ONLY AND ARE SUBJECT TO AMENDMENT FOLLOWING REVISED TRAFFIC MODELLING AND PRELIMINARY INTERSECTION DESIGN.
3. ROAD RESERVE TRUNCATIONS AT INTERSECTIONS ARE BASED ON THE STOPPING INTERSECTION SIGHT DISTANCE PROVIDED UNDER AUSTROADS GUIDANCE AND MAY CHANGE FOLLOWING PRELIMINARY DESIGN.
4. TRUNCATION REQUIREMENTS AROUND ROAD CURVES AND INTERSECTIONS ARE INDICATIVE ONLY AT THIS STAGE, AND WILL BE CONFIRMED ONCE INTERSECTION DESIGN IS AGREED WITH COA AND MRA.
5. ROAD RESERVE WIDENING TO ACCOMMODATE TURN POCKETS IS BASED ON ADDITIONAL 3.5m WIDTH PER LANE.
6. TURNING POCKET LENGTHS ARE BASED ON MODELLED VEHICLE STORAGE CAPACITIES AND DECELERATION LENGTH GUIDANCE FROM AUSTROADS AND MAY CHANGE FOLLOWING PRELIMINARY DESIGN.
7. ONLY APPROXIMATE LOCATIONS OF MAJOR TRANSMISSION GRADE SERVICES ARE SHOWN. THESE SHOULD BE PHYSICALLY VERIFIED PRIOR TO CONSTRUCTION.
8. DISTRIBUTION GRADE SERVICES ARE NOT SHOWN ON THESE DRAWINGS.
9. ROAD RESERVE WIDTHS ARE BASED ON FORECAST TRAFFIC VOLUMES GENERATED UNDER AN INCREASED TOTAL OF APPROXIMATELY 18,000 DWELLINGS WITHIN THE WUNGONG URBAN WATER REDEVELOPMENT AREA.
10. ON-STREET CAR PARKING BAYS ARE NOT SHOWN AND ARE TO BE DESIGNED BY OTHERS.
11. FOR TYPICAL CROSS SECTIONS REFER TO DRAWING NO. 61-30224-C401.
12. DRAWINGS TO BE PRINTED IN COLOUR.
13. ALL DIMENSIONS ARE IN METRES U.N.O.



A SECTION
N.T.S.

LEGEND - PLAN

- PROPOSED ROAD RESERVE
- PROPOSED ROAD CENTRE LINE
- EXISTING CADASTRAL BOUNDARY
- DESIGN BY OTHERS
- 22 LOT NUMBER
- ENVIRONMENTALLY SENSITIVE AREA
- CCW/ FORESHORE BUFFER
- ABORIGINAL HERITAGE SITE
- LAND TAKE AREA

LEGEND - PROFILE

- 100 YEAR FLOOD LEVEL
- DESIGN LEVEL BASED ON SURFACE WATER DESIGN CRITERIA
- DESIGN LEVEL BASED ON GROUNDWATER DESIGN CRITERIA
- GROUND WATER LEVEL (AAMGL)

MAJOR SERVICES

- EXISTING OVERHEAD POWER
- EXISTING SEWER
- EXISTING GAS
- EXISTING WATER
- EXISTING WATER (SURVEYED)
- PROPOSED SEWER MAIN
- EXISTING 132kV OVERHEAD POWER POLE

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WARNING
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NOT FOR CONSTRUCTION

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CITY OF Armadale

MRA Metropolitan Redevelopment Authority

ORCHARD AVENUE
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W.A. 6112

TELEPHONE: 9399-0111
FACSIMILE: 9399-0184

SCALE
1:1000 @ A1
20 0 20 40
METRES

SURVEYED -
DESIGNED J. GUDSELL 12.05.14
DRAWN J. SCHMECHTIG 15.05.14
CHECKED N. AHMED 21.11.14

ACCOUNT NO. -
APPROVED A. WILMOT

WUNGONG URBAN WATER
PRELIMINARY ROAD DESIGN
PLAN & PROFILE
FORREST ROAD

CAD FILE 61-30224-C146.dwg
DRAWING STATUS PRELIMINARY
SHEET 06 of 06
PLAN No. -
AMENDMENT D

PLAN VIEW

SCALE 1 : 500

V:\ENGINEERING & DESIGN DEPARTMENT\DESIGN DEPARTMENT_DESIGN PROJECTS\2021 DESIGNS\Forrest Road (Eighth Rd - Ninth Road)\3. Civil 3D - Working Folder\Concept Option-1.dwg

No	Date	Revision	By	Approved
	02/02/21	ISSUED FOR REVIEW	BV	V.B

Amendments

Scale: 1:500
Datum: AHD Grid: PCG94
Surveyed Date

CITY OF Armadale
7 ORCHARD AVENUE, ARMADALE, WA 6112

Drawn: BV	Date: 02/02/21	Signed:
Designed: BV	Date: 02/02/21	Signed:
Checked: M.C	Date: 02/02/21	Signed:
Manager Engineering & Design:		Signed:

Project: FORREST ROAD - HAYNES
EIGHTH ROAD TO NINTH ROAD

Title: CONCEPT PLAN - OPTION

PC No:
CMR No:
Sheet No: 1 of 1
Revision No:
DWG No: E20-176-SK3

PLAN VIEW

SCALE 1 : 500

V:\ENGINEERING & DESIGN DEPARTMENT\DESIGN DEPARTMENT_DESIGN PROJECTS\2021 DESIGNS\Forrest Road (Eighth Rd - Ninth Road)\3. Civil 3D - Working Folder\Concept Option-1.dwg

Amendments

No	Date	Revision	By	Approved
A	02/02/21	ISSUED FOR REVIEW	BV	V.B

Scale: 1:500
Datum: AHD Grid: PCG94
Surveyed Date

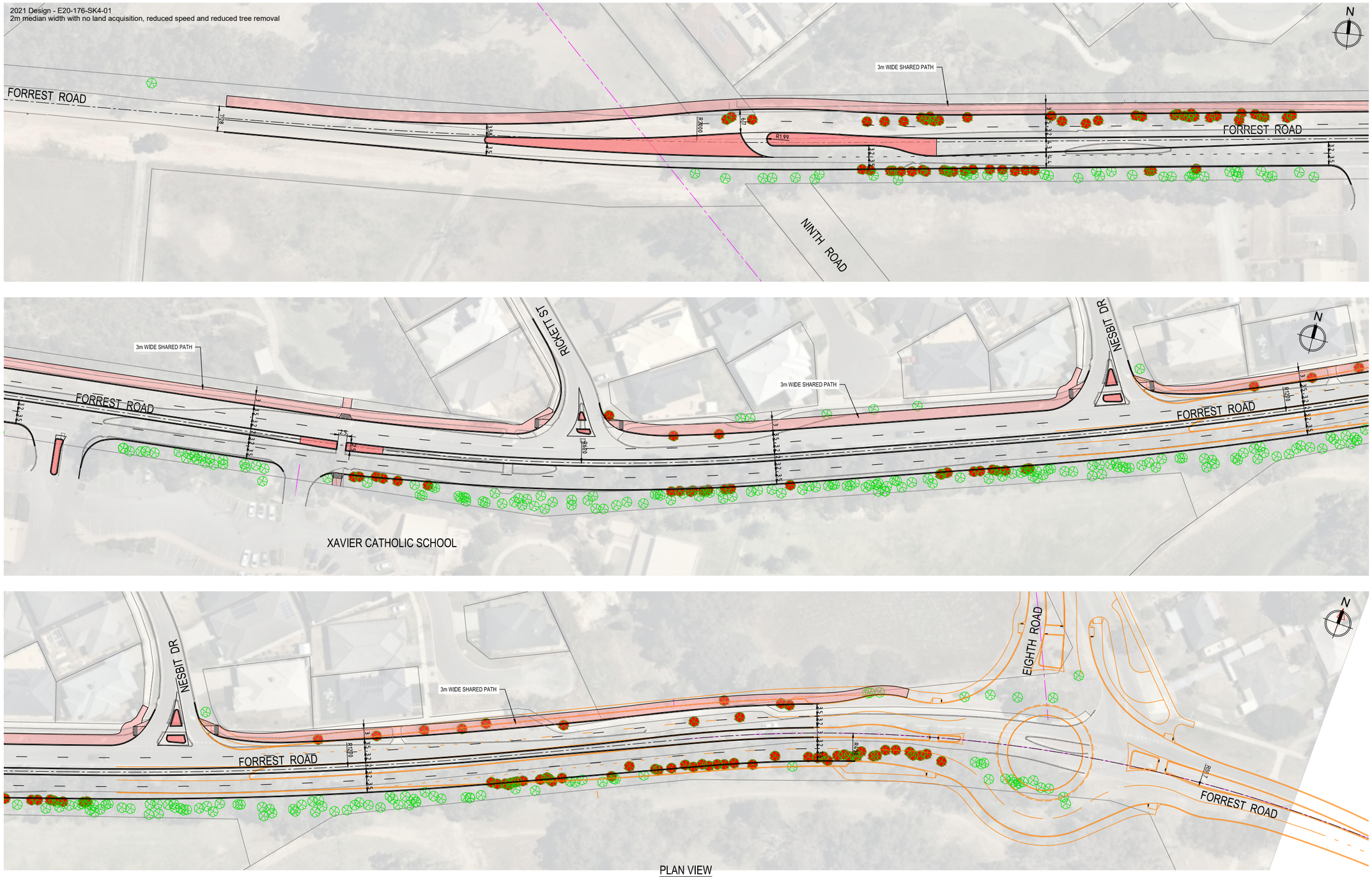
CITY OF Armadale
7 ORCHARD AVENUE, ARMADALE, WA 6112

Drawn: BV	Date: 02/02/21	Signed:
Designed: BV	Date: 02/02/21	Signed:
Checked: M.C	Date: 02/02/21	Signed:
Manager Engineering & Design:		Signed:

Project: FORREST ROAD - HAYNES
EIGHTH ROAD TO NINTH ROAD

Title: CONCEPT PLAN - OPTION

PC No:
CMR No:
Sheet No: 1 of 1
Revision No: A
DWG No: E20-176-SK3



PLAN VIEW

SCALE 1 : 500

V:\ENGINEERING & DESIGN DEPARTMENT\DESIGN DEPARTMENT_DESIGN PROJECTS\2021 DESIGNS\Forrest Road (Eighth Rd - Ninth Road)\3. Civil 3D - Working Folder\Concept Option-2.dwg

Amendments

No	Date	Revision	By	Approved
A	02/02/21	ISSUED FOR REVIEW	BV	V.B

Scale: 1:500
Datum: AHD Grid: PCG94
Surveyed Date

CITY OF Armadale
7 ORCHARD AVENUE, ARMADALE, WA 6112

Drawn: BV	Date: 02/02/21	Signed:	
Designed: BV	Date: 02/02/21	Signed:	
Checked: M.C	Date: 02/02/21	Signed:	
Manager Engineering & Design:		Signed:	

Project: FORREST ROAD - HAYNES
EIGHTH ROAD TO NINTH ROAD

Title: CONCEPT PLAN - OPTION 2

PC No:	
CMR No:	
Sheet No:	1 of 1
Revision No:	A
DWG No:	E20-176-SK4

Attachment 3: Potential Habitat Tree

Total for Removal	Tag No	Easting	Northing	Species	Common Name	Number of trees identifed as potential Breeding Habitat impacted by works (DBH >500mm)	Number of trees identified as potential Foraging Habitat impacted by works	Number of trees identified as Native Vegetation that require clearing
1	548	66702.411	240433.648	*Corymbia calophylla*	Marri			
2	552	66698.933	240432.655	*Corymbia calophylla*	Marri			
3	553	66698.047	240432.193	*Corymbia calophylla*	Marri			
4	559	66693.453	240430.618	*Corymbia calophylla*	Marri			
5	560	66690.924	240429.596	*Corymbia calophylla*	Marri	760mm		
6	562	66689.826	240429.596	*Corymbia calophylla*	Marri			
7	563	66688.729	240429.521	*Corymbia calophylla*	Marri			
8	568	66685.261	240428.235	*Corymbia calophylla*	Marri			
9	569	66683.614	240427.586	*Corymbia calophylla*	Marri			
10	570	66680.856	240426.614	*Corymbia calophylla*	Marri			
11	572	66676.210	240425.346	*Corymbia calophylla*	Marri	540mm		
12	573	66674.749	240424.483	*Corymbia calophylla*	Marri			
13	574	66674.428	240424.347	*Corymbia calophylla*	Marri			
14	612	66633.059	240409.979	*Corymbia calophylla*	Marri			
15	613	66632.362	240409.596	*Corymbia calophylla*	Marri			
16	619	66616.556	240404.533	*Corymbia calophylla*	Marri			
17	625	66615.046	240403.971	*Corymbia calophylla*	Marri			
18	626	66614.073	240403.034	*Corymbia calophylla*	Marri			
19	628	66610.306	240402.460	*Corymbia calophylla*	Marri			
20	630	66609.782	240401.711	*Corymbia calophylla*	Marri			
21	629	66609.096	240401.774	*Corymbia calophylla*	Marri			
22	636	66606.077	240401.124	*Corymbia calophylla*	Marri			
23	637	66605.553	240400.662	*Corymbia calophylla*	Marri			
24	639	66602.472	240400.013	*Corymbia calophylla*	Marri			
25	643	66600.164	240399.227	*Corymbia calophylla*	Marri			
26	652	66586.938	240395.055	*Corymbia calophylla*	Marri			
27	692	66531.304	240382.677	*Corymbia calophylla*	Marri	990mm		
28	698	66522.453	240381.634	*Corymbia calophylla*	Marri	760mm		
29	699	66518.140	240381.206	*Corymbia calophylla*	Marri			
30	700	66516.102	240381.193	*Corymbia calophylla*	Marri			
31	689	66512.611	240380.030	*Corymbia calophylla*	Marri			
32	702	66511.333	240379.909	*Corymbia calophylla*	Marri	790mm		
33	703	66509.829	240379.431	*Corymbia calophylla*	Marri			
34	704	66502.550	240377.173	*Corymbia calophylla*	Marri	1020mm		
35	722	66458.807	240373.295	*Corymbia calophylla*	Marri	1150mm		
36	723	66457.347	240373.039	*Corymbia calophylla*	Marri			
37	738	66372.609	240363.938	*Corymbia calophylla*	Marri	570mm		
38	745	66359.787	240362.122	*Corymbia calophylla*	Marri	510mm		
39	746	66359.075	240361.946	*Corymbia calophylla*	Marri			
40	755	66325.620	240358.473	*Corymbia calophylla*	Marri	670mm		
41	756	66323.313	240358.350	*Corymbia calophylla*	Marri	700mm		
42	2002	66320.302	240357.820	Tree removed (stump remains)	N/A			
43	757	66316.600	240357.884	*Corymbia calophylla*	Marri			
44	758	66312.983	240357.551	*Corymbia calophylla*	Marri	730mm		
45	761	66308.017	240357.013	*Corymbia calophylla*	Marri	700mm		
46	762	66305.756	240356.299	*Corymbia calophylla*	Marri			
47	763	66302.422	240355.843	*Corymbia calophylla*	Marri	510mm		
48	764	66301.258	240355.635	*Corymbia calophylla*	Marri			
49	765	66300.315	240355.807	*Corymbia calophylla*	Marri			
50	2006	66299.715	240355.880	Tree removed (stump remains)	N/A			
51	2007	66294.478	240354.996	Tree removed (stump remains)	N/A			
52	2008	66293.498	240355.332	Tree removed (stump remains)	N/A			
53	766	66290.496	240354.575	*Corymbia calophylla*	Marri	570mm		
54	767	66289.007	240354.333	*Corymbia calophylla*	Marri			
55	769	66287.304	240354.232	*Corymbia calophylla*	Marri			
56	770	66284.889	240354.183	*Corymbia calophylla*	Marri			
57	771	66284.252	240354.092	*Corymbia calophylla*	Marri			
58	772	66278.435	240353.651	*Corymbia calophylla*	Marri			
59	773	66276.022	240353.675	*Corymbia calophylla*	Marri	760mm		
60	787	66235.316	240363.990	*Corymbia calophylla*	Marri	570mm		
61	2009	66236.588	240364.864	Tree removed (stump remains)	N/A			
62	788	66275.961	240367.607	*Corymbia calophylla*	Marri	600mm		
63	789	66292.976	240369.842	*Corymbia calophylla*	Marri			
64	790	66294.024	240370.903	*Corymbia calophylla*	Marri			
65	791	66304.877	240371.889	*Corymbia calophylla*	Marri			
66	792	66339.357	240373.737	*Corymbia calophylla*	Marri	640mm		
67	793	66340.947	240374.604	*Corymbia calophylla*	Marri			
68	794	66342.775	240374.973	*Corymbia calophylla*	Marri	730mm		
69	795	66342.709	240376.045	*Corymbia calophylla*	Marri			
70	796	66343.753	240375.716	*Corymbia calophylla*	Marri			
71	797	66344.506	240374.914	*Corymbia calophylla*	Marri			
72	798	66353.543	240377.559	*Corymbia calophylla*	Marri			
73	799	66364.805	240378.804	*Corymbia calophylla*	Marri			
74	800	66365.489	240379.296	*Corymbia calophylla*	Marri			
75	801	66367.591	240378.891	*Corymbia calophylla*	Marri	530mm		
76	802	66368.918	240378.718	*Corymbia calophylla*	Marri			
77	803	66369.490	240379.853	*Corymbia calophylla*	Marri	600mm		

78	804	66370.458	240379.103	*Corymbia calophylla*	Marri			
79	806	66375.056	240379.241	*Corymbia calophylla*	Marri	670mm		
80	807	66376.912	240379.853	*Corymbia calophylla*	Marri	600mm		
81	808	66383.497	240379.394	*Corymbia calophylla*	Marri			
82	809	66384.007	240381.469	*Corymbia calophylla*	Marri	510mm		
83	810	66387.973	240381.533	*Corymbia calophylla*	Marri			
84	811	66390.003	240381.109	*Corymbia calophylla*	Marri	950mm		
85	812	66390.592	240382.567	*Corymbia calophylla*	Marri			
86	813	66390.752	240381.021	*Corymbia calophylla*	Marri			
87	2001	66397.313	240381.521	Tree removed (stump remains)	N/A			
88	814	66398.598	240382.370	*Corymbia calophylla*	Marri			
89	815	66535.720	240404.278	Eucalyptus sp. 5 (indet. planted non-endemic)	Unknown			
90	816	66544.271	240405.271	Eucalyptus sp. 5 (indet. planted non-endemic)	Unknown			
91	817	66596.554	240415.020	Eucalyptus sp. 4 (indet. planted non-endemic)	Unknown			
92	818	66609.223	240418.964	Eucalyptus sp. 4 (indet. planted non-endemic)	Unknown			
93	819	66614.003	240425.115	*Eucalyptus torquata*	Coral Gum			
94	820	66616.779	240425.725	Eucalyptus sp. 6 (indet. planted non-endemic)	Unknown			
95	821	66637.958	240432.643	Eucalyptus sp. 3 (indet. planted non-endemic)	Unknown			
						26	**82**	**83**

6	Tree Stumps only	
6	Planted exotics	
83	**Endemic trees**	
82	Corymbia callophylla	Marri
1	Eucalyptus Torquata	Coral Gum

Corporate Greenhouse Action Plan 2020/21 to 2029/30

CITY OF Armadale

Contents

Executive Summary

The City of Armadale's previous Corporate Greenhouse Action Plan was finalised in 2014 and covered 2014/15 to 2019/20. Consequently, a new Plan is due for Council consideration.

The Australian government has targets for carbon mitigation, known as 'Nationally Determined Contributions' (NDCs), as a result of the 2015 Paris Agreement. Australia has committed to reducing greenhouse gas emissions to 26–28 per cent below 2005 levels by 2030.

The aim of the Paris Agreement is to restrict global temperature rises this century to well below 2 degrees Celsius above pre-industrial levels. Further efforts may be pursued to ensure that this is limited to 1.5ºdegrees Celsius. Australia will submit its next NDC, with a post 2030 target, to the United Nations Framework Convention on Climate Change (UNFCCC) in 2025.

Given that National targets and milestones are scheduled to conclude in 2029/30, it is logical that this document covers the period 2020/21 to 2029/30.

A gap analysis has been performed, using a management tool developed by WALGA. This has spawned a series of improvement actions across Waste, Buildings, and Fleet. These range from the expansion of flaring infrastructure, to finalising a business case for the bulk changeover of LED streetlights.

An opportunity exists for the Flaring Project to be extended for a further five years to 2026/27. In conjunction with surplus credits from the existing contract, this has the potential to generate additional unbudgeted income of $979,000. These funds can be used to address the recommendations of this Plan ($145,000), leaving $834,000 for other initiatives.

Several emission reduction targets have been considered in the finalisation of this Plan. The recommended approach is to offset 100% of the carbon footprint of Buildings and Fleet for the period 2020/21 to 2029/30. The purchase of overseas offsets, allowable under the Climate Active Scheme, is forecast to cost $205,000. This leaves $629,000 for the implementation of energy efficiency projects in the City.

Other, more ambitious options are considered. However, these involve transferring far more significant funds overseas for offsets ($0.8 to $1.5m), with no ongoing benefit to the City.

The approach recommended assists in increasing carbon abatement, and stimulating the local economy. It is also more ambitious than the majority of Local Governments in Western Australia.

Finally, the Plan proposes the creation of a 'Carbon Reserve', enabling the accumulation of ring-fenced funds for the purchase of offsets and abatement initiatives.

Introduction

The first City of Armadale Corporate Greenhouse Action Plan (CGAP) covered the period 2008/09 to 2011/12. A subsequent report was produced for 2014/15 to 2019/20. This incorporated carbon reduction targets, on a per capita basis. Here, National reduction strategies, expressed in absolute terms, were converted to a per capita basis that reflected high levels of growth in the City:

'19% per capita reduction in 2000 levels by 2020'

The target was achieved, primarily through carbon abatement activities and the purchase of offsets, allowable under the federally supported Climate Active Scheme.

The expiry of the 2014/15 to 2019/20 Plan necessitates the production of a new CGAP. The focus is the mitigation of City of Armadale (the City) corporate emissions. It covers;

- International, national and state level carbon mitigation policy
- Western Australian Local Government initiatives
- The duration of the new CGAP
- Current and projected emissions profiles
- A synopsis of current abatement projects and opportunities for improvement
- The development of carbon reduction targets
- An Offsets Strategy, addressing any residual emissions to the target

The cost implications of future strategies will be presented, facilitating transparent decision-making.

Global and Domestic Context

International Initiatives

The central aim of the 2016 Paris Agreement (PA) is to facilitate a global response to the threat of climate change. It seeks to ensure that global temperature rises this century are limited to less than 2ºdegrees Celsius above pre-industrial levels. Efforts will be made to further limit temperature increases, to 1.5 degrees.

The PA includes commitments from all major emitting countries to reduce carbon emissions, and to periodically review and strengthen targets over time. It requires that all make their 'best efforts' through Nationally Determined Contributions (NDC's) (carbon abatement targets).

The PA opened for signature 22nd April 2016 ('Earth Day'), and came into force 4th November 2016 (thirty days after 55 countries, accounting for at least 55% of total global greenhouse gas emissions, deposited instruments of ratification with the United Nations). The 4th November 2016 is the point at which the 'Double Threshold Test' was passed.

As of July 2021, 191 countries are a party to the PA. The carbon mitigation targets, or NDC's, for a cross section of parties are included as Appendix 1.

The UK will host the 26th UN Climate Change Conference of the Parties (COP26) in Glasgow on 31ºOctober – 12 November 2021. The run up to this conference will see countries updating their plans for reducing emissions. It is hoped that countries will be more aggressive in revising targets, to limit temperature rises to 1.5 degrees Celsius.

Recent Developments

The Intergovernmental Panel on Climate Change (IPCC) is the United Nations' body for assessing the science related to climate change. It was created to provide policymakers with regular scientific assessments, its implications and future risk, as well as to put forward adaptation and mitigation options.

A sixth "Assessment Report" has recently been released. It examines a series of different possible scenarios, and in all of them, the 1.5 degree threshold is reached before 2035, and in the worst case scenario by 2028.

The Climate Council is an Australia climate change communications organisation. They provide advice to the public on climate change, energy solutions and international action, based on the science available. They include some of the country's leading climate scientists. As a result of the IPPC Report, they have announced that the following targets are appropriate:

- 75% on 2005 levels by 2030
- Net zero by 2035

These are more ambitions than most National targets (see below).

Australian National Policy

Carbon Mitigation

Australia has committed to a 26 to 28% reduction in carbon emissions by 2030, relative to 2005 levels.

