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# Melton East PSP – Climate Resilience Assessment

## Victorian Planning Authority

HIP V. HYPE

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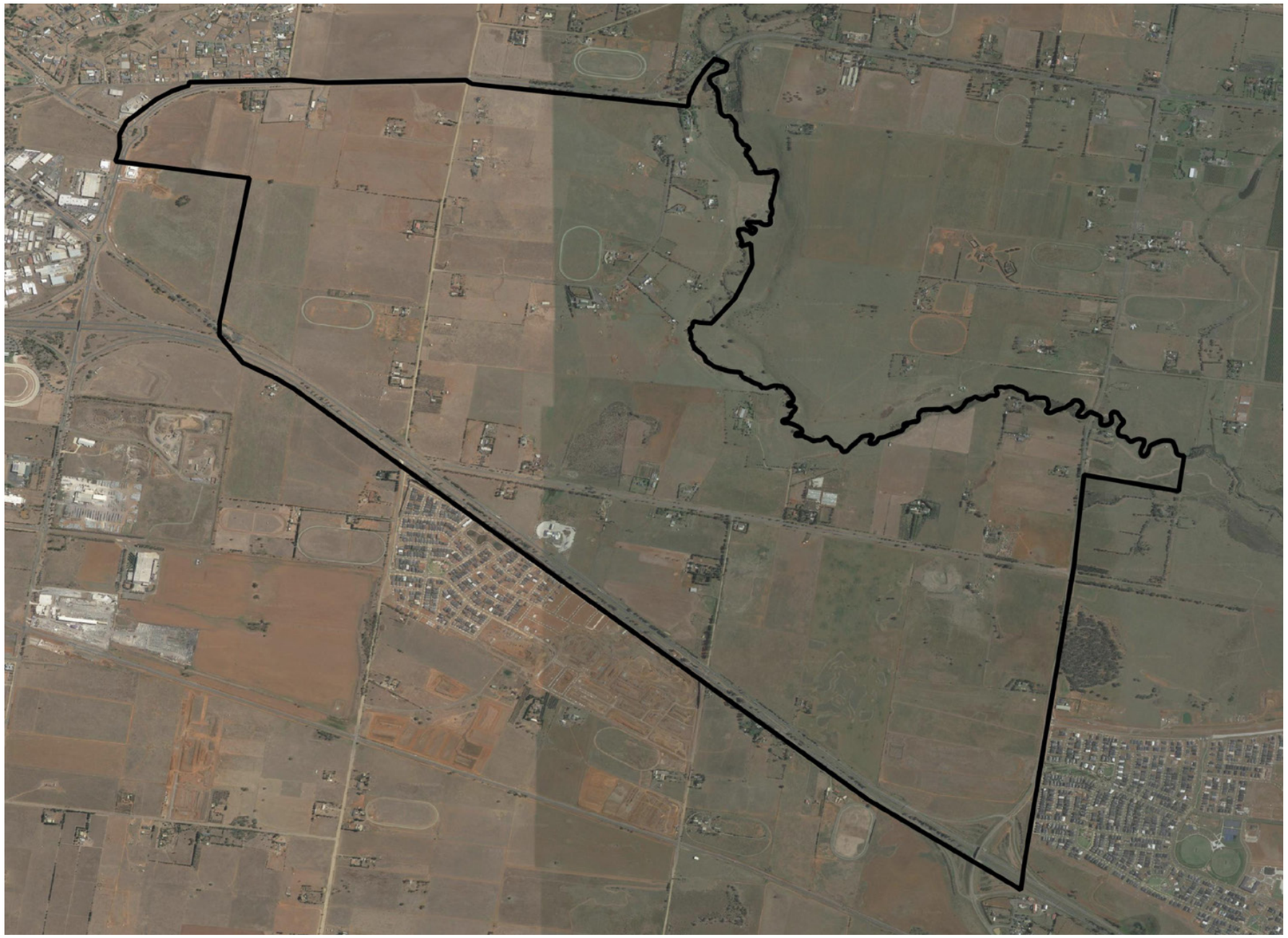
# Contents





The Melton East PSP area. Image by HV.H

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# Executive Summary

# Executive Summary

The Precinct Structure Plan (PSP) for Melton East will set out the preferred spatial location of key land uses and infrastructure within the area planned for development.

For the Melton East PSP, the Victorian Planning Authority has engaged HIP V. HYPE to prepare a Climate Resilience Assessment to identify climate impacts and propose climate adaptation recommendations for the PSP area as a background technical input into the project.

The process adopted involved an analysis of historic weather hazards and impacts experienced within the region, before exploring the climate hazards and impacts expected as a result of climate change across four different climate scenarios.

Critical risks were identified that increase in likelihood over time. Adaptation responses were developed to address each of the risks within Melton East that could in some way be influenced through a PSP process.

In addition, the work explored opportunities to reduce carbon emissions (the root cause of climate change. A carbon model was also developed to highlight the mitigation opportunities across stationary energy, transportation and waste emissions.

## OVERVIEW

In setting high level direction for new communities, Precinct Structure Plans (PSP) have significant control over the location and design of key assets and infrastructure. While often supported by a variety of background documents that provide technical information on the cultural and ecological value of the site, regional and local stormwater management and soil conditions, specific climate resilience opportunities have not been routinely explored.

The recently updated PSP Guidelines prepared by the Victorian Planning Authority (VPA) articulate the need for 'climate resilient communities' and the importance of undertaking a climate impacts assessment and adaptation planning process as part of the background technical work for PSP preparation.

This report provides that foundational climate resilience assessment for the new Melton East community.

### Historic and Existing Conditions

Climate risk assessment and adaptation planning includes assessment of the historic weather impacts. The analysis revealed Greater Melbourne an increasing occurrence of severe weather events such as droughts, extreme rain, thunderstorms and bushfires over recent periods, in particular since 2000. For Melton East, annual rainfall levels are typically more than 30% lower than areas in the south-east of Greater Melbourne. The site is relatively flat and contains three depressions and abuts the Kororoit Creek which presents a flood risk during extreme rainfall events.

### Climate Scenarios

Representation Concentration Pathways (RCPs) are the emission trajectories developed by the Intergovernmental Panel on Climate Change (IPCC) which inform the expected level of global warming and resulting intensity of climate change impacts.


Melbourne is no stranger to extreme weather (1972 flooding pictured above), but the frequency of such events has been increasing since the 1970s (see page 18). Image by Neville Bowler

For this report two primary RCPs have been selected; RCP 4.5 which is a moderate scenario, and RCP 8.5 which is a high emissions scenario and therefore represents a 'worst case' or no action outcome. The time frames of 2050 and 2070 were selected for analysis as respresentative of the lifespan of the majoirty of assets within the precinct.

### Expected Climate Hazards

As a result of climate change, Melton East will be experiencing increased average temperatures, increased extreme heat days, more extreme storms, but decreased rainfall over all.

Across the four climate scenarios (2050 RCP 4.5, 2050 RCP 8.5, 2070 RCP 4.5, and 2070 RCP 8.5) the severity of these climate hazards varies. However by 2070 (RCP 8.5) Melton East will can expect average temperatures rises of 2.5 °C, extreme heat days to increase in temperature by 3.3 °C, spring rainfall to decrease by 11% and extreme rain events to be 37% more intense.

# Executive Summary

The Kororoit Creek is an incredible natural asset that will provide a range of passive recreation, environmental education and other ecosystem services, but is at risk from a variety of climate impacts and introduces flooding risk into the precinct. Image by Mamma Knows West

## CLIMATE RISK ASSESSMENT

The climate risk assessment and adaptation plan has been developed around the 5-capitals framework (which includes natural, social, financial, human and physical capital) to ensure a holistic approach to assessing and improving adaptive capacity.

### Natural capital

Natural capital refers to biodiversity and ecological assets such as land, water, ecosystems and the wildlife, the biological materials (E.g. timber) and ecosystem services (E.g. stormwater management) they support.

Critical climate impacts identified for natural capital within Melton East included; stress on flora and fauna from increased temperatures, damage to waterways from intense rainfall events, and reduced water quality and biodiversity support from decreased annual rainfall. Many of these were assessed as medium to high climate in 2022, but increased to high and extreme risks by 2070 RCP 8.5.

Adaptation actions included; an increased canopy cover target (40%), climate resilient species specified, recycled water connection for open space irrigation, hydrological regime and drainage scheme to manage the health of existing water assets on site as well as operational opportunities around community engagement and environmental stewardship.

### Social capital

Social capital is associated with the institutions, networks and services that build social fabric including families, schools, and community and sporting organisations.

The primary social impacts identified for Melton East included: impact to outdoor recreation and events from increased temperatures, short term isolation of community members from flash flooding, and restricted water supply for open space irrigation. By 2070 RCP 8.5 these risks were identified as medium to extreme.

Key adaptation actions include: supply of Class B recycled water for open space irrigation, multiple crossings over key overland flow paths and minor elevation of bridges and finished floor levels, providing climate risk and technical information to developers and Council, and increased shading and cool routes between local destinations.

### Financial capital

Financial capital refers to the future earnings and financial stability, and liquidity within a community.

For Melton East the primary financial risks include the loss of retail expenditure due to extreme heat days, and disrupted supply chains and business continuity from extreme weather days. The risk assessment saw the ratings increase from low-medium to medium-high by 2070 RCP 8.5.

Adapting and overcoming these risks involves design guidance for non-residential land use areas (for increased weather protection), electrical back up for critical healthcare and essential retail and ‘click and collect’ service models that can distribute goods during extreme weather events.

### Human Capital

Human capital is the health, knowledge, skills and motivation of people within a community and is linked to education and training opportunities.

Beyond general mental health stressors from cumulative climate events, key human related climate risks within Melton East include health impacts from reduced outdoor activity due to increased temperatures and heat-related deaths amongst the elderly and disadvantaged. Given the risk to human health these were identified as high and extreme by 2070 RCP 8.5.

Matching rooftop solar PV systems to expected electric vehicle demand has significant carbon emission reductions for stationary energy. Image by Kim Landy

Key Adaptation actions include a dedicated co-design process to maximise pedestrian health and amenity outcomes within streetscapes, ensuring community health services have capacity for mental health and broader support services, and increasing access to local employment through enhanced connections to surrounding activity centres.

### Physical Capital

Physical capital refers to the man-made physical assets and infrastructure within a community such as roads, bridges, telecommunications and power networks. Physical capital influences other forms of capital due to our reliance on physical infrastructure and service networks.

Some of the main physical risks for Melton East include increased energy demand (E.g. for AC cooling), loss of transportation routes and connectivity during extreme heat and weather events, and building inundation and road closure due to flooding. Risk generally increased from low to medium/high by 2070 RCP 8.5.

Adapting physical assets to the expected climate involves locating essential retail outlets and service stations on arterial roads that are accessible during storm events, and designing buildings and public realm that mitigate urban heat (through high solar reflective index finishes), incorporate rooftop solar PV and storage to reduce the risk of blackouts and improve energy resilience.

A summary of the key adaptation actions that can be delivered by the VPA and PSP process are provided on page 6 to 8, with the full adaptation action plans for each impact / capital area provided from page 41.

## CARBON REDUCTION

Carbon reduction is focussed on reducing carbon emissions, making a contribution to the global efforts to reduce climate change and the associated hazards and impacts.

A carbon model of Melton East was created to identify key emission reduction strategies that the PSP could influence in terms of stationary energy, transportation and waste.

Four options were presented and modelled for stationary energy; all-electric buildings, all-electric with energy efficiency requirements, all-electric with energy efficiency and solar PV, and a combined scenario which modelled an increase in solar PV to support greater EV penetration. All together, these initiatives have the potential to deliver zero net emissions from stationary energy within Melton East.

For transport emissions, three primary options were proposed including: increased active travel, optimised land use and local services and accelerated EV transition. When combined carbon emissions associated with transportation was reduced by approximately 20%.

Finally, waste emissions were assessed within the model, which focussed on a long-term waste education program to reduce the landfill diversion rate and reduce methane emissions from the breakdown of food and other organic matter.

Altogether the carbon reduction initiatives could see a 70% reduction in carbon emissions for Melton East - from 160,701 to 49,006 tonnes of C02e / year (see page 9 & 74).

# Executive Summary

**The table below summarises the key actions outlined in the Adaptation Action Plan on page 40. These actions were either perceived to have high levels of control through the PSP process.**

| ACTION | IMPACT AREA | TIME FRAME |
|---|---|---|
| Precinct Structure Plan to require subdivision applications to meet a minimum 40% canopy tree cover target within streets (method as per the VPA Evidence base developed by HV.H) | Natural | Immediately and ongoing |
| Connect Melton East to the Class B recycled water scheme noted by Greater Western Water, and test capacity of the network to still supply open space irrigation under drought conditions | Natural, Social, Financial and Physical | Immediately and ongoing |
| Provide guidance and financial support for the delivery of community garden/s (in collaboration with Council and developers) located within proximity to higher-density areas of the PSP | Natural and Social | Immediately |
| Planting palette in street trees and parks adopt climate resilient species (with adequate canopy coverage) selection that also responds to underlying soil conditions. Recommendation is to adopt MCC Street Tree list and collaborate on required adjustments | Natural | Prior to any development |
| Street trees should be passively irrigated or connected to recycled water where available | Natural | Immediately and ongoing |
| Precinct Structure Plan to require subdivision applications to meet a minimum 35% permeability target within streets (delivered through a combination of increase of landscaping reserve areas, permeable surface treatments for visitor parking, tree outstands, visitor parking provision, reduced pavement widths for residential streets (below traffic volumes) | Natural and Human | Immediately and ongoing |
| Planting palette in conservation area(s) to adopt climate resilient species selection | Natural | Prior to any development |
| Urban design layout and open space network to support delivery of north-south ‘green links’ that support fauna movements within the precinct and are connected to the Kororoit Creek | Natural | Through PSP |
| Undertake feasibility for on-site stormwater harvesting in north east corner of precinct, connecting to residential areas of the precinct (to consider funding mechanism, governance and integration with MW assets) | Natural, Social, Physical and Financial | Immediately |
| Undertake feasibility for on-site rainwater tanks on residential properties (subject to further modelling, this dual-approach will reduce low and moderate flooding impacts by retaining flows on-site.) | Natural | Immediately |
| Consider a variation to increase the permeability requirement in the Small Lot Housing Code requirement to 20% (to encourage two-storey dwellings of modest scale) | Natural | Through PSP |
| Ensure climate risks and technical information highlighted in this report are available to both developers and Council as a reference document for the design, delivery and maintenance of assets within the PSP to ensure adaptive capacity is maximised | Social and Financial | Immediately and ongoing |
| Provide funding and spatial allocation for local repair cafés (not only facilitate a step-change towards the circular economy, they also provide spaces for social interactions, knowledge sharing and skill building within the community across diverse groups) | Social Cohesion and Circular Economy | Immediately |

# Executive Summary

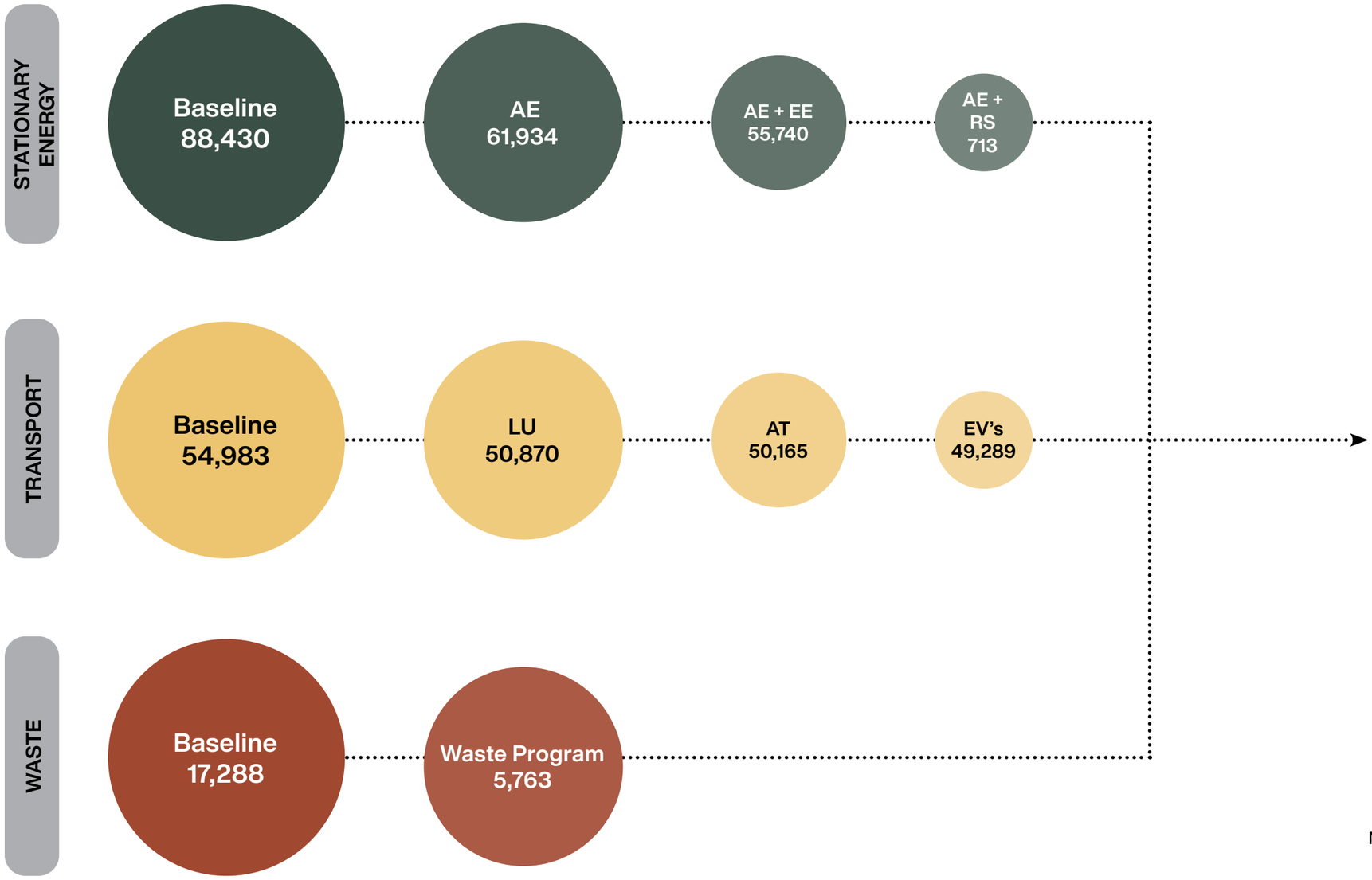
| ACTION | IMPACT AREA | TIME FRAME |
|---|---|---|
| Provide multiple crossings across key overland flow paths to de-risk, providing more access options for the community and emergency services during storm events | Social, Financial and Physical | Through PSP |
| Provide dedicated space in community centres with access to outdoor space for raising awareness on and learning relating to climate change and sustainable lifestyle choices | Social | Through PSP and during DD |
| Consider shaded activity areas within recreation reserves (e.g. exercise equipment adjacent canopy vegetation or shade structures) and maximising cool routes / shadeways for access to local destinations like primary schools and neighbourhood parks | Social and Human | Through PSP and during DD |
| Develop design guidance and performance targets for non-residential land use areas (see right). This would include:<br>– Awnings for weather protection in commercial streets<br>– Protection for public transport users at all stops<br>– Thermal performance benchmarks for public and education buildings<br>– Shade and extreme weather protection as key design attributes of civic spaces<br>– A 40% tree canopy target | Financial | Immediately |
| Town centre design to provide circulation for 'click and collect' which is now an essential component of retail, but allows for access to key goods and services during extreme weather events | Financial | Through PSP |
| Undertake a dedicated co-design process specifically to resolve high quality street sections and plans for the PSP (see right). This will include representation from utilities (electricity, water supply), Melton CC (including active transport, civil, landscape), VPA, Melbourne Water and major developer representatives | Human | Immediately |
| All residential development must meet the maximum cooling requirements (30MJ/m2) in standard D6/B35 as outlined in the Better Apartment Design Standards | Human and Physical | Through PSP and ongoing |
| Build redundancy into critical health care (hospital and clinics) during extreme heat events to cater for spikes in admissions / presentations | Human | Through PSP and during DD |
| Ensure delivery of community health services has capacity for local mental health and support services such as: psychology, counselling, and gambling and substance abuse, misuse and addiction programs | Human | Through PSP and during DD |
| Support access to local employment through enhanced connections (physical pathways and increased public transport services) to surrounding activity centres and employment lands such as Cobblebank Metropolitan Centre and the surrounding Rockbank town centres | Human | Through PSP and ongoing |
| To guide the location of open spaces and active transport infrastructure with respect to flooding; open space planning for the Melton East precinct should outline the key types of open space and active transport assets (different programming needs etc.) and develop minimum service levels with respect to occasional flooding (days unusable per decade for example) and irrigation levels to be maintained (during periods of drought) | Physical | Through PSP |

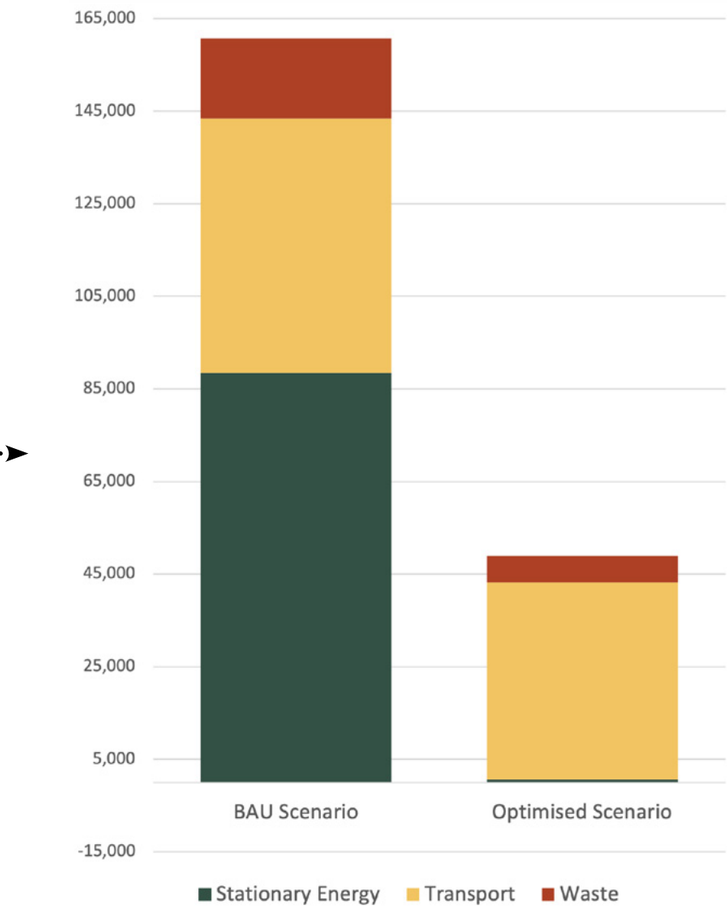
# Executive Summary

| ACTION | IMPACT AREA | TIME FRAME |
|---|---|---|
| Zoning to encourage service stations / public EV charging to be located with uninterrupted access to Western Freeway and in conjunction with arterial roads that are elevated 'significantly' above the 1% AEP | Physical | Through PSP |
| Locate essential retail, fuel / EV charging facilities on arterial roads for community access during storm events | Physical | Through PSP |
| All development must have light coloured roofs (i.e. an initial solar reflectance index - minimum 82) | Physical | Through PSP and ongoing |
| All dwellings to have a minimum solar PV system plus pre-wiring for EV-ready homes. (In the near future, EV's will be used as mobile batteries to power homes. They can eliminate the risk of power outages by both reducing the load on the grid, and providing households an alternative if a blackout is experienced.) | Physical | Through PSP and during DD |
| All public access and major commercial buildings designed with roof plumbing (e.g. gutter capacity) able to cater for 56% increase in 1 in 20 year wettest day | Physical | Through PSP and during DD |
| For buildings located within 1% AEP areas, consider flood-proof design for lower levels (raised General Power Outlets (GPO's) / masonry finishes) if urban design is compromised by significantly raising finished floor levels | Physical | Through PSP and during DD |
| Major roads should consider appropriate vegetation to stabilise verges, battering and scour-prevention measures. Street sections should note slopes for at-risk major roads (e.g. either sides of bridges) or connectors that dip into inundation zones | Physical | Through PSP and during DD |
| Capacity of larger underground stormwater pipes (>600mm dia) to ensure capacity for an increase of 56% increase in 1 in 20 year wettest day | Physical | Through PSP and during DD |
| Local preparedness and response planning to consider Strategy and Action plans for disaster and emergency management focusing on (see right):<br>– Establishing centralised connection network hubs- emergency buildings i.e. CFA, community neighbourhood houses utilised for emergency connectivity during a disaster<br>– Pre-deployment and pre-positioning of assets including equipment, personnel, resources i.e.. Mobile generators, backup fuel, cell on wheels (COWs), Cell-on-Light Trucks (COLTs),and temporary microwave/satellite communications necessary for service recovery<br>– Path diversification enhancing telecommunication network resiliency (combined utilisation of terrestrial lines, Very Small Aperture Terminal (VSAT) satellite communication network, Cell towers, and traditional emergency responses (COWs, Flying COWs- drone network tethered to vehicle-based ground station)<br>– Expansion of fuel models reliance away from fossil fuels and pre-staged *appropriate for local area (dependent on accessibility- solar, hydro, wind)<br>– Technological innovation utilisation (e.g. mesh extenders and drone networks) | Physical | Through PSP and ongoing |

# Executive Summary

**The graphic below summarises the potential reductions in GHG emissions for Melton East, from a total of 160,701 to 49,006 tonnes of C02e / year. For stationary energy, three scenarios have been proposed: all-electric (AE), all-electric + energy efficiency (EE), and all-electric and rooftop solar (RS). For transport emissions the three scenarios proposed include: Optimised land use (LU), supporting active travel (AT) outcomes and increased electric vehicle (EV's) usage. Waste emission reductions are delivered through an ongoing waste education program. More details of these initiatives and carbon reductions is outlined from page 62.**




Melton East can reduce carbon emissions by approximately 70% – from 160,701 (left) to 49,006 (right) tonnes of C02e / year. Image by HIP V. HYPE

# Context

# Introduction

To inform preparation of the Melton East Precinct Structure Plan (PSP), the Victorian Planning Authority (VPA) engaged HIP V. HYPE (HV.H) to prepare a Climate Resilience Assessment for the site. The aim is to look at climate impacts and various climate resilience initiatives that can be integrated into the PSP.

The assessment will highlight all the anticipated climate change impacts, with a range of objectives, targets and actions developed to ensure the delivery of a climate resilient community.