As highlighted in Appendix 1, Australia's short term target is in line with that of the United States, Canada and New Zealand. Russia and the United Kingdom use 1990 as a baseline year, with 2030 reduction targets of 25 to 30% and 40% respectively. The target of the European Union is similar to that of the UK.

Alternative approaches have been adopted by other countries, examples as follows;

Table 1: Examples of Alternative Approaches to Emissions Target Setting

Country	Approach
India	33 to 35% in carbon emissions relative to Gross Domestic Product by 2030 (known as an 'emissions intensity' approach)
Brazil	Absolute target of 1.3GtCO_2-e by 2025
China	Peak CO2-e emissions by 2030 at the latest Non-fossil fuel sources: 20% in 2030 Forest stock – Increase of 4.5 bnm3 by 2030 relative to 2005 Emissions intensity (carbon relative to GDP) – 60 to 65% below 2005 levels by 2030

There are also longer-term targets in place. For example, the United Kingdom has committed to net zero emissions by 2050. Australia has yet to commit to a longer term objective.

Renewable Energy

A Renewable Energy Target (RET) was introduced by the Federal Government in 2001. This had the initial aim of acquiring two percent of national electricity from renewable sources. In 2009, this was increased to 20 percent of Australia's electricity supply (41,000 gigawatt hours – GWh).

In 2011, the RET was split into two parts; the Large-Scale Renewable Energy Target and the Small Scale Renewable Energy Scheme. Through this, high energy users are obligated to acquire a fixed proportion of their electricity from renewable sources. This is achieved by surrendering Large-Scale Generation Certificates (LGCs) or Small Scale Technology Certificates (STCs).

LGCs are typically generated by renewable energy power stations (e.g. wind and solar farms), STCs through small scale systems; rooftop solar; solar water heaters; and: heat pumps. The government issues LGCs to the electricity provider, in line with production. These are then be sold to high energy users, who surrender them in order to meet their target.

STCs are provided as up-front financial incentives to the installer, in the form of a discount.

In June 2015, the Australian Parliament passed the *Renewable Energy (Electricity) Amendment* Bill. This reduced the Large-Scale Renewable Energy Target in 2020 from 41,000 to 33,000GWh in 2020, to reflect updated energy production forecasts.

The 20 percent power supply target was achieved in November 2019. Both LGC and STC schemes have been extended until 2030, with a continued annual target of 33,000GWh.

State Government Response

These have responded differently to National carbon abatement policy:

Table 2: State Governments Response to National Targets

State	Details
Australian Capital Territory	50 to 60% reduction on 1990 levels by 2025 65 to 75% on 1990 levels by 2030 90 to 95% on 1990 levels by 2040
New South Wales	35% reduction on 2005 levels by 2030 Net zero emissions by 2050
Northern Territory	Net zero emissions by 2050
Queensland	30% reduction on 2005 levels by 2030 50% Renewable Energy by 2030 Net zero emissions by 2050
South Australia	50% below 2005 levels by 2030 Net zero emissions by 2050
Tasmania	At least 60% below 1990 levels by 2050
Victoria	Targets for 2025 and 2030 to be set imminent Net zero emissions by 2050
Western Australia	Net zero emissions by 2050

New South Wales and Queensland are broadly in line with the 2030 national objective. South Australia and the ACT have more stringent targets, and Victoria has yet to announce an abatement pathway. As it stands, Tasmania, the Northern Territory and Western Australia do not have targets for 2030. Western Australia has a 'net zero emissions' target for 2050.

Western Australia

The Department of Water and Environmental Regulation (DWER) has carriage over the '*Western Australian Climate Policy*'. This includes a plan for a climate resilient community, and prosperous low-carbon future.

The vision '*...is to harness Western Australia's innovation and wealth of natural and mineral resources to achieve net zero emissions and ensure a prosperous, resilient future for all Western Australians.'*

The Policy includes a number of streams;

- Clean manufacturing and Future Industries; Actions include the provision of support through, for example, the *Renewable Hydrogen Strategy* and *Future Battery Industry Strategy*.
- Transforming Energy Generation and Use; The *Energy Transformation Strategy* and *Distributed Energy Resources (DER) Roadmap* will enable continued uptake and better integration of resources such as a rooftop solar, batteries and electric vehicles.
- Storing Carbon and Caring for Our Landscapes; The Development of a *Western Australia Carbon Farming Strategy*, and the expansion of the conservation estate will assist in meeting 2050 targets.
- Lower-Carbon Transport; An *Electric Vehicle Strategy* has created a plan to support the uptake of battery electric vehicles, and hydrogen fuel cell electric vehicles.

There is also a work package dedicated to Climate Change Adaptation and includes, for example, the Waterwise Perth Action Plan.

Local Government

Carbon mitigation targets vary across WA Local Governments (LGs). Appendix 2 summarises the strategies of eleven LGs. These can be classed into a number of categories:

1. Those that do not account for carbon, or have carbon reduction strategies; or;
2. Those that do not have a landfill, but have carbon reduction targets (e.g. Melville); or:
3. Those that have a landfill, but may or may not account for carbon from municipal waste on the commissioning of the Waste to Energy Facility (WTEF) (Cockburn); or:
4. Those that have a landfill and have carbon reduction targets, but exclude waste emissions from the targets (e.g. Stirling); or:
5. Those that have a landfill, but do not account for carbon and have no emissions reduction targets (e.g. Rockingham).

The most ambitious targets are those of Cockburn (CoC) and Victoria Park (ToVP) (net zero emissions by 2030).

In 2022, CoC will be diverting waste to the new WTEF. The extent to which this waste will be accounted for by LGs is being reviewed by WALGA. Emissions from the Cockburn landfill site are approximately 50% of that of the City's.

ToVP's municipal waste is diverted to a regional facility, but they have made the decision to account for the carbon. The annual footprint of this waste is 20,000tCO_2-e, circa 50% of the Hopkinson Road Landfill and Recycling Facility (the 'Landfill Site').

There is an inconsistent approach across local governments in setting targets, and in accounting for landfill waste. Furthermore, the size of the City's landfill, and the commercial setting means that making a comparison with the CoC or ToVP on emission reduction targets is difficult.

Synopsis

There is no single consistent approach to carbon mitigation in the international arena. Although Australia has a national target, State governments do not have a unified strategy.

Western Australia has a 'net zero emissions' commitment for 2050, but does not have a carbon reduction commitment for 2030. WA local governments are equally inconsistent in their approach

Regulatory Framework

National Greenhouse and Energy Reporting Act 2007

The *National Greenhouse and Energy Reporting Act 2007* (NGER Act) governs the accounting and reporting of greenhouse gas emissions. This enables the periodic calculation of a National carbon 'inventory', and reporting against international carbon emission commitments.

If certain thresholds are exceeded, corporations must report emissions for individual facilities over which they have 'Operational Control'. This is deemed to apply if an organisation has the authority to introduce and implement policies in the following areas;

1. Operational
2. Health and Safety
3. Environmental

The range of emission types, and those that are reportable under NGER, are summarised below.

Table 3: Emission Classifications - NGER Act

Emissions Category	Definition	Reportable Under the NGER Act?
Scope 1	Also known as 'direct emissions', they are released to the atmosphere as a result of activities at a facility level, from owned or controlled sources. E.g. the City's Landfill Site	Yes
Scope 2	Indirect emissions from the generation of purchased energy. Scope 2 emissions from one facility are part of the Scope 1 emissions from another facility (e.g. Coal fired power stations). E.g. CoA buildings and fleet	Yes
Scope 3	These are indirect emissions (other than scope 2 emissions), generated in the wider economy. They occur as a consequence of the activities of a facility, but from sources not owned or controlled by that facility's business. E.g. CoA Councillor/employee flights to conferences	No

Officers are currently investigating the extent to which the City has reporting obligations under the NGER Act.

The City's emissions profile will be mapped against the different Scopes.

Climate Active

The Climate Active Scheme (the 'Scheme') is an ongoing partnership between the Federal government and Australian business to drive voluntary climate action. The brand represents Australia's collective effort to measure, reduce, and offset carbon emissions.

The *Climate Active Carbon Neutral Standard for Organisations* (the 'Standard') is a guideline to manage greenhouse gas emissions and achieve carbon neutrality, overseen by the Scheme. It provides best-practice guidance on how to measure, reduce, offset, validate and report emissions that occur as a result of the operations of an organisation.

The Standard can be implemented in a number of ways. It can be used to better understand and manage carbon emissions, to credibly claim carbon neutrality and to seek carbon neutral certification. A set of broad principles underpin the approach.

The emphasis of the NGER Act is reporting, but the focus of the Standard is mitigation of organisational carbon footprints. This can lead to differences in the inclusion/exclusion of certain components.

For example, Scope 3 emission reporting is not required under NGER (see above). However, under the Standard, they must be considered, tested for relevance, and potentially mitigated, if carbon neutrality is sought.

Under the 'Additionality' principle, any emissions reduction achieved '*must represent abatement that has not been double counted*'. This has direct relevance to the City, in the previous and potential future treatment of carbon credits arising from the Flaring Project. This is discussed in more detail below.

At a very high level, the Standard suggests that organisations should adopt the following approach to carbon management; 1) Identification of emissions; 2) Reduction of Emissions; 3) Offsetting of Emissions.

Safeguard Mechanism

The Safeguard Mechanism (the 'Mechanism') provides a framework for Australia's largest emitters to measure, report and manage their emissions. It does so by encouraging large facilities, whose net emissions exceed the safeguard threshold, to keep carbon footprints below baselines set by the Clean Energy Regulator.

The Mechanism applies to facilities with Scope 1 emissions exceeding 100,000 tonnes of carbon dioxide equivalent (tCO_2-e) per year. If the baseline is exceeded there are options to neutralise any surplus, all of which have negative financial impacts. These include, for example, the purchase of an equivalent number of Australian Carbon Credit Units (ACCUs) on the 'Voluntary Market' (VM). They must then be cancelled (surrendered) to the Federal government. This then bring corporate emissions back to baseline levels.

It is this demand from large corporations that may provide a market for future carbon credits generated by the City. The VM provides an opportunity for companies with Climate Solutions Fund (CSF) (see below) projects to sell their credits, and for those triggering the Safeguard Mechanism to buy them. Emitters wishing to voluntarily reduce their carbon footprint may also purchase credits through the VM.

Activities at the City's Landfill Site fall under the definition of Scope 1 emissions. However, in 2020 the carbon footprint of the site was 47,553tCO2-e, well below the 100,000tCO_2-e threshold.

Climate Solutions Fund

The CSF provides incentives to adopt carbon efficient practices or technologies to reduce emissions. It is enacted through the *Carbon Credits (Carbon Farming Initiative) Act 2011*, the *Carbon Credits (Carbon Farming Initiative) Regulations 2011* and the *Carbon Credits (Carbon Farming Initiative) Rule 2015*.

Through the initiation of carbon abatement projects, the CSF provides an opportunity to earn revenue through; 1) A contract with the Federal government; or: 2) the 'Voluntary Market'. The City's Flaring Project is accredited under the CSF, and a contract in place with the Federal government. This is nearing completion.

Historical Application in the City

The City has not been in a position to set or achieve targets in relation to carbon neutrality/net zero emissions. Nevertheless, the principles of the Standard have been followed in relation to alternative targets;

1. Identification of emissions
2. Abatement activities through project delivery e.g. the Flaring Project, solar panel installation, geothermal bore
3. Process improvement e.g. diversion of green waste away from the landfill
4. The purchase of offsets through accredited schemes, to address residual carbon emissions

In the purchase of offsets, only those recommended by the Climate Active Scheme have been purchased. This ensures that a robust accreditation process has taken place.

The Additionality principle of the *Climate Active Carbon Neutral Standard for Organisations* has been followed. As highlighted above, the Standard suggests that there should be no double counting of abatement. Only corporations that 'cancel' (surrender) credits are able to count the mitigation (cancelling or surrendering = 'donating' to the relevant regulatory agency). Specifically;

'Eligible offset units must be cancelled via an offsets registry. The cancellation should be clearly attributed to the carbon neutral claim and the organisation or responsible entity making the claim. The cancellation and attribution of eligible offset units is important to prevent resale or double counting of offset units.'

The City has previously sold credits from the Flaring Project, not cancelled them. For this reason, any credits sold to third parties have been replaced, and cancelled. This means that the City has still been able to count the abatement, albeit from a different source.

Given that neutrality has not been sought, the CoA has previously only included Scope 1 and Scope 2 emissions in carbon mitigation calculations. Scope 3 emissions have not been covered. This decision has been on the basis of materiality, and complexities associated with calculating the City's component (e.g. See example provide in Table 3 above – Councillor Flights).

A very high level calculation estimated that Scope 3 emissions were circa 500tCO_2-e in 2019/20 (1% of City emissions).

City of Armadale Emissions Profile

2019/20 Carbon Footprint

City emissions for 2019/20 are summarised below. These are consistent with previous reports to Council and the methodology of the NGER Act (only Scope 1 and 2 emissions):

Table 4: Analysis of City Emissions in 2019/20

Emissions Component	Tonnes of Carbon Dioxide Equivalent (tCO_2-e)	Emission Scope
Gross Waste Emissions	**52,887[1]**	**1**
Amounts Flared	**(9,833)[1]**	**1**
Net Waste Emissions	**43,055[1]**	**1**
Buildings	**4,366[2]**	**2**
Fleet	**132[2]**	**2**
Total	**47,553**	

[1] Calculated using the Federal government Solid Waste Calculator
[2] Provided by carbon accounting software (third party)

The Landfill Site accounts for 91% of the City's carbon footprint, from methane (CH_4) from the anaerobic decomposition of waste. According to the IPCC, CH_4 has an Emissions Factor that is twenty eight times the global warming potential of carbon dioxide (the IPCC regularly reviews the Emissions Factors of all greenhouse gases, based on scientific analysis). The operation of the flare, converting methane into CO_2, abates 20% of gross emissions at the Landfill Site.

The remainder of the profile consists of the City's building portfolio (9%), and a small fleet component.

If the City's population (94,348) is compared to the carbon footprint, emissions equate to circa 0.5tCO_2-e per capita in 2019/20. The baseline for Australia's national targets, and a number of State governments, is 2004/05. Appendix 3 highlights the City's emissions profile at this point. Per capita emissions were 35,782tCO_2-e/51,795 = 0.69tCO_2-e.

Emissions intensity has reduced over time in the City, due to efficient waste management practices (segregation of green waste) and the Flaring Project.

Non-Reportable Emissions

Streetlight emissions in 2019/20 were 4,118tCO_2-e. Prior to the previous CGAP, the Western Australian Local Government Association (WALGA) performed an assessment of whether streetlights are under the Operational Control of local governments (see 'Operational Scorecard' - Appendix 4).

The review concluded that Western Power has control. Streetlights have therefore not been considered part of the City's carbon footprint.

As per the approach discussed above (see 'Historical Application in the City'), the City has never reported on Scope 3 emissions.

Duration of Plan

Under the PA, National carbon emission targets are set to be achieved in 2030. This milestone is replicated by many countries, and several Australian states.

Consequently, it is proposed that the term of this Plan is 2020/21 to 2029/30. This enables a clear indication of how the City's activities contribute towards National and International carbon reduction targets.

Future Forecasts and Initiatives

WALGA recently released a comprehensive list of actions with the capacity to reduce greenhouse gas emissions (the WALGA Action Planning Tool – 'WALGA Tool'). This was developed in collaboration with Ernst and Young, and a Local Government Working Group.

The list of 49 actions has been considered, and a gap analysis performed by City staff. This took place in an internal workshop, with a multi-disciplinary team. It identified existing practices and opportunities for improvement. The results are documented in Appendix 5.

The City's emissions profile provides a framework for the discussion of these opportunities. Forecast emissions for each source (Waste, Buildings and Fleet) are provided for 2020/21 to 2029/30, giving context to the assessment of opportunities.

However, consideration will also be given to the potential for additional strategic documents, and carbon accounting aspects, to provide overarching guidance around carbon mitigation.

Climate Change/Mitigation Policies

<u>Context</u>

The City of Armadale Strategic Community Plan has an outcome (2.1) to ensure '*Conservation and restoration of the natural environment'* and a supporting action of '*Minimising corporate and community carbon footprints'*. This is replicated in the City's Strategic Environmental Commitment, approved by council in 2019.

<u>Opportunities/Results of Gap Analysis</u>

1. *Strategic Policy Positions*

The WALGA Tool was issued in conjunction with the following templates:

1. Climate Change Declaration: Provides a clear statement that Local Governments accept the science of climate change and commit to adopting climate change adaptation and mitigation strategies.
2. Climate Emergency Declaration: May be adopted by Local Governments committed to taking urgent climate action and allocating resources accordingly. This involves rapidly scaling up mitigation and adaptation actions.
3. Corporate Adaptation Plan Template: This specifically focuses on identifying actions for Local Governments to manage climate risks, and adapt to the operational impacts of climate change.
4. Corporate Mitigation Action Plan: This identifies actions that Local Governments can take to reduce greenhouse gas emissions and help avoid future impacts of climate change.

The City has not endorsed a Climate Emergency Declaration, but did sign a Climate Change Declaration in 2011 that was submitted to State Council (see Appendix 6). Given its age, the currency of this document needs to be reviewed, as does the potential for developing an Emergency Declaration.

Recommendation 1	**Responsibility and Timescale**
Provide a report to Council, proposing an approach to the development of a Climate Change Declaration and Climate Emergency Declaration	Manager Environmental Services 2022/23
Budget Required	$Nil

The potential impacts of climate change are evaluated through the City's Risk Management Framework. Risks and mitigating controls are periodically evaluated by the Executive Leadership Team (ELT).

Nevertheless, it would be beneficial to conduct a review of the Climate Change Adaptation WALGA template, and assess any potential implementation benefits.

Recommendation 2	**Responsibility and Timescale**
Report to Council, proposing an approach to the production of a Climate Change Adaptation Management Plan and/or Strategy	Manager Environmental Services 2022/23
Budget Required	$Nil

Recommendations 1 and 2 may be addressed through a 2020/21 $35,000 budget allocation, (for supporting consultant activities associated with the Corporate Greenhouse Action Plan). This has been identified as a Strategic Operational Carry Forward.

Hopkinson Road and Landfill Recycling Facility

Context

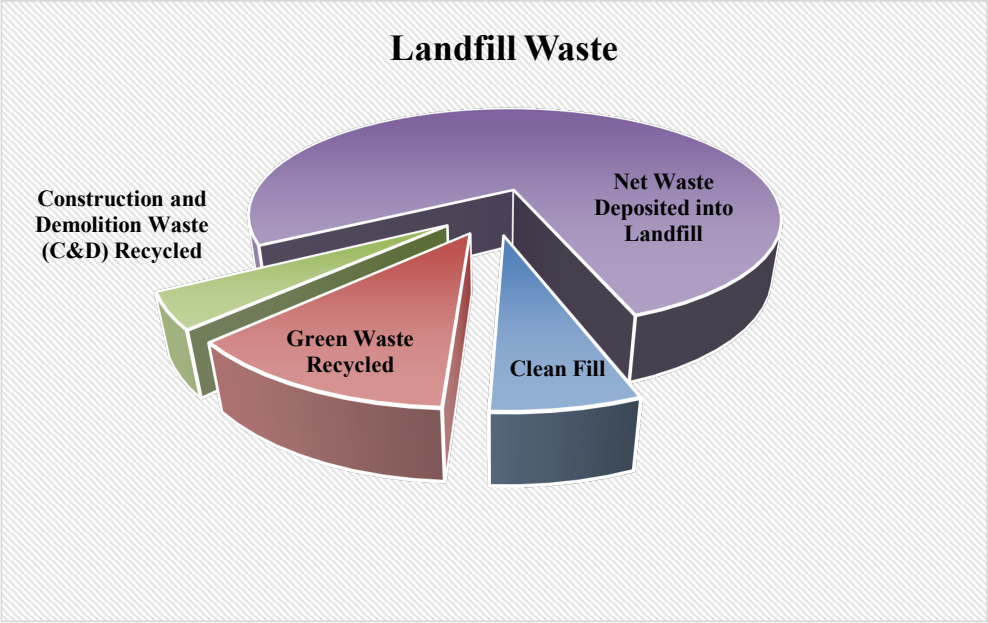
The site opened for business in 1974. For context, a reconciliation of waste receipts to landfill deposition is highlighted below:

Table 5: Landfill Waste in 2019/20

Component	Tonnes	Notes
Gross Receipts	**57,662**	
Clean Fill	(3,625)	Used as final cover Inert material.
Green Waste Recycled	(6,882)	Mulched by a third party
Construction and Demolition Waste (C&D) Recycled	(2,517)	Stockpiled and used on site
Net Waste Deposited	**44,638**	
Analysed as Follows:		
Municipal Solid Waste (MSW)[1]	30,412	73% of waste deposited
Commercial and Industrial Waste (C&I)	3,353	8% of waste deposited
C&D Waste[1]	7,772	19% of waste deposited

[1] Trailer waste of 10,292t is allocated to MSW (31.3%) and C&D Waste (68.7%), as per audit findings.

Figure 1: Landfill Statistics for 2019/20



Using the Federal government's Solid Waste Calculator, landfill deposition resulted in a gross (pre abatement) figure of 52,887tCO_2-e in 2019/20.

The City has entered into a contract with Avertas Energy, operators of the new Waste to Energy Facility (WTEF). On commissioning, expected in March 2022, all MSW generated by residents will be processed in Kwinana.

Carbon Accounting Matters

WALGA has recently established a 'Carbon Accounting Group, consisting of LG members. The City has been added as a participant. The Terms of Reference include an objective to '*Establish an agreed guide as to what corporate carbon emission sources should be tracked by Local Governments*'.

The Group intends to formulate an accounting position on household waste diverted to the WTEF. This will guide the extent to which LGs incorporate carbon emissions into their profile (as a Scope 3 emission).

Avertas will receive the waste, in consideration for Local Government financial contributions. It is also possible that they will seek to register the combustion process as an abatement project (as it avoids CH_4 emissions). This may result in an additional income stream for the WTEF.

Avertas therefore receives a financial benefit for the service provided, at a cost to the LGs, including the City. From this perspective, it would be inequitable for the CoA to account for the carbon, and any potential related costs (e.g. mitigation through the purchase of offsets, or staff time in the preparation of carbon statements).

From this perspective, the 'carbon burden' should be matched with the revenue, and not borne by the City.

Recommendation 3	**Responsibility and Timescale**
Irrespective of the results of the WALGA review, the City of Armadale does not account for carbon emissions associated with household waste diverted to the Waste to Energy Facility	N/A
Budget Required	$Nil

Forecast

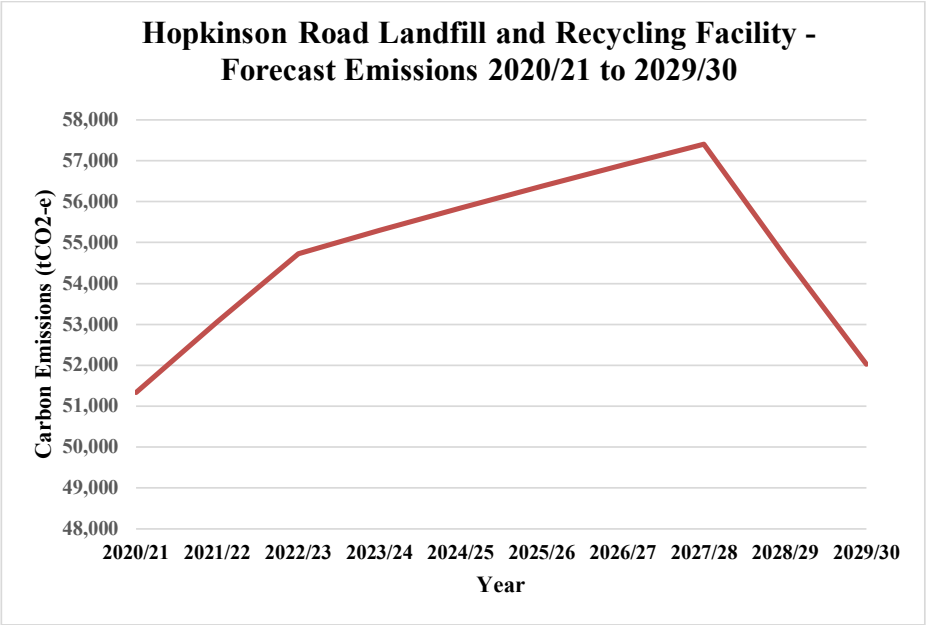
Adopting the above recommendation means that, from 2022, waste from residents will no longer drive emissions. The recent 'Air Space Tender' sought proposals to accelerate deposition rates at the site. This will advance the closure date and generate income for the City, supplementing reserve funding levels. The intent is for this to address landfill closure and rehabilitation costs.

It is anticipated that from 2022/23, the deposition profile will approximate to 12% MSW and 88% C&I. This will arise from new commercial contracts, and the continued receipt of waste from small LGs.

The Landfill Site is scheduled to reach full capacity by the end of 2027/28. However, this is dependent on the number of commercial contracts in place, and the volumes received.

Assumptions underpinning the forecast are highlighted in Appendix 7. Detailed supporting waste volume calculations are within Appendix 8. These form an input into the 'Solid Waste Calculator', a Federal Government tool that automatically calculates landfill emissions (see below):

Figure 2: Hopkinson Road Landfill and Recycling Facility Forecast Emissions 2020/21 to 2029/30



All emissions calculated in accordance with the Federal Government Solid Waste Calculator

Figure 2 highlights that gross emissions are projected to gradually increase, and then tail off, over the term of the Plan. During this period, the City has elected to receive commercial waste and municipal waste from adjacent Local Governments, after the diversion of household waste to the WTEF.

Legacy waste will continue to decay and produce methane for a number of years after deposition. While waste from future contracts will produce less methane than current levels of municipal waste, this is more than offset by the volumes projected. In addition, during this period, legacy waste will continue to contribute to the emissions profile.

Net annual emissions at the Landfill site will be 9,800tCo_2-e less than displayed above, due to the Flaring Project (conservative estimate based on 2019/20 performance). Nevertheless, it is more appropriate to highlight Gross emissions, as the City may sell, rather than cancel the Flaring Project abatement. Hence, the above Figure shows the actual contribution to the City's footprint.

The approach to waste emissions is consistent with the City's historical methodology, used in the preparation of Flaring Project Offset Reports. These were submitted to the Clean Energy Regulator, and subject to pre-submission audits. These concluded that the process, and interpretation of relevant legislation were sound. Consequently, Council can have confidence over the forecasting methodology.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

Site processes ensure that waste deposition to the tip, and carbon emissions, are minimised;

1. Green Waste: Material from two verge collections is transferred offsite for mulching. A small component is returned and available free of charge to the community.
2. Construction and Demolition waste: After compaction, used on-site as road base material.
3. Drop and Shop: Goods having the potential of a 'second life' are sold to the public.
4. E-Shed: Electrical components are dismantled and sold to a contractor.
5. Transfer Station: Waste sorting results in the segregation and re-use of wood, metal, glass and polystyrene.
6. Tyres, white goods, cardboard and PVC polypipe are recycled and/or stockpiled for re-use or resale when market conditions are optimal.

The flare has operated at the site since 2014, converting methane to carbon dioxide. This abated 91,050tCO_2-e during the last CGAP period (2014/15 to 2019/20), equating to circa 32% of gross emissions.

Climate Solutions Fund

The Flaring Project is CSF accredited. The conversion of methane to carbon dioxide generates an asset to the City, Australian Carbon Credit Units. Since 2014, ACCUs have been sold, generating income under a seven year contract with the Federal government.

The City elected to replace these credits, with alternatives accredited under the Climate Active Scheme. The price difference between income received and offsets purchased has been allocated to the Wungong River Project, an environmental rehabilitation initiative. The intent was for these funds to be invested into a local project, benefitting the local community.

Opportunities/Results of Gap Analysis

Documented in Appendix 5, these are summarised below.

1. *Expansion of Flaring Infrastructure*

The flare generated 9,833tCO_2-e of abatement in 2019/20, mitigating 20% of site emissions.

The continued extension of the pipework and well heads will ensure ongoing methane abatement. This provides the most effective mechanism available to the City to minimise carbon emissions:

Recommendation 4	**Responsibility and Timescale**
Implement the continued expansion of infrastructure associated with the Flaring project, enabling continued carbon abatement at the site	Manager Waste Services Ongoing
Budget Required	Already Funded in Waste Services budget

No additional budget allocation is required.

2. *Lifespan - Flaring Project*

Finalisation of Contract

The City is party to a seven year contract with the Federal government. This is for the provision of 68,000 tonnes of carbon abatement.

As previously reported, enough surplus credits have accrued to complete the contract. The City's Australian National Registration of Offset Units account (ANREU) displays a holding of 16,810tCO_2-e ACCU's. However, only 9,716tCO2-e are required to satisfy the contract, leaving a residual 7,094tCO_2-e.

The City may request that the Clean Energy Regulator draw the arrangement to a conclusion, triggering the transfer of 9,716 units from the City's ANREU account. The Manager Environmental Services and Executive Director Technical Services are the respective 'Initiator' and 'Approver' of transactions on the ANREU system (as approved by the previous CEO).

Recommendation 5	**Responsibility and Timescale**
The Climate Solutions Fund contract with the Federal Government is to be completed early, through the provision of the total amount of contracted carbon credits	Manager Environmental Services/ Executive Director Technical Services 2021/22
Budget Required	Implications Already Included in the Long Term Financial Plan

There are no further budgetary implications.

Additional Reporting and Income

Despite contractual obligations being fulfilled early, there is a requirement to produce a final Offset Report for 20 June 2020 to 13 December 2021 (the scheduled end date of the project).

This is likely to record that abatement of approximately 12,000 to 13,500 units has been generated over the final project period (eighteen months). This is above and beyond the requirements of the contract.

These units may be combined with residual holdings of 7,094tCO_2-e, resulting in a total of 19,000 to 20,500tCO_2-e.

An option is to sell these on the Voluntary Market as a 'one-off' sale. The current spot price of carbon is $18.50. Following the application of a 15% contingency, to cover broker commission and market fluctuations, a price of $15.7 per unit is likely. Hence, they have an approximate value of $310,000.

Recommendation 6	**Responsibility and Timescale**
Council authorise the sale to the Voluntary Market of surplus carbon credits (7,094tCO_2-e), and those generated in the period 20 June 2020 to 13 December 2021	Manager Environmental Services 2021/22
Budget Required	See Table 6 below

This will result in an additional unbudgeted income stream:

Table 6: Income Stream from Surplus Credits

Income or Cost	**Origin**	**2021/22 Additional Income Generated or Budget Required $**
Additional Income Streams[1]	Surplus Credits 7,094tCO_2-e x $15.7 Final Offset Period 20 June 2020 to 13 December 2021 12,750 x $15.70 **Total**	111,376 $200,175 **$311,551**

A budget allocation for the preparation of the supporting Offset Report is already in place for 2021/22.

3. *Future Flaring Project Options*

The regulator recently announced that all CSF Flaring projects may be extended by five years. For the City, this means a potential total life span of twelve and a half years.

There are three possible approaches to the treatment of the project, summarised below and evaluated in Appendix 9. The merits of the Voluntary Market are discussed below:

Table 7: Financial Summary of Options for the Flaring Project

Option	Explanation	Net Financial Impact $
1.	Extend the project – Sell City generated Australian Carbon Credit Units (ACCU's) on the Voluntary Market	666,890
2.	Extend the project – Do not sell City generated ACCU's and surrender credits to the Federal government	(105,000)[1]
3.	Do not extend the project – Account for flare abatement in-house	0

[1] The result of compliance costs

Option 1 creates a position of financial surplus. This places the City in a position to potentially fund the recommendations of this Plan.

Projected income and cost streams, associated with the project extension, are summarised below:

Table 8: Forecast Income and Cost Schedule for the Project Extension Phase

Year	2023/24 $	2024/25 $	2025/26 $	2026/27 $	2027/28 $	2028/29 $	Total $
Income[1]	-	308,756		308,756		154,378	**771,890**
Compliance Costs[1]	(45,000)		(45,000)		(15,000)		**(105,000)**
Total	**(45,000)**	**308,756**	**(45,000)**	**308,756**	**(15,000)**	**154,378**	**666,890**

[1] Assumes Offsets Report and Audit are due after the completion of year two and four in December 2023 and 2025, with income collected the following financial year (audit process can take 3 months, and the regulator has a three month determination period).

The spot price of carbon is considered a conservative estimate. As 2030 approaches, the demand for ACCU's is likely to increase, as State and Local Government commitments are delivered. This will quite probably lead to an increase in price.

Income and cost allocations have been made in the Long Term Financial Plan. However, these need to be amended to reflect the above projections. This will be performed as part of the four year budget process.

The Voluntary Market is the most appropriate sales avenue for carbon credits. This enables the City to sell as many or as few credits as it likes, at a time that suits. Buyers will be those with voluntary targets, or corporations seeking to meet obligations under the Safeguard Mechanism.

The alternative is entering into a new contract with the Federal government. In this scenario, Council will be obliged to provide fixed amounts at a specific point in time. This could prove to be a risky strategy, given the Landfill Site is in a period of transition. For this reason, the Voluntary Market is recommended as the preferred approach.

The spot price of carbon is consistently higher than weighted average values in Federal Government contracts. Hence, there is the potential to maximize revenue.

Recommendation 7	**Responsibility and Timescale**
Council authorise an application to the Federal government, seeking an extension to the life of the Flaring Project by a further five years	Manager Environmental Services 2021/22
Budget Required	$Nil

Recommendation 8	**Responsibility and Timescale**
Council endorse the principle of selling carbon credits for the extension period on the Voluntary Market	N/A
Budget Required	See Table 8 above

Council approval will be sought prior to the sale of carbon credits in the extension period, facilitating an analysis of project performance against forecast.

Buildings

Context

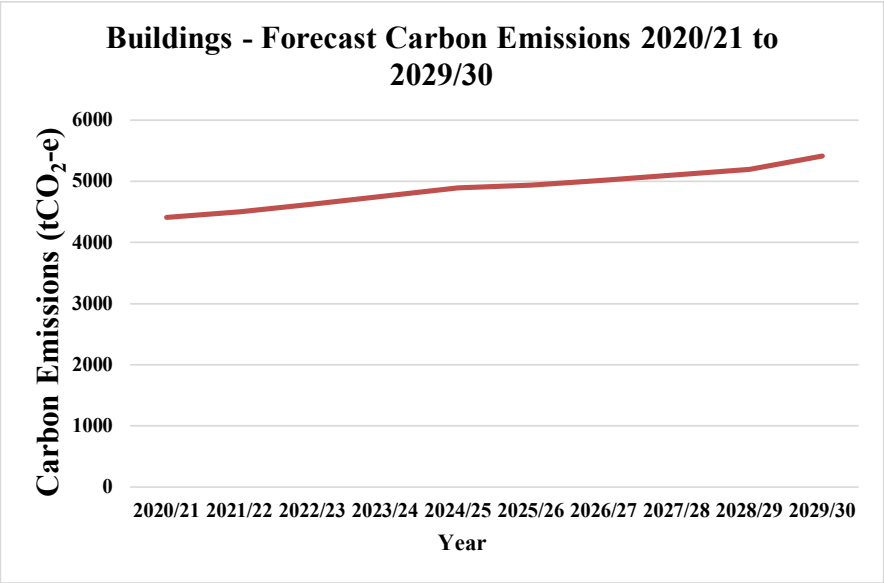
The City manages a portfolio of 135 community buildings. This includes sporting clubs, two recreation centres, three libraries and seven operational facilities. Electricity associated with 116 metered irrigation bores is included within buildings emissions.

In 2019/20 the carbon footprint equated to 4,366tCO_2-e (9% of the City's total).

Forecast

Anticipated emissions are presented below:

Figure 3: Building Facility Forecast Emissions 2020/21 to 2029/30



Calculated using carbon accounting software from a third party

Population growth is used as a proxy for emissions.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

These are summarised as follows:

1. Finalisation of energy audits, and subsequent implementation of actions for AFAC (2016), Armadale Arena (2016), the Depot (2016), Piara Waters Pavilion (2016) and the Champion Centre (2014)
2. Solar panel installation at Armadale Arena, Armadale Fitness and Aquatic Centre (AFAC), Main Administration Building and the Depot
3. Geothermal bore at AFAC for water heating

An energy audit of the Landfill Site is currently in progress, facilitated by Switch Your Thinking.

The City is installing new solar systems at the Champion Centre (30kW) and Orchard House (160kW). The existing solar panels at AFAC are now under-sized, given facility upgrades. Consequently, a 500kW system is being installed. All systems will be commissioned by 31 December 2021, and funded by government stimulus packages. Collectively, these will produce an annual energy saving of 1,000MWh (circa $300,000), and reduce the carbon footprint by 700tCO_2-e.

City facilities are either 'Contestable' or 'Non-Contestable' electricity users. The former utilise in excess of 50 megawatt hours per annum, and a competitive quotation process is undertaken. The City has eleven contestable sites, accounting for 70% of electricity consumption, and 65% of total cost.

Non-Contestable sites are supplied by Synergy, with no option for a competitive process. In this case, prices paid are mandated by the economic regulator.

At the time of writing, the carbon footprint of the City's Contestable sites is nil, as Council elected to procure 100% renewable power for the current contract.

Energy efficiency projects will therefore not reduce the City's carbon footprint for Contestable sites, but will result in electricity cost savings. For Non-Contestable sites, they also reduce the carbon footprint.

Opportunities/Results of Gap Analysis

The WALGA Tool (Appendix 5) highlights potential opportunities for the City.

1. *Building Policy*

The City does not have a policy position on standards associated with new or refurbished buildings. This would be of benefit, providing consistency across all facilities, and the deployment of energy efficient technology.

Recommendation 9	**Responsibility and Timescale**
Develop a Policy for Green Buildings	Property Services Manager 2021/22
Budget Required	$Nil

2. *Energy Efficiency*

Solar installation at City facilities has been opportunistic, with efforts focused on sites demonstrating the most likely attractive payback periods. Installations have also been in response to specific grant opportunities.

The City would benefit from a formal feasibility study, covering the top 20 energy using sites. Installation may then be prioritised, with 'grant ready' projects available.

Recommendation 10	**Responsibility and Timescale**
Complete a solar feasibility study for the City's top 20 electricity using facilities	Property Services Manager/ Manager Environmental Services 2022/23
Budget Required	$50,000

Energy audits at City facilities have also been opportunistic. A formal programme may be introduced, focusing on high consumption sites.

Recommendation 11	**Responsibility and Timescale**
Complete energy audits for two City facilities per annum, focusing on the top 20 electricity consuming sites	Property Services Manager/ Manager Environmental Services 2022/23
Budget Required	$10,000 per annum

3. *Monitoring*

The City deploys a carbon, energy and water monitoring system. Consumption reports are reviewed quarterly by a multi-disciplinary City team. This enables the identification of unusual trends and/or efficiency opportunities.

Whilst the carbon component of the system is effective, and used for Council reporting purposes, there is an opportunity to upgrade electricity and water consumption components.

'Real-time' monitoring, rather than retrospective review, enables a swift response to emerging issues (e.g. water leaks, energy spikes). It also enables a unified approach to the monitoring of solar PV production (currently measured through a number of disparate systems). The existing consultant contract expires in September 2021, at which point the City can consider alternatives.

Recommendation 12	**Responsibility and Timescale**
Progressively implement a real-time energy and water monitoring system, initially targeting high demand (top 20) facilities.	Property Services Manager/ Manager Parks/ Manager Environmental Services 2021/22
Budget Required	Already Funded in Environmental Services budget

No additional budget allocation is required.

4. Energy Sharing

Traditionally, electricity has been supplied through a linear chain, incorporating generation, transmission, distribution and retail.

This system is evident in the energy produced from solar panels. When power is generated, surplus to the requirements of the facility, it is exported to the grid. The facility owner derives no financial benefit.

The South West Interconnected System has recently undergone a change, due to the enormous uptake of solar systems. The grid has transitioned from a linear model, to a network of generation and storage assets, including solar PV, battery storage, electric vehicles and metering devices.

The governance and regulatory framework to support this advancement is in development. However, the potential exists for Local governments to share renewable energy between facilities, through 'Micro-Grids' or 'Virtual Power Plants'. This could, in theory, reduce operating costs and provide cheaper electricity.

This matter is discussed in detail in Appendix 10 (Switch Your Thinking discussion paper presented to the South East Regional Energy Group).

Recommendation 13	**Responsibility and Timescale**
Switch Your Thinking remain abreast of regulatory developments, and through Council reporting, recommend implementation projects in the City of Armadale	Switch Your Thinking Ongoing
Budget Required	$Nil

5. Electricity Procurement

As discussed, the City's Contestable sites are currently supplied by renewable power. This comes at a premium, at approximately 15% more expensive than traditional energy sources.

WALGA are investigating the possibility of a bulk purchase of Renewable energy. This will take the form of a Power Purchase Arrangement, scheduled to commence April 2022. It is hoped that this will introduce economies of scale.

The City has provided energy use profiles to WALGA, to assist in setting procurement volumes. Suppliers may then use this to determine pricing.

A Memorandum of Understanding has also been signed by the City's Chief Executive Officer, enabling participation in the quotation process. A chosen supplier will be selected by WALGA in October 2021. It is not compulsory for the CoA to accept the preferred supplier or pricing on offer.

At this point, a report will be produced for Council to consider the commercial and environmental benefits of contracting with the preferred supplier.

Recommendation 14	**Responsibility and Timescale**
Produce a report to Council, providing a cost benefit analysis of the City entering into a contract with the WALGA preferred supplier	Manager Environmental Services 2021/22
Budget Required	$Nil

Fleet

Context

The City owns and maintains the following assets:

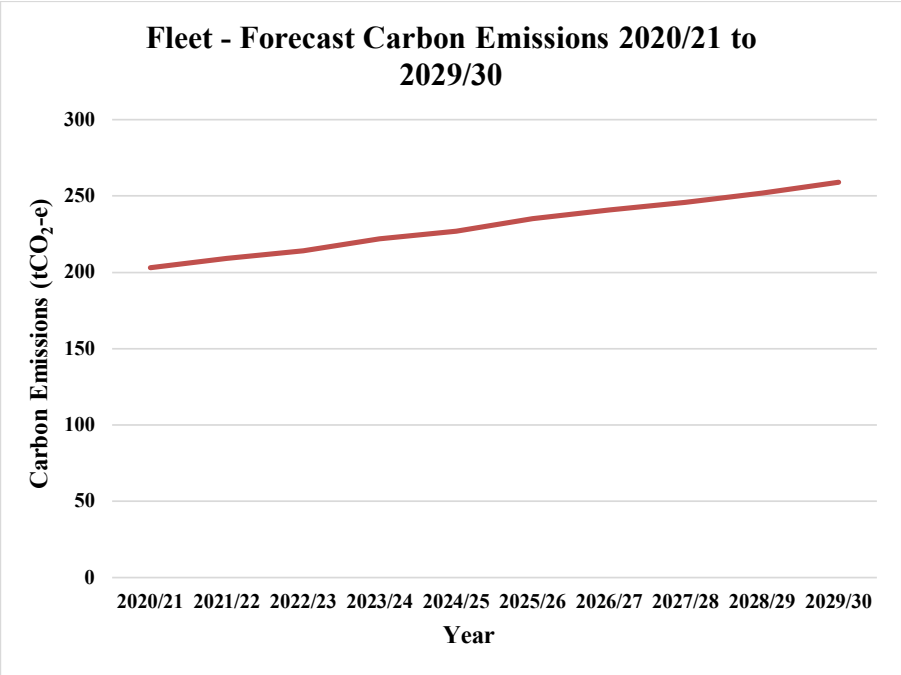
Table 9: City of Armadale Fleet

Type	Number
Light Fleet (e.g. cars)	131
Light Plant (e.g. cement mixer)	85
Heavy Fleet (e.g. waste truck)	40
Heavy Plant (e.g. tractor)	13
Other	1
Total	**270**

Forecast

This is summarised as follows:

Figure 4: Fleet Emissions 2020/21 to 2029/30



Calculated using carbon accounting software from a third party

Population growth forecasts are used as a proxy to estimate emissions.

Carbon Mitigation Measures

Existing Practices/Completed Initiatives

A report is currently in production, with the objective of recommending strategies to optimise operational fleet numbers.

The Australian Renewable Energy Agency (ARENA) Future Fuels Fund addresses barriers to the implementation of new vehicle technologies. Funding of $16.5m is available to finance Battery Electric Vehicle (BEV) fast charging stations in capital cities and regional centres.

Recently, Switch Your Thinking were approached by Synergy, CRC Future Battery Industries and the Gemtek Group, to identify potential suitable locations for installation in in the City. The Administration Building is ideally situated, close to both the Albany and South West Highways.

An application for $120,000 was submitted to the Future Fuels Fund for a charger at the City's Administration Building. Unfortunately, this was unsuccessful. The Switch Your Thinking team, however, will continue to monitor potential funding opportunities to deliver the project.

Opportunities/Results of Gap Analysis

1. *Deployment of Electrical Vehicles*

Aside from one vehicle, the City's fleet is fuelled by traditional sources. There is an opportunity for an ongoing evaluation of alternative technologies and the benefits they may introduce. These include, for example, electric or hydrogen powered vehicles.

Recommendation 15	**Responsibility and Timescale**
Develop options for improving the sustainability of the City's fleet such as transitioning to electric or non-hydrocarbon vehicles	Manager Assets 2022/23
Budget Required	$Nil

Other Initiatives

The benchmarking exercise has yielded a number of additional actions.

1. *Streetlights*

Most street lights in Australia are owned and operated by Distribution Network Service Providers. In Western Australia, this is Western Power.

There are 11,000 streetlights in the City, attracting a flat daily tariff. There is limited transparency over the components of this charge, particularly for electricity and maintenance costs. The City's lighting stock consists of inefficient, antiquated technology and there are environmental issues associated with disposal (e.g. mercury vapour lights).

The annual street lighting bill to the City is $2.2m, with no opportunity for contestability. Although not included in the City's carbon footprint, street lights in Armadale generate emissions of 4,118tCO_2-e.

In 2020, a Street Lighting Working Group was formed by the Cities of Albany, Armadale, Canning, Cockburn and Melville. The purpose is to implement, in partnership with Western Power, bulk changeover projects to replace old lights with LED smart ready lighting.

An indicative business case, provided by a third party consultant, was presented to Council in August 2020. This highlighted that a changeover project will cost in the region of $6.4m. This will reduce the cost of street lighting by $1.1m per annum, with a payback period in the order of six years. The carbon footprint associated with street lights will be halved.

The working group continues to liaise with Western Power to advance the project, and derive certainty over costs.

Recommendation 16	**Responsibility and Timescale**
When there is certainty over implementation costs and ongoing tariffs, provide a business case report to Council on a bulk changeover to LED street lights	Manager Environmental Services Timescale Dependent on Western Power
Budget Required	Implications will be discussed in the report to Council

A policy is currently in draft form, covering lighting standards in new development areas, and an approach to replacement lighting in older suburbs. This provides an additional opportunity to implement energy efficient lighting.

Recommendation 17	**Responsibility and Timescale**
Finalise, and present to Council, a Streetlighting Policy around the deployment of energy efficient lighting in the City	Manager Engineering Design 2021/22
Budget Required	$Nil

The City owns and manages approximately 500 decorative lights. There is an opportunity to change these over to LED models.

Recommendation 18	**Responsibility and Timescale**
Prepare a business case for the potential changeover of decorative lights to more energy efficient models	Manager Engineering Design 2021/22
Budget Required	$15,000

2. *Revolving Energy Fund*

Council considered the possibility of a Revolving Energy Fund (REF) in 2002, and during the finalisation of the *2009 to 2012 Corporate Greenhouse Action Plan*.

Through 2009/10 budget deliberations, $100,000 was allocated as seed funding. The reserve was set up to fund energy audits and the implementation of energy efficiency measures. Initial capital project costs were to be funded by the REF, and the account replenished by utility savings. This then provides funds for further re-investment.

The REF is still in operation, used several years ago to fund solar panels for the Administration Centre, Armadale Arena, Depot and AFAC. The balance on the fund is now $235,000.

There is an opportunity to clarify the rules around the mechanism of the Fund. Thus far, replenishment of the REF ends when the capital cost is fully recovered. This increases the utility budget, but does not encourage additional continuous improvement. Consequently, it is proposed to allocate annual cost savings to the REF in perpetuity, however this will require strategic direction from Council . The use of the REF should be captured in a formal policy.

Recommendation 19	**Responsibility and Timescale**
Develop a policy around the use of the Revolving Energy Fund	Manager Environmental Services 2023/24
Budget Required	$Nil

3. *Divestment*

In 2015, Council considered a report on the City's investment practices, focusing on projects funded by investing institutions. The merits of 'Divestment' were considered as part of this review. Divestment is the process of steering funds away from institutions supporting projects that involve the exploitation of fossil fuels.