This draft Climate Resilience Report for the Melton East PSP summarises various technical and policy documents relevant to the site, explores the historic and expected weather patterns and the expected climate change impacts, with a detailed risk assessment and preliminary suite of actions to respond to these and deliver a climate resilient community. In addition, a carbon model has been developed and actions developed relating to energy, transport related Greenhouse Gas (GHG) emissions and approaches to waste management to reduce the expected carbon emissions generated within the PSP.

## PROJECT CONTEXT

### Melton East PSP

The Melton East PSP is approximately 35 kms North-West of the Melbourne Central Business District (CBD), and 4.5 kms East of the Melton CBD. The precinct is approximately 1,005 hectares and is expected to deliver 12,895 residential lots and 1,500 jobs.

The site, which is bound by the Kororoit Creek to the North-East, with the Melton Highway to the North, Leakes Road to the East, and the Western Freeway to the South.

The preliminary PSP vision states: *Environmental sustainability will underpin the planning for communities within the Melton East PSP, making it an exemplar of practicable sustainable precinct structure planning for greenfields Melbourne'.*

An example of the existing conditions within the Melton East PSP site. Image by VPA

### Report Structure

This report includes the following content:

- Existing site conditions: An initial assessment in regards to vegetation, urban heat and flooding
- Historic weather impacts: summarising historical weather and storm events
- Emission Scenarios: Outlining the relevant Representative Concentration Pathways (RCPs) and emissions scenarios the climate risk assessment and adaptation planning will respond to
- Vulnerability and Resilience: Clarifies how hazard, vulnerability and exposure interact to create climate change impacts
- Assets and community sectors: Outlines relevant assets (physical, natural and social) that the risk assessment will respond to
- Climate hazards and impacts: A summary of climate impacts expected, highlighting what the PSP can control and manage
- Risk, likelihood and consequence: An overview that sets the foundations for the risk-assessment of applicable climate change impacts
- Climate Impact Risk Assessment: Across the four emission scenarios
- Objectives and Adaptation Actions: that respond to the highlighted impacts and affected asset classes
- Carbon Analysis: Which details a number of scenarios within stationary, transport and waste emissions
- Appendix A – Desktop Review: A review of existing technical documents prepared for the Melton East PSP site
- Appendix B – Policy Review: A review of existing state and local policies, strategies and plans and how they can support delivery of a climate resilient community
- Appendix C – Framework and Tool review: An assessment of relevant built-environment rating tools and frameworks potentially applicable to the Melton East PSP
- Appendix D – Case studies: Exemplars of climate resilient greenfield development and their alignment to the Melton East PSP
- Appendix E – Flood risk terminology
- Appendix F – References

# Existing Site Conditions

Melton East is approximately 35 kilometres North-West of the Melbourne CBD. The area has traditionally experienced lower levels of rainfall, and slightly higher temperatures compared to the CBD and suburbs to the South and East given the absence of coastal winds and associated rainfall.

While the site contains hydrological assets in the form of the Kororoit Creek and two existing wetlands, it can generally be described as dry pastoral land with minimal to moderate vegetation.

As a result the site is currently exposed to moderate flood risk and the potential for increased urban heat due to a lack of canopy cover.

## EXISTING CLIMATE AND SITE CONDITIONS

### Weather summary

The table below compares Melton, with the closest Bureau of Meteorology (BoM) weather station (Melbourne Airport) and additional locations to the East (Scoresby Research Institute) and South (Cranbourne Botanic Gardens) for the years 1991-2020[1].

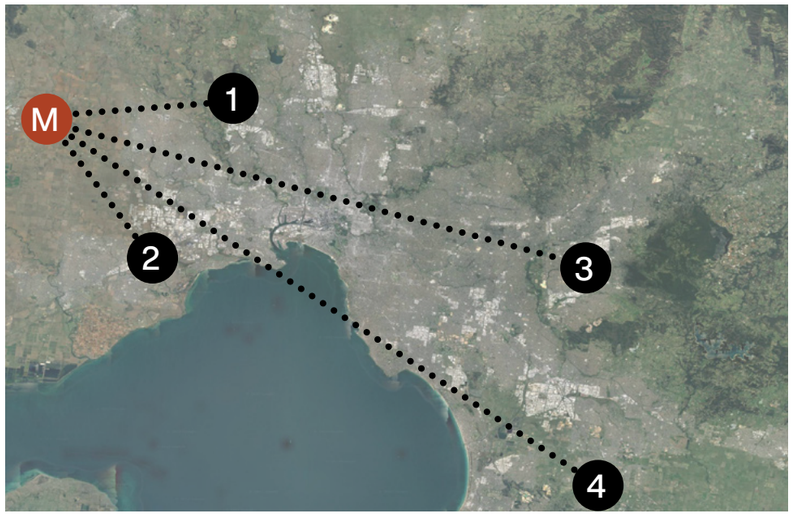
The summary provides clarity around the reduced levels of rainfall already experienced in the Western suburbs of Melbourne and Victoria more broadly.

More detailed weather data is provided in the following sections. More detailed month-by-month data is provided in page 16.

The locations are shown on the map to the right.

| STATION (NAME AND #) | DISTANCE FROM MELTON | MEAN MAX TEMP (°C) | MEAN RAINFALL (MM) |
|---|---|---|---|
| M. Melton (#87039) | - | n/a* | 484.2 |
| 1. Melbourne Airport (#086282) | 21 km N | 20.2 | 515.5 |
| 2. Laverton RAAF Base (#087031) | 25 km S-E | 20.1 | 481.1 |
| 3. Scoresby Research Institute (#086104) | 65 km S-E | 20.2 | 805.8 |
| 4. Cranbourne Botanic Gardens (#086375) | 80 km S-E | 19.5 | 806.4 |

*Note: There is no temperature data for the Melton weather station.




The Melton East PSP site ('M') in relation to the BoM weather stations described in the table to the left. Image by HV.H

### Additional analysis

The following section provides details about the existing site conditions within the Melton East PSP area, including:

- Vegetation cover and mature tree height (page 13)
- Ecological Vegetation Class (EVC) and soil type (page 14)
- Urban heat (page 15)
- Existing temperatures (page 16); and
- Hydrological assets and flood risk (pages 17)

# Existing Site Conditions

## VEGETATION COVER

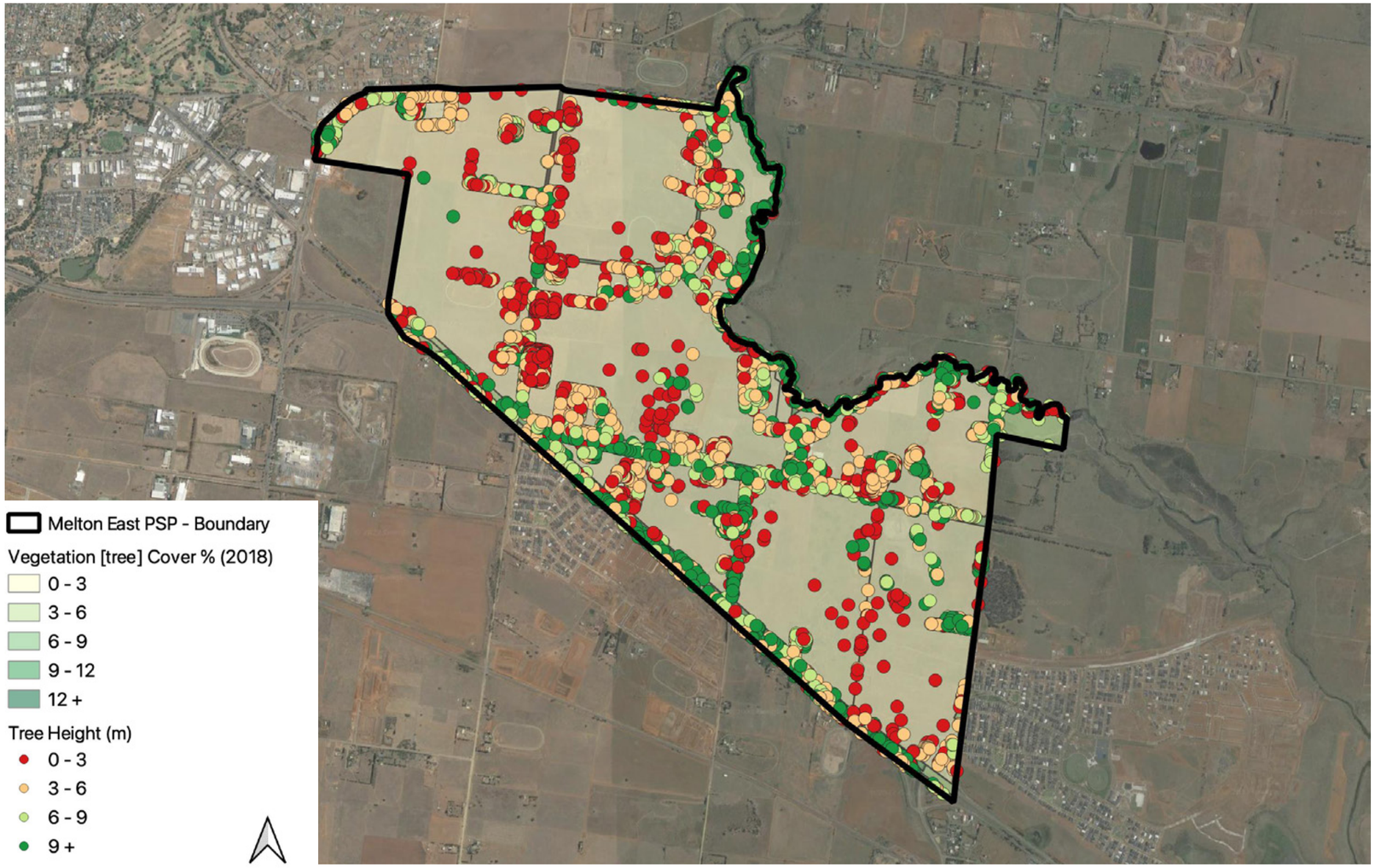
In addition to the information provided by the VPA and other project partners about the sites existing condition, preliminary Geographic Information System (GIS) analysis was conducted to understand how the current state in relation to vegetation and canopy cover, urban heat and flooding.

In regards to vegetation, while the site has large areas of cleared, pastoral land, there remains - as per the image to the right - pockets of established trees of varying heights (and species). These are primarily concentrated within the existing road and creek corridors and were likely planted by the existing (and previous) landowners given the EVC for the site is predominantly Plains Grasslands with underlying basalt clay soils. More information is provided on page 14.

As a percentage, trees cover less than 3% for the majority of the site, with that number increasing to 3-6% in the North-East and up to 12% along the existing roads.

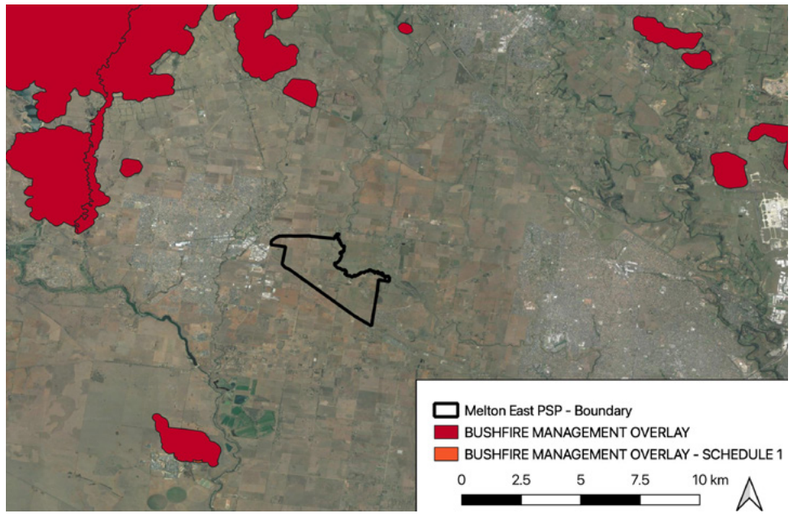
New PSP Guidelines establish a minimum canopy cover target of 30% for the public realm. As Melton East transitions to a community, consideration must be taken to retain and conserve vegetation where possible and target significant canopy tree coverage as a key focus of streetscapes and public open space. The Flora and Fauna assessment for the site will provide further guidance on retention of vegetation from a biodiversity perspective, however it should be noted that existing canopy cover provides a 'head start' in delivering other ecosystem services such as urban heat mitigation.

The development of new canopy cover is somewhat more challenging in the west of Melbourne, where poor underlying soil conditions (basalt clay) and lower rainfall provide more difficult growing conditions. Soil conditions will have to be managed and improved to ensure healthy vegetation and canopy cover.




Vegetation [tree] cover % and tree heights within the Melton East PSP. Image by HV.H (using DELWP and VPA datasets)

# Existing Site Conditions



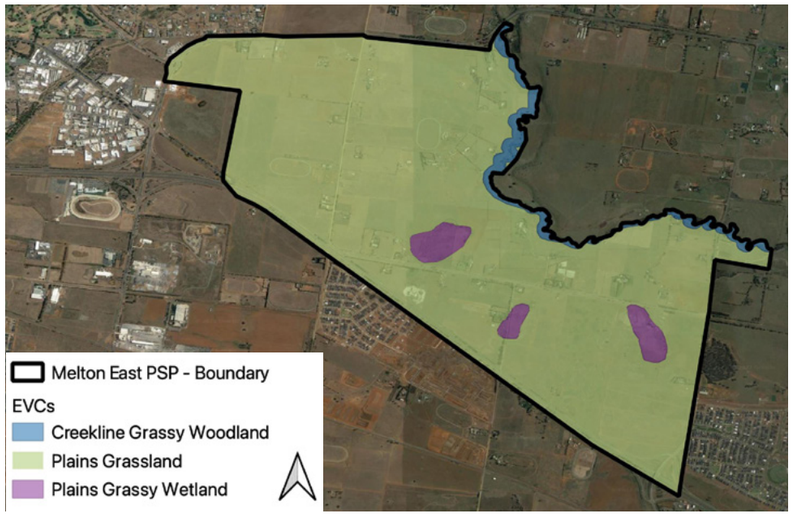

The site is not directly impacted by a Bushfire Management Overlay (BMO) as per the available data, which would require consideration of building siting, design, on-site water and vegetation management. Image by HV.H

## ECOLOGICAL VEGETATION CLASS AND SOIL CONDITIONS

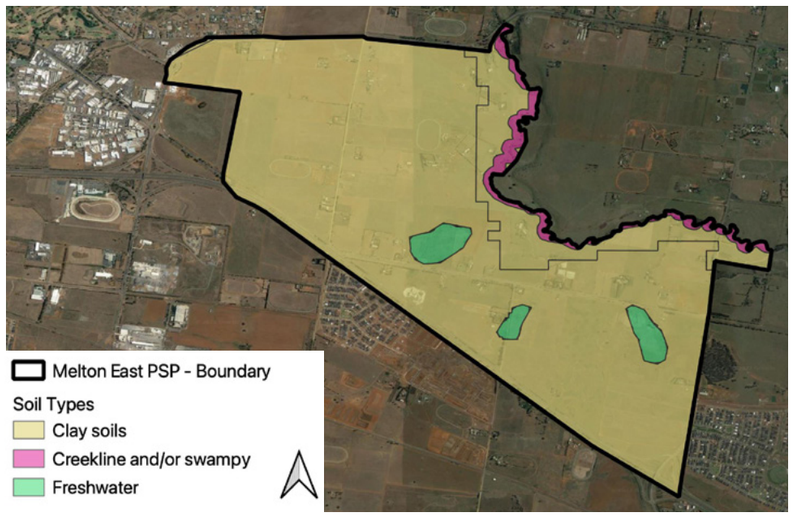
The primary EVC across the Melton PSP site is Plains Grasslands, with some creekline and wetland variations. The table below provides a description of each EVC, with these mapped to the right.

| EVC (# / NAME) | DESCRIPTION[2] |
|---|---|
| **#132 Plains Grassland** | Treeless vegetation mostly less than 1 m tall dominated by largely graminoid and herb life forms. Occupies fertile cracking basalt soils prone to seasonal waterlogging in areas receiving at least 500 mm annual rainfall. |
| **#68 – Creekline Grassy Woodland** | Eucalypt-dominated woodland to 15 m tall with occasional scattered shrub layer over a mostly grassy/sedgy to herbaceous ground-layer. Occurs on low-gradient ephemeral to intermittent drainage lines, typically on fertile colluvial/alluvial soils, on a wide range of suitably fertile geological substrates. These minor drainage lines can include a range of graminoid and herbaceous species tolerant of waterlogged soils, and are presumed to have sometimes resembled a linear wetland or system of interconnected small ponds. |
| **#125 – Plains Grassy Wetland** | This EVC is usually treeless, but in some instances can include sparse River Red Gum Eucalyptus camaldulensis or Swamp Gum Eucalyptus ovata. A sparse shrub component may also be present. The characteristic ground cover is dominated by grasses and small sedges and herbs. The vegetation is typically species-rich on the outer verges but is usually species-poor in the wetter central areas. |

Clay soils (also referred to as Vertosols) shrink and swell throughout the seasons and are common in the Northern Victoria and floodplain areas.[3]




EVCs within the Melton PSP site. Image by HV.H




Soil types across the Melton PSP site. Image by HV.H

# Existing Site Conditions

## URBAN HEAT

The site is currently exposed to significant levels of urban heat, due largely to the absence of significant vegetation and canopy cover, and exacerbated by drier ground conditions.

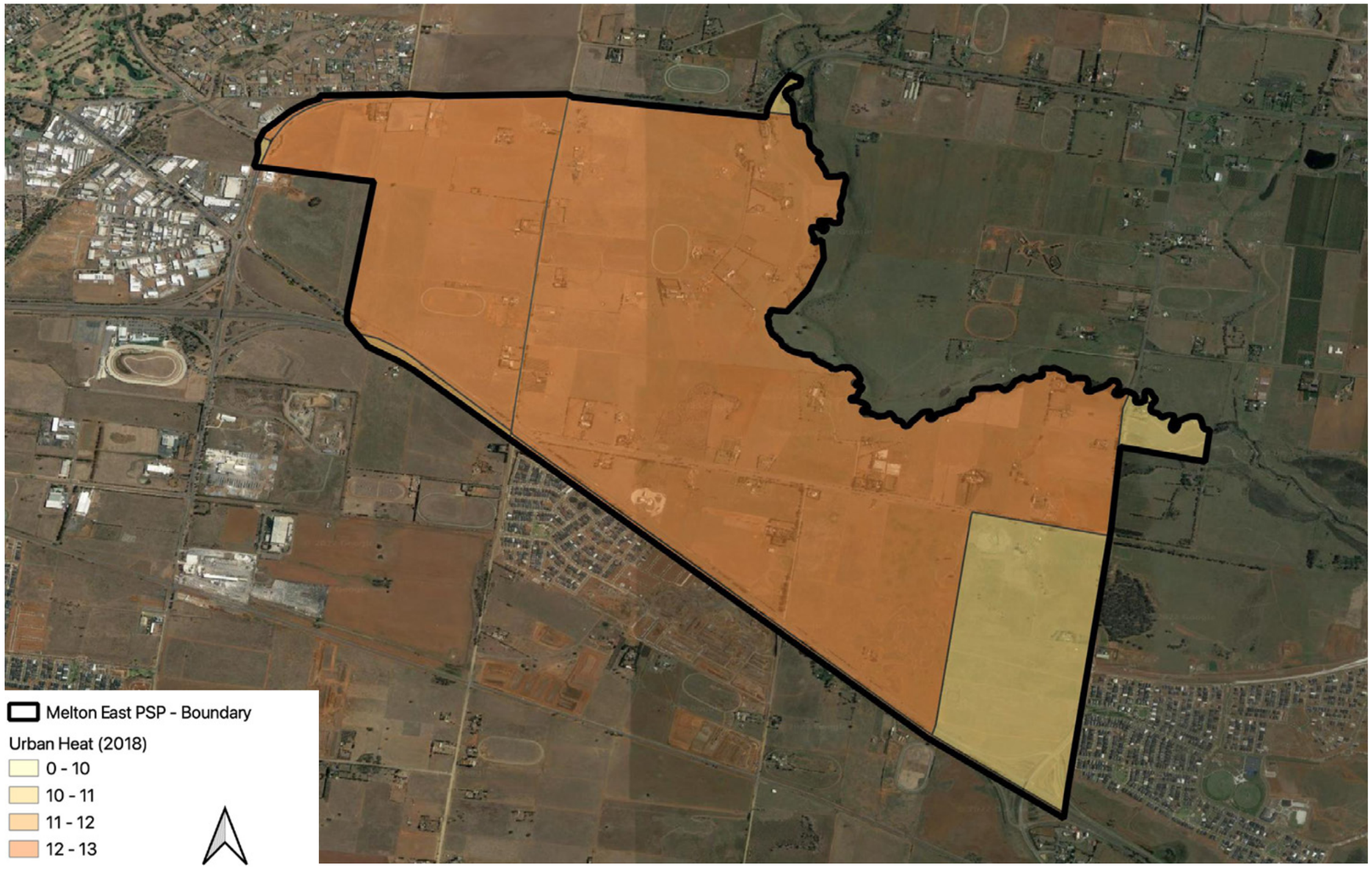
Urban heat, more formally referred to as the Urban Heat Island (UHI) Effect, is a phenomenon whereby the trapping of solar radiation and the release of anthropogenic heat waste leads to higher temperatures in the urban environment compared to their rural surroundings[4].

The map to the right indicates that temperatures within the subject site are approximately 10-13 °c higher than a rural (moderately vegetated) environment, despite the absence of significant urban development. The current conditions are already similar to highly developed industrial areas such as the precinct West of the Melton Highway (shown with white roofs on the map to the right).

Given that land development can exacerbate urban heat by replacing natural surfaces with non-permeable, high thermal mass materials – these conditions prompt a need to design the built environment and streetscape to instead provide shade, reflect heat and where possible embrace and retain water to deliver urban cooling benefits.

Urban heat is further compounded by climate change which promises to bring its own temperature increases, and as such should be prioritised as one of the critical design drivers for the precinct.

Future development will have to mitigate this through increased vegetation and canopy cover, passive irrigation and material and colour selections that reflect heat away (i.e. lighter colours) as opposed to absorbing it (i.e. darker colours).



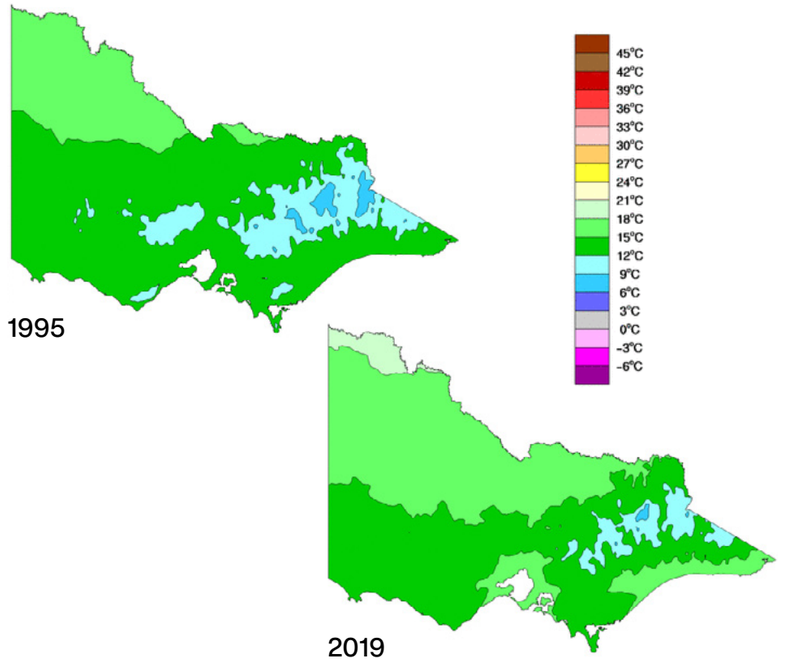

The map above indicates that temperatures within the Melton East PSP are 10-13 ˚c higher than the non-urban baseline. Image by HV.H (using DELWP and VPA datasets)

## EXISTING TEMPERATURES

### Monthly Mean

The table below summarises the monthly mean temperatures for the site (using data from the Melbourne Airport Station) from 1970-20221.

| MONTH | MEAN TEMP (°C) | LOWEST MEAN TEMP (°C) | HIGHEST MEAN TEMP (°C) |
|---|---|---|---|
| January | 26.6 | 21.9 | 30.4 |
| February | 26.6 | 23.3 | 30.3 |
| March | 24.2 | 20.9 | 27.8 |
| April | 20.4 | 17.3 | 23.4 |
| May | 16.7 | 15.2 | 18.7 |
| June | 13.7 | 12.4 | 15.4 |
| July | 13.2 | 11.7 | 15.1 |
| August | 14.5 | 12.8 | 17.4 |
| September | 16.8 | 13.7 | 19.1 |
| October | 19.5 | 16.3 | 25.5 |
| November | 22.1 | 19.4 | 26.8 |
| December | 24.7 | 20.2 | 29.1 |




Comparison of mean temperatures across Victoria in 1995 and 2019 – Illustrating an increase in temperature across much of the State. Images by the Bureau of Meteorology.

### Lowest and highest annual mean

The lowest annual mean temperature on record was 18.5 °C in 1995 and the hottest annual mean temperature on record was 21.3 °C which occurred in 2007 & 2019 (with both 2017 and 2018 recording mean temperatures of 21.1 °C).[5]

This trajectory aligns with the analysis of historic weather impacts on page 18 – which shows an increase in climate hazards (extreme rain and weather, severe thunderstorms, drought, heatwave, and bushfire) from 1890 to 2020, caused by a combination of climate change and increased urbanisation and subsequent exposure.

# Existing Site Conditions

## HYDROLOGICAL ASSETS

The Kororoit Creek is an 81-kilometre watercourse that runs from Mount Aitken, Deverall Hill and Beattie Hill, through the Melton East PSP side (forming the North-East boundary) before emptying into Altona Bay in-between Seaholme and Williamstown[1].