The report resulted in an amendment to Council policy FIN4 '*Investments*', and the accompanying Management Practice. The changes ensure that the City prioritises investments in institutions with a portfolio of 'green' investments. Qualifying criteria accompanied the changes, ensuring that ratepayer funds are also invested in a financially responsible manner, and only with appropriately rated institutions.

The policy was last reviewed in 2018, and the relevant extracts were unchanged. There is a Monthly Financial Report to Council, highlighting the proportion of the City's investments in 'green' and 'non green' institutions. Hence, appropriate oversight is in place.

4. Sustainable Procurement Policy

Appendix 5 highlights an opportunity to reduce Scope 3 carbon emissions, through the implementation of responsible purchasing practices. For example, when purchasing paper, the City may elect to procure only recycled material. Larger City purchases could be the focus of any guidelines or policy. Alternatively, it may be focused on large scale project implementation, to implement sustainable practices.

The *Switch Your Thinking Business Plan 2020/21 to 2024/25* includes an action to develop a Sustainable Purchasing Policy template for all partner Councils. This will provide guidance on the principles to be applied in the procurement process.

Recommendation 20	**Responsibility and Timescale**
In partnership with the Switch your Thinking team, investigate the feasibility of implementing a Sustainable Purchasing Policy, and develop appropriate City supporting documentation	Switch Your Thinking 2022/23
Budget Required	$Nil

5. Staff Incentives

It is becoming increasingly common for organisations to offer employee incentives to adopt more sustainable procurement practices. These include subsidies for staff to use public transport. It is possible that an incentive scheme could work effectively in the City, and in relation to a broad range of areas.

Recommendation 21	**Responsibility and Timescale**
Complete an investigation into possible incentives for employees to adopt sustainable practices. The study should cover options for behaviours that could be incentivised, in conjunction with the potential rewards offered	Switch Your Thinking 2022/23
Budget Required	$Nil

City of Armadale Targets

The International community, Australian government and many State governments have 2030 targets for carbon abatement. It is appropriate that the City follow suit, enabling a transparent link between efforts on the micro and macro scale. A cost benefit analysis is required to determine which target the City should apply.

Options

Six potential targets have been considered, and the rationale documented. The results are summarised in Table 10.

In five of the six options, a progressive or tapered approach is taken towards target achievement. Annual emissions are compared against an emissions reduction trajectory. To avoid double counting, the City's actual emissions are not reflective of any flare abatement.

The sixth option involves the City considering only emissions from Buildings and fleet, in accordance many WA Local Governments.

A worst case scenario is applied when calculating the 'emissions gap', where it is assumed that no abatement activity is achieved in the City, and that Green power is not purchased (nil carbon footprint). This is considered prudent.

In all scenarios, abatement activities are highly unlikely to meet the target. As a result, offsets will need to be purchased.

The table highlights two options for the purchase of offsets; 1) Those allowable under the Climate Active Scheme (probably sourced from overseas); or 2) Australian Carbon Credit Units. The former come at a much lower price (estimated at $4 per tCO_2-e compared to $18.50).

For reference, income from the sale of surplus credits, credits generated over the last eighteen months of the project, and credits from the five-year extension are displayed at the top of the table. Costs associated with the Plan are also displayed.

This enables all financial aspects to be considered holistically. In this sense, income may be used to fund the recommendations of this Plan ($145,000), and the purchase of offsets. The table therefore also displays residual income or net costs after the purchase of offsets.

Table 10: Target Options and the Price of Offsets

Income/Cost Source			**$**
Surplus Credits and the Final Project Period (18 months)			**312,000**
Flaring Project Extension			**667,000**
Actions in CGAP			**(145,000)**
Residual Income			**834,000**
Target	**Rationale**	**Income, Cost of Offsets and Residual Amounts/(Cost) $**	
		CA Scheme $	**ACCU's $**
1. Emissions at 2005 Levels by 2030	2005 is commonly used as a baseline year	**834,000** **(752,000)** **82,000**	**834,000** **(3,478,000)** **(2,644,000)**
2. 28% Reduction on 2005 Levels by 2030	Aligned to Australian National target	**834,000** **(972,000)** **(138,000)**	**834,000** **(4,497,000)** **(3,663,000)**
3. 45% Reduction on 2005 Levels by 2030	Based on IPCC publication *'Special Report 'Special Report - Global Warming of 1.5 Degrees C'* states that '(to limit)…*global warming to 1.5 degrees....Global net human-caused emissions of carbon dioxide would need to fall by about 45% from 2010 levels by 2030, reaching 'net zero' by 2050*	**834,000** **(1,106,000)** **(272,000)**	**834,000** **(5,116,000)** **(4,282,000)**
4. 75% Reduction on 2005 Levels by 2030	Based on recommended Climate Council target	**834,000** **(1,342,000)** **(508,000)**	**834,000** **(6,208,000)** **(5,374,000)**
5. Zero emissions by 2030	Elimination of the City's carbon footprint	**834,000** **(1,539,000)** **(705,000)**	**834,000** **(7,119,000)** **(6,285,000)**
6. Offset Buildings and Fleet Only for 2020/21 to 2029/30	Many LGs with or without Landfill Sites only have targets in relation to Buildings and Fleet	**834,000** **(205,000)** **629,000**	**834,000** **(947,000)** **(113,000)**

In all cases, it is clear that the costs of ACCU's are price prohibitive. Hence, it is advantageous to the City to purchase offsets allowable under the Climate Active scheme.

As highlighted above, a prudent approach has been taken. If Green power is purchased, this will mean a reduction in the carbon footprint over the 2020/21 to 2029/30 period of 45,000tCO_2-e. This will reduce offset costs by $180,000 (Climate Active) or $710,000 (ACCU's).

Limitations

It should be noted that the financial analysis presented above is predicated on several assumptions. These have been 'de-risked' wherever possible, ensuring a conservative approach is taken;

Table 11: Uncertainties Associated With Plan

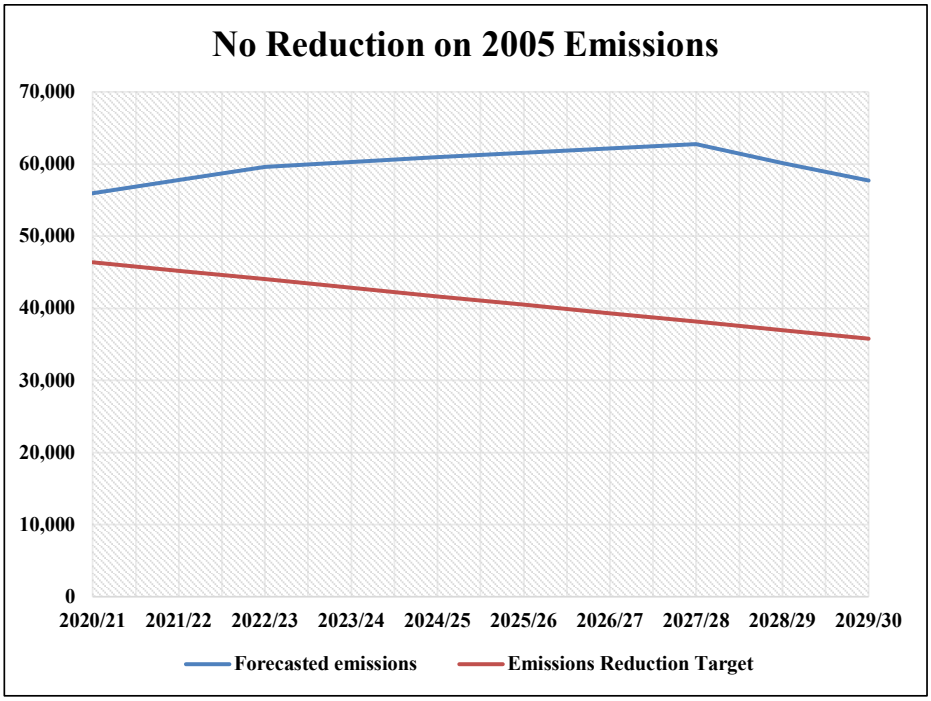
Broad Level Assumption	Influence	Explanation/Mitigation Strategy
1. Future Waste Streams include 50,000t of Commercial Waste and 7,000t of MSW per annum, with tip full by 2026/27	Impact on Waste Emissions if volumes change Emissions 'tail off' will change if the Landfill Site takes longer to fill	Biennial review of waste streams and calculation of impact on carbon footprint/future offset liabilities
2. Performance of Flare	Impacts on Carbon Credit Income (through volumes)	Lowest annual flaring volume to date used as a conservative estimate. Likely to be an 'upside' on volumes and, subject to impact of 1 above, the results of the proposed expansion of flaring infrastructure
3. Spot Price of Carbon on the Voluntary Market	Impacts on Carbon Credit Income (through price)	Conservative estimate of $15.70 per tonne applied, although market rate is $18.50. Possibility of an 'upside', as prices likely to increase closer to 2030
3. Price of Offsets	Impacts on Cost of Plan	Current market rate for Climate Active offsets is between $2.50 and $4 per tonne. Applied $4 per tonne in calculations Residual risk is that this continues to rise (will be addressed through biennial forecasts – see 1 above)
4. Global Warming Potential (GWP) of Methane	Adjustments influence calculated waste emissions and flaring quantities	In 2020, the Clean Energy Regulator adjusted the GWP of methane from 25 to 28, as a result of studies concluded by the IPCC. Updates are periodically incorporated into the Solid Waste Calculator and the Methodology for Flaring projects. This impacts on the Waste carbon footprint and amounts flared Mitigation Strategy - Biennial review of waste streams and calculation of impact on carbon footprint

Calculations have been based on the best information to hand, and provide a mechanism for the evaluation of the options.

Evaluation of Options

Option 1

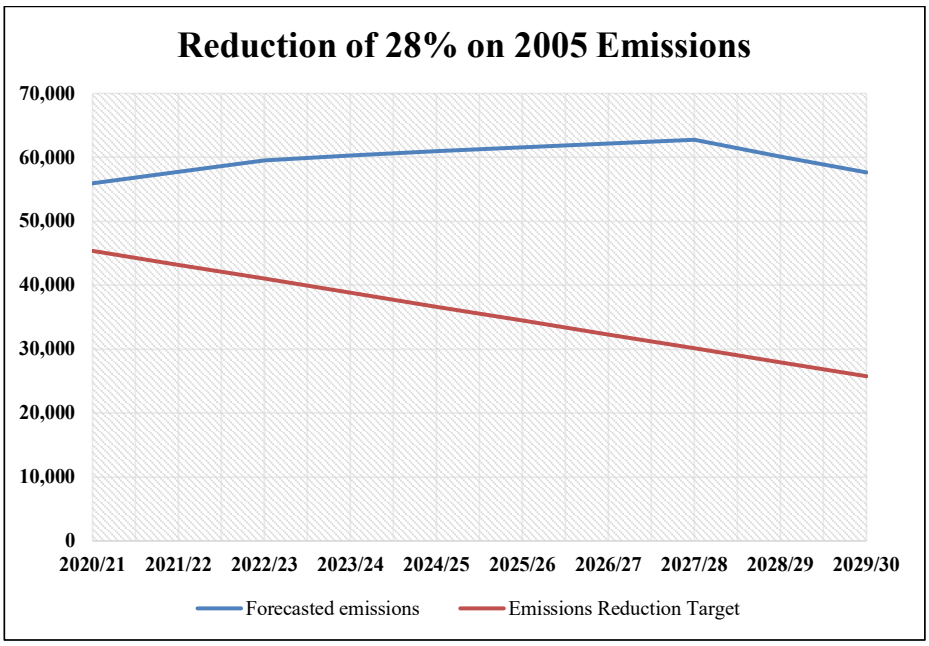
Figure 5: Graph Highlighting 2005 Abatement Target



This could be self-funded. The cost of offsets is $752,000 and $834,000 of income is available.

Option 2

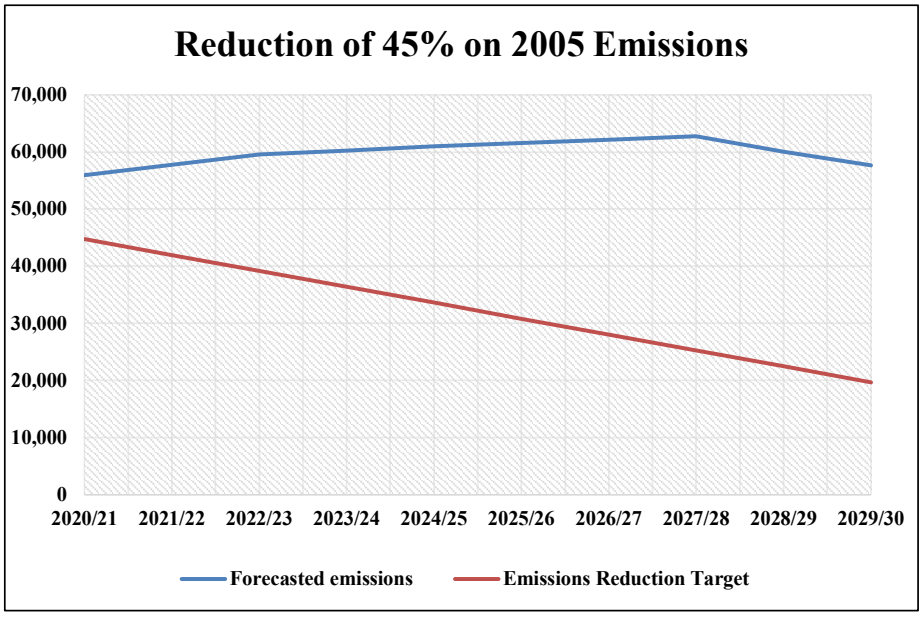
Figure 6: Graph Highlighting 28% Abatement Target



This matches National efforts, and is not quite self-funded (offset cost is $972,000 against income of $834,000). Adopting this approach would require an injection of municipal funds ($138,000).

Option 3

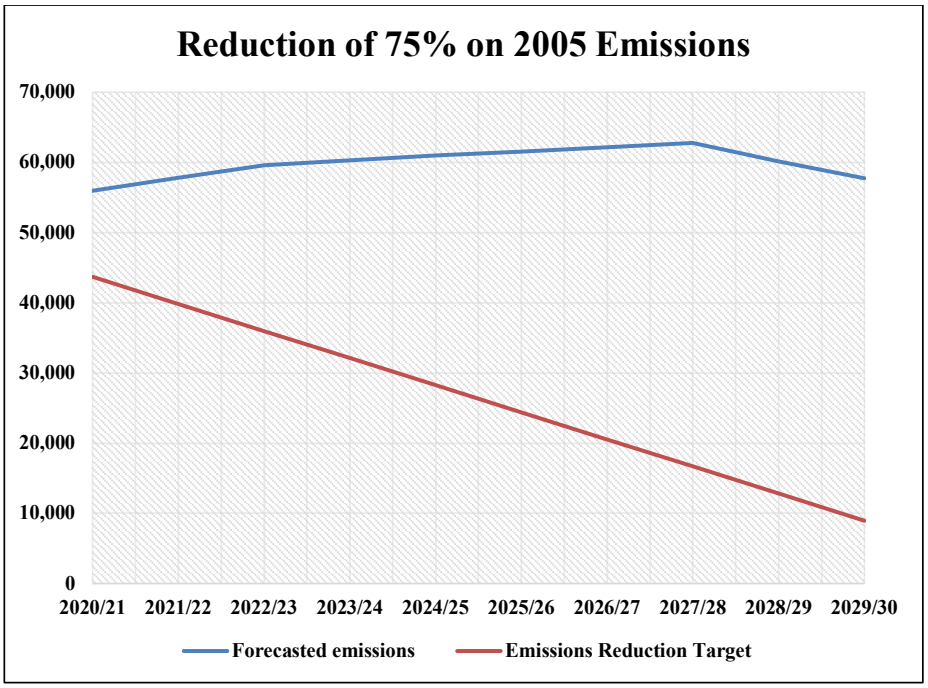
Figure 7: Graph Highlighting 45% Abatement Target



Setting a 45% reduction target, in reference to 2005, will cost $1,106,000 in offsets. When compared to income, this results in a deficit of $272,000.

Option 4

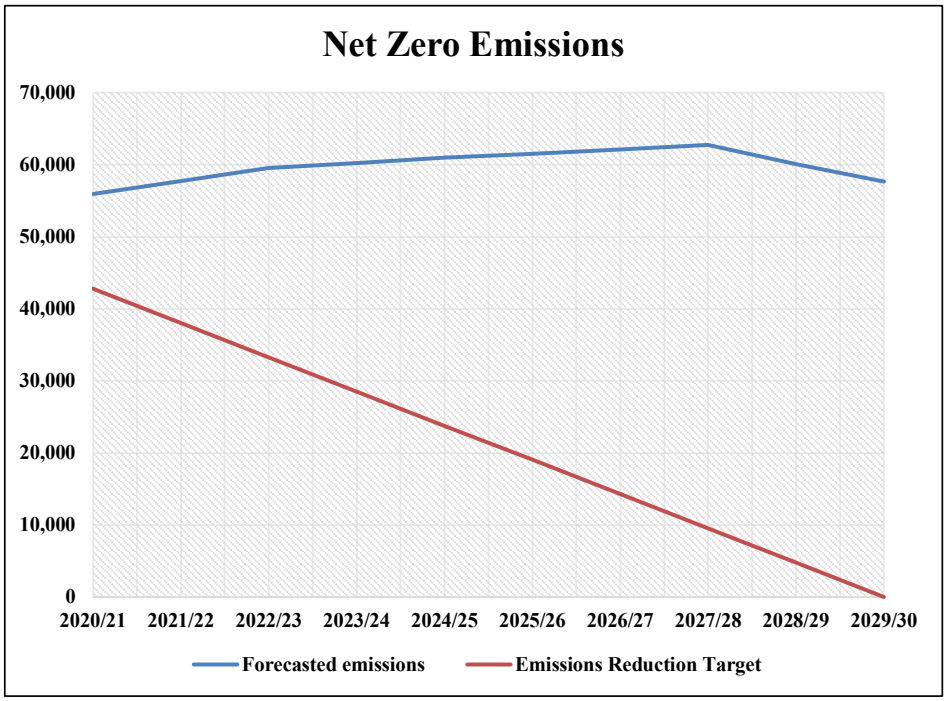
Figure 8: Graph Highlighting 75% Abatement Target



This matches the recommendations of the Climate Council. Offset cost is $1,342,000 against income of $835,000). Adopting this approach would require an injection of municipal funds.

Option 5

Figure 9: Graph Highlighting Net Zero Emissions



This would also require an allocation from municipal funds. The cost of offsets is $1,539,000, against income of $835,000.

Option 5

Emissions from Buildings and Fleet are highlighted above in Figures 3 and 4. These equate to 51,175tCO_2-e in the period 2020/21 to 2029/30. For these to be 100% offset, will cost $205,000 for Climate Active offsets and $947,000 for ACCUs.

Analysis

It would be advantageous for income from the Flaring Project to fund the recommendations of the Plan ($145,000). Residual income of $834,000 may be used to pursue an offsets strategy.

Australian generated offsets are very expensive, and not a viable option. The focus must therefore be on units allowable under the Climate Active Scheme.

For Options 2 (28% reduction on 2005 emissions), 3 (45% reduction), 4 (75% reduction) and 5 (net zero emissions), income of $835,000 does not cover the cost of offsets. A supplemental injection of municipal funds is required to purchase the requisite number of offsets. This injection ranges from $138,000 to $705,000. In this case, the total spend on offsets is significant, from $972,000 to $1,539,000.

Option 1 (emissions at 2005 levels by 2030) is achievable, with $82,000 left over (total spend on offsets = $752,000). This is also the case for Option 6 (100% offset of buildings and fleet), $629,000 remaining (total spend on offsets = $205,000).

Conclusion

Options 1 to 5 require $752,000 to $1,539,000 to be spent on offsets. Of these targets, the Climate council of Australia purports that a 75% reduction on 2005 emissions (Option 4) is effective. It is also fiscally responsible, compared to an aspiration for net zero emissions. For option 4, offsets will cost $1,342,000, with a net cost after income of $508,000.

However, once the offsets are purchased, there is very little additional benefit to the City, and these funds are likely to be channelled overseas. For this reason, this target is not recommended.

Option 6 may assist in implementing a more balanced and beneficial approach. This enables the recommendations of the Plan to be funded, in conjunction with offsets for Buildings and Fleet. The remaining $629,000 may then be used for energy efficiency/carbon mitigation projects in the City.

This approach may not eliminate as much carbon as the purchase of offsets, but the approach will still reduce the City's footprint, assist in stimulating the local economy, and provide ongoing reductions in operating costs. As highlighted above, it is possible that a retrofit of LED streetlights may be feasible at some point in the near future. An injection of $629,000 would represent 10% of the capital cost.

An approach to offsetting 100% of Building and Fleet emissions is above and beyond the aspirations of many Local Governments (see Appendix 2). Hence, through this approach, the City can consider itself a sector leader.

Finally, in order to be consistent with State government, the City should also adopt a target of net zero emissions by 2050. By this time, the Landfill Site is anticipated to be long closed. Buildings and Fleet will dominate emissions.

Recommendation 22	**Responsibility and Timescale**
Council adopt the following approach to carbon abatement: - A target to offset 100% offset Building and Fleet emissions over the 2020/21 to 2029/30 period - Fund the recommendations of this Plan from Flaring Project income - Allocate of residual income from the Flaring Project towards energy efficiency/carbon mitigation projects - A target of net zero emissions by 2050	N/A
Budget Required	Recommendation is 'self-funded'

It is imperative that variables in the financial analysis are continuously monitored, and periodically updated financial forecasts prepared. This will provide an indication of funds available for energy efficiency projects, and also give assurance on the achievement of the objectives of this Plan. Updates can be provided through the Environmental Services biennial report to Council.

Recommendation 23	**Responsibility and Timescale**
Provide an analysis to Council as part of the biennial Environmental Services report on the financial impact of achieving the carbon abatement target. This should cover: - The results of updated modelling from the Solid Waste Calculator, which is influenced by the type and quantities of waste received and forecast for the Landfill Site - Flare performance - The spot price of Australian Carbon Credit Units, facilitating forecast income calculations - Purchase price of offsets under the Climate Active scheme	Manager Environmental Services
Budget Required	$Nil

<u>Carbon Neutrality</u>

The recommended target means that the City does not have the option of becoming 'Carbon Neutral' under the Climate Active Scheme. This requires net zero emissions.

However, this may be something that is considered at some point in the future. Key features of this scheme include:

- Base year is set for carbon emissions, enabling a comparison over time
- Requirement to demonstrate emissions reduction in priority over offsetting
- The consideration of Scope 3, as well as Scope 1 and 2 emissions
- Application for a Federal Government license every two years (Certification cost of $15,000). Supporting consultant costs are estimated at $20,000 to complete the application, and $30,000 for it to be audited (total cost every two years = $50,000)
- Report publicly on emission status and reduction activities

Hence, these costs will need to be considered at the appropriate time.

Budget Allocation Process

The City requires a mechanism to accumulate funds for the purchase of offsets and energy efficiency projects. An effective way to achieve this is through the creation of a Carbon Reserve. Appendix 12 highlights the cash flows associated with this Plan.

In most years, there will be a net transfer of funds into the reserve. In others, transfers out are required, to fund the recommendations of the Plan. However, the reserve will always be cash positive, due to the initial influx of income in 2021/22, followed by regular deposits.

Rather than waiting till the end of the CGAP, it may advantageous to purchase offsets in increments, depending on their price. In this scenario, Council approval will be required to access the reserve.

Recommendation 24	**Responsibility and Timescale**
Council approve the creation of a Carbon Reserve, for the purpose of ring-fencing carbon credit income, purchasing carbon offsets and funding the recommendations of the Corporate Greenhouse Action Plan 2020/21 to 2029/30	Executive Manager Corporate Services 2021/22
Budget Required	$Nil

Summary of Recommendations

Recommendation	Responsibility/Timescale/ Budget Implications
1. Provide a report to Council, proposing an approach to the development of a Climate Change Declaration and Climate Emergency Declaration	Manager Environmental Services 2022/23 - $Nil
2. Report to Council, proposing an approach to the production of a Climate Change Adaptation Management Plan and/or Strategy	Manager Environmental Services 2022/23 -$Nil
3. Irrespective of the results of the WALGA review, Council endorse the approach of not accounting for carbon emissions associated with household waste diverted to the Waste to Energy Facility	N/A
4. Implement the continued expansion of infrastructure associated with the Flaring Project, enabling continued carbon abatement at the site	Manager Waste Services Ongoing - Already Funded in Waste Services Budget
5. The Climate Solutions Fund contract with the Federal Government is to be completed early, through the provision of the total amount of contracted carbon credits	Manager Environmental Services/ Executive Director Technical Services 2021/22 - $Nil
6. Council authorise the sale to the Voluntary Market of surplus carbon credits (7,094tCO_2-e), and those generated in the period 20 June 2020 to 13 December 2021	Manager Environmental Services 2021/22 - $ - See Table 6
7. Council authorise an application to the Federal government, seeking an extension to the life of the Flaring Project by a further five years	Manager Environmental Services 2021/22 - $Nil
8. Council endorse the principle of selling carbon credits for the extension period on the Voluntary Market	N/A $ - See Table 8
9. Develop a Policy for Green Buildings	Property Services Manager 2021/22 - $Nil
10. Complete a solar feasibility study for the City's top 20 electricity using facilities	Property Services Manager/ Manager Environmental Services 2022/23 - $50,000
11. Complete energy audits for two City facilities per annum, focusing on the top 20 electricity consuming sites	Property Services Manager/ Manager Environmental Services 2022/23 - $10,000 per annum
12. Progressively implement a real-time energy and water monitoring system, initially targeting high demand (top 20) facilities	Property Services Manager/ Manager Parks/ Manager Environmental Services 2021/22 - Already Funded in Environmental Services Budget
13. Switch Your Thinking remain abreast of regulatory developments, and through Council reporting, recommend implementation projects in the City of Armadale	Switch Your Thinking Ongoing - $Nil
14. Produce a report to Council, providing a cost benefit analysis of the City entering into a contract with the WALGA preferred supplier	Manager Environmental Services 2021/22 - $Nil

Recommendation	**Responsibility/Timescale/ Budget Implications**
15. Develop options for improving the sustainability of the City's fleet such as transitioning to electric or non-hydrocarbon vehicles	Manager Assets 2022/23 - $Nil
16. When there is certainty over implementation costs and ongoing tariffs, provide a business case report to Council on a bulk changeover to LED street lights	Manager Environmental Services Timescale Dependent on Western Power
17. Finalise, and present to Council, a Streetlighting Policy around the deployment of energy efficient lighting in the City	Manager Engineering Design 2021/22 - $Nil
18. Prepare a business case for the potential changeover of decorative lights to more energy efficient models	Manager Engineering Design 2021/22 - $15,000
19. Develop a policy around the use of the Revolving Energy Fund	Manager Environmental Services 2023/24 - $Nil
20. In partnership with the Switch your Thinking team, investigate the feasibility of implementing a Sustainable Purchasing Policy, and develop appropriate City supporting documentation	Switch Your Thinking 2022/23 - $Nil
21. Complete an investigation into possible incentives for employees to adopt sustainable practices. The study should cover options for behaviours that could be incentivised, in conjunction with the potential rewards offered	Switch Your Thinking 2022/23 - $Nil
22. Council adopt the following approach to carbon abatement: - A target to offset 100% offset Building and Fleet emissions over the 2020/21 to 2029/30 period - Fund the recommendations of this Plan from Flaring Project income - Allocate of residual income from the Flaring Project towards energy efficiency/carbon mitigation projects - A target of net zero emissions by 2050	N/A Recommendation is 'self-funded'
23. Provide an analysis to Council as part of the biennial Environmental Services report on the financial impact of achieving the carbon abatement target. This should cover: - The results of updated modelling from the Solid Waste Calculator, which is influenced by the type and quantities of waste received and forecast for the Landfill Site - Flare performance - The spot price of Australian Carbon Credit Units, facilitating forecast income calculations - Purchase price of offsets under the Climate Active scheme	N/A
24. Council approve the creation of a Carbon Reserve, for the purpose of ring-fencing carbon credit income, purchasing carbon offsets and funding the recommendations of the Corporate Greenhouse Action Plan 2020/21 to 2029/30.	Executive Manager Corporate Services 2021/22

Conclusion

This Plan is proposed to be implemented until 2029/30, in alignment with Australian targets under the Paris Agreement.

The approach is broadly consistent with that of the previous CGAP. There are recommended abatement activities within the City's waste, building and fleet portfolios. An overall objective has been set to offset the carbon footprint of Buildings and Fleet for the period of the Plan. A Net Zero Emissions target is recommended for the year 2050.

In order to meet the 2029/30 target, abatement activities will need to be supplemented by the purchase of offsets. The City is in a fortuitous position, the Flaring Project able to be extended by a further five years. This is forecast to provide $834,000 of additional income, after compliance costs. This is able to fund the actions of this Plan ($145,000), and the purchase of offsets ($205.000). A surplus of $629,000 is forecast to remain, and proposed to be allocated to energy efficiency/carbon mitigation projects.

Finally, the Plan recommends strategic document production, including policy positions around Climate Change Adaptation and standards associated with new and upgraded buildings.

Appendix 1: International Government Targets

Country	Approach
India	**2030 Unconditional Target:** 33 to 35% below 2005 in carbon emissions relative to Gross Domestic Product by 2030 ('emissions intensity' approach) **2030 Conditional Target:** Non -fossil share cumulative power generation capacity by 40% by 2030 **Long Term Goal:** Per capita emissions never to exceed those of developed countries
Australia	**2030 Unconditional Target:** 26-28% below 2005 by 2030 **Long Term Goal**: None
European Union	**2030 Unconditional Target:** At least 40% below 1990 levels by 2030 **Long Term Goal:** 91 to 94% below 1990 levels by 2050 (excluding LULUCF, but including carbon removal)
United Kingdom	**2030 Unconditional Target:** 40% below 1990 by 2030, incl. LULUCF **Long Term Goal**: Net zero GHG emissions by 2050
Canada	**2030 Unconditional Target:** 30% below 2005 by 2030, excl. LULUCF **Long Term Goal:** 80% below 2005 levels by 2050 (65% below 2005 levels excl. LULUCF)
New Zealand	**2030 Unconditional Targets:** 30% below 2005 by 2030 **Long Term Goal:** Net zero emissions on all GHG emissions, excluding methane emissions from agriculture and waste sectors. 24 to 47% below 2017 by 2050 for methane emissions from agriculture and waste sectors
Brazil	**2030 Unconditional Targets:** 1.3 GtCO2e (GWP100; IPCC SAR) by 2025 incl. LULUCF. Absolute target of 1.3GtCO_2-e by 2025 **Long term Goal:** Strive for a transition towards energy systems based on renewable sources and decarbonisation of the global economy, by the end of the century
Norway	**2030 Unconditional Target:** At least 50% and towards 55 below 1990 by 2030 **Long Term Goals:** Low carbon society 2050 Reduction in GHG emissions by 80%-95% from 1990 reference
China	**2030 Unconditional Target:** Peak CO2-e emissions by 2030 at the latest Non-fossil fuel share: 20% in 2030 Forest stock – Increase of 4.5 bnm3 by 2030 relative to 2005 Emissions intensity (carbon relative to GDP) – 60 to 65% below 2005 levels by 2030 **Long Term Goal:** Carbon Neutrality by 2060l
United States	**2030 Unconditional Target:** 26 to 28% below 2005 by 2025, incl. LULUCF **Long Term Goal:** 80% below 2005 levels by 2050 incl. LULUCF
Russian Federation	**2030 Unconditional Targets:** 25to 30% below 1990 by 2030, incl. LULUCF **Long Term Goal:** None
Ukraine	**2030 Unconditional Targets** At least 40% below 1990 level incl. LULICF by 2030 **Long Term Goals:** 50% below 1990 by 2050

Appendix 2: WA Local Government Initiatives

Local Government	Landfill Operated by Council?	Corporate Greenhouse Strategy?	Measure and Track emissions?	Emissions Targe	Key measures
City of Cockburn	Yes - diverting waste to WTEF by 2022	Yes - Climate Change Strategy 2020-2030	Yes	Net zero emissions by 2030	Transfer of waste to WTEF; Transition to renewable energy providers; fleet to transfer to EV's; LED Streetlighting
City of Rockingham	Yes	Sustainability Strategy - 2020	No	None	Methane capture at landfill; Solar PV on buildings; offset vehicle (fleet) emissions; LED Streetlighting
City of Canning	Yes	No - Climate Action Plan currently in development	No	None	LED Streetlighting; geothermal energy; solar PV panels on key assets
City of Mandurah	Yes - diverting waste to WTEF by 2022	No	No	None	Transfer of waste to WTEF; Solar PV on buildings; LED bulb replacement on buildings
City of Gosnells	No	No	Yes	None	Unable to find information
City of Stirling	No (transfer and recycling centre)	Draft Sustainable Energy Action Plan	No	Reduce corporate carbon emissions by 70% by 2030 (not inclusive of landfill/waste emissions)	LED lighting in City assets; Solar PV installations; power purchase agreement to source 100% renewable energy by 2030

Local Government	Landfill Operated by Council?	Corporate Greenhouse Strategy?	Measure and Track emissions?	Emissions Targe	Key measures
Town of Kwinana	No	Climate Change Mitigation and Adaptation plan 2015-2020	Yes	Yes - reduce carbon dioxide equivalent emissions by 10% below 2009/10 levels by 2020	Solar PV installation on key assets, energy efficient lighting upgrades, adopt energy efficiency measures, community awareness raising
City of Kalamunda	Yes - Walliston Transfer Station	No	No	None	Community awareness
City of Melville	No	No	Yes	48% emission reduction on 2005-2006 levels from its own facilities and operations by 2025	Solar PV installation, LED light replacement, staff education
City of Swan	No	No	No	None	Energy efficient alternatives, energy audits, fleet upgrades for more fuel efficient alternatives
Town of Victoria Park	No - but landfill emissions are included in their carbon accounting	No - developing a Climate Emergency Plan	Yes	Zero Carbon emissions by 2030	Achieve at least 40% emissions reduction through direct action (i.e.not through carbon offsets) Support the community and businesses in working towards their own zero-carbon target

Appendix 3: City Emissions in 2004/05

Emissions Component	Tonnes of Carbon Dioxide Equivalent (tCO_2-e)
Gross Waste Emissions	**34,345**[1]
Amounts Flared	0
Net Waste Emissions	**34,345**
Buildings	**1,332**[2]
Fleet	**105**[2]
Total	**35,782**

[1] Calculated using the Federal government Solid Waste Calculator
[2] Extrapolated from Average fleet emissions (between 2014 to 2021) and scaled down to reflect difference in population in 2005 (no records for 2005)

Appendix 4: Operational Control Scorecard for Streetlights

	Policy	Policy Score (0-30)	LGA	Western Power
Operating Policies	Responsibility for provision of lighting services (ERA governed)	20	20	0
	Authority to commission lighting	30	0	30
	Specification of road type (and therefore lighting requirements)	20	20	0
	Design of lighting	30	30	0
	Approval of lighting design	30	30	0
	Establishment of lighting options	20	20	0
	Lamp selection	30	20	10
	Luminaire selection	30	20	10
	Pole selection	10	20	10
	Installation of lighting	30	15	15
	Establishment of operating hours	30	NA	NA
	Meeting operation hours	30	NA	NA
	Responsibility for paying electricity bills	30	30	0
	Establishment of maintenance schedule	30	0	30
	Maintenance of luminaires	30	0	30
	Replacement of lamps	30	0	30
	TOTAL	430	225	165
Environment Policies	Efficiency of lighting	20	20	0
	GreenPower purchase	10	20	0
	Environment management system (e.g. ISO14001)	30	15	15
	TOTAL	60	55	15
OH&S Policies	Provision of safety equipment	20	0	20
	Establishment of personnel safety requirements during installation	20	10	10
	Implementation of personnel safety requirements during installation	20	10	10
	Establishment of personnel safety requirements during maintenance	20	0	20
	Implementation of personnel safety requirements during maintenance	20	0	20
	Road traffic safety	30	15	15
	Safe globe disposal	30	0	30
	OHS Systems & Processes	30	0	30
	TOTAL	190	35	155
	OPERATIONAL CONTROL TOTAL	680	315	**335**

Appendix 5: WALGA Tool - Gap Analysis/Opportunities

Appendix 6: City of Armadale Climate Change Declaration

CITY OF Armadale

WESTERN AUSTRALIAN LOCAL GOVERNMENT ASSOCIATION

The Western Australian Local Government Declaration on Climate Change

The City of Armadale acknowledges that:

- Evidence shows that climate change is occurring.
- Climate change will continue to have significant effects on the Western Australian environment, society, and economy and the Local Government sector.
- Human behaviours, pollution and consumption patterns have both immediate and future impacts on the climate and environment.

The City of Armadale supports the:

- Environmental, social and economic benefits of addressing climate change immediately.
- Opportunity for Local Government to demonstrate leadership in climate change management at a community level.
- Development of equitable and implemental State and Commonwealth strategies for climate change management.

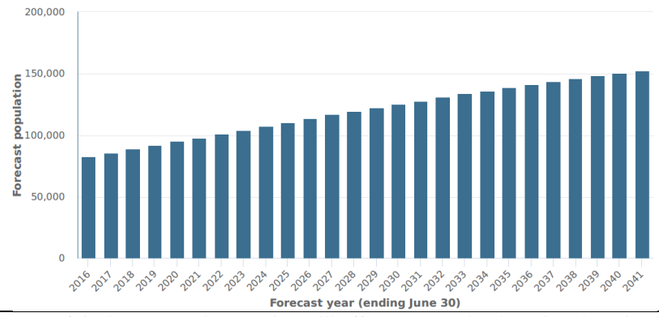
The City of Armadale commits to:

- Monitoring existing Local Government emissions reduction targets, and work towards their achievement.
- Work with the support of State and Federal Government to ensure achievement of greenhouse gas emissions reduction targets, as set out in key national and international agreements.
- Work with the support of State and Federal Government to implement key actions and activities for climate change management at a local level.
- Implement the City of Armadale Corporate Greenhouse Action Plan across all Local Government functions, to be reviewed every five years.
- Ensure that, at appropriate review intervals, the strategic plan and policies for the Local Government are reviewed and amended to reflect climate change management priorities.
- Encourage and empower the local community and local businesses to adapt to the impacts of climate change and to reduce their greenhouse gas emissions
- Monitoring the progress of climate change initiatives and ensure full communication of achievements for Council and Community.

Cr Linton Reynolds AM JP, Mayor

R S Tame, Chief Executive Officer

Appendix 7: Assumptions Underpinning Forecasts

Data Set	**Description**	**Assumptions**
City Building and Fleet Emissions	In order to determine the likely emissions footprint of the City's buildings and fleet historical emissions are considered against trends in population growth. The assumption being that as the City's population increases, so will the need for additional community buildings/facilities and increased use of these assets Plus increased workforce and resources required to support this growing population and asset base Population growth forecasts are taken from Forecast.id.com.au which is used by the City and other Local Governments to help understand population changes to inform infrastructure spend and other community related decision making. The data provided by Forecast.id.com.au is illustrated below: Forecast population City of Armadale  	1. Forecast emissions from buildings and fleet have been calculated to increase at the same rate as population growth 2. Population growth data has been taken from 'Forecast.id.com.au' which is considered the most accurate predictor of population growth related to Local Government areas
Waste Inputs (Waste Volume - Appendix 7)	One of the important changes that will affect waste going into the City's landfill is the fact the City entered into a contract to send municipal waste to a commercial Waste to Energy Facility (WTEF) offsite. Given the landfill still has capacity to accept waste, it was decided that for the interim the City would generate an income by accepting commercial waste. Therefore while it will be the responsibility of the commercial operators of the WTEF to account for any emissions generated at that facility (including the City's municipal waste), the City will still be accepting waste into our landfill and will therefore account for any emissions generated. The estimated tonnages which were provided by the City's waste team for post 2022 were input into a 'Lead Schedule' which analyses all the raw waste data provided by the landfill and sorts this into specific waste categories (refer to Appendix 7). The total waste input and volumes associated with the different categories are then input into the Federal Government's Solid Waste Calculator, which uses complex calculations to determine the emissions generated based on the volume of waste and the waste types, including legacy emissions (emissions generated in previous years). Therefore, assuming the estimated waste tonnages that the landfill will accept from 2020 to 2030 is accurate then the forecasted emissions profile should be correct. However despite best efforts to predict future inputs into the landfill, there are a number of influencing variables.	<u>Forecasted waste inputs for each year based on the following assumptions:</u> 2020/21: 1. Accepting waste as per normal operations (transfer of waste to WTEF not scheduled until mid- 2022) 2. Total waste collected = average of total waste collected for last 11 years (since 2009/10) 3. Commercial and industrial (C&I) = average of C&I for last 11 years (since 2009/10) plus 6,000 tonnes to reflect commencement of C&I contract on Jan 2021 (12,000 tonnes per FY contracted) 4. Trailer waste = Average of trailer waste volumes across last 11 years (since 2009/10) 5. Municipal Solid Waste (MSW) = Average of MSW volumes across last 11 years (since 2009/10) 6. C&D = Average of C&D volumes across last 11 years (since 2009/10) 2021/22: 1. Currently contracted to move waste to WTEF in Jan 2022, but estimates assume this will commence 1st July 2022 in case of delays) 2. Total waste collected = average of total waste collected for 11 years prior to 2020/21 (since 2009/10) 3. C&I = average of C&I for last 11 years (since 2009/10) plus 15,000 tonnes to reflect C&I contract (15,000 tonnes is an estimate provided by waste team)

Data Set	Description	Assumptions
		4. Trailer waste = Average of trailer waste volumes across 11 years prior to 2020/21 (since 2009/10) 5. MSW = Average of MSW volumes across 11 years prior to 2020/21 (since 2009/10) 6. C&D = Average of C&D volumes across 11 years prior to 2020/21 (since 2009/10) 2022/23,to 2029/30: 1. All MSW and trailer waste now diverted to WTEF 2. C&I now at 50,000 tonnes per annum up to end of 2027 on advice from waste team 3. Landfill facility to close from 2028 onwards (no waste inputs) 4. No other waste deposited in City landfill apart from recycling and greenwaste(non-emission sources)

Appendix 8: Waste Volume Forecast and Solid Waste Calculator Output

Year	Reference	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30
WASTE											
Total waste collected		79,426	79,426	57,000	57,000	57,000	57,000	57,000	0	0	0
Total g/waste recycled	G										
Cleanfill for capping	CAP										
C&D waste stored for recycling	CD Recycled										
NGERS - Total Deposited											
Trailer Waste											
Trailer Waste	T	10,143	10,143	-	-	-	-	-	-	-	-
Municipal Solid Waste											
MSW	MSW										
plus 30% trailer waste	-										
Revised MSW	-	30,015	30,015	7,000	7,000	7,000	7,000	7,000	0	0	0
Commercial and Industrial											
Commercial and Industrial	CI	8,914	17,914	50,000	50,000	50,000	50,000	50,000	0	0	0
Construction and Demolition											
Construction and Demolition	CD										
plus 70% of trailer waste	-										
Revised Commercial and Industrial Waste	-	11,272	11,272	-							
TOTAL Deposited	-	50,201	59,201	57,000	57,000	57,000	57,000	57,000	0	0	0

Notes

Year	Reference	2020-21	2021-22	2022-23	2023-24	2024-25	2025-26	2026-27	2027-28	2028-29	2029-30

1. Total amount of waste accepted at the weighbridge
2. Greenwaste entering the facility as per the weighbridge
3. Inert Material for capping of the landfill, as per weighbridge.
4. Construction and demolition waste separated and stored on site in readiness for selling amount stored reaches a certain level and when market prices are favourable). Again, this is as per the weighbridge and is the amount received at site.

% composition

MSW		60%	51%	12%	12%	12%	12%	12%	-	-	-
C&I		18%	30%	88%	88%	88%	88%	88%	-	-	-
C&D		22%	19%	0%	0%	0%	0%	0%	-	-	-

Year	Gross Waste Input (from Lead schedule above)	Flare Inputs (not applicable)			Emission Output
2021	79,426	0	0	0	51,335
2022	79,426	0	0	0	53,068
2023	57,000	0	0	0	54,726
2024	57,000	0	0	0	55,294
2025	57,000	0	0	0	55,846
2026	57,000	0	0	0	56,382
2027	57,000	0	0	0	56,902
2028	0	0	0	0	57,406
2029	0	0	0	0	54,645
2030	0	0	0	0	52,023

Appendix 9: Flaring Project Approach

The City has the option of extending the term of project accreditation, under the Climate Solutions Fund, beyond December 2021 for a further five years. This will result in a total life span of twelve and a half years.

There are three possible approaches in the treatment of the project:

1. Extend the project, and sell City generated ACCU's on the voluntary market
2. Extend the project, but do not sell City generated ACCU's and surrender these to the Federal government
3. Do not extend the project, and account for flare abatement in-house

The benefits of selling credits on the voluntary market, as opposed to entering into a new Federal contract, are discussed in the main body of the report. In summary, selling on the voluntary market, ensures that the City avoids any risk in relation to contract delivery.

Compliance activities follow the extension the project, irrespective of whether the City sells credits. These include audit inspections, providing assurance to the Clean Energy Regulator that carbon abatement is appropriately calculated.

The implications of each option are considered below.

1. **Extend the Project – Sell ACCU's on the Voluntary Market**

A summary of implications is provided below.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
Sale of ACCU's: 5 years x 9,833tCO_2-e x $15.7[1] = **$771,890**	Compliance Costs[2] (Three Offsets Reports, Two Audits): (3 x $15,000[3]) + (2 x $30,000[3]) = **$105,000**	**$666,890**	Staff time for compliance activities (Offsets Reports and Audits Potential for broker's fees in the sale of ACCU's Funds generated are available for other City initiatives, including the purchase of offsets under the Climate Active Program to cover the wider City of Armadale carbon footprint. Therefore, any carbon mitigation targets may be achieved

[1] 15% contingency deducted off the current spot rate ($18.50) of carbon. Spot rate may vary over time.
[2] Offset Reports and Audits are mandatory if the project is extended.
[3] Based on amounts paid over the last six years.

As highlighted above, in pure financial terms, there is a benefit to the City in adopting this approach.

2. **<u>Extend the project – Do not sell City generated ACCU's and surrender these to the Federal government</u>**

In this instance, there is no revenue from the sale of carbon credits.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
Sale of ACCU's: **$Nil**	Compliance Costs (Three Offsets Reports, Two Audits): (3 x $15,000) + (2 x $30,000) = **$105,000**	**($105,000)**	Staff time for compliance activities (Offsets Reports and Audits) Opportunity for positive 'PR' Funds for carbon offsetting for the achievement of targets will need to be 100% funded from municipal funds

This produces a negative swing of $771,890, in comparison to Option 1.

3. **Do not extend the project – Account for flare abatement in house**

For this option, there are no external revenues or costs.

Income	Costs	Net Financial Impact – Positive/(Negative)	Other Aspects
$Nil	**$Nil**	**$Nil**	Staff time for internal calculations and reporting Funds for carbon offsetting for the achievement of targets will need to be 100% funded from municipal funds

This approach is financially neutral, and is preferable to Option 2.

Conclusion

If a fiscally responsible approach, in conjunction with meeting carbon targets, are the primary drivers of the approach, the options may be listed in the following order of preference:

- **Option 1**: Extend the project, selling City generated ACCU's on the voluntary market
- **Option 3**: Do not extend the project and account for the abatement in-house (neutral cash flow and low impact on staff resources)
- **Option 2**: Extend the project, cancelling/surrendering ACCU's to the Federal government (negative cash flow of $105,000 and significant impact on staff resources – although potential reputational benefits)

Option 1 also provides the opportunity for financial benefits to be deployed elsewhere in the City to the benefit of the community, and also partially offset the wider carbon footprint of the City.

Appendix 10: Switch Your Thinking Energy Sharing Report

Introduction

Traditionally, electricity has been supplied to consumers through a linear supply chain of generation, transmission, distribution and retail of electricity with a regulatory system that is designed to facilitate this.

The South West Interconnected System (SWIS) has undergone an unprecedented transition in the way electricity is supplied and used with an enormous up take in rooftop solar photovoltaic systems. Large-scale renewable generators are also supplying an increasing amount of our electricity needs. The grid has moved from a linear chain of supply to a network of connected generation and storage assets, or Distributed Energy Resources. Distributed Energy Resources include solar PV, battery storage, electric vehicles, appliances and metering devices. These coordinated Distributed Energy Resources can ultimately supply power in a cheaper, cleaner and more reliable way[1]

An essential part of this transition is the ability to share renewable energy between facilities so unused power from one facility can be used by another. This can be done in a variety of ways including microgrids, virtual power plants, power purchase agreements and energy trading. There are many different permutations of these approaches depending on the physical location, proponent and regulatory environment. Some examples allow for small scale generators (such as a building with solar panels) to sell their electricity.