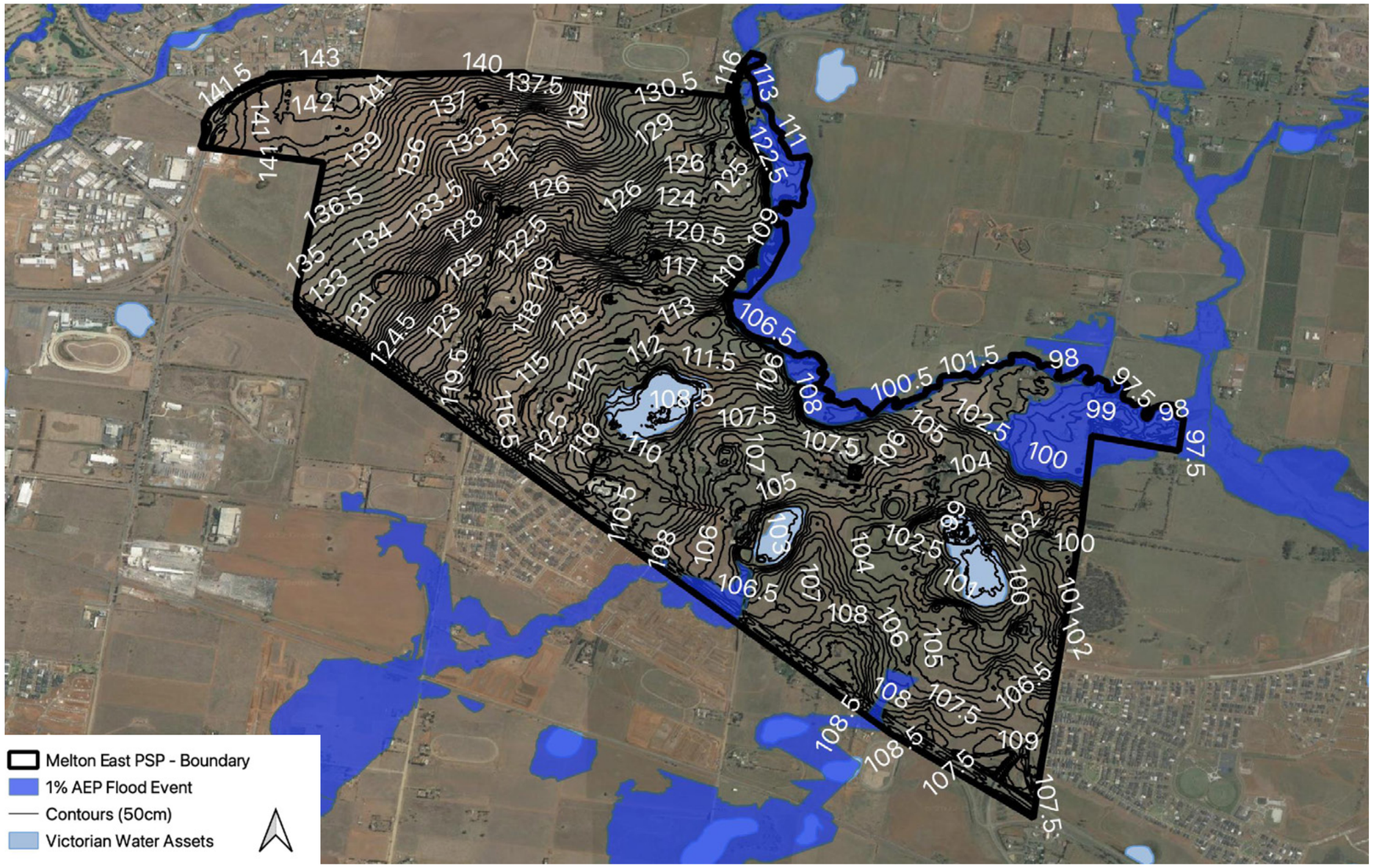
While the creek is largely contained within a narrow flood plain and alluvial terrace (indicating a historically higher creek level), and rainfall is expected to decline, the risk of storm events and flash flooding is still present, and expected to be influenced by urban development. The site drops approximately 35 metres from the North-West to the North-East corner, which is where the primary flood risk remains - an area of floodplain of approximately 40 Ha.

Clearances between the creek level and surrounding land uses in the bottom third of the site will need to be considered, with further flood modelling required to influence the location of key services and infrastructure.

The image to the right shows the 1% Annual Exceedance Probability (AEP) flood risk within and around the PSP, in addition to existing water assets^ and 50cm contouring. Flood terminology is discussed in more detail in appendix E (page 103). We note that development of the PSP area will impact the flood risk.

Flood modelling proposed to be led by Melbourne Water to finalise the drainage scheme will consider the impacts of climate change. Stakeholder discussions will confirm how flood risk can be informed by the same four climate scenarios (presented on page 20) to align with increased rainfall intensities to ensure flood risk is thoroughly considered when developing the Melton East PSP.

^ Victorian Water Assets include features such as: lakes, rivers, creeks, wetlands, water storages, estuaries, groundwater aquifers, springs, large marine intertidal zones, but does not include specific irrigation and water supply infrastructure such as irrigation channels, bores and irrigation distribution networks.




A 1% AEP Flood Event, 0.5m contouring and Victorian Water Assets within and surrounding) the Melton East PSP. Image by HV.H (using DELWP and VPA datasets)

# Historic Weather Impacts

Our climate is becoming hotter, drier and more volatile.

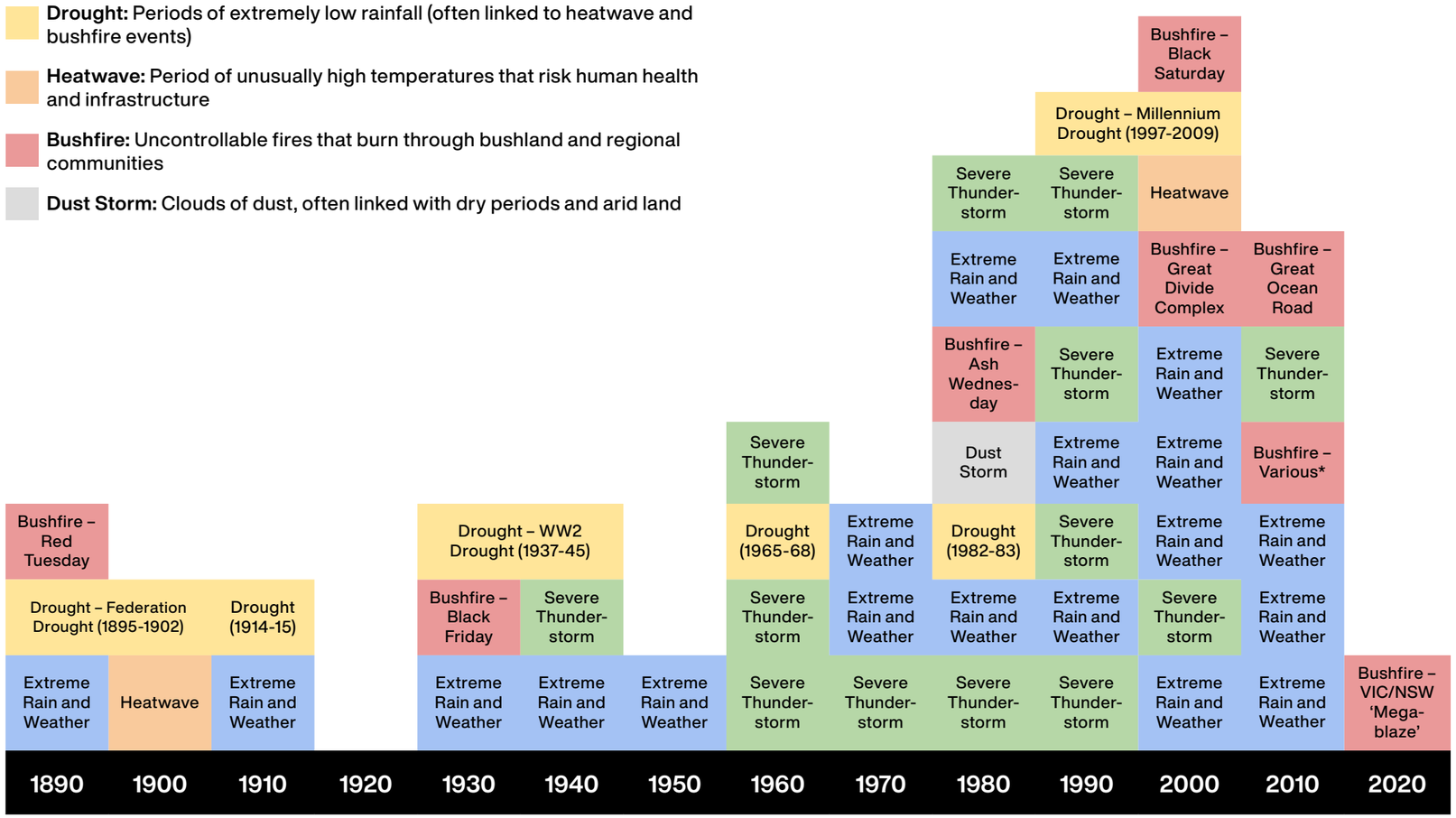
When we look at the historical weather events experienced within Victoria, we can see an upward trajectory in terms of frequency and intensity of events.

While a portion of this can be attributed to improvements in monitoring and reporting – it remains clear that climate change will continue to adversely impact the frequency and intensity of events.

The table to the right summarises data from the Bureau of Meteorology (BoM), the Country Fire Authority (CFA) and the Australia Disaster Resilience Knowledge Hub to represent the type and frequency of weather events experienced within Victoria from 1890 to 2020.

Understanding historic weather is a key component of planning for the future, to ensure we create communities that can adapt to existing and future impacts of climate change.

- **Extreme Rain and Weather:** Heavy rainfall and flooding impacts experienced
- **Severe Thunderstorms:** Significant rainfall, wind and hail events
- **Drought:** Periods of extremely low rainfall (often linked to heatwave and bushfire events)
- **Heatwave:** Period of unusually high temperatures that risk human health and infrastructure
- **Bushfire:** Uncontrollable fires that burn through bushland and regional communities
- **Dust Storm:** Clouds of dust, often linked with dry periods and arid land




Severe weather events experienced in Victoria by decade from 1890-2020 (Bureau of Meteorology and Country Fire Authority)

* In January and February 2013 a number of bushfires were active across Victoria, with the longest burning for 70 days across East Gippsland

# Climate Change, Scenarios and Hazards

# Emission Scenarios

Increases in the global mean surface temperature are largely determined by the cumulative emissions and concentration of $Co_2$ in the atmosphere. The Intergovernmental Panel on Climate Change (IPCC) has produced four Representation Concentration Pathways (RCPs) that map expected emission scenarios against their associated temperature increases[6].

The RCPs ultimately inform the severity of expected climate change hazards and downstream impacts and will be used to inform adaptation solutions for the PSP area.

## CARBON EMISSIONS AND TIMELINES

### Representation Concentration Pathways (RCPs)

RCPs refer to the portion of carbon concentration within a particular emission pathway or trajectory extending to 2100 – with an associated global temperature increase. The IPCC has identified four RCPs: 2.6, 4.5, 6.0 and 8.5 – which are named after their expected radiative force ($W/m^2$), or difference between sunlight absorbed by the earth and energy radiated back to space[6].

The pathways are based on: population size, economic activity, lifestyle, energy use, land-use patterns, technology and climate policy[6].

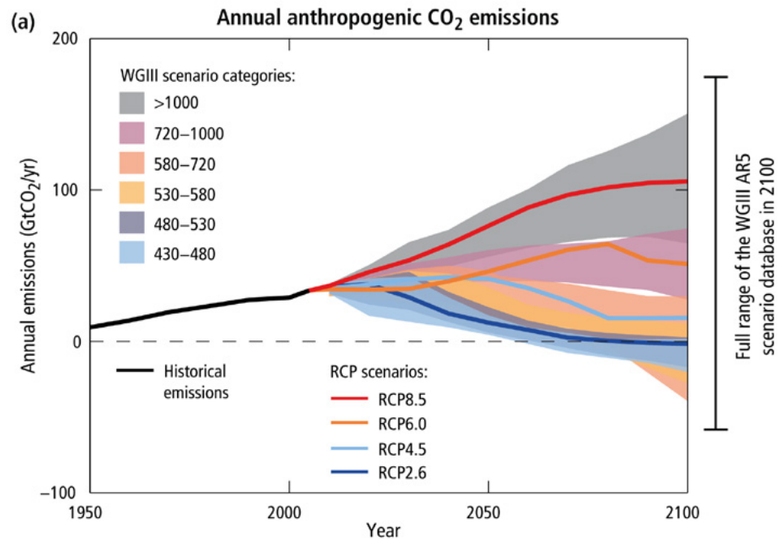
RCP2.6, which outlines the most dramatic decrease in carbon emissions has not been chosen for the analysis as we are already very much within the 0.9-2.3°C increase it proposes. RCP6.0 has also been excluded. For the purpose of the Melton East PSP Climate Impact Analysis and broader Climate Resilience Assessment, RCP 4.5 and 8.5 will be used. These align with the best available datasets for Victoria and are described in more detail below.

### RCP 4.5

One of two intermediate scenarios, where the global average temperature is expected to reach 1.7 to 3.2°C by 2100, with the ppm of $C0_2$ over 530[6].

### RCP 8.5

This pathway extrapolates a 'business as usual' approach to emission reduction, with little transformation or mitigation through to 2100 resulting in a global average temperature increase between 3.2 and 5.4°C, and the concentration of $C0_2$ exceeding 1,000 (ppm)[6].




Historical and expected emissions for each RCP scenario through to 2100. Image by IPCC

### Timelines and Scenarios

The planning of PSPs and ultimate delivery of new communities takes place over extended timeframes and the foundations of decisions made now will be felt over hundreds of years. As such, the analysis has focussed on 2050 (as in intermediate time frame) and 2070 (as a long-term time frame) to assess the anticipated climate hazards and impacts to inform climate response for the Melton East PSP.

As such, the scenarios the climate and risk assessment will respond to are:

- 2050 RCP 4.5
- 2050 RCP 8.5
- 2070 RCP 4.5
- 2070 RCP 8.5

# Expected Climate Hazards

The increased concentration of $C0_2$ in our atmosphere will have significant consequences and influence the global climate.

Within Australia and more locally Victoria, these hazards are expected to include: increased temperatures and solar radiation, increased extreme heat days, more extreme storm events and decreased annual rainfall.

The tables on pages 21 and 23 provide an overview of the specific changes expected across each of the four emissions scenarios.

The data has been sourced from both the Greater Melbourne Climate Projections (2019) developed by the Department of Environment, Land, Water and Planning (DELWP) and Commonwealth Scientific and Industrial Research Organisation (CSIRO) and where available, more site-specific data for the Melton PSP area generated using the underlying (5km) gridded change datasets provided by CSIRO and the Bureau of Meteorology (shown in bold).

The baseline data is the mean climate between 1986-2005, which represents the 'time lag' between the end of 'historic' observations and subsequent climate modelling and analysis for IPCC reports[7]. The baseline climate figures presented have used available data from BoM, with some time periods differing slightly.

## CLIMATE HAZARDS

### Increased average temperature and solar radiation

The baseline mean temperature is 19.6 °C (1986-2005), and solar radiation of 14.9 $MJ^{-2}$ (1990-2005)[8].

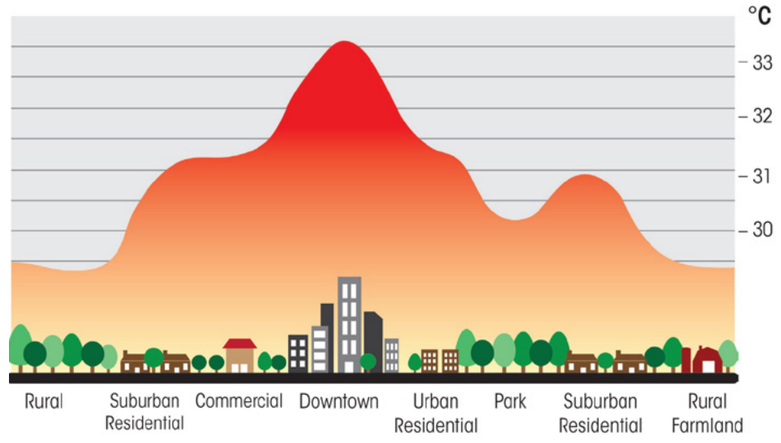
The table below summarises the expected increase in the mean annual temperature (°C) and solar radiation across each emission scenario. An analysis of how this will compound the already concerning UHI effect mentioned earlier, is presented on page 15.

| CLIMATE HAZARD | Temperature (°C) | Solar Radiation (%) |
|---|---|---|
| SEASON | Annual (mean) | Annual (mean) |
| 2050 – RCP4.5 | **1.28** | **1.43** |
| 2050 – RCP8.5 | **1.82** | **2.96** |
| 2070 – RCP4.5 | **1.62** | **2.40** |
| 2070 – RCP8.5 | **2.57** | **3.63** |

### Increased extreme heat days

The baseline mean temperature during summer months is 23.7 °C (1986-2005). While there was no accessible baseline for 1-in-20 year hottest day, between 1981-2010 there was an average of 10.3 days > 35 °C (and 1.5 days > 40 °C)[8].

The table to the right summarises both the annual mean increase in temperature (°C) for the 1-in-20 year hottest day, as well as the increases expected during summer – when heatwave events most often occur.

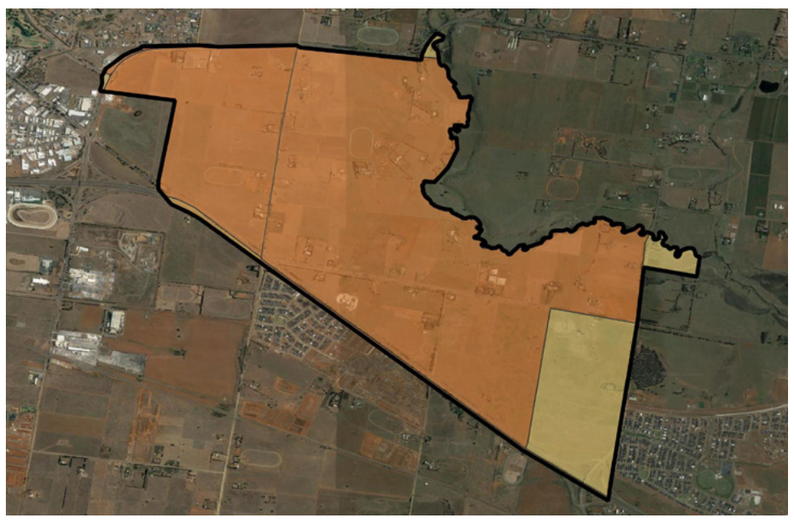



A graphic of the urban heat island effect, with increased heat experienced in urban environments due to materials and heat emissions (from cars and buildings) expected to increase. Image by Google Image

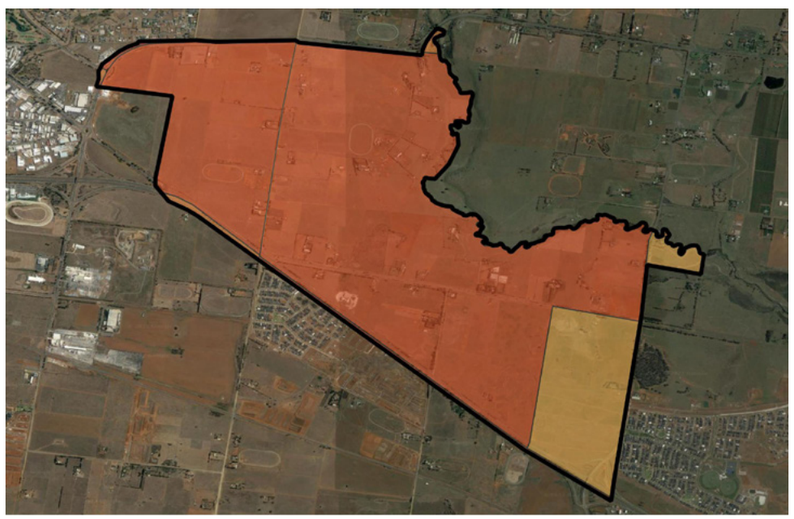
While the mean temperature will incrementally rise across the emission scenarios, this data shows us that extreme heat days will themselves become substantially hotter and subsequently increase the risk to human health, ecosystems and infrastructure.

| CLIMATE HAZARD | 1-in-20 Year Hottest Day (°C) | | Max Temp (°C) |
|---|---|---|---|
| SEASON | Annual (mean) | Summer (Upper) | Summer (mean) |
| 2050 – RCP4.5 | 2.08 | 4.28 | **1.37** |
| 2050 – RCP8.5 | 2.71 | 5.02 | **1.75** |
| 2070 – RCP4.5 | 2.0 | 3.5 | **1.88** |
| 2070 – RCP8.5 | 3.33 | 4.36 | **2.35** |

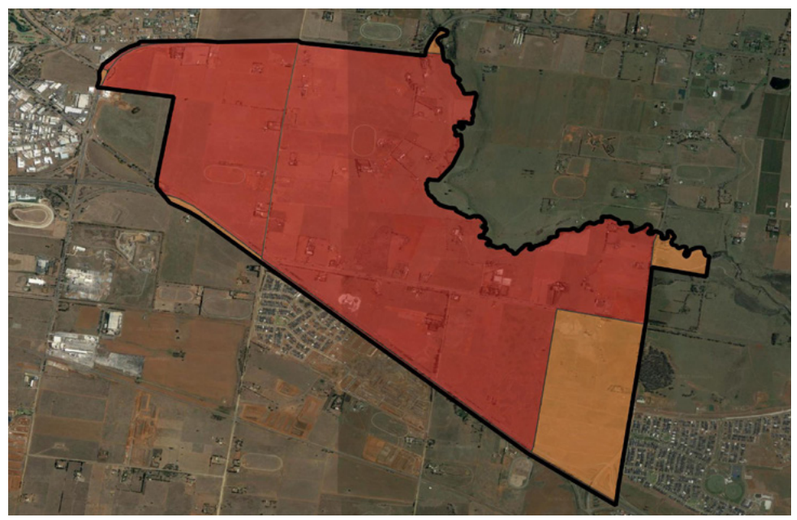
# Expected Climate Hazards



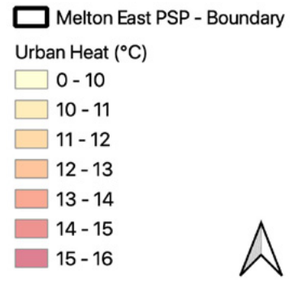
Urban heat (UHI) within the Melton PSP in 2018*^



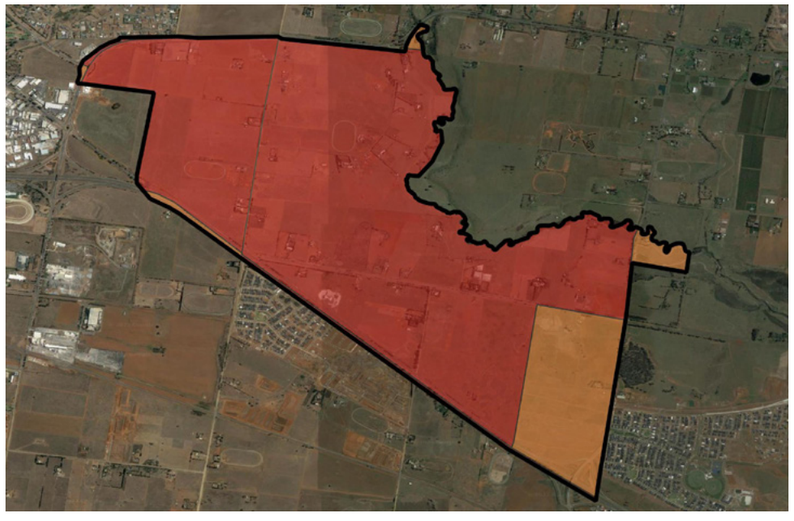
Urban heat (UHI) within the Melton PSP in 2050 (RCP 4.5)^



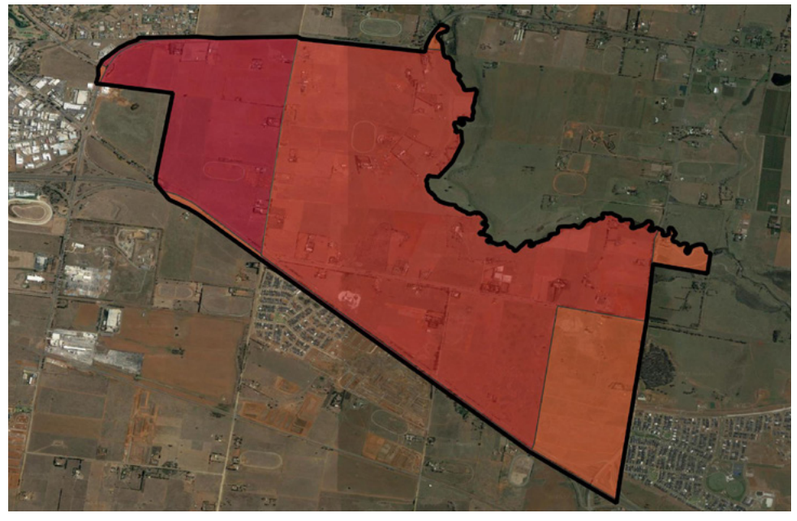
Urban heat (UHI) within the Melton PSP in 2050 (RCP 8.5)^




* Original urban heat data provided by DELWP and CSIRO is from 2018
^ All Images by HV.H using DELWP and CSIRO datasets)



Urban heat (UHI) within the Melton PSP in 2070 (RCP 4.5)^



Urban heat (UHI) within the Melton PSP in 2070 (RCP 8.5)^

# Expected Climate Hazards

### More extreme storm events

While there is not a clear baseline for 1-in-20 year wettest day, data from the BoM states that there has been an average of 2.5 days of rainfall >25mm per year (1991-2010), with spring wind speeds between 21 (9AM) and 23.4 (3PM) (1970-2010)[8].

The table below summarises the expected increase (%) in the 1-in-20 year wettest day and wind speed during future spring seasons. It tells us that extreme rainfall events are expected to significantly increase (potentially influencing the 1% AEP discussed previously).

| WEATHER HAZARD | 1-in-20 Year Wettest Day (%) | Wind Speed (%) |
|---|---|---|
| SEASON | Spring (upper) | Spring (upper) |
| 2050 – RCP4.5 | 16.08 | **-1.3** |
| 2050 – RCP8.5 | 56.76 | **-3.2** |
| 2070 – RCP4.5 | 31.38 | **-1.15** |
| 2050 – RCP8.5 | 37.65 | **-3.0** |

### Decreased rainfall

The baseline annual mean for rainfall is 502mm (1986-2005), with the spring mean rainfall for that same period 143mm[8].

The table to the right shows however that both annual mean and spring mean precipitation is expected to decrease across each of the four scenarios.

So while the analysis above indicates rainfall events will be more intense, the overall rainfall expected during spring (and annually) will decrease.

| WEATHER HAZARD | Precipitation (%) | |
|---|---|---|
| SEASON | Annual (mean) | Spring (mean) |
| 2050 – RCP4.5 | **3.05** | **-12.45** |
| 2050 – RCP8.5 | **-1.29** | **-22.10** |
| 2070 – RCP4.5 | **-3.91** | **-18.9** |
| 2050 – RCP8.5 | **-2.77** | **-10.99** |

The breadth of downstream impacts associated with these four primary climate hazards is presented on pages 30-34.