There is the potential for Local Government to participate in this new energy distribution framework either within their own facilities, in partnership with the community or participating in State Government coordinated projects. Such projects could, in theory, reduce the local government's operating costs or provide cheaper electricity for their ratepayers. This document outlines the current situation with regards to energy sharing projects in WA and opportunities for Switch your thinking or the SEREG member councils.

Types of energy sharing

Electrically-connected microgrid
A microgrid is a subset of the broader electricity network with all the necessary components to operate independently. A microgrid can operate while connected to the grid however, importantly it can break off and operate on its own using local energy generation. It can be powered by renewable or non-renewable forms of energy or a combination of both.

[1] https://www.brighterenergyfuture.wa.gov.au/

A microgrid has a monitoring and control platform used to coordinate the supply and demand of the customers connected to the microgrid. A renewable microgrid uses this platform to aggregate and optimise the Distributed Energy Resources delivering power where it is needed and storing excess power in batteries to be used later.

A microgrid can range in size from one building to whole sections of a town (sometimes the terms 'nanogrids' and 'macrogrids' will be used to refer to smaller- and larger-scale microgrids). "Mini-grids", which are not connected to a larger grid at all, have been in operation for a long time outside of the SWIS (Horizon Power operates 37). These mostly use diesel fuel for generation, with increasing numbers of solar PV and diesel hybrid generation systems.

Microgrids are now beginning to become established within the SWIS as well particularly in fringe of grid areas. Western Power operates WA's largest microgrid in Kalbarri which is powered by a wind farm and rooftop solar PV. Energy is stored in a 4.5MWh battery. Development WA have also recently established a consortium which will operate a grid-connected microgrid at Peel Business Park, an industrial and agri-business precinct.

Microgrids don't rely on long transmission lines so they can reduce transmission losses and improve reliability when power lines are affected by weather events and bushfire. They can also improve grid power supply issues related to the increased use of solar power.

Grid parallel mode microgrid

In partnership with Murdoch University, the City of Melville ran a two-year project (Oct 2018 to Oct 2020), that aimed to provide a reliable monitoring system to improve energy and water efficiency[2]. It is also the first step in having the data required to successfully share electricity between their own facilities.

Using this data, the City of Melville attempted to work with their existing energy retailer to allow net generation and consumption of solar across 14 buildings. These buildings are not electrically connected but net generation and consumption billing would mean that the excess electricity generated by (for example) a community facility on the weekend would in effect be powering their aquatic centre which requires the additional energy on the weekends rather than being exported to the grid for free. To date they have not been able to establish this arrangement with their retailer.

In this case this arrangement has been called a "grid parallel mode" microgrid as the facilities are not directly electrically connected rather energy would be traded across one organisation's multiple facilities.

The City of Melville intends to run a public seminar on the results of this project in the coming months.

[2] https://arnowa.com/melville-smart-grid-project/

Virtual power plant

A Virtual Power Plant (VPP) is a 'power plant' made up of distributed energy resources e.g. batteries, appliances, solar PV and smart meters, working together and communicating with each other via a cloud based software aggregator. The aggregator can act on the member's behalf trading energy in the wholesale market which individuals could not gain access to.

The distributed energy resources participating in the VPP are not directly electrically connected, but virtually connected via the cloud and could be owned by different organisations who participate via a third party aggregator organisation. The Distributed Energy Resources participating in the VPP need to be grid-connected.

In comparison to microgrids, VPPs can cover a wider area and are flexible enough to expand or contract the area in which they operate, depending on market conditions.

Powerbanks

The Western Power community energy project, the PowerBank Trial, includes utility-scale batteries, owned and maintained by Western Power, integrated into an already-established major metropolitan electricity network. Western Power has installed infrastructure at multiple locations across Perth metro area, including Southern River. Phase 3 of the community battery trial was announced on the 10th of February with the only additional batteries in the SEREG region being located in Southern River[3].

The Powerbanks operate as a VPP. Customers export excess solar energy during the day to the Powerbank and can draw it back out later in that 24 hour period. It does not allow peer to peer trading between dwellings in the trial.

Peer to Peer trading

Western Power and Curtin University are trialling a shared energy model through a solar-powered microgrid, battery storage system and peer to peer trading through Power Ledger[4]. Power Ledger is a blockchain enabled software platform for trading renewable energy and environmental commodities.

Unlike a centralised record keeping system, blockchain-enabled ledgers are decentralised. This means market transactions are recorded across multiple locations at the same time, creating multiple copies and offering protection from targeted cyber-attacks.

The project is located in White Gum Valley development, Fremantle and includes 80 co-located dwellings. Residents are able to trade between the co-located dwellings only.

[3] https://www.westernpower.com.au/our-energy-evolution/projects-and-trials/powerbank-community-battery-storage/
[4] https://westernpower.com.au/community/news-opinion/sharing-energy-in-white-gum-valley/

A second, very similar project, was undertaken by the same partnership at ReNeW Nexus, also in Fremantle. The main difference between the White Gum Valley project and ReNeW Nexus is that Nexus residents in the trial are able to set their own rates for the electricity they want to buy or sell. [5]

Current requirements to become an energy retailer

An aggregator is a party which facilitates the grouping of Distributed Energy Resources to act as a single entity when engaging in power system markets (both wholesale and retail) or selling services to the system operator.

Currently it is possible to offer these services by applying for a licence or exemption under the Electricity Industry Act 2004 (the Act). This is a costly and involved process.

A review is underway to identify a regulatory framework that facilitates businesses providing innovative behind-the-meter electricity services, including microgrids and VPPs, while ensuring that adequate consumer protections are available for consumers of those services. The Act is currently being amended to accommodate alternative electricity service provision to small use customers. The proposed timeframe for the Act appearing before WA Parliament is January 2022.

New businesses entering the market will only be able to supply small-scale consumers and not industry. There are costs incurred including a set-up fee of $5000 - $7000 (estimated), an annual licence ($2400 - $3400), a standing charge to the ERA to support the Energy and Water Ombudsman scheme, an energy safety levy, and auditing.

The Act is also concerned with providing rigorous consumer protections, thus all new suppliers will be required to provide:

- Tariffs at rates which are regulated by the ERA
- Concession rates
- Hardship payment plans
- Do not disconnect plans
- Adherence to all rules of the Australian Energy Supplier Code of Conduct

Regulatory environment

In addition to the energy retailer requirements, there are currently regulatory and structural barriers to energy sharing and small scale energy generators and aggregators entering the market in WA.

A major example is that existing network access arrangements are precluding a number of proposed renewable energy generation projects from connecting to the grid.

The Energy Transformation Strategy states "*Under existing network access arrangements, there is not sufficient spare capacity available in the areas of the network they want to*

[5] https://www.synergy.net.au/Our-energy/For-tomorrow/RENeW-Nexus-Trial

connect to. In most cases this network constraint is contractual rather than physical, with a number of large, long-established generators having a contractual right to the network capacity, even if they do not use it all. This means that new parties cannot access the network unless they pay for expensive and often unnecessary upgrades.

The State Government is changing the network access arrangements to a 'constrained access' model, which provides a more level playing field for all generators seeking access to network capacity. All generators will be required to share network capacity and bid for the right to supply power through the network.

Introducing this constrained access model will enhance utilisation of existing network capacity, meaning cleaner and potentially cheaper generation sources can connect – without the need to spend billions of dollars on new poles and wires to increase network capacity that is not actually needed. [6].

Changes to facilitate the reforms will be progressed largely through amendments to the Wholesale Electricity Market Rules and the Electricity Networks Access Code 2004. The new Wholesale Electricity Market Rules were gazetted in December 2020.

The Distribution Storage Plan

Within the Distributed Energy Resources plan, Western Power has prepared the Distribution Storage Plan. In this document Western Power has used modelling to determine constrained parts of the network. Once this is confirmed a competitive procurement process will be released to provide those storage services including behind the meter residential and commercial batteries as well as flexible loads and other innovative demand reduction services[7].

Western Power will be preparing an Alternative Options Strategy and the Network Opportunity Map (NOM). This map will provide greater transparency and opportunity for 'alternative options' service providers to provide a contracted service with their equipment to address network capacity constraints. The first iteration of the NOM is expected to be released 1st October 2021.

There is an Indicative Distribution Storage Opportunities Map within the paper which identifies Byford and Southern River Distribution Networks as having large scale distribution storage needs. The Indicative Storage Opportunities Map also identifies further community batteries (approx.10-15 per year at various locations across the SWIS)[8].

What form these alternative solutions providers might take and whether local government could participate is not yet clear, however it can be surmised that suburbs within the SEREG council's local government areas are priorities for energy sharing initiatives.

[6] https://www.wa.gov.au/organisation/energy-policy-wa/energy-transformation-strategy
[7] https://www.westernpower.com.au/community/news-opinion/50mw-of-extra-battery-storage-planned-for-the-swis/
[8] https://www.westernpower.com.au/about/reports-publications/distribution-storage-plan/

Current Opportunities

DER Orchestration Trial - Project Symphony

A State Government led virtual power plant entitled "Project Symphony" was announced on the 3rd of February 2021.

500 households and businesses are expected to participate in $35 million Project Symphony pilot in Southern River, City of Gosnells – set to be WA's largest VPP. Southern River has a particularly high uptake of rooftop solar (50% of households)[9].

Energy Policy WA has in the past indicated that local government facilities may be eligible to participate in this project. The project is still being developed and Expressions of Interest have not yet been invited.

Switch your thinking have been in contact with Energy Policy WA and Synergy who are aware of our interest in this project and we will be kept informed of developments as the project progresses.

Local government facility microgrids

SEREG could initially look to establish microgrids within Council owned facilities to reduce energy costs prior to looking to the community as an aggregator. There are a number of things that local governments can do now to prepare for energy sharing schemes.

The first step in this process is installing solar PV systems and storage batteries on as many council owned buildings as possible. Solar PV in particular offers excellent financial returns as a stand-alone project which will only be enhanced if connected to a microgrid or VPP at a later stage. Switch your thinking has been working with the SEREG councils on opportunities to do this.

The second step would involve improving data collection systems, similar to the approach taken by the City of Melville. This has the additional benefit of allowing improved energy efficiency as unusual patterns of energy use can be identified and acted on. The Switch your thinking Business Plan also includes actions to assist with installing data monitors on meters.

[9] https://www.mediastatements.wa.gov.au/Pages/McGowan/2021/02/Virtual-Power-Plants-to-become-a-reality-in-WA-first.aspx

Solar PV and batteries in new developments

SEREG councils could work with developers in constrained areas to encourage the installation of solar panels and batteries in new housing with a view to establishing a microgrid or VPP.

Conclusion

Until legislative reforms are undertaken the opportunity for a local government to act as an aggregator would be limited.

In the meantime there are a number of opportunities that Switch your thinking can pursue which will allow us to increase our understanding and capacity in this field in the lead up to these legislative changes taking place.

This is a rapidly evolving field and other opportunities may present themselves in the coming months and years. Switch your thinking will continue to monitor these developments and present opportunities to SEREG in that time.

Appendix 11: Cash Flow Forecast

	2021/22	2022/23	2023/24	2024/25	2025/26	2026/27	2027/28	2028/29	2029/30	2030/31	Total
Opening Account Balance	**0**	**311,551**	**236,551**	**181,551**	**480,307**	**425,307**	**724,063**	**699,063**	**843,441**	**833,441**	
Flaring Project - Initial Phase											
Income	311,551										**311,551**
Flaring Project - Extension Period											
Income				308,756		308,756		154,378			**771,890**
Compliance Costs			-45,000		-45,000		-15,000				**-105,000**
Initiatives											
Building Policy											
Solar Feasibility		-50,000									**-50,000**
Energy Audits		-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000	-10,000		**-80,000**
Decorative Lighting Study		-15,000									**-15,000**
Offsets Purchase										-205,000	
Net Annual Impact	**311,551**	**-75,000**	**-55,000**	**298,756**	**-55,000**	**298,756**	**-25,000**	**144,378**	**-10,000**	**-205,000**	
Closing Amount	**311,551**	**236,551**	**181,551**	**480,307**	**425,307**	**724,063**	**699,063**	**843,441**	**833,441**	**628,441**	

Ironbark Sustainability

Perth Southern Metropolitan and Regional Western Australian LED Street Lighting Business Case

City of Cockburn wetlands to waves

CITY OF Armadale

City of Albany

CITY OF CANNING

City of Melville

Prepared for
City of Cockburn

Version	Author	Date	Description of changes
V1a	Paul Brown	30/12/2020	First Draft Release Copy
V1b	Paul Brown	29/1/2020	Updated version based on comments from Cockburn and Melville councils and GRA Partners. Release copy is word document with tracked changes for ease of further comment.

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About Ironbark Sustainability
Ironbark Sustainability is a specialist consultancy that works with government and business around Australia by assisting them to reduce energy and water usage through sustainable asset and data management and on-the-ground implementation. Ironbark has been operating since 2005 and brings together a wealth of technical and financial analysis, maintenance and implementation experience in the areas of building energy and water efficiency, public lighting and data management. We pride ourselves on supporting our clients to achieve real action regarding the sustainable management of their operations.

Our Mission
The Ironbark mission is to achieve real action on sustainability for councils and their communities.

Ironbark are a certified B Corporation. We have been independently assessed as meeting the highest standards of verified social and environmental performance, public transparency, and legal accountability to balance profit and purpose.

Perth Sth. Metro LED Street Light Business Case Report

Ironbark

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1 Executive Summary

The report summarises the benefits to replacing existing streetlights with LEDs and the application of smart technology by Western Power within the Perth Southern Metropolitan Region and Albany local government area of Western Australia.

These replacement programs are widespread in many other Australian states and the cities of Albany, Armadale, Canning, Cockburn and Melville have been working collaboratively with the South West Group of Councils, the Western Australian Local Government Association (WALGA) and Western Power to build the case for a large scale roll out in their local government areas.

This program proposes to replace around 47,000 streetlights to energy efficient and low maintenance LED lights. The program will be funded by the participating councils.

Table 1 provides a summary of the expected outcomes for the councils from the program and the potential for this if extrapolated across the entirety of the Western Power managed SWIS Grid.

Table 1: Summary of results

Region	Number of lights	Project Cost (inc. interest)	Total Cost Savings (20 yrs.)	Total Energy Savings (MWh, 20 yrs.)	Total Greenhouse Savings (tCO2-e, 20 yrs.)	Payback (yrs.)
Perth Sth Metro and Albany	47,000	$25 to 29m	$107 to 123m	300,000 to 370,000	210,000 to 250,000	5.0 to 6.3
All of Western Power SWIS Grid (est.)	276,000	$150 to $170m	$620 to $720m	1.7m to 2.2m	1.2m to 1.5m	5.0 to 6.3

It demonstrates a direct benefit of around $4 saved for every $1 spent over the life of the new lighting assets. In addition, the program demonstrates a reduction of 55-60% in overall energy and emissions from the lighting system.

There are a range of other benefits for the Western Australian Community and for Western Power that are delivered by the project. The main additional community benefits include improved road safety through better designed, more reliable streetlights and the ability to control the lights to reduce overlighting and light spill.

For Western Power this program will support the roll out of a smart city system (the "advanced metering system"). Lighting will be one part of a widespread network that will enable automatic electricity meter reading and improved network fault detection. The lighting system will help by adding sensors to the system which will improve overall network coverage as well as supporting the business case for the smart city network deployment.

In addition, many of the lights being replaced will need replacement within the next 3-5 years to meet the requirements of the International Minamata Convention to limit mercury. The current lighting assets include large numbers of mercury based products, by replacing them now at Council cost this will negate the need for added investment by Western Power in this replacement.

1.1 Key Recommendations

The key next steps to deliver this program are as follows:

- Negotiate agreed project costs, product selection and future system management models with Western Power. Importantly the project partners need to ensure an open book sharing of costs and savings so that the overall system costs and benefits are clear and overarching community benefit the main test of the overall project outcomes.
- Undertake lighting design based on the preferred project option. This is best directed by Council.
- Work with Western Power and Synergy to ensure the preferred technology (including smart lighting systems) are used within this project and there are appropriate tariffs for these.

It is the intent to ensure this program can be delivered in the short term, in conjunction with the roll out of the proposed smart city system. This "advanced metering system" is currently in roll out planning and councils desire roll out of the lighting replacement to begin in the 2021/22 year.

2 Introduction

The South West Group of Councils, the Western Australian Local Government Association (WALGA) and a number of Metropolitan and Regional Local Governments have been exploring a proposal involving the replacement of existing streetlight lamps with LED lamps and the application of smart technology to achieve a range of community benefits with Western Power.[1]

This report analyses the costs and savings that can be expected from a replacement of all non-LED light types for the following cities:

- Albany
- Armadale
- Canning
- Cockburn
- Melville

This report includes a summary of the lights considered for replacement to LEDs within the region (Section 3), external funding opportunities (Section 6) and the impact of the lighting upgrade on social, environmental and health impacts of the upgrade (Section 7). However, the main focus is to report on the expected business case outcomes from different project scenarios (Section 4).

[1] Image on page courtesy Western Power: https://www.westernpower.com.au/our-energy-evolution/projects-and-trials/smart-streetlights-trial/

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3 About the Regions Street Lights

Public lighting consists of unmetered street lighting and off-street lighting in Public places such as beaches, parks, public facilities and car parks. The scope of this report is limited to the management of streetlights within the unmetered streetlighting network.

Synergy is the retailer and charges tariffs for the cost of operation, maintenance and electricity use. Western Powers maintenance and operation charges are charged within these tariffs.

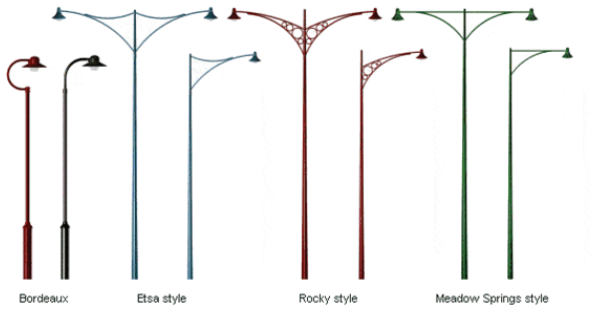
This business case considers the replacement of 35,888 minor road streetlight types (typically under 130W for non-LED lights) and 11,122 major road streetlights. Details of lighting types, road types and quantities can be found in Table 2.

Table 2: Council light types included in business case

Type	Nominal Wattage	Road Type (Indicative)	Quantity
CFL	42	Minor	9,051
HPS	250	Major	8,216
	150	Major	1,816
	70	Minor	80
LED	17	Minor	63
	20	Minor	330
	22	Minor	152
	36	Minor	108
	42	Minor	34
	53	Minor	115
	80	Major	64
	100	Major	5
	160	Major	43
	155	Major	1
	170	Major	97
MH	70	Minor	2,359
	250	Major	148
	150	Major	500
MV	50	Minor	2
	80	Minor	14,699
	125	Minor	8,895
	250	Major	232
Total Non-LEDs			45,998
Total LEDs (not included for replacement)			1,012
Total Lights			47,010
Total Minor Road Lights			35,888
Total Major Road Lights			11,122

3.1 Decorative street lighting

Councils commonly have a number of decorative lighting types which consist of several different luminaire models, paint colours and spigot entry points and sizes[2]. This presents challenges for the accuracy of feasibility studies as well as for future stock management compared to the one size fits all approach that can be used for standard streetlight replacement programs. For the sake of this business case, these lights have been excluded from the analysis.



Careful planning of a bulk replacement of decorative lights is required as material costs can be up to 300% greater than standard lights and each error that is passed through to the project implementation phase can result in additional project costs of $1,000, thus highlighting the importance of having an accurate asset register of decorative street lighting assets. This is typically addressed within the planning and preparation stage of the project.

3.2 Off Street Lighting

For off street lighting assets an audit and management program can be developed. This has been completed by Cockburn and many of these assets replaced with LED lighting with smart controls. Within the same timeframe of the bulk LED street lighting program an audit of off-street lighting can be carried out by the other participating councils to determine future project scope for this replacement program. Typically, councils have around 10% of total lights in off street locations and 90% are unmetered streetlighting. Based on that analysis within the region it is expected that around 5,000 off streetlights in parks, carparks, sporting grounds and other public spaces will be present.

3.3 Technology Choice

We have assumed for the purpose of this report that Council will install the luminaire with the lowest pay-back period and the lowest wattage that meets standards. In some circumstances

[2] Image Courtesy https://adcoote.net.au/lighting-columns/architectural-columns/street-vision/

that has meant identifying and utilising products that are the latest version of approved Western Power suppliers and products. It is important to check the price and wattages of the approved luminaires in the lead up to any streetlight bulk change as prices and wattages can drop, therefore influencing the pay-back periods of the approved luminaires.

Based on discussion with industry suppliers, suitable replacement options based on current luminaire types and lights wattages have been identified. In future, these choices will be available at a lower wattage and capital cost as technology improves.

In this business case the table below outlines the assumed technology for the replacement project.

Table 3: LED Residential LED replacement technology options

Current Light	Preferred equivalent LED luminaire
80W MV	Sylvania-Schréder 13.7W StreetLED3
150W HPS	Sylvania-Schréder 70W RoadLED Midi
250W HPS	Sylvania-Schréder 150W RoadLED Midi

4 Benefits for Western Power and State Government

This section outlines some of the benefits to both Western Power and the Western Australian State Government/Community. This is not a full outline, but simply a summary of the range of potential community wide benefits the program will deliver.

4.1 Benefits for Western Australian State Government/Community

- Reduced greenhouse gas emissions
- Reduced energy use and lower energy demand reducing upward pressure on electricity prices
- Creation of approximately 50 jobs during the project
- Reduced crime by providing more consistent and reliable night time lighting
- Improve night-time safety for all road users. This is expected to have significant health benefits to the hospital system as well as property and vehicle damage. Initial estimates indicate benefits of in excess of $1,000 per light over 20 years from smart lighting as a result of reduced accidents.
- Improved tourism opportunities in the region (night time –space/star viewing through lower light spill and the ability to dim and control lights)
- Western Power to lead the nation for a whole of grid conversion to Smart LED streetlights in collaboration with Local Government and State Government
- Short term action to counter criticism received regarding recently released Climate Change Paper regarding lack of short term emissions reduction actions (this assumes that energy production will be reduced to matched reduced demand)
- Significant Partnership initiative at no cost to State Government that can be announced within the next few months
- Accelerates State Government response to the international Minimata Convention which bans the sale of mercury based products (the majority of the lamps replaced are mercury based products)

4.2 Benefits for Western Power

- Significantly reduced maintenance costs. LEDs are shown to reduce failure rates by 80-90% over comparable technology
- Low or no capital investment to upgrade the technology reducing the need for further investment by WP to replace lights (in particular mercury products which will need replacing by 2025)
- Public lighting that meets an improved Australian Roadlighting Standards
- Improved public perception through lower light failure rates and rapid maintenance response through smart control, resulting in lower complaints

- Contribute to electricity network stability through reduced electricity demand in the peak evening and pre-dawn periods
- Protect against the impact of a ban on manufacture and trade of mercury containing globes
- Lower transition cost than the alternate replace on failure approach
- Supports the business case for the wide scale network roll out of smart city technology which has a host of other benefits including:
  - Additional service opportunities through partnerships with other state agencies (e.g. Water Corp remote water meter reading and real-time consumption data)
  - Consistency of smart technology and parallel timing with the rollout of Smart Meters (50% households in metro area in 2021)
  - Adding sensors to the system which will improve overall network coverage
  - Community benefits through availability and utilisation of other smart applications (moisture meters, noise meters, traffic counters, etc.)

5 Business Case Summary

A project to replace streetlighting on a large-scale in the Southern Metropolitan region of Perth and regional Western Australia makes financial sense if the Western Power project costs fall within the expected range and Synergy pass through the energy benefit to councils through reduced tariffs. The modelling has assessed the business case for the region as a whole. Individual Council modelling can be readily completed.

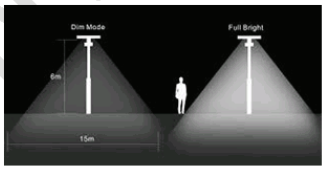
5.1 Business Case Options Considered

This section analyses the project considering three replacement options:

- Option 1: Standard, like for like replacement at the average national project cost
- Option 2: Standard, like for like replacement at the average contestable project cost
- Option 3: Smart lighting enabled and designed at the average contestable project cost

5.1.1 About Lighting Design Options

The like for like replacement options (option 1 and 2) assume only minor consideration of lighting design and that the lights include smart cells, however, they are not designed to improve lighting to Australian Standards. The smart lighting enabled and designed option (option 3) includes project costs to ensure the installations meet Australian Standards (where possible within project constraints) and to take advantage of the smart lighting functionality to reduce energy from the final LED installation by a further 30%. In practice this additional energy savings ranges from 25 to 40% based on a low number of installations nationwide.