While annual and spring mean rainfall is expected to fall, the 1-in-20 year wettest day in spring is expected to dramatically increase – suggesting an increased risk of flash flooding and inundation in low lying areas. Image by Anna Atkins on Unsplash

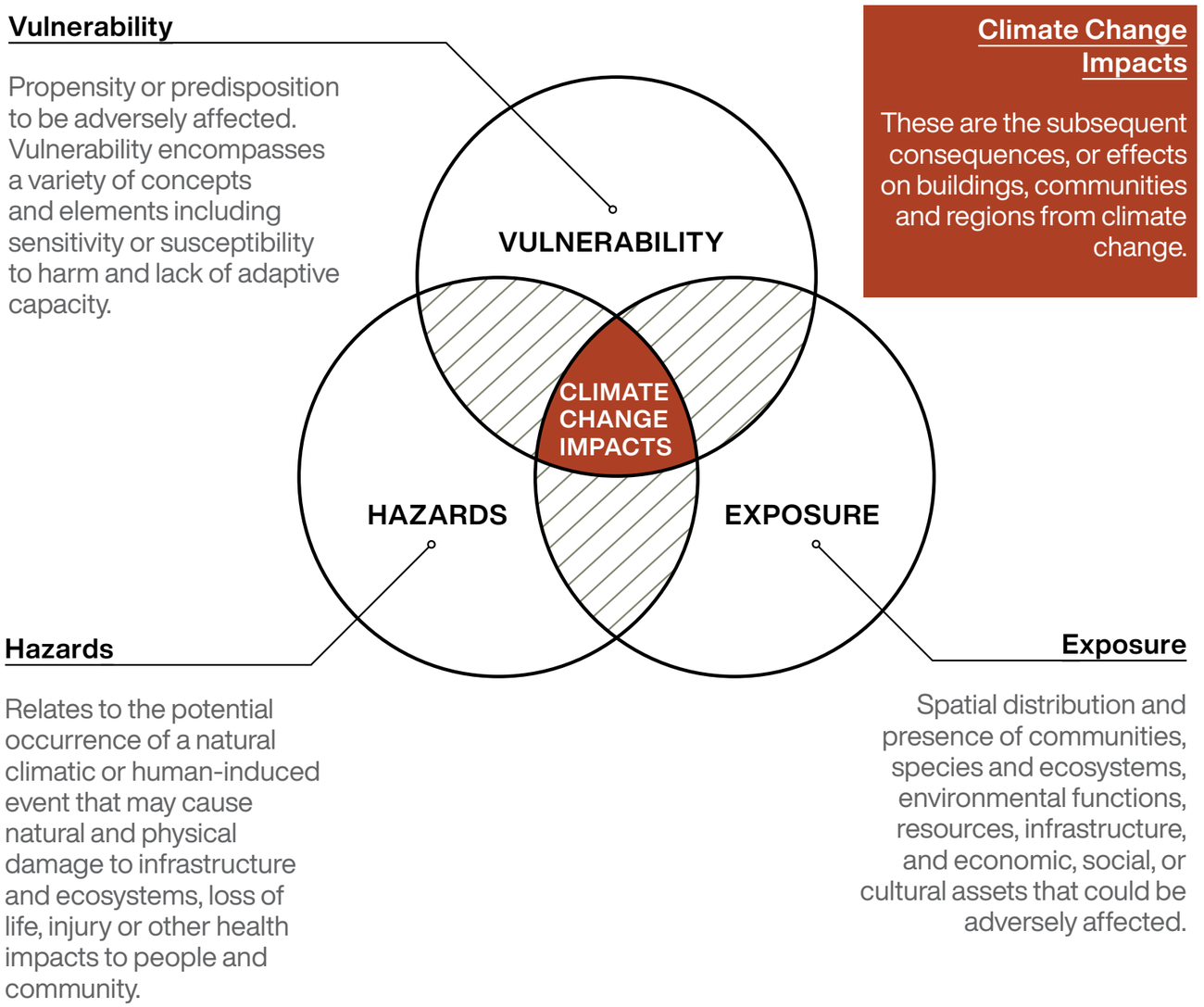
# Climate Impacts and Adaptive Capacity

Climate change impacts are not equally distributed across the community due to the nature of weather hazards, and varying levels of exposure and vulnerability of people, ecosystems and assets.

The image to the right summarises how climate change impacts can be viewed through this hazards / exposure / vulnerability lens.

A detailed list of climate change impacts expected for the Melton East PSP site are provided on page 30-34.

One of the primary objectives of this report and the assessment, is to inform design of the community and use the PSP as a tool to reduce vulnerability and limit exposure, noting that the severity of hazards are a product of global responses to climate change (mitigation efforts to reduce carbon emissions), but there is significantly more control and influence over vulnerability and exposure at the local level.




An overview of the relationship between hazards, vulnerability and exposure which exposes the hierarchy of climate change impacts.
Image by HIP V. HYPE

# Climate Impacts and Adaptive Capacity

**When considering how to adapt to climate impacts, adaptive capacity – or the ability of systems to adjust to potential damage and respond to consequences – plays a critical role. The 5-capitals framework outlined to the right acts as a critical lens to explore deeper elements of capacity and resilience within the community.**

**The 5-capitals encompasses the full range of ecological and man-made assets and infrastructure within a community, and the tangible and non-tangible connections in-between. Physical capital for example underpins both human and social capital by providing the infrastructure, technology and services to connect people and communities – which is critical when responding to climate events and natural disasters.**

**While this is the case, it is essential to design communities and the systems they rely on in a way that reduces the reliance, or dependence on any one type of capital to effectively respond or 'bounce back'.**

**For the remainder of this report and through the climate risk assessment stage, we will refer to each of the 5-capitals as 'impact areas' – with the climate impacts within the PSP being categorised as such.**

## 5-CAPITALS FRAMEWORK

The 5-capitals framework (created by the Forum for the Future) allows for a holistic understanding of adaptive capacity, acknowledging that beyond the natural and physical impacts (such as damage to infrastructure and ecosystems), human and social systems such as knowledge and networks are critical determinants of the ability to 'bounce back' after shocks and deal with stressors.

An overview of each is provided below.

### Natural Capital

Refers to biodiversity and ecological assets such as land, water, ecosystems and the wildlife they support. Natural capital can also cover biological materials (i.e. timber) and ecosystem services (i.e. stormwater management from waterways)[9].

### Social Capital

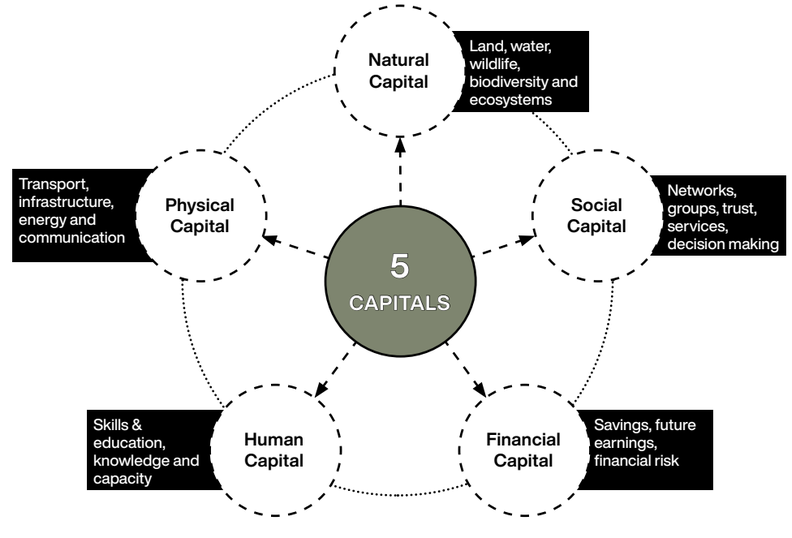
Social capital is associated with the institutions, networks and services that build human capital such as; families, schools, and community and sporting organisations. It impacts the trust and decision making within a community[9].

### Financial Capital

This refers to the savings, future earnings and financial risk present within a community. Liquidity during weather events to purchase supplies, and increased maintenance and repairs costs are all included within financial capital[9].

### Human Capital

This is the health, knowledge, skills and motivation of the people within a community, and is strongly linked to education and training opportunities[9].




The 5-Capitals lens provides a holistic framework for interpreting climate change impacts.
Image by HIP V. HYPE

### Physical Capital

Physical capital refers to the man-made physical assets and infrastructure within a community. Critical infrastructure such as roads and bridges, telecommunications and power networks and physical structures such as dwellings are all included[9].

Physical capital can influence other system capital. For example, if a storm disrupts the power and telecommunications network, financial transactions and communication between community members and emergency services (i.e. social and financial capital) may also be disrupted - often until the physical asset/s are repaired. Ensuring both building and infrastructure assets are designed to withstand climate impacts is critical in climate adaptation.

# Assets and Community Sectors

**The Melton East PSP will support a community of approximately 13,000 dwellings and almost 4,000 jobs. To support a community of such size, a variety of community, commercial, infrastructure and ecological assets are required.**

**The table opposite highlights the range of physical and natural assets and the key stakeholders responsible for their ongoing management.**

**A key response to climate change impacts will be to reduce the exposure and vulnerability and exposure of key assets through measures such as selection, siting, design and governance arrangements.**

| CATEGORY | SUB-CATEGORY | ASSET / SECTOR | KEY STAKEHOLDER ROLE |
|---|---|---|---|
| Residential | Housing | Residential Dwellings (approx. 10,100) | Resident |
| Community | Education | Long Day Childcare | Melton City Council (and private providers) |
| | | 3-4 Year Preschool | Melton City Council (and private providers) |
| | | Maternal and Child Health | Melton City Council |
| | | Government Primary School | Department of Education and Training (& VSBA) |
| | | Government High School | Department of Education and Training (& VSBA) |
| | Indoor / Recreation | Neighbourhood House | Melton City Council |
| | | Large Multi-purpose Community Centre - Level 1-3 | Melton City Council |
| | | Indoor Multi-purpose Court | Melton City Council |
| | | Indoor Sports Stadium - Level 2 | Melton City Council |
| | Outdoor / Open Space | Playground | Melton City Council |
| | | Outdoor Court | Melton City Council |
| | | Football Field | Melton City Council |
| | | Cricket Field | Melton City Council |
| | | Soccer Field | Melton City Council |
| | | Tennis Court | Melton City Council |
| | | Lawn Bowls Green | Melton City Council |
| | | Recreation Pavillion | Melton City Council |

# Assets and Community Sectors

| CATEGORY | SUB-CATEGORY | ASSET / SECTOR | KEY STAKEHOLDER ROLE |
|---|---|---|---|
| Community | Outdoor / Open Space | Local Active Space Reserve | Melton City Council |
| | | Passive Open Space - Level 1 | Melton City Council |
| | | Regional Open Space | TBD |
| Commercial | Retail & employment | Local Convenience Stores | Private Sector |
| | | Town Centre / Shopping Centre | Private Sector |
| | | Commercial / Warehouse | Private Sector |
| Infrastructure | Transportation | Road Network | Melton City Council / Department of Transport |
| | | Bridges | Melton City Council / Department of Transport |
| | | Pedestrian / cycling network | Melton City Council / Department of Transport |
| | Services | Electrical / Power Lines | Powercor |
| | | Telecommunications | Telstra, Optus etc, NBN Co |
| | | Fresh (potable) Water Supply | Greater Western Water |
| | | Stormwater Drainage | Melton City Council / Melbourne Water |
| | | Gas Mains (if proposed) | Ausnet Services |
| | Services / Ecological | Stormwater Basin (if required) | Melbourne Water |
| Ecological | Ecological | Kororoit Creek | Melbourne Water |
| | | Street trees | Melton City Council |
| | | Conservation Area (Wetland) | TBD |

# Assets and Community Sectors

Another key response will be to reduce the vulnerability and exposure of key community sectors through services, supporting infrastructure, communication networks and governance arrangements. Some of these responses may be delivered wholly or in partnership with community groups.

We note that a PSP may have limited opportunity to direct operational service requirements or governance arrangements, however these community sectors are identified here (see table to right) in the interests of exploring the full range of responses.

The community sector groupings will be further refined in the stakeholder workshop.

| CATEGORY | SUB-CATEGORY | ASSET / SECTOR | KEY STAKEHOLDER ROLE |
|---|---|---|---|
| Human | Residents | Children | Various |
| | | Youth | |
| | | Elderly | |
| | | Disability | |
| | | Culturally and linguistically diverse (CALD) | |
| | | Traditional Owners / Custodians | |
| | | Other | |
| | Businesses | Trades | |
| | | Goods | |
| | | Services | |
| | Visitors | Tourists / Visitors | |
| | | Distribution workers (i.e. couriers) | |
| | Community Groups | Faith | |
| | | Sports | |
| | | Environmental | |
| | | Arts | |
| | | Special interest | |
| | | Instagram / Other socials | |

# Hazards and Impacts

# Climate Hazards and Impacts
# Natural

The tables presented in this section provide an overview of the expected climate impacts associated with the primary and secondary climate hazards for each of the five capitals.

Each climate impact is coded to correspond to the associated capital category, for example N1-N7 are natural impacts, S1-3 are social impacts etc. These codes are used throughout the assessment.

The impacts highlighted in blue represent those that the PSP could potentially influence – and are the focus of the climate risk assessment and adaptation planning.

The other impacts (not highlighted) are not unimportant, however are less likely to be influenced through the development of a PSP. Further commentary on building social resilience and adaptive capacity is provided on page 61.

| CLIMATE HAZARDS - GREATER MELBOURNE (INCLUDING MELTON) | | | | | |
|---|---|---|---|---|---|
| PRIMARY | GENERAL | INCREASED TEMPERATURE AND SOLAR RADIATION | INCREASED EXTREME HEAT DAYS | MORE EXTREME STORM EVENTS | DECREASED ANNUAL RAINFALL |
| SECONDARY | | HEATWAVES, HUMIDITY, EVAPOTRANSPIRATION AND LONGER FIRE SEASONS | BUSHFIRE / GRASSFIRE RISK | FLASH FLOODING, INCREASED WIND AND STORMS | DROUGHT |
| **CLIMATE IMPACTS** | | | | | |
| **NATURAL IMPACTS**<br><br>E.g. Land, water, wildlife, biodiversity and ecosystems | Amplification of existing threats to flora and fauna | Earlier flowering and planting times | Wider distribution of invasive species | N3 – Environmental damage to waterways from more intense rainfall events | Changes to habitat |
| | | N1 – Stress on flora & fauna | Intense fire events can damage surrounding water quality and biodiversity quality | N4 – Environmental damage to vegetation from more intense wind events | N6 – Reduced flow into local waterways hindering water quality and biodiversity |
| | | Changed distribution of pests and diseases | | N5 – Increased runoff and flash flooding | N7 – Amplification of existing water scarcity threats to flora and fauna |
| | | Changing dynamics of invasive species | | | |
| | | Altered disturbance regimes | | | |
| | | N2 – Greater evaporation leading to further loss of water supplies | | | |

* Existing research and government reports indicates that subsequent secondary impacts, such as heatwaves, humidity, grassfire risk, flash flooding and drought can potentially cascade from the four primary hazards we have outlined in detail.

# Climate Hazards and Impacts
# Social

Increased temperatures will potentially impact outdoor sporting events and restrict traditional irrigation. Image by Watermatic Irrigation

| CLIMATE HAZARDS - GREATER MELBOURNE (INCLUDING MELTON) | | | | | |
|---|---|---|---|---|---|
| PRIMARY | GENERAL | INCREASED TEMPERATURE AND SOLAR RADIATION | INCREASED EXTREME HEAT DAYS | MORE EXTREME STORM EVENTS | DECREASED ANNUAL RAINFALL |
| SECONDARY | | HEATWAVES, HUMIDITY, EVAPOTRANSPIRATION AND LONGER FIRE SEASONS | BUSHFIRE / GRASSFIRE RISK | FLASH FLOODING, INCREASED WIND AND STORMS | DROUGHT |
| **CLIMATE IMPACTS** | | | | | |
| **SOCIAL IMPACTS** E.g. Networks, groups, trust, services, decision making | Higher incidence of family violence | S1 – Impact on outdoor sporting events, social gatherings and events | More stress on health and emergency services | More stress on health and emergency services | S3 – Water scarcity and restrictions to supply and uses (i.e. no irrigation) |
| | Stress and demand on communication networks | | | S2 – Short term isolation of community members (exacerbating recovery efforts) due to transportation disruptions | |

# Climate Hazards and Impacts
# Financial


Road closures associated with localised flooding can impact supply chains and retail revenue. Image by Courier Mail

| CLIMATE HAZARDS - GREATER MELBOURNE (INCLUDING MELTON) | | | | | |
|---|---|---|---|---|---|
| PRIMARY | GENERAL | INCREASED TEMPERATURE AND SOLAR RADIATION | INCREASED EXTREME HEAT DAYS | MORE EXTREME STORM EVENTS | DECREASED ANNUAL RAINFALL |
| SECONDARY | | HEATWAVES, HUMIDITY, EVAPOTRANSPIRATION AND LONGER FIRE SEASONS | BUSHFIRE / GRASSFIRE RISK | FLASH FLOODING, INCREASED WIND AND STORMS | DROUGHT |

| CLIMATE IMPACTS | | | | | |
|---|---|---|---|---|---|
| FINANCIAL IMPACTS<br>E.g. Savings, future earnings, financial risk | Increased cost of business inputs | Reduced productivity due to OHS or machinery malfunction | F1 – Loss of retail expenditure due to uncomfortable conditions | Increased threats to tourism infrastructure | F4 – Reduced water security |
| | Increased cost and access to fresh food | | Loss of productivity due to uncomfortable conditions | Reduced financial capacity for asset renewal | Increased costs for asset managers, reduced service quality and availability |
| | Increased insurance costs (or reduction of coverage) | | | F2 – Supply chain affected by flooding and soil runoff | Reduced water quality affecting agricultural, ecological, amenity and recreational values in region |
| | | | | F3 – Loss of business continuity to extreme weather events | F5 – Decreased potable supply and associated increased cost of potable water |

# Climate Hazards and Impacts
## Human

The PSP can support a public realm that responds to increased heat impacts and provides safety and refuge for the elderly and disadvantaged groups.
Image by Nathan Anderson on Unsplash

| CLIMATE HAZARDS - GREATER MELBOURNE (INCLUDING MELTON) | | | | | |
|---|---|---|---|---|---|
| PRIMARY | GENERAL | INCREASED TEMPERATURE AND SOLAR RADIATION | INCREASED EXTREME HEAT DAYS | MORE EXTREME STORM EVENTS | DECREASED ANNUAL RAINFALL |
| SECONDARY | | HEATWAVES, HUMIDITY, EVAPOTRANSPIRATION AND LONGER FIRE SEASONS | BUSHFIRE / GRASSFIRE RISK | FLASH FLOODING, INCREASED WIND AND STORMS | DROUGHT |
| **CLIMATE IMPACTS** | | | | | |
| **HUMAN IMPACTS**<br><br>E.g. Skills & education, knowledge and capacity] | H1 – Cumulative mental health stressors, exacerbated by multiple climate events | H2 – Health impacts from reduced physical activity due to high outdoor temperatures | H3 –More heat-related deaths, particularly among the elderly and disadvantaged | Increases in food-,water- and vector-borne diseases due to the altered distribution of vectors (including mosquitoes) | Disruptions to wastewater treatment |
| | | More heat-related deaths among elderly (65+) and disadvantaged | | Health impacts associated with the displacement of populations | Increase in illnesses related to drinking water and recreational water – for example, due to increases in blue-green algae |
| | | | | H4 – Higher incidence of mental health impacts, trauma and longer term disruptions to social systems – for example, due to lost income and property damage or loss | |

# Climate Hazards and Impacts
## Physical

Flooding can damage physical assets such as roads, buildings and personal property (e.g. vehicles). Image by Reuters

| CLIMATE HAZARDS - GREATER MELBOURNE (INCLUDING MELTON) | | | | | |
|---|---|---|---|---|---|
| PRIMARY | GENERAL | INCREASED TEMPERATURE AND SOLAR RADIATION | INCREASED EXTREME HEAT DAYS | MORE EXTREME STORM EVENTS | DECREASED ANNUAL RAINFALL |
| SECONDARY* | | HEATWAVES, HUMIDITY, EVAPOTRANSPIRATION AND LONGER FIRE SEASONS | BUSHFIRE / GRASSFIRE RISK | FLASH FLOODING, INCREASED WIND AND STORMS | DROUGHT |
| **CLIMATE IMPACTS** | | | | | |
| **PHYSICAL IMPACTS**<br><br>E.g. Transport<br>Infrastructure<br>Energy<br>Communication | Increased asset maintenance costs | P2 – Increased energy usage via higher demand for AC/cooling etc. | Failure of cooling infrastructure to perform on extreme heat days | Increased damage and maintenance costs of buildings | P9 – Decreased water recycling ability |
| | P1 – Disruptions to roads and supply chains | Decreased durability of certain building elements (i.e. soft-timber and render) due to increased heat and radiation | P3 – Loss of transportation routes and connectivity due to infrastructure failure | Increased damage and maintenance costs of infrastructure | Infrastructure and buildings impacts due to drying soils vulnerable to degradation and structural failure |
| | | | Increased road maintenance due to faster deterioration of transport assets (e.g. roads) | P5 – Loss of usable land - Land subject to inundation in 1% AEP event to increase | |
| | | | P4 – Power outages due to increased electricity demand on hot days | Increased damage to roads and disruption to transport services | |
| | | | | P6 – Building inundation due to flooding | |
| | | | | P7 – Transport route inundation or damage due to flooding | |
| | | | | P8 – Stormwater overflow and drain blockages | |
| | | | | Damaged underground infrastructure | |

# Climate Risk Assessment

# Defining Risk

Risk denotes a deviation from the expected (which can be positive or negative) and is often characterised by reference to potential events (both their likelihood and consequence)[10].

Risk assessment is the process of risk identification» analysis of the nature and level or risk, and evaluating whether the risk is acceptable or requires an adaptation response[10].

This section provides clarity around these elements – defining likelihood and outlining consequence ratings across each of the 5 impact areas.

The risk assessment process aligns with AS5334-2013 'Climate change adaptation for settlements and infrastructure— A risk based approach'.

AS5334 identifies risk and explores:

- What could happen
- What it would lead to (downstream impacts)
- The causes; and
- The existing controls (what is already being done) and adaptive capacity (which links to the 5-capitals lens we defined earlier).

## DEFINING RISK

### Likelihood Rating

In risk management terminology, the word 'likelihood' is used to refer to the chance of something happening, whether defined, measured or determined objectively or subjectively, qualitatively or quantitatively, and described using general terms or mathematically (such as a probability or a frequency over a given time period)[10].

| | |
|---|---|
| **ALMOST CERTAIN** | Risk could occur several times per year |
| **LIKELY** | Risk may arise about once per year |
| **POSSIBLE** | Risk may arise once in 10 years |
| **UNLIKELY** | Risk may arise once in 10-25 years |
| **RARE** | Risk may arise less than 25 years |

### Consequence Rating

Consequences are the outcomes of an event that affect objectives[10].

AS5334-2013 provides the following notes:

1. An event can lead to a range of consequences
2. A consequence can be certain or uncertain and can have positive or negative effects on objectives
3. Consequences can be expressed qualitatively or quantitatively
4. Initial consequences can escalate through knock-on effects.

The full consequence rating table is provided on page 38.

# Defining Risk

| CONSEQUENCE RATING | | | | | |
|---|---|---|---|---|---|
| **RATING** | **PHYSICAL** | **NATURAL** | **HUMAN** | **SOCIAL** | **FINANCIAL** |
| **Catastrophic** | Catastrophic damage and failure of key infrastructure and physical assets causing downstream impacts on financial, human and social capital | Catastrophic and irreversible damage to environmental assets, ecosystem services and ecological species | Catastrophic impacts on health and well-being including loss of life or irreversible loss of skills, knowledge and capacity within the community | Severe long-term failure of social networks and services leading to community isolation and sustained and significant impacts on community cohesion | Irrecoverable loss in financial capacity as a result of failed infrastructure, increased maintenance, insurance costs and/or litigation that transcends financial capacity of responsible stakeholder |
| **Major** | Major impact and damage to infrastructure and physical assets with major disruptions to services | Major sustained damage to environmental assets, ecosystem services and ecological systems | Major and sustained impacts on health and well-being for high-risk groups within the community (i.e. elderly) | Major stress and reduced capacity to use key social networks and services | Major reduced financial capacity for responsible stakeholders, with reduced access to financial capital |
| **Moderate** | Moderate temporal stress and damage to exposed infrastructure and physical assets with potential disruption to associated services | Moderate acute stress on environmental assets and disruptions to ecosystem services and ecological species | Moderate, temporal stress on health and well-being outcomes for the community | Moderate short-term stress and reduced capacity to deliver key social networks and services | Moderate stress for responsible stakeholders and disruptions to financial systems within the community |
| **Minor** | Minor damage to infrastructure and physical assets with no disruptions to services | Minor disruptions of environmental assets, ecosystem services and ecological species | Minor short-term stress and reduced motivation and capacity within the community | Minor disruptions to social networks and services | Minor costs for responsible stakeholders with potential restrictions on accessing financial assets within the community |
| **Insignificant** | Negligible damage to infrastructure and physical assets | Negligible environmental damage | Negligible impact on human networks | Negligible impact on social networks | Negligible impact on financial capital |

The consequence ratings for each of the 5 impact areas (i.e. 5-capitals categories). Image by HV.H

# Defining Risk

**RISK MATRIX**

The risk matrix below combines both the likelihood and consequence, to define whether it is deemed: low, medium, high or extreme.

The responding risk assessment will use these risk definitions for each climate change impact identified across each of the 5 impact areas (pages 30-34) across each of the four climate scenarios, and align responses to ensure the various assets (pages 26-28) are able to adapt and support a happy and healthy community.

**How does risk change?**

As we map the impacts across each of the four climate scenarios (pages 20), many will trend upward in terms of their severity.

This is because as the climate hazards we outlined earlier continue to become more prevalent (and increase in intensity across the four climate scenarios), the likelihood may be increased.

For example, if we look at the first impact identified for physical capital within the PSP on page 34, 'P1 – Disruptions to roads and supply chains' we might determine that currently (while not yet constructed) roads within the PSP are *unlikely* to be impacted by flooding and thus poses a low risk.

However, in 2050 under RCP 8.5 we have already discussed that the '1-in-20 year wettest day' is expected to increase by 56.76%. This will increase the likelihood of roads being inundated by flash flooding to *possible* (with the risk increasing to medium) unless measures to limit exposure to the risk are delivered through the PSP.