5.1.2 Project Cost Benchmarking

Ironbark has collated current data on project costs from 7 DNSPs (Distribution Network Service Provider) nationally (not including Western Power) who have delivered similar projects. Each of these include comparative technologies, often from the same technology providers using the same products available for this project. The results of this benchmarking is outlined in Table 4.

Table 4: LED Street Lighting Benchmark Pricing in Australia

	DNSP A	DNSP B	DNSP C	DNSP D	DNSP E	DNSP E	DNSP F	Average
Minor Road – 80W MV LED equivalent	$260	$260	$388	$405	$396	$344	$350	$343
Major Road - 150W HPS LED equivalent	$587	$587	$726	$737	$715	N/A	$620	$662

This pricing is based on large scale replacements (greater than 2000 units) and includes luminaire material costs (exc. Smart cells), labour, traffic and project management costs.

These prices do not include written down value or taxation on gifted assets or council side design, negotiation and preparation costs.

For the Options analysed within this business case we have utilised the average national project cost from these 7 DNSPs (for option 1 and 2) and the average contestable project cost (option 3), whereby councils could directly engage all contractors except for minor works of the DNSP such as end of project sample auditing and updating data systems. To these project costs has been added a cost for written down value ($60/light) and the smart cells ($100). In reality the project costs may or may not be within the range of costs estimated with this report and is currently subject to negotiation between councils and Western Power.

5.1.3 About the Modelling

The modelling has been developed by Stuart Downing, Director of Finance & Corporate Services, from the City of Cockburn and reviewed and built upon by Paul Brown, Managing Director of Ironbark Sustainability to create the tables and graphs within this report. As with all modelling this includes a range of assumptions which are outlined in Appendix 1. The major input into the modelling, other than the project costs (as outlined above) are the tariffs for maintenance and provision of energy for each luminaire by Synergy. This report assumes the current system and the basic model continues and that the lower energy lights and smart enabled lighting are rewarded with lower tariffs by Synergy.

5.2 Summary of Business Case Outcomes

Table 5 provides a summary of the outcomes of each of the three options. It demonstrates that the range of potential costs are expected to fall within the $25 to $29m range and the total savings over 20 years (the life of the light) ranges from $107m to $123m. Total greenhouse savings range from 210,000 to 250,000 tonnes and paybacks are expected to be between 5 and 6.3 years.

Table 5: Summary of results

Scenario	Project Cost (inc. interest)	Total Cost Savings (20 yrs.)	Total Energy Savings (MWh, 20 yrs.)	Total Greenhouse Savings (tCO2-e, 20 yrs.)	Payback (yrs.)
Option 1: Average national project cost with like for like design	$29m	$107m	300,000	210,000	6.3
Option 2: Average contestable project cost with like for like design	$25m	$107m	300,000	210,000	5.4
Option 3: Average contestable project cost with smart lighting enabled design	$26m	$123m	370,000	250,000	5.0

Figure 1 graphically represents the full range of costs and net savings range for these options. The best option is Option 3 as a result of the improved energy savings over the project lifetime. The savings estimates from smart lighting are based on comparative projects in other cities, however, a full understanding of the costs and savings from this option will only be known once preparatory design work is completed.

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Figure 1: Lifetime cashflows of different scenarios

5.3 Key Recommendations

A project to replace lighting rapidly on a large-scale in Southern Perth Metropolitan region and regional Western Australia is expected to result in a positive project outcome and reasonable paybacks (between 5 and 7 years).

In preparation for the project, it is recommended that negotiations with Western Power be progressed to confirm all project costs and confirm the management model for smart lighting systems to ensure ongoing community benefit.

The project preparation and delivery steps to implement the project over the next 12-24 months are well known and have been delivered by many other councils around Australia.

The recommended project stages to deliver an improved lighting system are as follows:

1. Prepare
2. Fund
3. Define
4. Procure
5. Manage and Finalise

During Stage 1: Prepare the following is a summary of the key tasks Council can aim to achieve during this period:

- Negotiate the preferred project costs, product selection and future system management models with Western Power
- Undertake design based on the preferred project option.

western power

This is best directed by Council. Examples of the standard process for both standard, like for like projects and for detailed smart lighting designs can be provided to Council from other jurisdictions.

- Work with Western Power and Synergy to ensure the preferred technology (including smart lighting systems) are used within this project and there are appropriate tariffs for these.

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Perth Sth. Metro LED Street Light Business Case Report

6 External Funding

Over the last 10 years, there have been a range of funding and financing opportunities available for street lighting projects and Ironbark has been assisting councils with these options. Many of these are no longer running (such as the Community Energy Efficiency Program. Two current avenues from the Federal Government available to Council are the Local Roads and Community Infrastructure Fund and the Roads to Recovery Program.

6.1 Local Roads and Community Infrastructure Fund (LRCI)

The Federal Government have announced $1.5bn for local governments to spend to help the economic recovery after the COVID-19 pandemic. The federal Treasurer states (after the program was expanded from $500m to 1.5bn):

"We are also expanding the Local Roads and Community Infrastructure program. Investing an additional $1 billion to support local councils' immediate upgrades of local roads, footpaths and street lighting. These investments in our local communities will support local jobs."

Dozens of councils are using this funding for street lighting bulk replacements. However, the timing of the funding means the project needs to be complete by June 2021 (for the first $500m tranche) and December 2021 for the second tranche.

For more information see:
https://investment.infrastructure.gov.au/infrastructure_investment/local-roads-community-infrastructure-program/

6.2 Roads to Recovery Funding (R2R)

Under the Roads to Recovery Program, direct funding to local councils is distributed as untied grants for local roads as part of annual financial assistance grants to councils. In other LED replacement projects, some councils have chosen to use the R2R funding to deliver the project.

Features of local roads grants are:

- Each state receives a fixed share of the grant.
- Each council's share of the grant is determined by the state's local government grants commission

For more information, see
https://investment.infrastructure.gov.au/infrastructure_investment/roads_to_recovery/

7 Social, Environmental and Health Implications

The LED options all perform comparably under a range of social criteria. All are a significant improvement on the existing lamps, particularly in terms of evenness of light spread and reduced mercury content. Many of these options are manufactured in Australia and are Australian owned technologies.

7.1 Social Considerations

It is undesirable to light residential streets above the minimum required standard. Doing so creates unnecessary cost and greenhouse emissions. In many areas, residents have a preference for low levels of lighting.

However, in some areas higher levels of lighting may be desirable to encourage walking, cycling and use of public transport. In areas where there are concerns about safety at night, it may improve perceptions of safety and residential amenity to exceed the Australian Standards for lighting levels. Council may also have specific policy objectives (such as pedestrian connectivity between transport nodes and shopping centres) that can be supported with higher levels of light in strategic locations.

Many councils, when delivering these projects undertake detailed design to ensure improved road and pedestrian safety. In addition, these can deliver improved energy savings through smart lighting. These improved design outcomes can be planned for in the standard bulk replacement program and has been included within Option 3 of this modelling.

7.2 Environmental Considerations

LED lights are substantially more efficient than current lighting, particularly MV lamps. The greenhouse savings are significant.

Some traditional light technologies such as MV are manufactured using harmful substances such as lead and mercury which are not used in the manufacturing of LEDs. These substances risk being introduced into the environment during a light's service life and must be carefully disposed of when a light is retired. However, while not containing mercury, LEDs contain printed circuit boards (PCBs), which include electronic waste that causes potential problems if not disposed properly.

Consideration should also be made on effects to local biodiversity – from insects such as moths through to birds and small marsupials. These can be addressed by cutting down glare and installing shields or installing "warmer colour" LEDs where there are

protected or endangered species. Generally, LEDs are advantageous because there is significantly less light spill.

There are now numerous completed projects around Australia demonstrating how bulk LED changeovers have resulted in reduced upward lighting spill and light pollution, such as the image above from the "Lighting the Regions" project in Bendigo, Victoria in 2015.

Figure 2: Bendigo glare "before" (in March 2015) and "after" (in August 2015) a change from 80W MVs to 18W StreetLED (HPS lights not yet replaced)

7.3 Health Considerations

There is an increasing amount of public discourse around the potential negative effect of public lighting on human health due to too much "blue light". In June 2016, a report by the American Medical Association (AMA) adopted guidance for local communities on selecting among LED lighting options to minimize potential harmful human and environmental effects. While the report is based on the experience in the USA, it reinforces what could be considered as "best practice public lighting" which dictates that lighting should be designed and managed by professionals and with concern for broader environment, health and social factors.

The AMA also blames high colour temperatures and recommends a colour temperature of 3000K or lower for LED street lighting to limit the amount of blue light. Unfortunately, many 3000K lights can have high blue light content and Figure 35 shows that the warmer colour temperatures (LPS and HPS at 3000K or lower) result in slower driver reactions times and have direct road safety implications.

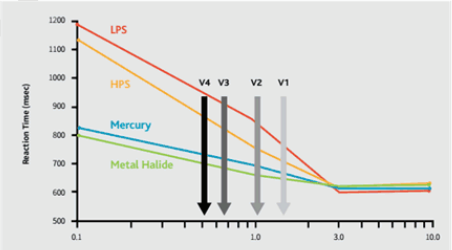

Figure 3: Australian Highway Lighting Categories, reaction times improved by white light (Davis 1999, Arizona DoT, SLPC, from IPWEA SLSC Roadmap 2016)

According to the IPWEA Street Lighting and Smart Controls Roadmap (2016) "in practical terms, this means that at a vehicle speed of 50km/hr, the stopping distance might be reduced by 4.2m" when using a higher colour temperature compared to the warmer colours. The understanding of reaction times for LEDs at warmer colours is not yet known. The Australian Standard (SA/SNZ TS 1158.6) that states a "recommended" colour temperature of 4000K for street lighting.

It's important to note that much of the public discourse around "over lighting" and too much "blue white" is based on experiences in the USA and Europe. While still important, it is of less relevance to Australia because Australian street lighting levels are relatively low by international standards. In the UK, the minimum lighting levels are up to 7 times higher than the minimum levels in Australia. What's more, the "old" lights in USA and Europe are commonly HPS lights which generally have a lower colour temperature than the MV lights in Australia.

In the absence of any conclusive research or evidence, the potential risks of blue lighting can be managed by good design. For example, lighting to the levels required (not higher), reducing light spill through well-designed luminaires and lighting schemes and the use of glare shields where appropriate. These issues and actions are generally discussed and decided during the Design and Preparation Stage of a lighting project.

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Appendix 1: Modelling Assumptions

- All luminaires to be replaced over a 12-month period
- Borrowings at WATC rates including Loan Tax of 0.7%
- Aim to repay loan ASAP which forms payback period
- Number of lights as per latest Synergy bill supplied
- Discount rate 3.8% - NB if the discount rate matched the loan rate, the NPV would increase by about 25%
- NPV Period is over 20 years
- Current project pricing as per benchmarked and $100 for smart lighting PE $60 for WDV
- Increase both current lighting and LED lighting tariffs by 2.5% pa
- Tariffs are based on daily rates as per Synergy website including discount for councils paying for changeover
- The savings would be greater for growing councils such as Kwinana, Rockingham and Cockburn as streetlights are growing by approx. 1% per annum on top of the price increase.
- Estimated kWh rate at 17c/kWh. This is relevant for the smart lighting benefits (Option 3)
- Technology power consumption is as per National Electricity Market Load Tables for Unmetered Connection Points
- All savings and cost figures are GST exclusive

CITY OF COCKBURN - STREETLIGHT CHANGEOVER - SMART ENABLED LED LIGHTS

Wattage	Type	Model	Quantity	Cost per Luminaire	Current Rate ex GST	Cost PA	LED SL	Current Rate inc GST	Current Rate ex GST	Cost PA	rate ex cap contribution + SED Service cost	cost after cap contrib	base	consumed per day Kwhrs	consumed per year Mwhrs	base	consumed per day Kwhrs	consumed per year Mwhrs	Energy Saving per Class	Tonnes CO2 for current	Tonnes CO2 for LED	Saving
42	CFL	SE-C	1878	$655	0.3868	$265,140	20	0.271531	0.2468	$169,206	0.2325	$159,367	42	0.5796	397.30	20	0.276	189.19	-52%	278.11	132.43	-145.68
20	LED	RG-C	48	$0	0.2449	$6,078	20	0.271531	0.2468	$6,127	0.2811	$6,977	20	0.276	6.85	20	0.276	6.85	0%	4.80	4.80	0.00
80	MV	C	4852	$655	0.4194	$742,749	20	0.271531	0.2468	$437,160	0.2325	$411,740	80	1.104	1,955.16	20	0.276	488.79	-75%	1368.61	342.15	-1026.46
125	MV	C	2812	$655	0.5333	$547,368	53	0.339612	0.3087	$316,883	0.2933	$301,042	125	1.725	1,770.51	53	0.7314	750.69	-58%	1239.35	525.49	-713.87
42	LED	BH-C	75	$0	0.4017	$2,199	20	0.271531	0.2468	$1,351	0.2811	$2,539	42	0.5796	3.17	20	0.276	1.51	-52%	2.22	1.06	-1.16
70	MH	C	660	$655	0.6827	$364,462	80	0.392853	0.3571	$86,035	0.3430	$82,630	70	0.966	232.71	80	1.104	265.95	14%	162.90	186.17	23.27
250	MH	C	48	$742	1.0972	$19,223	160	0.569611	0.5178	$9,072	0.4907	$8,597	250	3.45	60.44	160	2.208	38.68	-36%	42.31	27.08	-15.23
53	LED	RG-C	13	$0	0.3099	$1,440	53	0.339612	0.3087	$1,463	0.3430	$1,627	53	0.7314	3.47	53	0.7314	3.47	0%	2.43	2.43	0.00
250	HPS	C	2239	$742	0.7697	$629,026	160	0.569611	0.5178	$421,187	0.4907	$402,037	250	3.45	2,819.46	160	2.208	1,804.45	-36%	1973.62	1263.12	-710.50
170	LED	RF-C	37	$0	0.3582	$4,837	170	0.39402	0.3582	$4,837	0.3924	$5,300	170	2.346	31.68	170	2.346	31.68	0%	22.18	22.18	0.00
100	LED	PK-C	4	$0	0.5771	$843	100	0.63481	0.5771	$843	0.6113	$893	100	1.38	2.01	100	1.38	2.01	0%	1.41	1.41	0.00
125	MV	A	4	$655	0.462	$675	53	0.339612	0.3087	$451	0.2933	$428	125	1.725	2.52	53	0.7314	1.07	-58%	1.76	0.75	-1.02
150	HPS	C	410	$655	0.579	$86,647	80	0.392853	0.3571	$53,646	0.3430	$51,331	150	2.07	309.78	80	1.104	165.21	-47%	216.84	115.65	-101.19
160	LED	RF-C	14	$0	0.502	$2,565	160	0.569611	0.5178	$2,646	0.5521	$2,821	160	2.208	11.28	160	2.208	11.28	0%	7.90	7.90	0.00
17	LED	BH-C	53	$0	0.2812	$5,440	17	0.395626	0.3086	$6,961	0.3941	$7,624	17	0.2346	4.54	17	0.2346	4.54	0%	3.18	3.18	0.00
22	LED	C	93	$0	0.2812	$9,545	22	0.38347	0.2759	$9,365	0.3101	$10,527	22	0.3036	10.31	22	0.3036	10.31	0%	7.21	7.21	0.00
250	HPS	A	3	$742	0.619	$678	160	0.569611	0.5178	$567	0.4907	$537	250	3.45	3.78	160	2.208	2.42	-36%	2.64	1.69	-0.95
250	MV	C	28	$742	0.7812	$7,984	160	0.569611	0.5178	$5,292	0.4907	$5,015	250	3.45	35.26	160	2.208	22.57	-36%	24.68	15.80	-8.89
36	LED	C	10	$0	0.2728	$996	36	0.2394	0.2176	$794	0.2033	$742	36	0.4968	1.81	36	0.4968	1.81	0%	1.27	1.27	0.00
42	CFL	BH-C	565	$655	0.4032	$83,150	20	0.271531	0.2468	$50,906	0.2325	$47,946	42	0.5796	119.53	20	0.276	56.92	-52%	83.67	39.84	-43.83
42	CFL	XN-C	6	$655	0.4184	$960	20	0.271531	0.2468	$541	0.2325	$509	42	0.5796	1.27	20	0.276	0.60	-52%	0.89	0.42	-0.47
42	CFL	SE-A	3	$655	0.3598	$394	20	0.271531	0.2468	$270	0.2325	$255	42	0.5796	0.63	20	0.276	0.30	-52%	0.44	0.21	-0.23
42	CFL	SE-M	1	$655	0.3527	$129	20	0.271531	0.2468	$90	0.2325	$85	42	0.5796	0.21	20	0.276	0.10	-52%	0.15	0.07	-0.08
42	LED	C	15	$655	0.4017	$2,199	42	0.44187	0.4017	$2,199	0.4359	$2,387	42	0.5796	3.17	42	0.5796	3.17	0%	2.22	2.22	0.00
70	HPS	C	31	$655	0.4144	$4,689	36	0.303949	0.2763	$3,127	0.2620	$2,964	70	0.966	10.93	36	0.4968	5.62	-49%	7.65	3.93	-3.72
80	LED	PK-C	3	$0	0.506	$554	80	0.5653	0.5139	$563	0.5482	$600	80	1.104	1.21	80	1.104	1.21	0%	0.85	0.85	0.00
80	LED	RF-C	18	$0	0.3492	$2,294	80	0.5653	0.5139	$3,376	0.5482	$3,697	80	1.104	7.25	80	1.104	7.25	0%	5.08	5.08	0.00
150	MH	C	235	$742	0.9089	$77,961	80	0.5653	0.5139	$44,081	0.4998	$42,868	150	2.07	177.55	80	1.104	94.70	-47%	124.29	66.29	-58.00
	Minor	11250																				
	Major	2525																				
	LED	343	14118		PA	$2,670,226				$1,640,841		$1,560,991			7,983.81			3,972.38		5,588.66	2,780.67	2,808.00
			343		PCM	$222,519				-39%		-42%						-50%				
	Avg Cost per luminaire		**$673.74**																			
	Capital cost - Smart LED		**$9,253,284.50**							Savings		-$1,109,235										
	LRCI Grant and WP RAB		$6,913,630	$1,723,182	WP's RAB	$1,383,527		-														

Year	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Old Streetlight cost	$2,670,226	$2,736,982	$2,805,406	$2,875,541	$2,947,430	$3,021,116	$3,096,644	$3,174,060	$3,253,411	$3,334,747	$3,418,115	$3,503,568	$3,591,157	$3,680,936	$3,772,960	$3,867,284	$3,963,966	$4,063,065	$4,164,641	$4,268,757
LED Street Light cost	$1,560,991	$1,600,016	$1,640,016	$1,681,017	$1,723,042	$1,766,118	$1,810,271	$1,855,528	$1,901,916	$1,949,464	$1,998,200	$2,048,155	$2,099,359	$2,151,843	$2,205,639	$2,260,780	$2,317,300	$2,375,232	$2,434,613	$2,495,479
Saving	$1,109,235	$1,136,966	$1,165,390	$1,194,525	$1,224,388	$1,254,998	$1,286,373	$1,318,532	$1,351,495	$1,385,283	$1,419,915	$1,455,413	$1,491,798	$1,529,093	$1,567,320	$1,606,503	$1,646,666	$1,687,832	$1,730,028	$1,773,279
Capital Cost	$6,913,630																			
Loan Reducing Balance	$0	$5,939,210	$4,918,059	$3,848,571	$2,729,093	$1,557,922	$333,304	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Interest on loan at 1.95%	$134,816	$115,815	$95,902	$75,047	$53,217	$30,379	$6,499	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Op saving after Int	$974,419	$1,021,151	$1,069,488	$1,119,478	$1,171,171	$1,224,618	$1,279,873	$1,318,532	$1,351,495	$1,385,283	$1,419,915	$1,455,413	$1,491,798	$1,529,093	$1,567,320	$1,606,503	$1,646,666	$1,687,832	$1,730,028	$1,773,279
Capital Repayment	$974,419	$1,021,151	$1,069,488	$1,119,478	$1,171,171	$1,224,618	$333,304	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0	$1,773,279
Cash Saving	$0	$0	$0	$0	$0	$0	$946,569	$1,318,532	$1,351,495	$1,385,283	$1,419,915	$1,455,413	$1,491,798	$1,529,093	$1,567,320	$1,606,503	$1,646,666	$1,687,832	$1,730,028	$0
Discounted Cash Saving				-	-	-	729,073	978,990	966,136	954,036	942,088	930,289	918,638	907,133	895,772	884,553	873,475	862,535	851,733	-
NPV	**$11,693,851**																			

	Year 1	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.00
Capital loan	$6,913,630	$5,939,210	$4,918,059	$3,848,571	$2,729,093	$1,557,922	$333,304	$0	$0	$0
Interest	$134,816	$115,815	$95,902	$75,047	$53,217	$30,379	$6,499	0	0	0
Repayment	$974,419	$1,021,151	$1,069,488	$1,119,478	$1,171,171	$1,224,618	$333,304	$0	$0	$0
Balance	$5,939,210	$4,918,059	$3,848,571	$2,729,093	$1,557,922	$333,304	$0	$0	$0	$0

Minor Road	Wood	Metal	Double	Weighted Avg	SED Dev	total inc SED	5 % Bulk Disc	10% bulk disc
Cost per Luminaire	$500	$480	$440	$480	$175	$655	$631	$607
weighting	10%	85%	5%					
Major Road								
Type	wood	metal	double					
weighting	5%	85%	10%					
Cost per Luminaire	$590	$570	$525	$567	$175	$742	$713	$685

Model Assumptions	NPV	Net Cost	PA savings	Payback	Payback
Base Price + SED Service +RAB	$11,693,851	$6,913,630	-$1,109,235	6.23	5.4
5% Disc Price +SED Services+RAB	$11,996,122	$6,571,628	-$1,109,235	5.9	5.1
10% Disc Price +SED Services+RAB	$12,303,143	$6,230,800	-$1,109,235	4.67	3.78
Base Price + SED Service + No RAB	$12,931,117	$6,913,630	-$1,109,235	5.05	4.12
5% Disc Price +SED Services + No RAB	$13,243,203	$5,188,101	-$1,109,235	4.71	3.81
10% Disc Price +SED Services + No RAB	$13,555,795	$4,846,099	-$1,109,235	4.4	3.5
Original NPV No SED Service+RAB	$14,536,219	$6,913,630	-$1,109,235	5.41	4.38
Original NPV No SED Sevice+No RAB	$15,791,981	$5,530,103	-$1,109,235	4.4	3.56

Cost per group of luminaires	New LED Base Tariff	Less Capital Contribution	Smart LED tariff $12.50	New LED Tariff
$1,230,090	0.2468	0.0486	0.034247	0.2325
$0	0.2468	-	0.034247	0.2811
$3,178,060	0.2468	0.0486	0.034247	0.2325
$1,841,860	0.3087	- 0.0497	0.034247	0.2933
$0	0.2468	-	0.034247	0.2811
$432,300	0.3571	- 0.0484	0.034247	0.3430
$35,592	0.5178	- 0.0614	0.034247	0.4907
$0	0.3087	-	0.034247	0.3430
$1,668,219	0.5178	- 0.0614	0.034247	0.4907
$0	0.3582	-	0.034247	0.3924
$0	0.5771	-	0.034247	0.6113
$2,620	0.3087	- 0.0497	0.034247	0.2933
$268,550	0.3571	- 0.0484	0.034247	0.3430
$0	0.5178	-	0.034247	0.5521
$0	0.3598	-	0.034247	0.3941
$0	0.2759	-	0.034247	0.3101
$2,225	0.5178	- 0.0614	0.034247	0.4907
$20,762	0.5178	- 0.0614	0.034247	0.4907
$0	0.2176	- 0.0486	0.034247	0.2033
$370,075	0.2468	- 0.0486	0.034247	0.2325
$3,930	0.2468	- 0.0486	0.034247	0.2325
$1,965	0.2468	- 0.0486	0.034247	0.2325
$655	0.2468	- 0.0486	0.034247	0.2325
$9,825	0.4017	-	0.034247	0.4359
$20,305	0.2763	- 0.0486	0.034247	0.2620
$0	0.5139	-	0.034247	0.5482
$0	0.5139	-	0.034247	0.5482
$174,253	0.5139	- 0.0484	0.034247	0.4998
$0	-	-	0	-
$0	-	-	0	
$9,253,285				

0.034247

LED Street Light Trial, Atwell and Spearwood

Community Feedback Summary
April 2021

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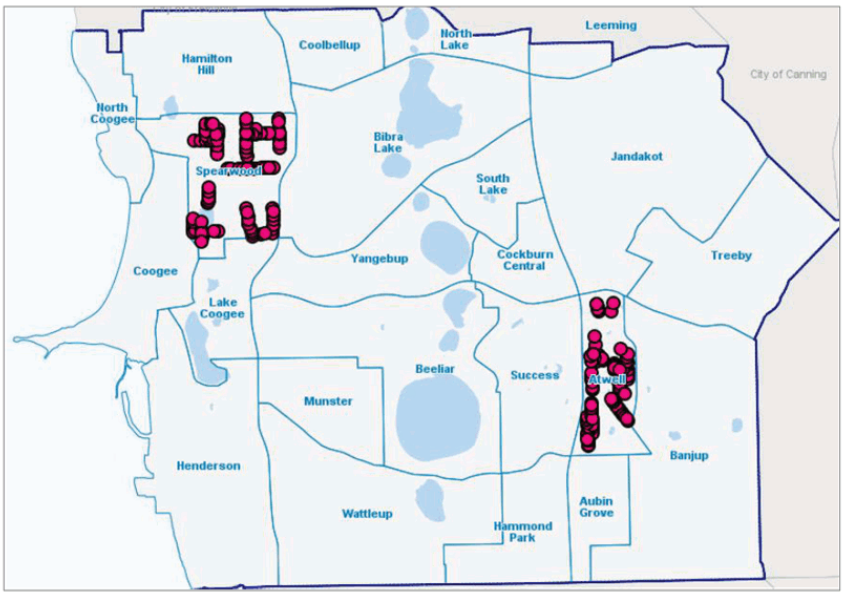
1. Context

The City's operational activities generate over 30,000 tCO2-e per annum. This equates to 1.2% of emissions in the Cockburn municipality. Purchased electricity and gas are the second largest source of emissions (35%) and include energy used in street lighting, facilities, parks and sporting facilities.