The consequence of an impact remains constant, only the likelihood is altered to generate the revised risk rating.

| | CONSEQUENCE | | | | |
|---|---|---|---|---|---|
| **LIKELIHOOD** | **INSIGNIFICANT** | **MINOR** | **MODERATE** | **MAJOR** | **CATASTROPHIC** |
| **ALMOST CERTAIN** | Low | Medium | High | Extreme | Extreme |
| **LIKELY** | Low | Medium | High | High | Extreme |
| **POSSIBLE** | Low | Low | Medium | High | High |
| **UNLIKELY** | Low | Low | Low | Medium | Medium |
| **RARE** | Low | Low | Low | Low | Low |

Risk Matrix used for the assessment

# Risk Assessment

The risk matrix tables presented in this section summarise the shifting levels of risk for each of the climate impacts identified within the PSP.

We begin by setting a 2022 benchmark, and then map the changing risk profiles across each of the four emissions pathways.

The legend at the bottom of the page indicates the level of risk, from low to extreme.

## RISK MATRIX TABLES

### 2022

The risk matrix table below categorises the level of risk for each of the climate impacts identified within the PSP. Essentially, if the PSP was built-out today, given the existing climate hazards and weather events – how would the likelihood and consequence of each impact generate risk.

### 2050 and beyond

The risk matrix tables on page 40 show these same impacts, mapped cross each of the four climate scenarios: 2050 RCP 4.5, 2050 RCP 8.5, 2070 RCP 4.5 and 2070 RCP 8.5.

As climate hazards increase, so to does the likelihood that those impacts will occur, thus increasing the risk categorisation.

The Kororoit Creek flooding in Altona (across Racecourse Road) in 2020.
Image by Andrew Henshaw

| CONSEQUENCE – 2022 | | | | | |
|---|---|---|---|---|---|
| LIKELIHOOD | INSIGNIFICANT | MINOR | MODERATE | MAJOR | CATASTROPHIC |
| ALMOST CERTAIN | | | | | |
| LIKELY | | | F5 | | |
| POSSIBLE | | P8, S1, F4 | N5, N7, H2, F1 | N1, N6, H1, S3 | N2, H3 |
| UNLIKELY | | | P7, P9, N4 | N3, P4, H4, F3 | |
| RARE | | P2 | P1, F2 | P3, P5, P6, S2 | |

Low Risk  Medium Risk  High Risk  Extreme Risk

HIP V. HYPE

# Risk Assessment

| CONSEQUENCE – 2050 RCP 4.5 | | | | | |
|---|---|---|---|---|---|
| LIKELIHOOD | INSIGNIFICANT | MINOR | MODERATE | MAJOR | CATASTROPHIC |
| ALMOST CERTAIN | | | | | |
| LIKELY | | P2 | N5, F1 | N1, H4, F3 | H3 |
| POSSIBLE | | P8, S1, F4 | P7, P9, N7, F2, F5, H2 | N3, N6, P4, H1, S3 | N2 |
| UNLIKELY | | | P1, N4, | P3, P5, P6, | |
| RARE | | | | S2 | |

| CONSEQUENCE – 2050 RCP 8.5 | | | | | |
|---|---|---|---|---|---|
| LIKELIHOOD | INSIGNIFICANT | MINOR | MODERATE | MAJOR | CATASTROPHIC |
| ALMOST CERTAIN | | | N5 | N1 | |
| LIKELY | | P2, P8, S1 | P7, N7, F1, F5 | N3, N6, P4, H1, H4, F3 | N2, H3 |
| POSSIBLE | | F4 | H2, P9, F2 | P3, P5, S2, S3 | |
| UNLIKELY | | | P1, N4 | P6 | |
| RARE | | | | | |

| CONSEQUENCE – 2070 RCP 4.5 | | | | | |
|---|---|---|---|---|---|
| LIKELIHOOD | INSIGNIFICANT | MINOR | MODERATE | MAJOR | CATASTROPHIC |
| ALMOST CERTAIN | | | | N6 | |
| LIKELY | | P2, P8, S1, F4 | N5, N7, F1, F5 | N1, N3, H1, H4, F3, S3 | H3 |
| POSSIBLE | | | H2, P7, P9, F2 | P4, P5, S2 | N2 |
| UNLIKELY | | | P1, N4 | P3, P6 | |
| RARE | | | | | |

| CONSEQUENCE – 2070 RCP 8.5 | | | | | |
|---|---|---|---|---|---|
| LIKELIHOOD | INSIGNIFICANT | MINOR | MODERATE | MAJOR | CATASTROPHIC |
| ALMOST CERTAIN | | P2, S1, F4 | N5, F1 , F5 | N1, S3 | N2, H3 |
| LIKELY | | P8 | P9, N7, H2 | N3, N6, P4, H1, H4, F3 | |
| POSSIBLE | | | P1, P7, F2 | P3, P5, P6, S2 | |
| UNLIKELY | | | N4 | | |
| RARE | | | | | |

Low Risk  Medium Risk  High Risk  Extreme Risk

# Adaptation Action Plan

# Objectives and Adaptation Actions

Based on the impacts highlighted through the previous stages, this section proposes a number of adaptation actions which can assist in addressing impacts.

The following actions have been categorised according to the type of action (timing etc).

The structure on the following pages responds to the categorisation of impacts on pages 30 to 34.

## ADAPTATION ACTIONS

### Process Recommendation

This action type relates to adjustments from standard process as to how PSP direction might be resolved.  They do not necessarily involve increased capital investment, just a change in the way elements of the PSP are developed.

### Infrastructure Investment

These actions require up-front investment and would ideally be delivered early in the land development process.

### Design Recommendation / Requirement

These actions are recommended design interventions which may require changes in the way infrastructure, buildings or other assets are designed / delivered.

### Design Considerations

These actions, while also critical in delivering resilience, are listed as considerations. They should be factored into the design / delivery of the precinct where possible, but may need to be prioritised / further tested through other scopes / phases of work.

### Operational Opportunity

Beyond the delivery of the physical infrastructure within the community, these actions relate to operational opportunities to improve the precinct's adaptive capacity over time for example through programs etc.


Achieving net zero will require action to reduce stationary, transport and waste emissions. Image by Kim Landy

*The objectives have been articulated or supported by various state and local government legislation, policies and strategies (See references in Appendix A). Some additional objectives have been drafted by HIP V. HYPE to ensure each climate impact identified within the PSP is comprehensive.

# Objectives and Adaptation Actions – Natural

The average consequence rating for natural impacts was perceived as moderate – with the average risk rating increasing from medium in 2022 to high in the 2070 RCP 8.5 scenario.

To assist in guiding a resilient natural environment within Melton East, the following objectives have been developed:

- Manage natural resources and local ecosystems to promote biodiversity health and resilience [13, 16, 21]
- Manage stormwater to ensure waterway health outcomes, while supporting increased vegetation through passive irrigation [17]
- Consider topography and other natural features in community design and the transport network [21]
- Provide green infrastructure for a range of ecosystem services (including CO2 reduction and habitat for biodiversity), to reduce the heat island effect, and to provide shade for active transport pathways [21]
- To protect, retain and enhance native vegetation and habitat over the long term and promote the creation of conservation and habitat corridors [21]
- To ensure ecological assets are resilient to increasing extreme weather and other climate impacts

| IMPACT | IMPACT AREA | CONSEQUENCE | 2022 RISK | 2070 RCP 8.5 RISK |
|---|---|---|---|---|
| N1 – Stress on flora & fauna | Ecological | Major | High | Extreme |
| N2 – Greater evaporation leading to further loss of water supplies | Ecological, Services and Outdoor / Open Space | Major | High | Extreme |
| N3 – Environmental damage to waterways from more intense rainfall events | Ecological | Moderate | Medium | High |
| N4 – Environmental damage to vegetation from more intense wind events | Ecological | Moderate | Medium | Medium |
| N5 – Increased runoff and flash flooding | Ecological | Minor | Medium | High |
| N6 – Reduced flow into local waterways hindering water quality and biodiversity | Ecological | Moderate | High | High |
| N7 – Amplification of existing water scarcity threats to flora and fauna | Ecological | Moderate | Medium | High |


On-lot rainwater tanks can reduce stormwater flows (lessening damage to local waterways), while also providing alternative water sources for uses such as landscape and garden irrigation. Image by Kim Landy

# Objectives and Adaptation Actions – Natural

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Process Recommendation | Precinct Structure Plan to require subdivision applications to meet a minimum 40% canopy tree cover target within streets (method as per the VPA Evidence base developed by HV.H) | High | N2 | VPA, MCC and developers | Immediately and ongoing |
| Infrastructure Investment | Connect Melton East to the Class B recycled water scheme noted by Greater Western Water, and test capacity of the network to still supply open space irrigation under drought conditions | High | N1, N7, S1, F4, P9 | Greater Western Water | Immediately and ongoing |
| | Environmental Management Plan for Kororoit Creek and conservation area (with Wurundjeri consultation) to guide early vegetation planting and erosion control | Medium | N3 | TBC | Prior to any development |
| | Provide guidance and financial support for the delivery of community garden/s (in collaboration with Council and developers) located within proximity to higher-density areas of the PSP | Medium to High | N1, S2 | VPA, MCC, developers and community | Immediately |
| Design Recommendation / Requirement | Drainage service scheme to be designed to maximise surface water treatments and reduce reliance on underground grey infrastructure | Medium | N3, N6, P8 | Melbourne Water | Immediately |
| | Provide a hydrological regime that provides seasonal water availability to support Seasonal Herbaceous Wetland vegetation within the conservation area and responds to seasonal water requirements and/or water level monitoring information[26] | Medium | N1, N3, N6, N7 | Melbourne Water | Immediately |
| | Planting palette in street trees and parks adopt climate resilient species (with adequate canopy coverage) selection that also responds to underlying soil conditions. Recommendation is to adopt MCC Street Tree list and collaborate on required adjustments (see right) | High | N1 | VPA and MCC | Prior to any development |

Urban canopy cover within the Melbourne CBD. Image by Outdoor Design Source

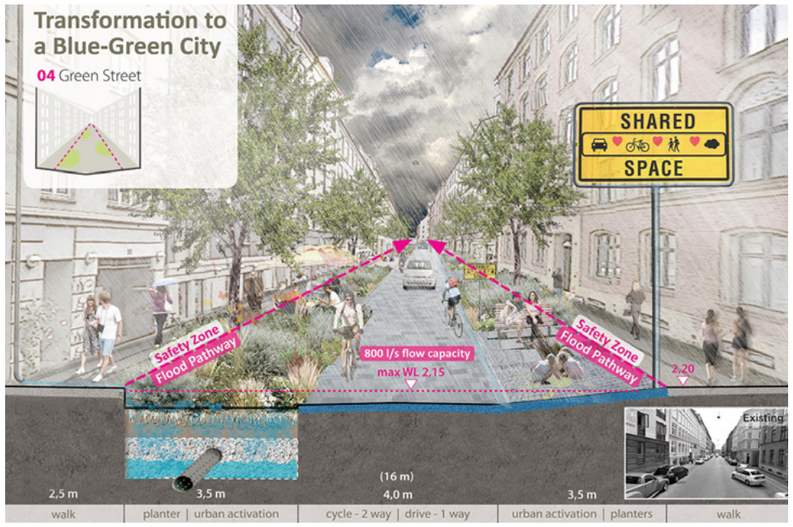
**Species selection for adaptation**

The city of Melbourne has identified the need to utilise tree species that are adaptable and resilient to an increasingly changing climate. Through the Future Urban Forest project, analysis of existing and projected climate data including examinations of temperature, rainfall, drought, and extreme heat has aided the identification of 1) vulnerabilities for current taxa (groups of species) within Melbourne, and 2) a palette of plants adaptable and resilient for Melbourne's future climate. In parallel to the analysis, the project highlights considerations and recommendations including the need for species diversity for increased urban forest resilience, as well as maladaptation awareness to avoid exacerbation of local effects of climate change.

Through a similar project which may be best delivered at the municipal level, the Melton East precinct can develop a locally relevant planting palette that is resilient and adaptive to the increasing dry conditions predicted for the future of Melton/ West Victoria and recognises the challenging soil conditions.

# Objectives and Adaptation Actions – Natural

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Recommendation / Requirement (cont.) | Street trees should be passively irrigated or connected to recycled water where available | High | N1 | VPA and MCC | Immediately and ongoing |
| | Development Services Scheme to control stormwater quality to required levels, including deployment of gross pollutant traps | Medium | N6 | Melbourne Water | Prior to any development |
| | Set minimum standard for soil volumes for large and medium trees (nominally 12m³ for medium trees and 25m³ for large trees) including cross sections to support implementation. | Medium | N4 | VPA and developers | Ongoing |
| | Precinct Structure Plan to require subdivision applications to meet a minimum 35% permeability target within streets (delivered through a combination of increase of landscaping reserve areas, permeable surface treatments for visitor parking, tree outstands, visitor parking provision, reduced pavement widths for residential streets (below traffic volumes). | Medium to High | N5, H2, H3 | VPA and MCC | Immediately and ongoing |
| | Design one or more commercially focused connector streets as 'Cloudburst' typologies which employ a central median with drainage towards the middle of the street section (see right) | Medium | N5 | VPA, MCC and developers | Prior to any development |
| Design Considerations | Planting palette in conservation area(s) to adopt climate resilient species selection (see page 44) | High | N1 | VPA and MCC | Prior to any development |
| | Urban design layout and open space network to support delivery of north-south 'green links' that support fauna movements within the precinct and are connected to the Kororoit Creek | Medium | N1 | VPA and developers | Through PSP |
| | Planting palette for ground cover in landscape verges and other locations which also protect soil from evaporation | Medium | N2 | VPA and MCC | Prior to any development |




An example of cloudburst urban design which utilises blue-green elements to mitigate heavy rainfall events. Image by City of Copenhagen

**Cloudburst urban design**

Following a 1000-year storm event in 2011 which left some areas of Copenhagen inundated with 1 metre of water the city responded with a new approach to urban design. Their 'Copenhagen Cloudburst Formula' is a flexible, universally adaptable model for mitigating flooding in urban environments, using blue-green infrastructure and designing open space areas to have dual functions as water retarding basins during rainfall events.

The model has since been adopted by New York City in their 'Cloudburst Resiliency Planning Study'.

Melton East can adopt similar approaches to key connector streets which have the space to incorporate dual-purpose blue-green median strips to manage high rainfall events.

# Objectives and Adaptation Actions – Natural

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Considerations (cont.) | Undertake feasibility for on-site stormwater harvesting in north east corner of precinct, connecting to residential areas of the precinct (to consider funding mechanism, governance and integration with MW assets) | High | N3, N6, S3, P9, F4 | VPA, Greater Western Water and Melbourne Water | Immediately |
| | Undertake feasibility for on-site rainwater tanks on residential properties (subject to further modelling, this dual-approach will reduce low and moderate flooding impacts by retaining flows on-site.) | High | N3 | VPA, Greater Western Water and Melbourne Water | Immediately |
| | Planting palette to provide guidance on species selection including the avoidance of species susceptible to higher winds - especially on elevated areas in the west of the precinct. Plant trees on elevated areas in copses where possible | Medium | N4 | VPA and MCC | Prior to any development |
| | Consider a variation to increase the permeability requirement in the Small Lot Housing Code requirement to 20% (to encourage two-storey dwellings of modest scale) | Medium | N5 | VPA and developers | Through PSP |
| | Consider the creation of guilgides within landscape planning for the precinct (small depressions in the landscape that can capture inundation and dry out over a few weeks with a variety of plantings to support a diversity of fauna like frogs) | Medium | N7 | VPA and MCC | Prior to any development |
| Operational Opportunity | Develop deep engagement and connection with Friends of Kororoit Creek group – with potential connection of a Melton East chapter for environmental stewardship | Low | N3 | MCC and Friends of Kororoit Creek Group | In combination with initial residential development |
| | Melton Council to increase compliance relating to avoidance of topsoil removal and excessive cut and fill during construction | Low | N4 | MCC | During detailed design (DD) and construction |

Eades Place, West Melbourne. Image by City of Melbourne

**Permeable surfaces for biodiversity and storm water systems**

Permeable surfaces treatments offer an assortment of benefits including enhanced environmental advantages for biodiversity and water systems. As seen in Eades Place, a residential street in West Melbourne, known as one of the hottest streets in the city, permeable surfacing was used to ensure access to water runoff and enhance future canopy cover. Previous impermeable surfacing resulted in severe tree health decline due to increased heat and drought conditions.

Melton East can consider similar surfacing solutions that secure improved biodiversity and stormwater quality outcomes for the precinct.

# Objectives and Adaptation Actions – Social

The average consequence rating for social impacts was perceived as moderate – with the average risk rating increasing from low in 2022 to high in the 2070 RCP 8.5 scenario.

The objectives for building social capital include:

- Provide community infrastructure and services that supports vulnerable communities and promotes social justice and equality [13]
- Deliver a socially connected, inclusive and diverse community with infrastructure and programming to support [17]
- Promote governance and operational arrangements that allow clear roles and responsibilities and partnership between Council, the community and key stakeholders to support participation and community connection [17]
- Design infrastructure including telecommunications and transportation to allow social connection to be maintained during extreme weather events

| IMPACT | IMPACT AREA | CONSEQUENCE | 2022 RISK | 2070 RCP 8.5 RISK |
|---|---|---|---|---|
| S1 – Impact on outdoor sporting events, social gatherings and events | Residents and Community Groups | Minor | Low | Medium |
| S2 – Short term isolation of community members (exacerbating recovery efforts) due to transportation disruptions | Transportation and Residents | Major | Low | High |
| S3 – Water scarcity and restrictions to supply and uses (i·e· no irrigation) | Outdoor / Open Space, Residents, Businesses and Community Groups | Moderate | High | Extreme |

Social groups and the networks that support human interaction are critical in ensuring community resilience . Image by Kim Landy

# Objectives and Adaptation Actions – Social

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Process Recommendation | Ensure climate risks and technical information highlighted in this report are available to both developers and Council as a reference document for the design, delivery and maintenance of assets within the PSP to ensure adaptive capacity is maximised | High | S1, F1 | VPA | Immediately and ongoing |
| Infrastructure Investment | Connect Melton East to the Class B recycled water scheme noted by Greater Western Water, and test capacity of the network to still supply open space irrigation under drought conditions | High | N1, N7, S1, F4, P9 | Greater Western Water | Immediately and ongoing |
| | Provide guidance and financial support for the delivery of community garden/s (in collaboration with Council and developers) located within proximity to high-density areas of the PSP | Medium to High | N1, S2 | VPA, MCC, developers and community | Immediately |
| | Provide funding and spatial allocation for local repair cafés (not only facilitate a step-change towards the circular economy, they also provide spaces for social interactions, knowledge sharing and skill building within the community across diverse groups) | High | Social cohesion + Circular Economy | Developers | Immediately |
| Design Recommendation / Requirement | Provide multiple crossings across key overland flow paths to de-risk, providing more access options for the community and emergency services during storm events | High | S2, F2, P1 | VPA and VicRoads | Through PSP |
| | Provide dedicated space in community centres with access to outdoor space for raising awareness on and learning relating to climate change and sustainable lifestyle choices | Medium | S2 | VPA, MCC and developers | Through PSP and during DD |

Diverse shelter and shading structures at Mount Isa's Family Fun Park. Image by Landmark

**Resilient Parks**

Mount Isa's Family fun park in Queensland received a $840,000 upgrade with new shade structures, seating, tables, softfall upgrade and renewal, and landscaping. The fun park enables community to access and utilise recreation areas and water play using recycled water. Shelters designed for the park included curved and nestled cantilevered shelters customised with laser cut art for the site. With support from Council, the upgrades provide vital infrastructure to attend and enhance future resiliency to increasing climate change impacts. Designing for future impact considerations is vital to ensure community safety and well-being, and Mount Isa's fun park provides a prime example of fit-for-purpose design for weather protection.

There is an opportunity for Melton East to consider urban heat and extreme weather in the design of community spaces for example through establishing parks with improved protection for community members interacting with the space.

# Objectives and Adaptation Actions – Social

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Considerations | Consider shaded activity areas within recreation reserves (e.g. exercise equipment adjacent canopy vegetation or shade structures) and maximising cool routes / shadeways* for access to local destinations like primary schools and neighbourhood parks (see page 48) | Medium | S1, H2, H3 | VPA, MCC and developers | Through PSP and during DD |
| | Consider minor elevation of bridges across overland flow paths to account for sensitivity analysis in hydraulic and hydrological modelling to RCP 8.5 @ 2070. Doing so can reduce damning effect from debris during flood events. Prioritisation should be provided to arterial roads, with connector roads a secondary priority | Medium | P1, P5, P7 , F2 | VPA and Melbourne Water | Prior to design of road network |
| | Consider minor elevation or improved siting of finished floor levels for uses providing critical supplies (e.g. essential retail, fuel / EV charging facilities / refuge centre) based on sensitivity analysis in hydraulic and hydrological modelling to RCP 8.5 @ 2070 | Medium | S2, P6 | Developers and MCC (depending on whether works in kind or delivered by Council) | Immediately and ongoing |
| | Undertake feasibility for on-site stormwater harvesting in north east corner of precinct, connecting to residential areas of the precinct (to consider funding mechanism, governance and integration with MW assets) | High | N3, N6, S3, P9, F4 | VPA, Greater Western Water and Melbourne Water | Immediately |
| Operational Opportunity | Undertake targeted campaign for new residents on saving water and making landscape decisions that still flourish through periods of extended low rainfall (see right) | Low | S3 | MCC | In combination with initial residential development |

* Shadeways (also known as 'cool routes') are streets in which increased levels of green infrastructure and other cooling elements are provided to ensure safe movements for pedestrians. They can be located within central boulevards alongside connector streets or within dedicated pedestrian and cycling reserves. Ideally they contain: canopy cover, rest nodes and drinking stations, light coloured pavement and open bodies of water or passive irrigation for evapotranspiration.

Ceres Environmental Park garden. Image by Ceres

**Community knowledge building for climate resiliency**

Ceres Environmental Park's School of Nature and Climate in Brunswick east offers a dedicated space for the community to access a variety of education and capacity building opportunities focused on climate and environmental topics including energy, climate change, renewables, permaculture, water use, sensitive urban design, waste, urban agriculture, landscape restoration and indigenous ecology. Delivered via workshops and courses and curriculum activities run throughout the year Ceres school enables local residents, schools, and the wider community of Melbourne to build critical knowledge and skills to actively employ to drive forward personal sustainable change.

Melton East can utilise similar pathways, establishing and developing dedicated knowledge spaces within the precinct to build direct community knowledge about individual and collective climate resilience approaches (e.g. food production, waterwise landscape design for backyards etc.).

# Objectives and Adaptation Actions – Financial

The average consequence rating for financial impacts was perceived as moderate – with the average risk rating increasing from low in 2022 to high in the 2070 RCP 8.5 scenario.

The objectives surrounding financial adaptation include:

- Support climate smart and green businesses to operate and flourish [14]
- Ensure climate change adaptation and emission reduction is integrated into relevant governance arrangements, including investment and decision making [20]
- To support the local economy by procuring local materials and labour [21]
- Ensure the design of physical assets reduces the future cost of maintenance and repair
- Reduce climate-related insurance liability through resilient design and operational arrangements
- Ensure life cycle cost is a core driver of infrastructure planning and design

| IMPACT | ASSETS | CONSEQUENCE | 2022 RISK | 2070 RCP 8.5 RISK |
|---|---|---|---|---|
| F1 – Loss of retail expenditure / productivity due to uncomfortable conditions | Businesses and Visitors | Moderate | Medium | High |
| F2 – Supply chain affected by flooding and soil runoff | Businesses | Moderate | Low | Medium |
| F3 – Loss of business continuity to extreme weather events | Businesses | Major | Medium | High |
| F4 – Reduced water security | Residents, Businesses and Community Groups | Minor | Low | Medium |
| F5 – Decreased potable supply and associated increased cost of potable water | Residents, Businesses and Community Groups | Moderate | Medium | High |

Climate resilient public realm design and business operations will help limit financial loss during extreme weather events . Image by Samee Lapham

# Objectives and Adaptation Actions – Financial

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Process Recommendation | Ensure climate risks and technical information highlighted in this report are available to both developers and Council as a reference document for the design, delivery and maintenance of assets within the PSP to ensure adaptive capacity is maximised | High | S1, F1 | VPA | Immediately and ongoing |
| | Provide guidance and support to developers in regards to the procurement of local goods and services (through section in the PSP or engagement workshop between developers and local producers) | Medium | F1 | VPA and developers | Prior to construction |
| Infrastructure Investment | Connect Melton East to the Class B recycled water scheme noted by Greater Western Water, and test capacity of the network to still supply open space irrigation under drought conditions | High | N1, N7, S1, F4, P9 | Greater Western Water | Immediately and ongoing |
| Design Recommendation / Requirement | Develop design guidance and performance targets for non-residential land use areas (see right). This would include:<br>– Awnings for weather protection in commercial streets<br>– Protection for public transport users at all stops<br>– Thermal performance benchmarks for public and education buildings<br>– Shade and extreme weather protection as key design attributes of civic spaces<br>– A 40% tree canopy target | High | F1 | VPA and MCC | Immediately |
| | Provide multiple crossings across key overland flow paths to de-risk, providing more access options for the community and emergency services during storm events | High | S2, F2, P1 | VPA and VicRoads | Through PSP |

Awnings and shaded pubic areas in Point Cook. Image by Forium

**Climate responsive design and economic growth**

Point Cook town centre offers streetscapes and public open space to residents /visitors protected from the elements allowing enhanced enjoyment, comfortability while utilising the area. The precinct features awnings along main commercial streets and shaded public spaces that improve amenity, but also address climate change considerations for community. The main street design presents a robust example of how urban centres can integrate increased protection, urban amenity and canopy coverage to town centres that not only address future climate change impacts but also contribute to an attractive business environment.

There is an opportunity for Melton East to drive masterplanning approaches, targeting multi-faceted objectives of climate change resilience, community enhancement and increased economic growth.

# Objectives and Adaptation Actions – Financial

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Recommendation / Requirement (cont.) | Critical healthcare, essential retail and community centres designed with electricity back-up available during outages batteries (with off-grid capability - islanding) / mobile / fixed diesel generators for critical health care, retail and community services. Council to deliver one community centre / public access buildings (e.g. libraries) with refuge capability (shelter, air conditioning, entertainment, device recharge, improved thermal performance) | Low | F3, H3, P4 | MCC, Department of Health and Human Services and developers | Through Community Infrastructure Assessment |
| Design Considerations | Consider minor elevation of bridges across overland flow paths to account for sensitivity analysis in hydraulic and hydrological modelling to RCP 8.5 @ 2070. Doing so can reduce damning effect from debris during flood events. Prioritisation should be provided to arterial roads, with connector roads a secondary priority | Medium | P1, P5, P7 , F2 | VPA and Melbourne Water | Prior to design of road network |
| | Town centre design to provide circulation for 'click and collect' which is now an essential component of retail, but allows for access to key goods and services during extreme weather events (see right) | Medium | F3 | VPA and MCC | Through PSP |
| | Undertake feasibility for on-site stormwater harvesting in north east corner of precinct, connecting to residential areas of the precinct (to consider funding mechanism, governance and integration with MW assets) | High | N3, N6, S3, P9, F4 | VPA, Greater Western Water and Melbourne Water | Immediately |
| Operational Opportunity | Establish a program for new businesses to develop a Business Resilience Plan - which looks at the impacts of climate change and how business processes can be optimised to minimise impact during extreme weather events | Low | F3 | MCC | In combination with initial commercial development |
| | Undertake targeted campaign for new residents on saving water and making landscape decisions that still thrive through periods of extended low rainfall | Low | F5 | MCC | In combination with initial commercial development |

'Click and collect' and online ordering of essential supplies would reduce access issues and manage panic buying during storm events. Image by Finance Buzz

**Consolidated 'click and collect' and delivery during storms**

Purchasing critical supplies (E.g. food, fuel and medicine) before and during storm events can be a stressful, and at times an impossible task for various members of the community such as the elderly. A surge in demand can cause waiting lines, conflicts between consumers and supply shortages. As society continues to adopt online technologies, providing consolidated 'click and collect' / delivery services for essential supplies both meet this changing consumer patterns and improve accessibility during storm events.

Melton East could consider designing for this function, by coordinating complementary land uses and access points of critical retail such as supermarkets, chemists and service stations. This function would benefit from electricity back-up and enhanced communications access as well as multiple access points to reduce risk of being cut off during storm events / other climate related events.

# Objectives and Adaptation Actions – Human

The average consequence rating for human impacts was perceived as moderate to major (given the importance of human health and well-being) – with the average risk rating increasing from medium in 2022 to high in the 2070 RCP 8.5 scenario.

In regards to human adaptation, the following objectives have been developed or currently exist in key strategic documents:

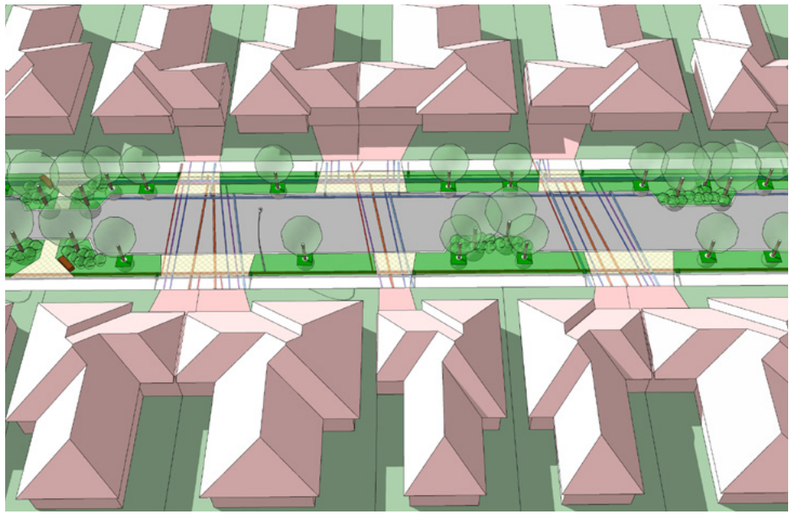
- Ensure urban environments are safe for pedestrian movements and maintain human health through anticipated climate impacts (i.e. heat waves and flooding)
- Support a healthy and happy community through the provision of key services, and the integration of natural features for passive recreation and active connection opportunities
- Provide long term employment, education, creative and recreation opportunities for all members of the community
- Embed physical and mental health as core drivers of the design of infrastructure and services

| IMPACT | ASSETS | CONSEQUENCE | 2022 RISK | 2070 RCP 8.5 RISK |
|---|---|---|---|---|
| H1 – Cumulative mental health stressors, exacerbated by multiple climate events | Residents | Major | High | High |
| H2 – Health impacts from reduced physical activity due to high outdoor temperatures | Residents and Visitors | Minor | Medium | High |
| H3 – More heat-related deaths, particularly among the elderly and disadvantaged | Residents | Catastrophic | High | Extreme |
| H4 – Higher incidence of mental health impacts, trauma and longer term disruptions to social systems – for example, due to lost income and property damage or loss | Residents | Major | Medium | High |

The health, knowledge skills and motivation of the people within a community determines human resilience . Image by Kim Landy

# Objectives and Adaptation Actions – Human

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Process Recommendation | Undertake a dedicated co-design process specifically to resolve high quality street sections and plans for the PSP (see right). This will include representation from utilities (electricity, water supply), Melton CC (including active transport, civil, landscape), VPA, Melbourne Water and major developer representatives | High | H2 | VPA to facilitate | Immediately |
| Design Recommendation / Requirement | Precinct Structure Plan to require subdivision applications to meet a minimum 35% permeability target within streets (delivered through a combination of increase of landscaping reserve areas, permeable surface treatments for visitor parking, tree outstands, visitor parking provision, reduced pavement widths for residential streets (below traffic volumes). | Medium to High | N5, H2, H3 | VPA and MCC | Immediately and ongoing |
| | All residential development must meet the maximum cooling requirements (30MJ/m²) in standard D6/B35 as outlined in the Better Apartment Design Standards | Medium | H3, P2, P4 | VPA, MCC, developers and builders | Through PSP and ongoing |
| | Critical healthcare, essential retail and community centres designed with electricity back-up available during outages batteries (with off-grid capability - islanding) / mobile / fixed diesel generators for critical health care, retail and community services. Council to deliver one community centre / public access buildings (e.g. libraries) with refuge capability (shelter, air conditioning, entertainment, device recharge, improved thermal performance) | Low | F3, H3, P4 | MCC, Department of Health and Human Services and developers | Through Community Infrastructure Assessment |



An example of consolidated service design to allow increased deep soil zones for canopy cover. Image by Spiire.

**Co-designing Street Sections**

Public streets must support a range of critical services that compete for limited space, which often cause conflicts and sub-par outcomes. The potential of canopy cover for example, is often limited by the location of underground services, landscape verge widths and excessive crossovers.

A Co-design process is a collaborative workshop (or series of workshops) where key stakeholders responsible for the elements within public streets (urban designers, Council, developers, water authorities, energy distributors etc.) work together to minimise these conflicts. Alternative approaches to locating infrastructure and on-street parking for example, can yield larger deep soil zones for healthier tree growth and canopy cover which provide shade and urban cooling benefits.

This process is recommended as part of the co-design stage for Melton East in order to address conflicts and competing space requirements and rebalance the role of streets in favour of humans and natural assets.

# Objectives and Adaptation Actions – Human

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Considerations | Consider shaded activity areas within recreation reserves (e.g. exercise equipment adjacent canopy vegetation or shade structures) and maximising cool routes / shadeways for access to local destinations like primary schools and neighbourhood parks (see right) | Medium | S1, H2, H3 | VPA, MCC and developers | Through PSP and during DD |
| Operational Opportunity | Incorporate programming for service delivery for vulnerable households specifically to deal with extended extreme heat scenarios | Low | H3 | MCC and Department of Health | In combination with initial residential development |
| | Build redundancy into critical health care (hospital and clinics) during extreme heat events to cater for spikes in admissions / presentations | Medium | H3 | Developers and Department of Health | Through PSP and during DD |
| | Ensure delivery of community health services has capacity for local mental health and support services such as: psychology, counselling, and gambling and substance abuse, misuse and addiction programs | Medium | H1, H4 | VPA and Department of Health | Through PSP and during DD |
| | Support access to local employment through enhanced connections (physical pathways and increased public transport services) to surrounding activity centres and employment lands such as Cobblebank Metropolitan Centre and the surrounding Rockbank town centres | Medium | H1 | VPA and MCC | Through PSP and ongoing |


The masterplan for Minta Farm, showing the 'Green Links' that runs down the centre of the site with peripheral connections.

**Shadeways and Cool Routes**

Shadeways and Cool Routes (terms used interchangeably) are pedestrian pathways with additional landscaping, canopy cover and other elements (water bodies, light coloured paving , rest stops etc.) to assist in comfortable travel in hotter conditions. Doing so enables more safe and resilient movements of people within a community during hot weather and heat wave events. Minta Farm in the City of Casey includes a system of 'Green Links' that connect residents to each other and key amenity within the community.

Melton East has an opportunity to deliver a similar networkwithin the precinct to facilitate improved active transport outcomes. These links are best located between key open spaces (E.g. playgrounds and public parks), education facilities and retail outlets, and integrated with any regional cycling networks to support all modes of active transport.

# Objectives and Adaptation Actions – Physical

The average consequence rating for physical impacts was perceived as moderate – with the average risk rating increasing from low in 2022 to high in the 2070 RCP 8.5 scenario.

The following objectives aim to increase physical resilience within the PSP area:

- Design and deliver resilient infrastructure that supports the community through effective adaptation and disaster responses [13, 16]
- Support physical and technological innovation that responds to climate change mitigation efforts globally and community needs (i.e. battery storage, recycled material use, next- gen telecommunications) [14, 21]
- Prioritise a human-centred pedestrian network and 20-minute neighbourhood that supports active travel within the PSP [17]
- Locate open space assets alongside key community infrastructure and pedestrian routes while ensuring adaptability to climate impacts [18, 21]
- Ensure the entire built environment system including housing and non- residential buildings are adapted to climate change and contributes to emission reduction [20]
- To integrate land use and transport, including providing for safe, efficient operation of public transport and the comfort and convenience of public transport users [21]
- Ensure buildings are fit for purpose and equipped to respond to increasing frequency and severity of extreme weather events
- To locate and design physical infrastructure and buildings to reduce exposure to climate change impacts (e.g. flooding and extreme heat)

| IMPACT | ASSETS | CONSEQUENCE | 2022 RISK | 2070 RCP 8.5 RISK |
|---|---|---|---|---|
| P1 – Disruptions to roads and supply chains | Transportation, Residents, Businesses and Visitors | Moderate | Low | Medium |
| P2 – Increased energy usage via higher demand for AC/cooling etc. | Housing, Education, Indoor / Recreation, Retail & Employment, Residents, Businesses and Community Groups | Minor | Low | Medium |
| P3 – Loss of transportation routes and connectivity due to infrastructure failure | Transportation, Residents, Businesses and Visitors | Major | Low | High |
| P4 – Power outages due to increased electricity demand on hot days | Housing, Education, Indoor / Recreation, Retail & Employment, Residents, Businesses and Community Groups | Major | Low | High |
| P5 – Loss of usable land - Land subject to inundation in 1:100 ARI event to increase | Outdoor / Open Space, Residents, and Community Groups | Major | Low | High |
| P6 – Building inundation due to flooding | Housing and Residents | Major | Low | High |
| P7 – Transport route inundation or damaged due to flooding | Transportation, Residents, Businesses and Visitors | Moderate | Low | Medium |
| P8 – Stormwater overflow and drain blockages | Services and Services / Ecological | Minor | Low | Medium |
| P9 – Decreased water recycling availability | Services and Services / Ecological | Moderate | Medium | High |

# Objectives and Adaptation Actions – Physical

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Infrastructure Investment | Connect Melton East to the Class B recycled water scheme noted by Greater Western Water, and test capacity of the network to still supply open space irrigation under drought conditions | High | N1, N7, S1, F4, P9 | Greater Western Water | Immediately and ongoing |
| Process Recommendation | To guide the location of open spaces and active transport infrastructure with respect to flooding; open space planning for the Melton East precinct should outline the key types of open space and active transport assets (different programming needs etc.) and develop minimum service levels with respect to occasional flooding (days unusable per decade for example) and irrigation levels to be maintained (during periods of drought) | High | P5 | VPA and MCC | Through PSP |
| Design Recommendation / Requirement | Provide multiple crossings across key overland flow paths to de-risk, providing more access options for the community and emergency services during storm events | High | S2, F2, P1 | VPA and VicRoads | Through PSP |
| | Zoning to encourage service stations / public EV charging to be located with uninterrupted access to Western Freeway and in conjunction with arterial roads that are elevated 'significantly' above the 1% AEP | Medium | P3 | VPA | Through PSP |
| | Design stormwater retention basins to serve multiple functions, including recreation and biodiversity outcomes, with Melbourne Water and others stakeholders as key partners (see right) | Medium | P5 | VPA and Melbourne Water | Prior to development |
| | Locate essential retail, fuel / EV charging facilities on arterial roads for community access during storm events | High | P6 | VPA | Through PSP |
| | Drainage service scheme to be designed to maximise surface water treatments and reduce reliance on underground grey infrastructure | Medium | N3, N6, P8 | Melbourne Water | Immediately |

A revitalised Armstrong Creek with new plantings and infrastructure to support passive recreation. Image by Warralily Estate

**Armstrong Creek revitalisation at Warralily Estate**

Winner of Landscape Victoria's Landscape of the year award in 2017, the Warralily Estate includes 82 hectares of parklands and waterways. The project assisted in a wetland and creekline restoration of Armstrong Creek which saw 3.36 hectares of native grassland re-establishment and over 1 million trees planted within the creek corridor.

The wetland and creek corridor has multiple functions for; stormwater management and biodiversity value while also providing the community with a natural, passive recreation asset to assist in health and well-being outcomes.

Melton East enjoys an opportunity, with Kororoit Creek and the existing wetland depressions which can be designed and linked in a way that assists with the management of water, improves biodiversity outcomes and allows passive recreation and pedestrian movements within the site.

# Objectives and Adaptation Actions – Physical

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Recommendation / Requirement (cont.) | All residential development must meet the maximum cooling requirements (30MJ/m²) in standard D6/B35 as outlined in the Better Apartment Design Standards | Medium | H3, P2, P4 | VPA, MCC, developers and builders | Through PSP and ongoing |
| | All development must have light coloured roofs (i.e. an initial solar reflectance index - minimum 82) | High | P2 | VPA, MCC and developers | Through PSP and ongoing |
| | Critical healthcare, essential retail and community centres designed with electricity back-up available during outages batteries (with off-grid capability - islanding) / mobile / fixed diesel generators for critical health care, retail and community services. Council to deliver one community centre / public access buildings (e.g. libraries) with refuge capability (shelter, air conditioning, entertainment, device recharge, improved thermal performance) (see right) | Low | F3, H3, P4 | MCC, Department of Health and Human Services and developers | Through Community Infrastructure Assessment |
| | All dwellings to have a minimum solar PV system plus pre-wiring for EV-ready homes. (In the near future, EV's will be used as mobile batteries to power homes. They can eliminate the risk of power outages by both reducing the load on the grid, and providing households an alternative if a blackout is experienced.) | Medium | P4 | VPA, developers and builders | Through PSP and during DD |
| | All public access and major commercial buildings designed with roof plumbing (e.g. gutter capacity) able to cater for 56% increase in 1 in 20 year wettest day | Medium | P6 | VPA, developers and builders | Through PSP and during DD |

Cool Centres are located in community facilities and Churches. Image by Blacktown City Council

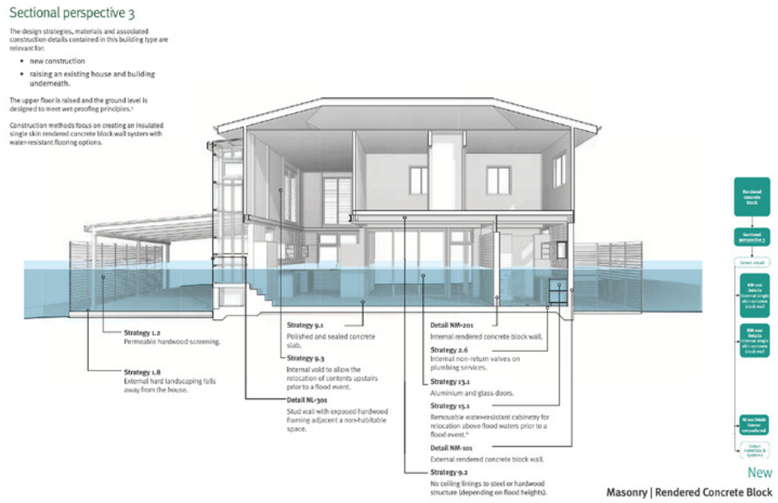
**Refuges in extreme weather**

Refuges are common adaptation measures, used globally for vulnerable people during times of prolonged heat or 'heatwaves' and other extreme events. A refuge is a building/space offering safety to outside conditions and basic facilities to provide the community with relief. Blacktown City Council in west Sydney has begun trialling a heat refuge program where venues, community spaces and council will work in partnership to offer 'Cool Centres' for community relief from environmental temperatures which are projected to climb. Extreme heat impacts community health via interrupted sleep, decreased exercise and/or movement, and dehydration. The Cool Centres have air-conditioning, drinking water, toilets, and family friendly activities, and will be available to the public when the BoM issues severe of extreme heat warnings. Currently five Cool Centres are available for use including three community centres/hubs and two churches.

Designated places are increasing in popularity as community look towards government for support during increasingly frequent heat waves and other weather events. Melton East can similarly develop such refuges, employing partnership to establish refuge centres that address the needs for community safety and adhere to emergency standards and specifications including back up electricity supply.

# Objectives and Adaptation Actions – Physical

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Consideration | Consider minor elevation of bridges across overland flow paths to account for sensitivity analysis in hydraulic and hydrological modelling to RCP 8.5 @ 2070. Doing so can reduce damning effect from debris during flood events. Prioritisation should be provided to arterial roads, with connector roads a secondary priority | Medium | P1, P5, P7 , F2 | VPA and Melbourne Water | Prior to design of road network |
| | Telecommunications towers preferentially located on higher land where flooding issues are unlikely to cause interruptions, with larger buildings in activity centres designated for temporary infrastructure to support telecommunications during extreme events (i.e. specified with a portion of flat rooftop to support temporary towers) | Low | P3 | VPA and telecom providers | Prior to construction |
| | Consider minor elevation or improved siting of finished floor levels for uses providing critical supplies (e.g. essential retail, fuel / EV charging facilities / refuge centre) based on sensitivity analysis in hydraulic and hydrological modelling to RCP 8.5 @ 2070 | Medium | S2, P6 | Developers and MCC (depending on whether works in kind or delivered by Council) | Immediately and ongoing |
| | For buildings located within 1% AEP areas, consider flood-proof design for lower levels (raised General Power Outlets (GPO's) / masonry finishes) if urban design is compromised by significantly raising finished floor levels (see right) | Medium | P6 | VPA, developers and buillders | Through PSP and during DD |
| | Major roads should consider appropriate vegetation to stabilise verges, battering and scour-prevention measures. Street sections should note slopes for at-risk major roads (e.g. either sides of bridges) or connectors that dip into inundation zones | Medium | P7 | VPA and VicRoads | Through PSP and during DD |
| | Capacity of larger underground stormwater pipes (>600mm dia) to ensure capacity for an increase of 56% increase in 1 in 20 year wettest day | Medium | P8 | VPA and Melbourne Water | Through PSP and during DD |




An example of the detailed cross sections provides in the flood resilient guide
Image by Queensland Government

**Flood Resilient Building Guidance in Queensland**

The Queensland Government published a flood resilient guide for homeowners following a series of unprecedented flood events in urban areas.

The guide provides design advice for a variety of housing typologies and materials (masonry, steel and timber framed homes). Some of the interventions include:

- Replacing batt insulation with closed cell rigid insulation
- Detachable kitchen benches that can be moved prior to flood events
- Elevate electrical services, hot water units and AC condensers

The guide highlighted payback periods of 1-12 years and provided a case study of a house in Graceville which installed a number of the flood resilient designs, reducing their insurance premium from $5,253 to $3,133 per annum, a 40% saving.

Melton East could employ a number of the (relevant) design outcomes listed in the guide to increase resilience of buildings located within the 1% AEP flood areas.

# Objectives and Adaptation Actions – Physical

| | ACTION | PSP INFLUENCE | ADDRESSING IMPACT | RESPONSIBILITY | TIME FRAME |
|---|---|---|---|---|---|
| Design Consideration (cont.) | Undertake feasibility for on-site stormwater harvesting in north east corner of precinct, connecting to residential areas of the precinct (to consider funding mechanism, governance and integration with MW assets) | High | N3, N6, S3, P9, F4 | VPA, Greater Western Water and Melbourne Water | Immediately |
| | Electricity infrastructure planning and design to consider opportunities for precincts to operate as micro-grids to 'island' during power outages | Low | P4 | VPA and Powercor | Immediately |
| Operational Opportunity | Local preparedness and response planning to consider Strategy and Action plans for disaster and emergency management focusing on (see right):<br>– Establishing centralised connection network hubs- emergency buildings i.e. CFA, community neighbourhood houses utilised for emergency connectivity during a disaster<br>– Pre-deployment and pre-positioning of assets including equipment, personnel, resources i.e.. Mobile generators, backup fuel, cell on wheels (COWs), Cell-on-Light Trucks (COLTs),and temporary microwave/satellite communications necessary for service recovery<br>– Path diversification enhancing telecommunication network resiliency (combined utilisation of terrestrial lines, Very Small Aperture Terminal (VSAT) satellite communication network, Cell towers, and traditional emergency responses (COWs, Flying COWs- drone network tethered to vehicle-based ground station)<br>– Expansion of fuel models reliance away from fossil fuels and pre-staged *appropriate for local area (dependent on accessibility- solar, hydro, wind)<br>– Technological innovation utilisation (e.g. mesh extenders and drone networks) | TBC | P3 | Multiple stakeholders to be resolved | Through PSP and ongoing |

Temporary mobile networks . Image by Verizon

**Hybrid Telecom network preparedness**

Hurricane Michael, (Cat 4) made landfall in Oct, 2018 in Florida U.S. causing widespread devastation. Robust Telecommunication preparedness and recovery planning enabled rapid response, returning networks to full capacity for the community. Ahead of landfall, asset pre-deployment and pre-positioning including personnel and resources i.e. mobile generators, backup fuel, cell on wheels (COWs), Cell-on-Light Trucks (COLTs), flying COWs (drone cell networks tethered to vehicle-based ground stations), temporary microwave/ satellite communications (VSATs), and wireless emergency communication centres were initiated and established to mitigate adverse network impacts. Utilising hybrid network path diversification assets enabled network resiliency via a broad array of telecom options when failures occur.

There is a similar opportunity for Melton East to emulate hybrid network preparedness and recovery planning to strengthen resiliency and network efficiency for the community.

# Building Social Resilience and Adaptive Capacity

This technical background report focuses primarily on responses that a Precinct Structure Plan, as a planning instrument can or could control as outlined on pages 42 to 60.

However, there are significant community building opportunities which may be beyond the scope of the PSP, but are highlighted here for further consideration to strengthen the social resilience and adaptive capacity of the future community.

These opportunities respond to the fact that communities which have a strong social fabric are the best able to cope with shocks and stressors.

An overview of these opportunities is provided to the right with the delivery varying from partnerships and collaboration to seed funding and modified governance arrangements.

## BUILDING SOCIAL RESILIENCE

### Good Karma Network/s

Good Karma Networks (GKNs) are online platforms where people can ask their neighbours for help[11]. Often hosted through Facebook as monitored groups, they extend the notion of 'asking your neighbour for a cup of sugar' to borrowing tools, looking for lost pets, finding babysitters and much more.

While such a requirement can't be written into a PSP, sponsorship / seed funding for setup may be used as a tool in building social cohesion and resilience in numbers.

### Local procurement

To build resilience into the local economy and support buying goods and services locally, we recommend that simple mechanisms such as local trades and services lists be developed as the community evolves. Successful models have been employed in primary schools where parents can recommend local services. This can obviously not be controlled by the PSP, but can be highlighted as an operational phase opportunity.

### Event activation

Another method to activate community and commence building of the local social fabric is through events and community programming. Early development of town centres is critical, but as the community evolves, developer or Council led events (arts, sport, cultural) and support for community run events are highly encouraged as immediate opportunties to allow community to mingle and start to form local networks.

### Kororoit Creek Custodianship

While there are a number of adaptation actions proposed through the PSP that aim to manage and improve the health of Kororoit Creek, the long-term health of the creek will also depend on a combination of paid and volunteer management.

Groups such as Friends of Kororoit Creek (pictured above) help establish custodianship and connection to local natural assets. Image by Friends of Kororoit Creek Facebook Group

Building a sense of custodianship and connection with the creek is critical. Existing groups such as 'Friends of Kororoit Creek' could be engaged to run revitalisation and planting days within the precinct to build that connection with the new residents.

### Fitness and Run Clubs

Group exercise is a great way to meet new people and improve health and well-being outcomes. As a result of COVID-19 there was an increase in the number and popularity of informal running clubs within Melbourne (and beyond).

From The Megarun, which hosts runs in every major city, to smaller niche groups such as AM:PM and Hunter Athletics (both Melbourne-based) – there is a group and pace for everyone.

Supporting the development of a similar group within Melton East would not only increase use of the active transport network, but also assist in building social connections and improve health outcomes within the community.

# Carbon Reduction

# Carbon Reduction Analysis

The focus of the technical analysis for the Melton East precinct is on climate resilience, in particular the reduction of climate impacts already being experienced and likely to get worse in climate change scenarios into the future.

The precinct can and should however also act to limit the carbon emissions associated with its operation as a global and local contribution with reducing the root cause of climate change.

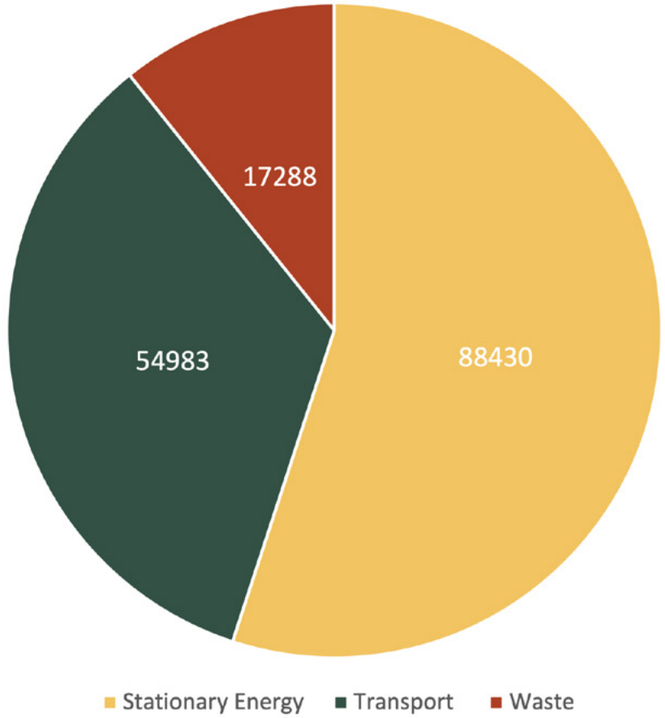
To assist in quantifying the benefit of a range of actions, HV.H has developed a basic baseline emissions profile and associated model for a future 2040 Melton East community, based on full roll out of the precinct comprising 35,000 residents and 4,000 workers. More detailed assumptions for the model are provided in Appendix F.