Street lighting contributes to almost half of the City's electricity consumption at a cost of $2.7 million per annum. Wider implementation of LEDs could reduce the City's street lighting emissions by around 50% while saving ratepayers.

Between December 2020 and March 2021, Western Power and the City of Cockburn trialled the use of 169 new LED luminaires on existing streetlight poles in sections of Spearwood and Atwell.



Above: Locations of the LED luminaires.

This trial was funded by the Australian Government (through the Local Roads and Community Infrastructure Program) and the City of Cockburn.

The purpose of this trial was to identify whether the existing streetlight poles are suitable for the LED luminaires, given LEDs have a different brightness and colour tone to the traditional mercury vapour/compact fluorescent luminaires.

Required luminance levels differ from area to area because of factors like road conditions. For this reason, the trial was carried out in areas of Spearwood and Atwell that reflect the variety of infrastructure in place across the City.

If the existing poles are considered suitable, it means LEDs could potentially be installed throughout Cockburn, without replacing the actual streetlight infrastructure.

While trial outcomes will be determined by technical criteria, community feedback provides valuable insight into the potential suitability of the LED luminaires on the existing poles. As such, the City invited feedback from residents who live near the modified luminaires during the trial. This document provides a summary of this process and the feedback received.

Above: LED street light, Spearwood.

2. Summary of Process

Information about the trial was communicated via the following channels:

- Letters to 2,236 households within the immediate vicinity of the trial areas.
- Signage affixed to street light poles at the following locations:
  - 5 Gerald Street, Spearwood;
  - 4 Kent Street, Spearwood;
  - 79 Edeline Street, Spearwood;
  - 22 Garden Road, Spearwood;
  - 4 Marvell Avenue, Spearwood;
  - 73 Beenyup Road, Atwell;
  - 10 Molloy Circuit, Atwell;
  - Intersection of Lydon Boulevard and Lipton Mews, Atwell.
- Footpath stickers with QR codes located under LED street lights along streets where the new luminaries were installed.
- A project page located on the City's consultation website, Comment on Cockburn.
- Social media posts.
- Articles in the City's Cockburn Soundings magazine.
- References and web-links in the City's e-newsletters.
- Media releases.
- Information on the City of Cockburn website.

Above: Footpath sticker.

The purpose of seeking feedback was to understand whether residents in the impacted areas felt the new LED lighting was adequate and whether there were specific design issues that needed to be considered.

Thus the feedback process actively targeted households within close proximity to the trial area. Participants were asked to share their views on the level of luminance, colour and brightness. An open ended section was provided for respondents to go into further detail or to provide any other suggestions.

While input was sought from those most impacted, the feedback form was available online to anyone and therefore a handful of non-local respondents submitted feedback. These responses are considered separately in the key findings.

The feedback period was open between 25 November 2020 and 31 March 2021.

Respondents were encouraged to wait a couple of weeks after the new luminaires were installed to adjust to the new lighting, before providing feedback.

Feedback was invited in the following ways:

- An online form available on the Comment on Cockburn website;
- Email
- Phone

In addition to the advertised feedback channels, a door-knock of a sample of households within the trial area was undertaken. Of the 33 properties door-knocked, 14 opted to provide feedback. City staff completed the feedback form with those interested in sharing their comments.

3. Key Findings

- During the feedback period, the project website on Comment on Cockburn had 221 visitors.
- A total of 28 responses were received:
  - 10 online feedback form responses were received.
    - Four responses were from residents outside of the trial area. These responses were about LEDs in general.
  - 14 online feedback forms were completed during the door-knock.
  - Four submissions were received via email.
- Responses received via the feedback form (from those that live in the trial area) indicated:
  - The majority of respondents are satisfied with the new LED lights in terms of overall lighting level in their street (75% said it was just right) and brightness of individual lights (70% said they were just right).

- Most respondents said the new LED lights made them feel either more safe (45%) or just as safe (25%) as before.
- The colour of the new lights attracted less feedback than brightness levels. 50% said the colour was just right, however 45% had no opinion.
- Of those less satisfied with street lighting (20%), all but one suggested this was a pre-existing concern as opposed to a result of the new lighting (e.g. “lights are blocked by trees”; “it is lighter than before but still not light enough”).
- Overall, respondents were either very positive about the new lighting or had not particularly noticed (e.g. “I think they are great, thank you for changing them”; “Haven’t noticed a difference, but I don’t go out at night”).

- Responses received via the feedback form (from those that do not live in the trial area) were general in nature and not specifically related to the trial lights. As feedback was unrelated to the trial lights, responses to the luminance, brightness and colour tones are omitted from the below points. General comments included:
  - Support for LED use elsewhere in Cockburn.
  - Comments on light colouring and the relationship to melatonin production.
  - How cost savings would flow on to ratepayers.
  - Technical queries regarding light patterns and illuminance distribution.
  - Comments on the intensity of LEDs and the potential for this to distract drivers.
- Responses received via email were mostly general in nature, including:
  - Support for LED use.
  - How cost savings would flow on to ratepayers.
  - The purpose of the trial.
  - Whether the trial includes smart lights (and a preference for smart LED lights not to be used in proximity to the respondent’s home).

Feedback form responses and submissions are provided in full in Section 2.

4. Next Steps

The feedback received will be considered alongside other technical information as part of the trial review.

Depending on the outcomes, the City plans to work with Western Power towards replacing incandescent street lighting throughout Cockburn with more energy efficient LED lighting.

For more information on the City's vision and roadmap towards a more climate resilient and sustainable future, view the City of Cockburn's Climate Change Strategy available at www.cockburn.wa.gov.au.

5. Results

5.1 Feedback Form Responses

In the interest of transparency, responses are as they appeared in the survey with minimal editing. Therefore some spelling and/or grammatical errors may exist.

Q1. What suburb do you live in?

Response	Count of responses
Spearwood	13
Atwell	7
Jandakot	1
Coogee	1
Success	1
Not specified	1

Q1b. (asked of those living in other suburbs) Do you have any other comments or feedback on the LED street lighting trial?

Comments
I like the idea, please do it in Jandakot.
Please use Warm yellower LED light as it is healthier than blue white lights. Warm light has a lower percentage of blue & green wavelengths. Blue & green wavelengths severely block melatonin production at night, leading to many of the maladies associated with shift work syndrome. Gingin's Observatory Discovery Centre astronomers talked about this on my visit there & advises our street lights should be warm white NOT blue white for this reason. Fauna also are affected by too much bright blue/white lighting.
Sounds like a great proposal for saving energy etc but we need to consider light pollution. Below is from the FAQ page. When compared to existing street lighting, LEDs may appear both brighter and whiter. This is largely due to the colour of the lights. See this article below which highlights some concerns. https://www.thenicee.com/Article/what-is-light-pollution Is it possible to consider utilising less bright or 'warm' coloured rather than white lights. We know that light pollution has a considerable impact on both people and animal populations especially ones who are nocturnal. With less bright, warm coloured light that is shielded and facing downwards rather than upwards into the sky and radiating further.
I have observed that the LED lights appear to be a high intensity type where the light

source causes intense glare and detracts from their lighting function of street furniture and the ground. Conventional lighting tends to use diffuser type covers or the light source itself is shaded from direct view of the observer. The intense LED light source tends to be visible to the observer and therefore causes distraction. How are the proposed energy savings going to be recouped by the rate payer? As I would understand it, street light circuits are not metered. How do LED lights perform in fog conditions? Is there information available on light pattern and illuminance distribution? Will street light distances need to change where existing conventional installations exist? The concept of reduced energy consumption and reduced maintenance costs is great but I remain to be convinced that the glare emitted from most I have seen is a good thing. Is any information available on the reasoning for the light colour selected in relation to observer (motorist) detecting movement such as pedestrians?

Q2. Now that the new LED lights have been installed, is the overall level of lighting in your street…

Response	Count of responses
Just right	15
Not light enough	5
Too light	1
No opinion	3

Q3. Compared to the previous street lights, do the new LED lights make you feel…

Response	Count of responses
More safe	10
Just as safe as before	5
Less safe	2
No opinion	7

Q4. Is the brightness level of the individual LED lights…

Response	Count of responses
Just right	14
Too dim	3
Too bright	1

No opinion	6

Q5. Is the colour of the new LED lights…

Response	Count of responses
Just right	10
Too warm	2
Too cool	1
No opinion	11

Q6. Do you have any other comments or feedback on the LED street lighting trial?

Comments
They are lighter, it's a good thing. The more light the better.
Brighter than the old lights. It's a good light up there.
Better than it was. Way brighter.
Fairly dark near my house, but a little brighter than before. Very sparse across the street – the path is not lit up. More light now, but still dark.
Could do with a few more street lights – it's a bit dark at this end of the street especially near the footpath.
Better lighting, it's brighter and the flood is wider. The colour is just right.
Lighter than before which is a good thing. Reduces crime.
Noticed the new lights were quite bright. No complaints. They are quite good. They are brighter so you can see things clearer when it's dark. I'm happy with them.
Did not notice a difference
Haven't noticed a difference, but I don't go out at night
I hadn't noticed but I have the blinds pulled down at night so I don't see it
No different - I hadn't noticed. I don't go out after dark. It's a good idea, they will be more economical.
The lights are crap. It's completely dark because the trees on the street are too thick and block the lights. My house is very dark at night. The lights do not shine at all to my house. It's pitch black. I haven't noticed any difference since the new lights were installed.
I am not living in the area where the lighting trial is in place. So I cant comment other than what I have been advised by the astronomers at Gingin who are asking for warm lighting not Blue White lighting in our street lighting.
please consult with an expert on light pollution if the project hasnt already been.

There is one up the corner i like to see another one down the middle of the street that is Daffodil Court
We've had the new LED fitted to a light post outside our house now for about 6 months. It's reduced the glare and although just as bright does not reflect back into the house or in eyes as you drive by. Great to see the rest of the street the same.
I am right outside a light pole and have been since 2001. [address] Fallow Crescent. the new LED light is not as bright, or at least it should much cooler in colour, the current light is too warm in colour, makes the area look definitely not as bright. thank you.
I think they are great, thank you for changing them.
This feedback form is pointless because your information provided does not name the streets in Spearwood that had new LED lights installed. I have checked twice - maybe I am blind. This does not surprise me though. Have you considered actually testing your consultation material to check you have provided enough information to allow the community to respond and make an informed decision or provide informed feedback? Whilst I support the concept of changing lights to LED for their cheaper running costs and less replacement requirements, LED street lights are known to cause undue and unnecessary brightness for some houses which affect peoples circadian rhythm and ability to rest and sleep. Again your consultation material lacks because it implies you are just straight out changing bulbs over. This does not address light direction, glow and spill. AS a result i dont think you're trial will be accurate and does not bode well for future decision making. Can you please confirm that the following national guidelines have been taken into account in this trial, given that we apparently have " world class wetlands" in Cockburn, but we also have protected marine species along the coast which is really the jewel in Cockburn's crown. There are roads and footpaths within proximity to the coast and the lightspill needs considering. ttps://www.environment.gov.au/biodiversity/publications/national-light-pollution-guidelines-wildlife
I live in Mac Morris Way Spearwood We have ongoing anti social behaviour drug houses nearby PowerWatch security light shining into Bavich Park and up the public access way.Improving the street lighting all the way along MacMorris Way would only improve the safety of residents and allow us to indentify the individuals who are creating problems for us and people who use the Park and Access Way to get to the Phoenix Shopping Centre

5.2 Email Submissions

Note: In the interest of transparency, responses are as they appeared in the survey with minimal editing. Therefore some spelling and/or grammatical errors may exist.

Comments

I have viewed the LED lights trialled in Kent Street and Sussex Street in Spearwood and have found them to be brighter than the original lighting, to look at as you drive down the street but seem to light the area directly below a little less, in my opinion. However, it's modern times and we must go with the times. LED lighting is the way to go and I'm all for it. One small detail in the letter sent, the wattage consumption of the existing lighting was mentioned but not of the new lighting. My understanding is the new lighting uses considerably less power, not just 50% as presented. Anyhow, I'm all for the new lights and it will be a saving in energy bills and maintenance for Cockburn in the future.
I have received the council letter with regards to the above subject. It's a great work, and I hope it all goes well. If the trial is deemed successful and the new LED lights are installed across the Atwell suburb, would it reduce our annual council rate? I presume that a portion of the council rate goes towards the street lighting. I look forward to hearing from you.
My house is on the corner of [street] in Atwell. I note that there will be a LED street lighting trial. I have a street light right outside the main bedroom and do not wish to have a smart LED street light right outside my bedroom. How can I opt out of having this installed on this particular corner? Is this street light going to be a 'smart' LED streetlight? Why I ask is because on Western Power`s website they talk of smart enabled LED streetlight technology. If it is a 'smart' LED streetlight, could you please tell me the radiofrequency electromagnetic energy associated with this infrastructure.
I don’t understand why you have to waste ratepayers money with a trial before retrofitting all lights poles to LED, if you already know, it will save costs and CO2 emissions? Why not just go straight to the retrofitting to a cold LED lighting (the brighter of the two). No question they reduce cost and are more reliable than incandescent lighting. You could have saved money by just rolling them out. Jobs could have been created for a faster roll out, people may feel safer on the streets, with brighter lighting. Sometimes I don’t understand local government, you spend a lot of money beautifying the streetscapes, median strip, not thinking how will this look in ten years? Ok when it is done but as trees grow can create blinds spots for traffic . One example is along Rockingham Rd, out front of KFC, the verge is tall with weed creating a not only danger to see cars coming if you come out of KFC or the bottle shop but unsightly, the verge is high than the road so it needs to be either concreted or some

Appendix A - List of Streets in Trial

Atwell trial streets (parts of the following roads):

Beenyup Road, Pindan Elbow, Avon Crescent, Lakehurst Way, Molloy Circuit, Jenniphur Court, Chivalry Way, Lyon Road, Congenial Loop, Balance Lane, Flourish Loop, Woodhead Way, Folland Parade, Nancarrow Way, Turnbull Close, St Claire Gardens, Freshwater Drive, Brenchley Drive, Mayhew Cross, Connolly Mews, Daley Court, Hedges Retreat, Haring Green, Dunnage Court, Kinship Way, Bartram Road & Bendee Drive.

Spearwood trial streets (parts of the following roads):

Gerald Street, Macmorris Way, Glendower Way, Gurney Road, Blunt Place, Bushy Road, Bolingbroke Street, Sussex Street, Hotspur Road, Edeline Street, Zlinya Circle, Mell Road, Bosnich Way, Newton Street, Ionesco Street, Fallow Crescent, Garden Road, Trellis Place, Daffodil Road, Marvell Avenue, Skeahan Street, Poins Place, Vernon Place, Kent Street, Leaside Way, Gerovich Way, Chesterton Street and Malcolm Street.

Appendix B – Frequently Asked Questions

What is the trial?
Western Power and the City of Cockburn have come together to trial new LED streetlights on existing street light poles in selected Cockburn suburbs.

What is the aim of the trial?
During the trial, existing street lights, which consist of old technology, will be replaced with modern LED lights in selected streets in Atwell and Spearwood. The LED lights will be retrofitted onto existing street light poles.

The trial will provide Western Power and the City of Cockburn with insight for the potential replacement of Western Power street lights in Cockburn.

Where is the trial happening?
This trial is occurring in two City of Cockburn suburbs, Atwell and Spearwood. The two suburbs were selected as they reflect both types of power infrastructure (underground and overhead).

A selection of streets in Atwell and Spearwood have been identified for the trial so that a range of new LED types can be tested.

Atwell trial streets (parts of the following roads):
Beenyup Road, Pindan Elbow, Avon Crescent, Lakehurst Way, Molloy Circuit, Jenniphur Court, Chivalry Way, Lyon Road, Congenial Loop, Balance Lane, Flourish Loop, Woodhead Way, Folland Parade, Nancarrow Way, Turnbull Close, St Claire Gardens, Freshwater Drive, Brenchley Drive, Mayhew Cross, Connolly Mews, Daley Court, Hedges Retreat, Haring Green, Dunnage Court, Kinship Way, Bartram Road & Bendee Drive.

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When is the trial happening?
The trial is expected to begin in December 2020 and be completed by March 2021. Feedback is invited until 31 March 2021.

Why do the street lights need upgrading?

Street light upgrades are being undertaken for a number of reasons:

- A number of current light types are no longer available, especially the 80w and 125w mercury vapour lights. Manufacturing here and overseas is moving to LED lights only.
- A coordinated move by both Western Power and the City of Cockburn to be more sustainable by reducing electricity consumption and the generation of carbon dioxide. This changeover will see a 50% reduction in CO2 production.
- LED lights are longer lasting and retain the quality of the light for a longer period, reducing ongoing maintenance expenditure.
- *"Smartlights"* – one of the trial's aims is to introduce smart-enabled lighting. These lights can alert Western Power when they fail, speeding up the replacement time.
- Improved lighting enhances safety on our roads and in our neighbourhoods. Consultation with the Western Australia Police favours the introduction on the new LED street lighting.
- LED street lighting is now being installed in Melbourne, Sydney, Adelaide and Brisbane.
- Western Power are currently installing LED lights on an ad-hoc basis and the proposed trial and replacement program will be the first retrofit program undertaken by Western Power and a council in WA.

What is the difference between LED lights and existing street lights?
Compared to existing street lights, LED street lights:

- Are more focussed, ensuring more of the light shines onto the street and sidewalks, with less light spill into adjacent areas.
- Provide a more uniform illumination of the area.
- Are brighter.
- Require less maintenance and last a lot longer than standard lighting.
- Use about 30% less energy than current street lighting technology.
- Reach full brightness instantly.
- Contain no mercury or lead which is better for our environment.
- Emit no UV rays or infrared radiation.
- Operate at a much cooler temperature, making them a safer option.
- Cut greenhouse gas emissions and reduce landfill.

Source: westernpower.com.au

Are LEDs brighter than previous street lights?
When compared to existing street lighting, LEDs may appear both brighter and whiter. This is largely due to the colour of the lights.
Fortunately, the direct light from LEDs will minimise glare which also reduces light into and onto properties in most situations.

Source: westernpower.com.au

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cockburn.gov.wa.au

SMART LED STREETLIGHT

REPLACEMENT SUPER TRIAL PROPOSAL

The local governments of Albany, Armadale, Canning, Cockburn and Melville have been working collaboratively with Western Power to deliver innovative, intelligent and future-focussed solutions for streetlighting. The proposal is subject to Council approval by the respective local governments.

An ambitious and widespread rollout program to replace approximately 47,000 streetlights with energy efficient and low maintenance Smart LED streetlights across the five local government areas is being proposed as a *Super Trial* covering almost 17% of streetlights across the South West Interconnected System (SWIS) power grid.

FAST FACTS

Smart LED has the potential to achieve a:

65% Reduction in greenhouse gas emissions compared to standard streetlights and

major energy savings of up to **40%** for each participating Local Government.

Streetlighting represents **40-50%** of total energy costs for most local governments

47,000 streetlight lamps in the Cities of Albany, Armadale, Canning, Cockburn and Melville

Approx. **278,000** streetlight lamps across the SWIS network covering the Perth Metropolitan Area and South West Region.

Western Power have already trialled **SMART LED** streetlights in the City of Melville

BACKGROUND

The five participating local governments have prepared a business case and are already advancing detailed replacement proposals with Western Power, based on the local governments meeting the capital cost of progressively replacing approximately 47,000 inefficient and poorer quality streetlights including mercury vapour streetlights that will need to be phased out under the Minimata Convention.

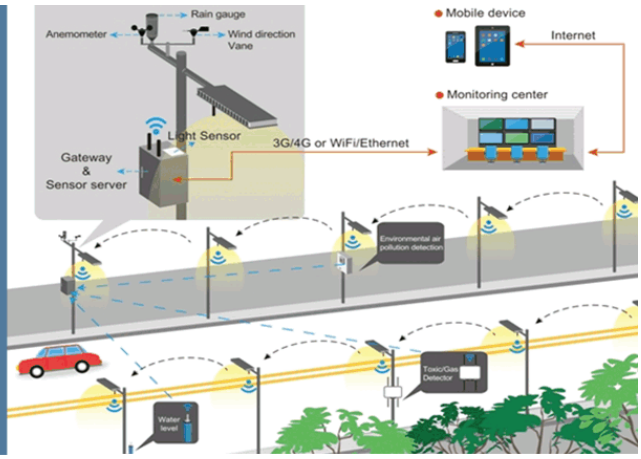
In the future, LED Smart Poles could be installed in key activity centres and popular community spaces with smart technology applications to facilitate art experiences, Wayfinding, PA systems, SOS, Public Wi-Fi, etc.

Sensors and cameras could also be installed for traffic counting, surveillance, environmental monitoring, etc. on poles as a valuable community asset supporting Smart City capability.

Albany | City of Armadale | City of Canning | City of Cockburn | City of Melville

COMMUNITY BENEFITS

1. Safer driving at night through better lighting
2. Safer communities as endorsed by the WA Police Service
3. Using technology to ensure 100% of the streetlights remain "on"
4. More efficient and better performing streetlights with superior lighting quality



BENEFITS

WESTERN POWER

1. Lower operating costs and improved efficiency for Western Power
2. Low or no capital investment required for street lights.
3. Public lighting that meets Australian Standards.
4. Improved public perception through lower light failure rates and rapid maintenance response using smart controls
5. Contribute to electricity network stability through reduced electricity demand in the peak evening and pre-dawn periods
6. Protect against the impact of a ban on manufacture and trade of mercury containing globes.
7. Lower transition cost than the alternate "replace on failure" approach

STATE GOVERNMENT

1. Contribute to greenhouse gas emissions reductions of up to 7,250 tonnes CO_2 per year
2. Create jobs from change over program
3. Reduce crime by providing Police with superior night time lighting
4. Improve night time safety for all road users
5. Improved tourism opportunities in the region (night time –space/star viewing)

LOCAL GOVERNMENT

1. Improved quality (colour temperature and light distribution) and reliability of public lighting
2. Lower electricity consumption (up to 50%) and greenhouse gas emissions (up to 65%)
3. More efficient operating and maintenance costs reflected in reduced tariffs
4. Reduced light spill and light pollution
5. Lower waste though longer life-cycle
6. Reduced impact of maintenance operations (lane closures etc)
7. Elimination of harmful mercury from the environment especially landfill
8. Ability to actively manage lighting to meet changing needs and respond to environmental impacts in sensitive locations

Albany City of Armadale City of Canning City of Cockburn City of Melville