## CARBON EMISSIONS MODEL

The emission scope for the Melton East precinct will include the following sources. The majority of these are Scope 1 and 2 emissions, however the waste category includes some Scope 3 emissions. The key driver to decisions on what Scope 3 components are included is relevance - asking the question as to what it is within the power of key stakeholders to influence within the geographic boundary of the Precinct Structure Plan.

- Stationary Energy
  - Residential buildings
  - Commercial and other non-residential buildings
- Transportation
  - On-road
  - Public transport
- Waste
  - Solid waste disposal

The pie chart opposite represents the breakdown of emissions sources in a BAU scenario in 2040. Each ‘wedge’ includes the emissions sources outlined, noting that the emissions profile does not include all Scope 3 emissions.




The breakdown of baseline emissions (tonnes C02) for stationary energy, transport and waste. Image by HIP V. HYPE

# Stationary Energy

Stationary energy emissions include all residential and non-residential emissions from buildings operating in the precinct. In some carbon models, this would extend to include infrastructure such as streetlights, pumps etc. As this is a very small component of overall energy however, it has been excluded from the emissions profile in this case.

The emissions are from electricity (scope 2 and 3) and gas (scope 1). Objectives for reducing stationary energy related emissions include:

- Deliver the foundation for net zero greenhouse gas emissions by 2050 [13, 14]
- Reduce energy use through energy efficient design and construction
- Reduce reliance on fossil fuels through prioritising the delivery of an all-electric approach
- Maximise the generation of renewable energy locally

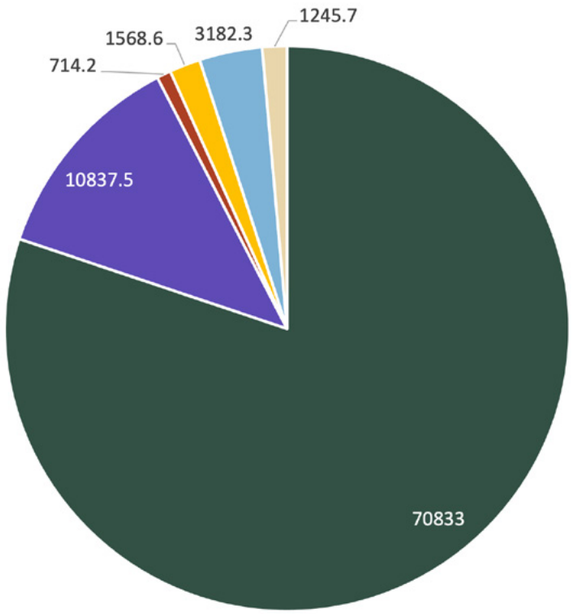
A baseline scenario has been developed which includes electricity and gas supply to all buildings within the precinct and no planning controls in place to influence energy efficiency or renewable energy uptake.

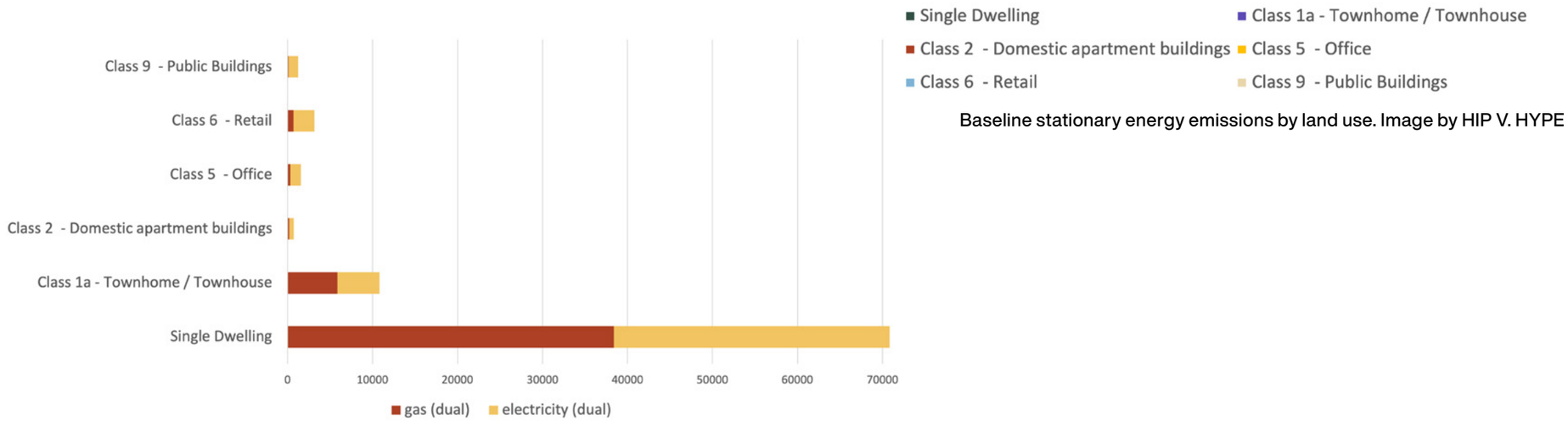
The baseline scenario assumes no change to building and planning legislation to 2040, but does envisage a declining greenhouse intensity of the Victorian electricity network, based on current targets and commitments.

Under the baseline scenario, the indicative emissions from buildings within Melton East in 2040 are outlined opposite.

To drive down energy related emissions, four options have been modelled;

- Option 1 - All electric buildings
- Option 2 - All electric with energy efficiency
- Option 3 - All electric with solar PV (with sensitivity testing to cater for increased EV penetration)




Baseline stationary energy emissions by land use. Image by HIP V. HYPE

Baseline emissions delineated by gas and electricity across the land use categories. Image by HIP V. HYPE

# All Electric Buildings

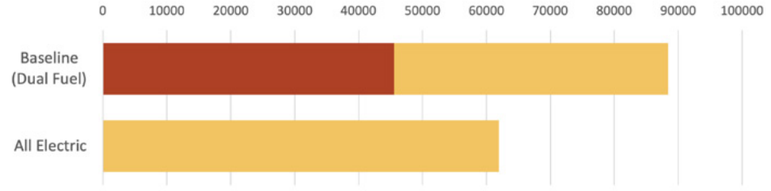
## DESCRIPTION

The provision of natural gas locks in fossil fuels that contribute to climate change, and requires expensive and path dependant infrastructure to deliver to customers. The Victorian Government's commitment under the Climate Change Act 2017 to reduce greenhouse gas emissions for Victoria to zero net emissions by 2050 requires a phase out of gas. The recently released Gas Substitution Roadmap does not rule out alternative gases (such as hydrogen and biomethane), however the uncertainty around their cost and availability means that this assessment has assumed all-electric as precedent exists commercial.

Improvements in technology have enabled highly efficient all-electric alternatives to gas applications such as heating, hot water and induction cooking. This action involves a restriction on gas to the residential areas of the precinct. A low carbon precinct is dependent on the removal of a natural gas supply i.e, is required to meet precinct, municipal and State ambitions for GHG emissions reduction. An alternative infrastructure investment (for solar, distribution and batteries) is required to ensure the precinct can support an all-electric fuel supply. We note that this proposed infrastructure restriction applies to mains gas supply only and for some cultural backgrounds bottled gas for cooking may be preferable and acceptable (given the small amount of energy required for cooking), while avoiding permanent infrastructure and connection fees and offering an easier transition to electric alternatives.

### Carbon Impact

- Reduction in carbon associated with stationary energy consumption, based on declining carbon intensity of the electricity network
- Carbon impact is provided below, based on a reduction in heating and cooling demand and a replacement of key appliances at the dwelling level with electric alternatives




Baseline (dual fuel) versus all electric (tonnes C02). Image by HIP V. HYPE

## BENEFITS

### Social

- Reduced health impacts from gas usage

### Environmental

- Reduces the carbon emissions associated with energy consumption
- Electricity can be matched with solar generation on site or locally, gas cannot
- Avoided double up of embodied carbon of space conditioning appliances (under a gas scenario, a separate heater and air con is required)

### Economic

- Gas prices have seen a significant rise
- Avoided costs of installing new utility (i.e. gas) only to eventually retrofit with inevitable reduction in gas to meet state-wide emissions reductions targets
- Provides industry with the certainty to invest and innovate
- Avoiding gas supply saves residents a $260 + supply charge annually
- Avoided future cost of transitioning gas infrastructure to meet State zero net emissions 2050 target
- Avoided the risk of stranded gas assets

## COST IMPLICATIONS

- Research has found that all-electric class 1 detached dwellings are not expected to cost more than dual-fuel equivalents, and all-electric townhouses can cost less[25]
- The operational benefit of all-electric dwellings is approximately $750 per year (compared to a dual-fuel home), with solar providing additional savings of $1,000 per year, and a battery providing a further $440 of operational savings

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Potential for pressure from developers / industry associations for gas

### Social

- Potential expectation of gas as a choice in the energy mix (for cooking in particular)

### Technical

- No specific built form controls within current planning schemes mandating all-electric buildings
- Slightly increased electricity infrastructure requirement due to increased peak demand (Confirmation from DNSP about any impact on the sizing of electricity infrastructure (e.g. additional sub-stations)
- 3-phase power optimal for all-electric homes (to support EV charging)


High energy efficient Daiken split-systems offered as part of resident packages at The Cape. Image by The Cape

# All Electric with Basic Energy Efficiency

## DESCRIPTION

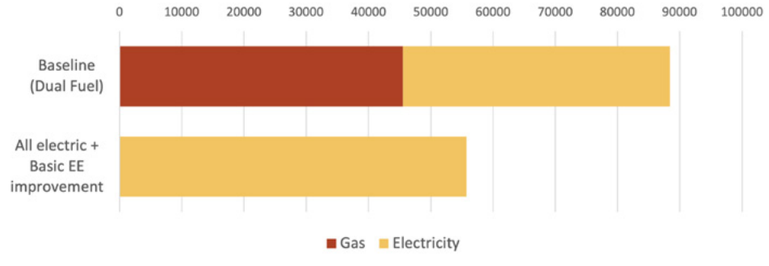
Buildings with improved thermal performance and energy efficient appliances will consume less energy - reducing operational energy costs while improving energy security for residents.

This design recommendation sets in place a 10% improvement on National Construction Code standards at the whole of building level.

Improvements may include: orientation to maximise solar exposure, building fabric and insulation improvements and glazing as well as optimisation of appliances and building services. The implementation mechanism would be either through the PSP, or through Design Guidelines which could be used to implement other outcomes relating to built form.

### Carbon Impact

- Reduction in stationary energy consumption for heating and cooling leading to lower carbon emissions
- Carbon impact is provided below, based on an estimated 10% improvement on the energy use.




Baseline (dual fuel) versus all electric and energy efficiency improvements (tonnes C02). Image by HIP

## BENEFITS

### Social

- Creation of more liveable environments by improving the indoor air quality for all buildings
- Passive design principles for balanced thermal comfort can lead to an improvement in health outcomes of residents / workers

### Environmental

- Reduces the carbon emissions associated with energy consumption in buildings, supporting state and local emissions reduction targets
- Meet environmental objectives faster through precinct wide application
- Improved climate resilience to extreme heat

### Economic

- Reduced heating and cooling bills for households and businesses (lower life-cycle costs)
- Could potentially reduce the additional electrical network infrastructure required to service a growing precinct (due to less demand from energy efficiency)
- Improved building value
- Reduced pressure on energy grid during heat events

## COST IMPLICATIONS

- Costs for improved energy performance are borne by the developer / builder initially but incorporated into the purchase cost. Generally speaking there will be a minor increase in the development cost, which is almost always offset by lower operational costs, often within a short payback. Sources indicate a potential increase in cost of $12 per sqm for a 28% increase in dwelling thermal performance
- Operational benefits vary depending on pathway chosen to meet 10% improvement.

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- State wide ESD policies are under development and could potentially duplicate place based controls for improved energy performance

### Financial

- There is a small increase in build cost relating to the building fabric

### Social

- Optimum performance is reliant on a degree of behaviour change by tenant

### Technical

- Integration of thermal efficient best practice with building designs
- Engagement and support of volume builders to deliver, and exceed BCA minimum requirements

Orientation, building fabric and glazing all set the foundation for energy efficient homes. Image by Elmwood Living

# All Electric with solar standards

## DESCRIPTION

The provision of renewable energy generation at the building scale is critical in pursuing emissions reduction for stationary energy. At the building-scale, dwellings use roof space for solar PV to offset electricity consumption behind the meter (where the full retail cost of electricity can be avoided).

The declining cost of solar and government programs in recent years have confirmed a very strong business case for solar at the building level.

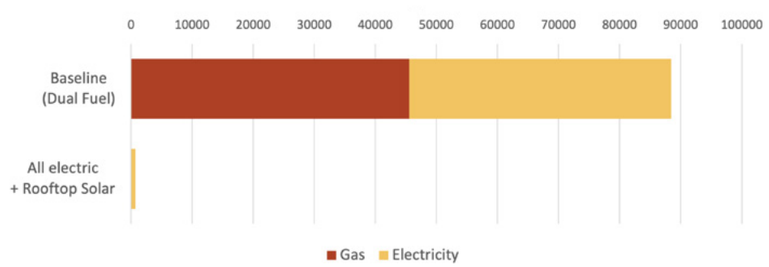
A building level control based on the following is recommended to implementing either through a Design Requirement in the PSP or a via Design Guidelines. To match demand the following is recommnended:

- At least 7.5 kWp for each single dwelling
- At least 4.5 kWp for each town house
- 75% of unencumbered roof space for all other buildings

If delivered, this is the most significant carbon reduction opportunity in the precinct by far.

### Carbon Impact

- Reduction in carbon associated with stationary energy consumption
- The mechanism offsets the electricity consumption only, so subject to adoption of an 'electric only' precinct the impact of this mechanism can increase the benefit of a system
- A larger system standard could be specified to provide additional capacity to provide renewable energy for EV's




Baseline (dual fuel) versus all electric, energy efficiency improvements and rooftop solar (tonnes C02). Image by HIP

## BENEFITS

### Environmental

- Reduces the carbon emissions associated with energy consumption, the larger the system size the greater the environmental benefit (noting best outcome when this is combined with an all electric home)

### Economic

- Standalone solar PV systems tend to have a payback period of under 7 years in the vast majority of residential applications (this changes in response to the amount of self consumption)
- No transmission losses when energy is self consumed
- Job creation for local renewable energy companies
- Availability of government grants / rebates
- Decreasing technology costs (for panels and batteries)

## COST IMPLICATIONS

- The cost of solar PV is borne by the developer initially but incorporated into the purchase cost. Sources indicate an increase in cost of approximately $1000 per kWp
- The operational benefit of this investment is approximately $1,000 per year in 2022 dollar terms and is expected to increase if energy prices rise

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Mandating renewable energy may be opposed by some developers / residents

### Financial

- There is an increase in capital cost of the dwelling
- Uncertain value of export value of solar generation in 2040

### Technical

- Depending on grid capacity generation may have to be 'export limited' meaning that a cap of say 2kWp can be exported
- Unless coupled with an electric only home, the benefit is somewhat limited by the retention of gas

## ENERGY NETWORK INNOVATION

As outlined in the previous sections and with high levels of solar penetration with support from a neighbourhood battery, there may be the opportunity to design the electricity network to 'island' to improve resilience to widespread blackouts and provide other demand management benefits.

This sort of approach would need to form part of early infrastructure planning for the precinct and require broad stakeholder alignment and benefit sharing.

It is not a recommendation for this project at this stage, as it requires standalone feasibility.

# Transport

Transport emissions include those resulting from travel activity within the precinct and from and to the precinct. There are four modes considered in this analysis, including walking, cycling, public transport and private vehicle.

Some forms of public transport and private vehicles cause emissions, however walking and cycling do not.

Transport emission reduction is guided by the following objectives:

- To integrate land use and transport
- To provide for safe, efficient operation of public transport and the comfort and convenience of public transport users
- To provide a safe, fully connected and integrated active travel network
- To provide for convenient community and retail infrastructure to reduce the length and number of transport trips

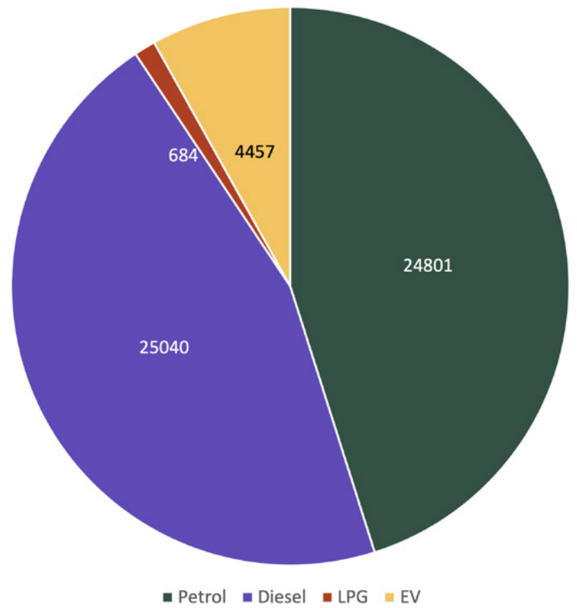
This baseline scenario for 2040 has been developed which includes emissions emanating from private vehicles (comprising passenger vehicles, commercial vehicles and trucks).

The baseline scenario also considers emissions emanating from public transport, but assumes that the Melton train line has been electrified and is 100% renewable consistent with existing policy commitments.

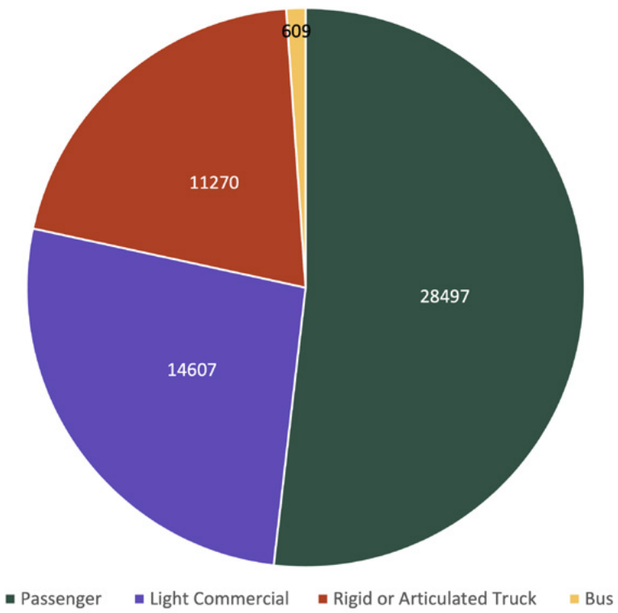
The baseline scenario also considers only a modest EV uptake based on no existing Federal and State policy.

To drive down transport related emissions, four options have been modelled;

- Option 1 - Increased Active Travel
- Option 2 - Optimised land use and local services
- Option 3 - Accelerated EV transition
- Option 4 - Combination of measures above




Transport emissions by fuel type (tonnes C02). Image by HIP V. HYPE




Transport emissions by vehicle type (tonnes C02). Image by HIP V. HYPE

# Optimised Land Use and Local Services

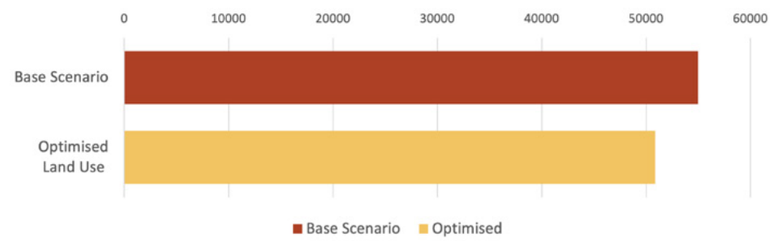
## DESCRIPTION

An optimised site layout which minimises the length of trips and the ability to service more than one need with a single trip is a critical determinant of both reducing trip numbers and lengths (making them more able to be serviced by active transport). From a precinct design perspective, this means the following:

- Infrastructure investment to ensure high school located in the precinct and maximum level of recreational and community investment to reduce out of precinct trips
- A number of design considerations, including:
  - + A minimum of two local town centres within the precinct, with strong town centre amenity to make them attractive for the vast majority of daily and weekly needs (avoiding longer trips east to the or south)
  - + Location of higher density locations adjacent to open space and town centres to ensure ready access to these amenities for the maximum number of the new population
  - + Targeting increased residential densities as outlined in the updated Precinct Structure Planning guidelines

### Carbon Impact

- Increased number of trips which can be serviced within the precinct, instead of relying on out of precinct trips
- Combined impact is demonstrated below in relation to transport




The base scenario for transport emissions (tonnes C02) against the reductions associated with optimised land use and local services. Image by HIP V. HYPE

## BENEFITS

### Social

- Improved walkability encouraging physical activity
- Increased diversity of housing types catering for a wider range of household types, increasing social diversity

### Environmental

- Reduced emissions from private vehicle trips by car due to ability to access community infrastructure by active transport means and shorter private vehicle trips
- Achieve a more compact sustainable urban area reduced pressure on housing supply in productive rural areas

### Economic

- Appropriate siting and increased density around retail convenience and community facilities will improve its economic viability
- Smaller lots meeting affordability/student/aged care housing need

## COST IMPLICATIONS

- The costs are relatively intangible and borne by different parties
- Community assets would be owned and operated by Council facility (funded through the Infrastructure Plan)
- Holding costs may accrue to landholders to ‘preserve’ super-lots for future medium density closer to services

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Lack of co-ordination in delivery due to varying ownership of land
- Desire by developers to progress development on own timeframe
- Potential pressure to maintain conventional densities if a ready market for denser housing typologies is not clear

### Financial

- Lack of viability of retail centre and/or secondary school in early stages of development
- Costs of holding larger lots while local housing market matures to support higher density housing choices
- Market resistance and cost to develop smaller lots (compared to business as usual)
- ‘Off the shelf’ housing products may not fit on smaller lots

### Social

- Potential resistance to denser housing typologies/preference for single detached dwellings
- Establishing active transport culture for shorter trips


Early delivery of town centre and retail amenity in Ecco Ripley, QLD. Image by Sekisui House Australia

# Accelerated Electric Vehicle Transition

## DESCRIPTION

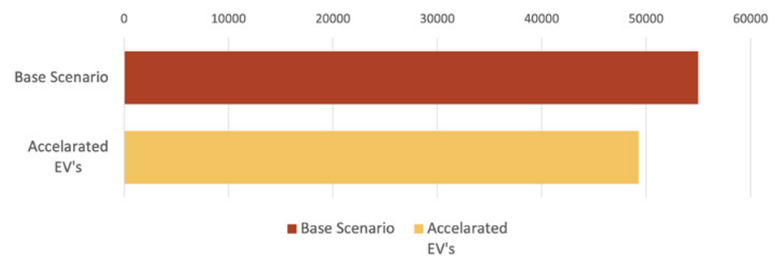
This action involves supporting a rapid acceleration of the uptake of electric vehicles through a combination of measures including:

- Design requirements for the provision for EV infrastructure at the dwelling-scale (wiring for future EV capabilities while allowing residents flexibility for location and equipment choice)
- A design requirement for the provision of public EV charging infrastructure at each neighbourhood level activity centre and service station within the precinct (charge speeds should reflect anticipated 'dwell time' of users)
- An infrastructure investment for alternative-fuel bus (EV and/or hydrogen) roll-out in new routes in the Melton East area

Acknowledging the transition away from Internal Combustion Engines (ICE) and providing fundamental infrastructure to support the uptake of Electric Vehicles (EV) is critical to creating a future-proofed, low carbon community. The Zero Emission vehicle (ZEV) Roadmap has targeted 50% of light vehicle sales to be ZEVs by 2030, however there will be significant lag for used cars. This will be key to meeting the Victorian Government's commitment under the Climate Change Act 2017 of zero net emissions by 2050, with an intermin target of a 50% reduction of 2005 levels by 2030.

### Impact

- Reduction in carbon emissions associated with vehicle and public transport trips (in particular as carbon intensity of grid declines or if charging is via renewable sources of electricity)
- Carbon impact is provided below, based on an accelerated take up of electric vehicles and buses




The base scenario for transport emissions (tonnes C02) against the reductions associated with accelerated EV use. Image by HIP V. HYPE

## BENEFITS

### Social

- Removes barriers/incentivises uptake of electric vehicles
- Lower noise impact and reduced air pollution will have positive health benefits across the precinct

### Environmental

- Reduction in emissions relating to private transport (a trip by an EV reduces emissions by 60% compared to a petrol vehicle in 2030, and by 80% in 2050 and by 100% if the electricity is renewably sourced). Note the impact is based on the action, ie a marginal increase in EV uptake (not the impact of the EV transition overall)
- EV batteries can make better use of solar PV if there is low daytime usage, 'soaking' up excess solar generation that may otherwise be lost if the network can't accomodate feed-in during these times

### Economic

- More cost effective to make provision for EV infrastructure requirements in the design and development of buildings, rather than as a retrofit
- Promote economic activity in neighbourhood activity centres

## COST IMPLICATIONS

- Likely to be life cycle benefits to owners of EVs as total cost of ownership lower than traditional vehicles by late 2020's
- Cost implication of mechanism to owners restricted to pre-wiring of garage (<$800) for a single phase 32 A Mode 3 EVSE

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Mandating EV charging infrastructure has not previously been implemented in a growth area context

### Financial

- Upfront cost of installation of EV infrastructure before wide-scale use/take up of EVs must be justified
- Cost of EV vehicles are declining but still high and current supply chain issues

### Social

- Public education and delivery of public charging to overcome 'range anxiety' will also be critical (despite the majority of charging to occur at home)

### Technical

- Rapidly changing technology area, would need to maximise opportunity for vehicle to grid (V2G) in future


EV Charging at the Cape. Image by Kim Landy

# Increased Active Travel

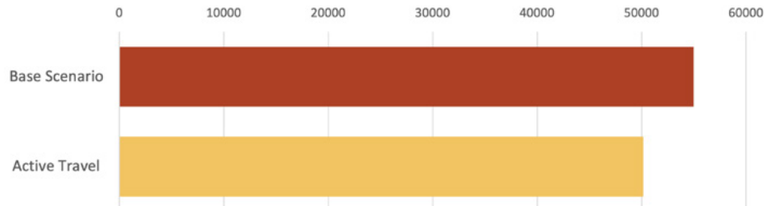
## DESCRIPTION

This action supports a range of government objectives to encourage modal shift from private vehicle use to walking and cycling. From a precinct design perspective, this means the following:

- **Design recommendations** to significantly improve the amenity of local streets (as outlined in the climate impacts section of this report including increased amenity and extreme weather protection)
- Making an **infrastructure investment** in dedicated, safe and connected active transport to major destinations outside the precinct including Melton Town Centre in the west, Woodlea Activity Centre in the east, Toolern Employment precinct and Rockbank Train Station
- The following design considerations
  + Ensuring east-west connectivity for cycling between activity nodes within the precinct, through consideration of active travel in road connections for east-west connection
  + Integrating shared use paths into Kororoit Creek reserve
  + Reducing travel speeds in local streets through a range of mechanisms including narrowing of road pavement
  + Ensuring that safe travel exists around primary and high schools such that cycling can be encouraged from early age

### Carbon Impact

- Reduction in vehicle trips per day (transport related carbon emissions)
- Carbon impact is provided below, based on a 10% increase in mode share due to improved infrastructure provision




The base scenario for transport emissions (tonnes C02) against the reductions associated with increased active travel patterns. Image by HIP V. HYPE

## BENEFITS

### Social

- Health benefits of increased active transport (walking/cycling)
- Ability to integrate pedestrian network with key precinct activities

### Environmental

- Reduction in carbon related to private transport
- Improved air quality
- Ability to combine conservation and active travel

## COST IMPLICATIONS

- Active transport shared paths and on-road funded through infrastructure plan
- An accurate cost for shared use path (2.4m) is being sourced
- Every active transport trip reduces the cost of personal vehicle travel - a 5km trip at ATO rates cost a driver approximately $3.50

Yarra City Trail. Image by RACV

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Demonstrating community uptake
- Land allocation for active travel infrastructure

### Financial

- Up front cost of provision

### Technical

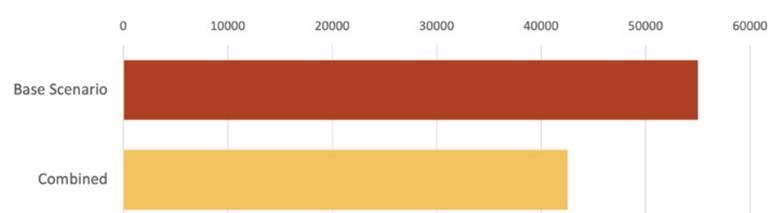
- Staging of rollout may leave infrastructure gaps for longer periods, locking in poor travel behaviour
- Planned activity centre within the precinct may not contain enough services, leading to external trips
- Alignment required with VicRoads and local government (particularly transport) in relation to delivery of public realm infrastructure such as cycling lanes and pedestrian areas

### Social

- Behaviour change within the community around active commuting may be difficult to influence

## REDUCTIONS ASSOCIATED WITH A COMBINATION OF STRATEGIES

The graph below provides an overview of the reductions possible if all three sustainable transport scenarios are realised.




The base scenario for transport emissions (tonnes C02) against the reductions associated with all actions being adopted. Image by HIP V. HYPE

# Waste

**Waste emissions include those resulting from residential and non-residential activity within the precinct. The most impactful waste streams from an emissions perspective are food and garden waste (FOGO) and paper and cardboard. Both these waste types cause methane emissions through anaerobic decomposition in landfills.**

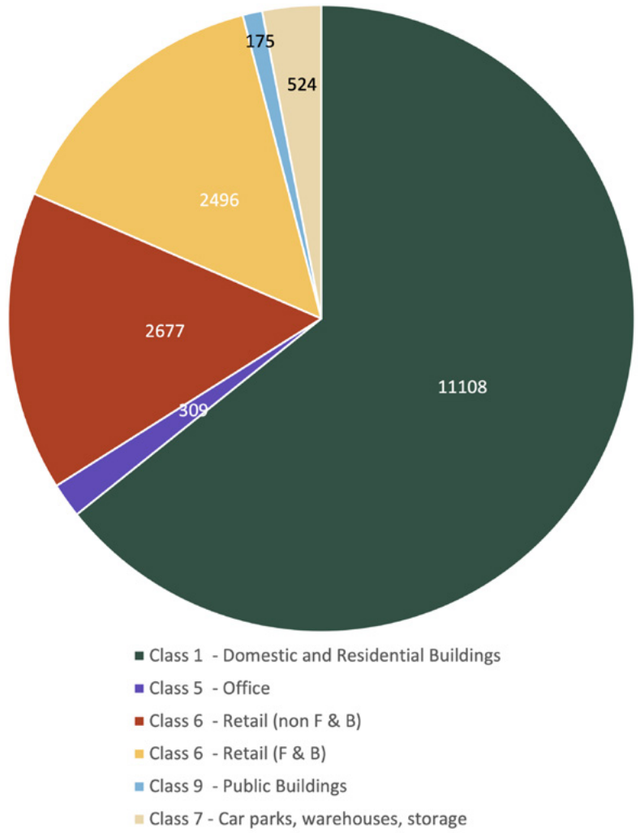
**Objectives for minimising waste related emissions include:**

- **Prioritise a transition towards a circular economy by reducing new material inputs, and implementing systems to support reductions in waste to landfill**
- **Increasing waste stream separation (organics, glass and e-waste) and creating markets for post-consumer resources**
- **To enable waste education and practice through appropriate community infrastructure and programming**

A baseline scenario has been developed which includes emissions emanating from food and garden organic waste.

The baseline scenario assumes that in 2040, 70% of food and garden waste is collected and 30% ends up in landfill. Whilst this is below the Recycling Victoria target, it is still above current recycling rates in Melton.

To drive down waste related emissions, the key strategy is around a funded program response over the long term that enables recycling rates to be significantly lifted and waste emissions reduced.




Waste Emissions by land use (tonnes Co02). Image by HIP V. HYPE

# Long term waste education program

## DESCRIPTION

Keeping FOGO out of landfill helps improve soils on local farms and increases carbon capture, generates significantly less methane and results in significant cost savings for council. Recycling Paper and Cardboard, also results in significant carbon savings.

An effective waste management system however relies on residents understanding how to use the service correctly, to keep contamination rates low and diversion rates high. In Victoria the average contamination rates of recycling services are 6.5%.

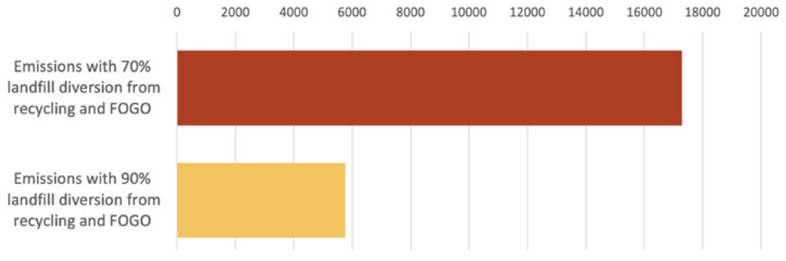
This proposed mechanism would deliver a behaviour change and education program to support residents to establish good waste management practices as they move into their newly built home and build and maintain their knowledge over time.

To achieve this, funding needs to be committed early and over the long term to ensure that each stage of residential development gets support and this support is enduring as the community evolves.

The key goal is to increase the rates of landfill diversion to reduce methane emissions from the breakdown of food and other organic matter.

### Carbon impact

Reduced carbon associated with waste management through increased use of existing FOGO collection and improved diversion of paper and cardboard from landfill.




The base scenario for waste emissions (tonnes C02) of 70% landfill diversion against the reductions associated with a 90% diversion. Image by HIP V. HYPE

## BENEFITS

### Social

- Contributing to making good quality compost locally
- Key opportunity for new residents to engage with Council and neighbours
- Waste as a starting point for engagement on broader environmental and climate issues (and education)

### Environmental

- Increased household waste diversion
- Reduced embodied carbon impact due to recycling of paper products
- Reduction in methane from landfill

### Economic

- Cost savings for council with improved rates of diversion
- Extend the life of landfill
- Creates value from organic waste (to be incorporated into local food production)

## COST IMPLICATIONS

- $250 per household ($3.5 m over 15 years)
- Opportunity to leverage existing investment in waste education
- Broader financial benefit from reduced cost associated with landfill

## BARRIERS / IMPLEMENTATION CONSIDERATIONS

### Political

- Mandating EV charging infrastructure has not previously been implemented in a growth area context

### Financial

- Upfront cost of installation of EV infrastructure before widescale use/take up of EVs must be justified
- Cost of EV vehicles are declining but still high and current supply chain issues

### Social

- Public education to overcome ‘range anxiety’ will also be critical

### Technical

- Rapidly changing technology area, would need to maximise opportunity for vehicle to grid (V2G) in future


Additional waste streams at Burwood Brickworks in Victoria. Image by Kim Landy

# Carbon Reduction Summary

**The carbon model developed for Melton East indicates total emissions could be reduced by 70% from 160,701 to 49,006 tonnes of C02e / year through the strategies outlined for stationary energy, transport and waste.**

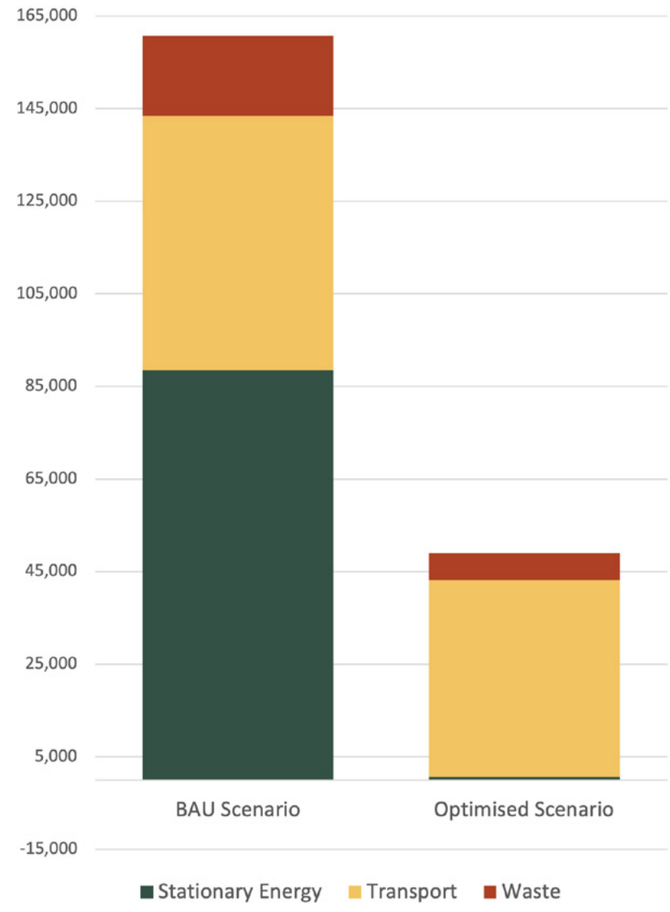
## CARBON REDUCTIONS

### Combined 'Optimised' Strategy

If all of the proposed strategies outlined on pages 64-73 for stationary, transport and waste emissions were delivered the Melton East precinct could see emissions reduce from a total of 160,701 to 49,006 tonnes of CO2e / year with the vast majority or remaining emissions in road transport that by 2040 is likely to be still undergoing transition to zero emissions alternatives. This is a reduction of approximately 112,000 tonnes of CO2e / year, or around 70% savings from the business as usual approach (see top right).

*Note: A re-election promise by the Victorian Government outlined a target to achieve 95% renewable energy by 2035.*

*Preliminary modelling suggests that if the 95% target was achieved by 2035, total carbon emissions for Melton East could be reduced from an updated baseline of 115,849 to 33,912 tonnes of CO2e / year. While the overall reduction is in-line with the model put forward in this report, the total amount of carbon emissions are lower due to the de-carbonised nature of the electricity grid in this scenario. The impact is that all electric buildings and zero emissions vehicles become even more compelling from a carbon reduction perspective.*




Melton East can reduce carbon emissions by approximately 70% – from 160,701 (left) to 49,006 (right) tonnes of C02e / year. Image by HIP V. HYPE

# Next Steps...

# Next Steps..

This report represents the research, stakeholder engagement, risk assessment, adaptation action development and carbon analysis that underpins the resilience assessment for the Melton East precinct structure plan.

This report will be used to inform decision making through the PSP to ensure delivery of a climate resilient precinct.

## NEXT STEPS..

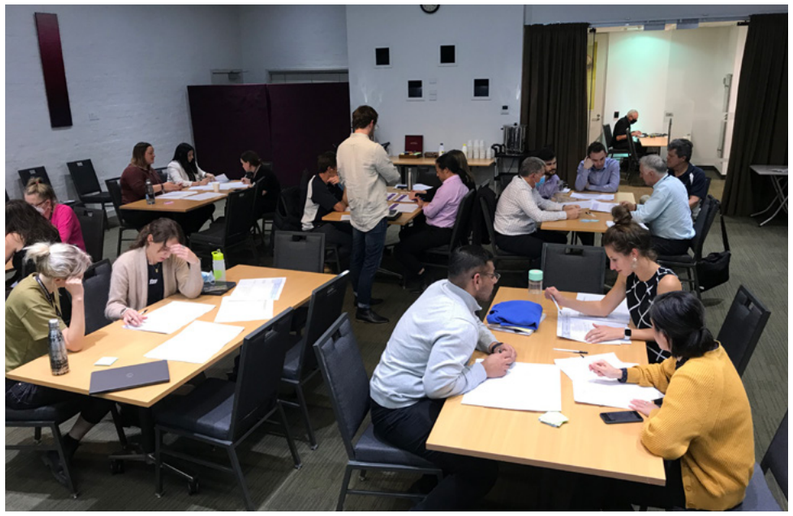
### Co-Design

This key findings of this report will be presented to stakeholders and landowners at the Melton East Co-Design Workshop in mid-November.

The workshop will be hosted by Niche Planning Studio and the VPA, and aim to test and refine the proposed urban structure (for transport, open space, and environment and sustainability) that will be put forward by the VPA.

### Melton East PSP

Following the workshop, the Climate Resilience Assessment (this report) will support the Melton East PSP as a technical document, with adaptation actions considered for delivery by the various stakeholders (outlined in the action plan).



A Co-Design workshop will be held to finalise the proposed urban structure put forward by the VPA. Image by HIP V. HYPE

# Appendices

# Appendix A – Desktop Review

A Desktop Review of relevant documents which specifically relate to the Melton East precinct was undertaken.

The review summarises each document, and highlights key opportunities and barriers relevant to the Melton East PSP.

We note that a number of these documents were commissioned on behalf of the 3L Alliance, and VPA is commissioning its own technical investigations.

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Grangefields PSP Preliminary Transport Assessment (2018)** | GTA Consultants<br><br>*For 3L Alliance | The Preliminary Transport assessment for the Grangefields PSP area, identifying: policy context, existing conditions, issues, opportunities and the transport network development. | – The Melton/Ballarat Railway Line has recently undergone a major upgrade to include new stations at Rockbank and Cobblebank, duplicated track, increased train frequencies and enable the future electrification of the line.<br>– Toolern identified as a future principal town centre and Rockbank and Rockbank North both identified as future major town centres (within 4km of site)<br>– Opportunity to locate future residential communities near public transport corridors<br>– The residential catchment can enable the earlier delivery of future town centres which will provide increased local job opportunities for existing and future residents<br>– Will require strong pedestrian/ cycling connections from the PSP to both Cobblebank (i.e. via Ferris Road) and Rockbank Stations respectively (via Paynes or Leakes Road) (both on Ballarat Line) | – An investment in the east-west link will increase resilience of road network, but may continue to make private vehicles more attractive than alternatives<br>– 84% of journeys to work from Melton made by car, spurred on by low employment to dwelling rate of 0.61 (compared to 1.33 for Metro Melbourne)<br>– Existing train frequencies: 30-40 mins peak, 60 mins off-peak not attractive to compete with private vehicles (future target of 10-20mins will underpin success)<br>– Key vehicle links to city already nearing capacity<br>– Existing bus services are underwhelming with poor connectivity - need coordination between activity centres and through PSP |

# Appendix A – Desktop Review


The Economic Considerations report by Ethos Urban.

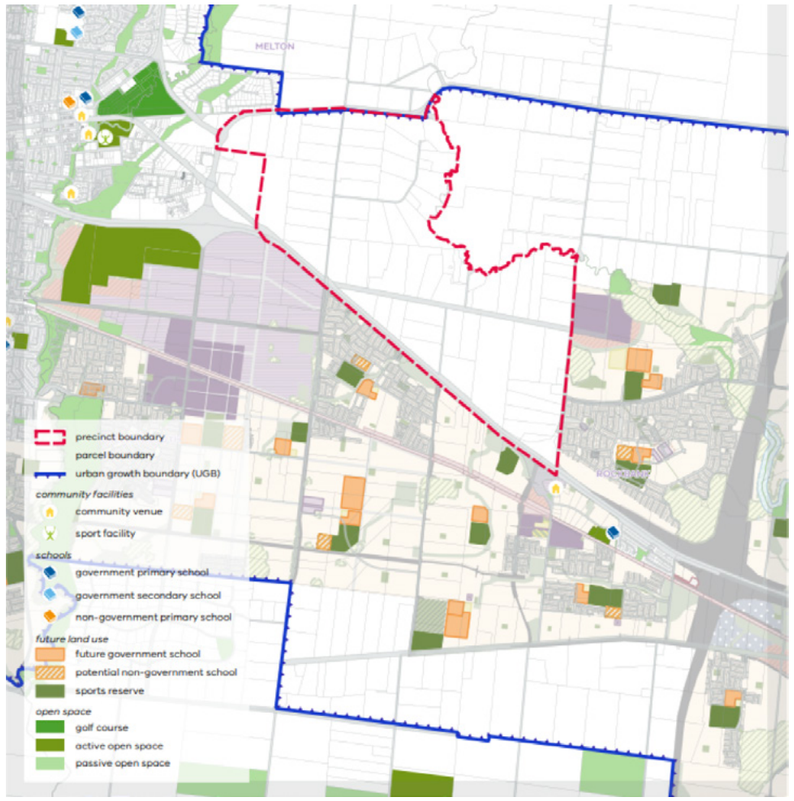
| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Grangefields Precinct Structure Plan, Economic Considerations (2020)** | Ethos Urban<br><br>*For 3L Alliance | In order to progress the planning for the PSP, 3L Alliance has engaged a team of consultants led by Tract Consultants, with Ethos Urban providing input in relation to economic and community needs assessments.<br><br>The report includes: Part A: Considerations for the Future Urban Structure and Part B: Overview of Economic-related Arguments to Bring Forward the PSP | – City of Melton's population is forecast to increase to 485,000 persons by 2051, approximately 320,000 persons above the current population (Melton East can support some of this population growth)<br>– The precinct can support approximately 10,100 dwellings / 30,300 people (sufficient to support three full-line supermarkets, however two possible if Rockbank North delivered)<br>– High rate of home ownerships (first and second home buyers), could motivate higher environmental outcomes and lower operating costs<br>– Rockbank North Major Town Centre will accommodate up to 36,500m² of retail floorspace<br>– Additional Local Town Centres will be required to support retail needs of the future community<br>– City of Melton recently released an Expression of Interest for a new Melton Hospital within the Toolern Metropolitan Centre (which would be a significant local employment generator)<br>– 1,010ha of vacant industrial zoned land in the City of Melton, plus a further 1,330ha of future industrial land which includes 350ha of land in the Toolern Employment Precinct and 330ha of land in Plumpton. | – Beyond Local Town Centres and local employment, Grangefields is expected to be residential-focused and NOT provide large employment areas<br>– Access to a suitably skilled and qualified 'white-collar' labour force has been a key constraint to the VPA's desire for Melbourne to become a 'poly-centric city' |

# Appendix A – Desktop Review

The Community Needs Assessment indicates the opportunity for a range of dwelling typologies to meet various community needs. Photography by Tess Kelly.

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Grangefields PSP, Community Needs Assessment (2020)** | Ethos Urban<br><br>*For 3L Alliance | This paper explores the opportunity for the Grangefields site to provide for regional attractors to the site and provides some context for likely household types and housing form.<br><br>The assessment includes an audit of nearby regional facilities and identifies key opportunities to explore further and an assessment of gaps within existing nearby Precinct Structure Plans (PSPs). | – The Western Growth Corridor has been historically under-provided in community infrastructure. Opportunities include health, education and recreation<br>– Support in State and Local policy for the establishment of multi-purpose community hubs as a preferred model for the delivery of community facilities and services<br>– State and local government policy acknowledge the importance of providing accessible and functional public open spaces to support community health, well-being and happiness<br>– A new regional park is currently under development along Toolern Creek, to the south of Melton<br>– To support intergenerational and multicultural cohesion through well designed and programmed community facilities<br>– Importance of arts and cultural facilities and events to supporting vibrant and creative communities and fostering a sense of local identity and belonging<br>– Opportunity to provide a range of dwelling types to meet different household needs in terms of age, culture and ability. The site can provide lower density detached homes through to attached and low-scale apartment typologies to meet the needs of single, family and group households<br>– Opportunity to provide a regional sporting hub to meet the needs of the broader regional catchment<br>– An EOI has been released to assess the opportunity for a new Melton Hospital at Cobblebank | – Growth Corridor Plan: Melbourne West suggests that a stand-alone TAFE facility is not justified in the region, however has been explored and should be co-located with other senior education facilities / activity centres |

# Appendix A – Desktop Review




Community, recreation and schools context for the Melton East site.
Image by VPA

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Melton East PSP, Inception Meeting Presentation (2022)** | Victorian Planning Authority (VPA) [Outer Melbourne West Team] | Overview of project and context of site. | – Melton East expected to deliver approximately: 12,895 lots and 3,868 jobs (note significant difference in target yield compared with Ethos Urban analysis<br>– 50 km from Melbourne CBD, with a Principal Town Centre (PTC) 1.5km away in Toolern, and Major Town Centres (MTC) in Rockbank North (500m) and Rockbank (1km)<br>– The 992 Hectare site is relatively flat and cleared<br>– Significant opportunities to retain additional areas of native vegetation to enhance the conservation value of the precinct | – Presence of flooding within the PSP area<br>– Limited bus network connectivity, with trains every 30-40 minutes from Rockbank (60 mins in off peak times) |
| **Grangefields (Melton East) PSP, Desktop Flora and Fauna Assessment (2019)** | SMEC Australia Pty Ltd (SMEC)<br><br>*For 3L Alliance | The purpose of the assessment is to obtain information on ecological values present within the study site and identify the relevant environmental planning approvals that may be triggered by the proposed development.<br><br>This report outlines the findings of the desktop assessment and provides information regarding potential impacts to the ecological values within the study site in addition to any additional requirements that may be triggered by State and Commonwealth legislation (i.e. referrals, permits, additional surveys etc.). | – The BCS conservation area, which must be retained and secured, generally via an on-title agreement or vested in a public authority.<br>– Mapped native vegetation that exists outside of the BCS conservation area could be incorporated into areas of open space<br>– Four endangered EVCs are identified on site, including: Plains Grassland, Heavier-Soils Plains Grassland, Low-rainfall Plains Grassland and Riparian Woodland<br>– A total of six scattered trees are identified in the BCS mapping<br>– Four modelled current wetlands have been identified within the study area using the Current wetlands mapping layer (DELWP 2019a)<br>– The VBA database identified previous records of 20 flora species and 34 fauna species of conservation significance (listed under one or more of the EPBC Act, the FFG Act or Advisory List) as occurring within the study area | – Any proposed infrastructure crossings encroaching into the conservation area will require additional DELWP approval and may be referred to DoEE |

# Appendix A – Desktop Review


The Preliminary Environmental Site Assessment by SMEC

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Grangefields (Melton East) PSP,**<br><br>**Preliminary Site Investigation - Phase 1 Environmental Site Assessment (2019)** | SMEC Australia Pty Ltd (SMEC)<br><br>*For 3L Alliance | The objective of this report is to document the nature and extent of any potential contamination on property parcels within the overall PSP area and assess the potential risk to human health and the environment associated with contamination sources both on site and off site in accordance with Ministerial Direction No. 1 – Potentially Contaminated Land, the NEPM (2013) and Ministerial Direction No. 19 – Information requirements for amendments that may result in impacts on the environment, amenity and human health (Direction No. 19) | – The review of Precinct history found that the land within the Precinct was previously used primarily for grazing and agricultural purposes<br>– The majority of the site is considered generally suitable for proposed redevelopment for urban uses including residential, provided: Level A sites (high risk child care, housing etc.) require environmental audit, Level B sites (medium risk housing and child care, retail, office or warehouse etc.) require site assessment by qualified person, and Level C sites (low risk open space, agriculture, retail, office or warehouse) require general duty of care | Potential sources of contamination include:<br><br>ON-SITE<br>– Agriculture use (various chemicals)<br>– Fuel and oil storage and use<br>– Importation of fill, illegal dumping and stockpiling (various chemicals)<br>– Livestock carcasses and burial pits<br>– Septic tanks and grey water tanks<br>– Service stations (storage use and leakages of fuel)<br>– Main road corridors<br><br>OFF-SITE<br>– Melton Recycling Centre<br>– Use of adjacent land by Defence Force (now Rockbank Residential Development)<br><br>Flood modelling and surveys of Kororoit Creek and un-named tributaries suggested to determine hydrological effects of new development, and design of drainage systems |

# Appendix A – Desktop Review

Key opportunities around integrated water management and flood mitigation exist within the site. Pictured is a bioswale in Sunshine. Photography by Emma Cross

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Grangefields PSP, Infrastructure Servicing Report (n.d)** | Spiire<br><br>*For 3L Alliance | The Grangefields Infrastructure Servicing Report highlights key objectives:<br>– Reduce demand on potable water supply<br>– Reduce stormwater discharge and pollution<br>– Increase flood resilience within the precinct<br>– Create open spaces that provide amenity and promote health and well-being.<br>– Support local waterways and surrounding environment. | – A significant amount of Melton's potable water is provided by Melbourne Water via a large transfer main from Melbourne's storage and distribution network<br>– From a sewer servicing perspective Grangefields is relatively simple and straight forward<br>– The existing main in Leakes Road has sufficient capacity to service a significant portion of the Grangefields PSP area<br>– We expect that electricity supply for Grangefields would come from existing HV infrastructure all along the Western Highway and Melton Highway nearer to the Melton Township<br>– Fibre networks are currently available in other surrounding developments including Thornhill Park, Woodlea and Atherstone with a known Opticom fiber hub near the intersection Ferris Road and the Western Highway<br>– Wetlands providing a drainage function can also supply significant amenity and recreation for the local community<br>– Educative signage around stormwater assets provides the public with opportunities to learn about the water cycle, water assets and the water story within the precinct<br>– Stormwater harvesting within flood plain of 90,000 m3 of water storage providing 92% reliability of non-potable end uses<br>– Management of wetland within conservation area to maximise environmental and biodiversity outcomes<br>– Passive irrigation in streetscapes to support tree health<br>[Note: Melton Recycled Water Plant produces both Class A and Class C recycled water] | – An existing wetland (27ha) has been identified as an environmental area of strategic importance and is within the conservation area boundary set by the Biodiversity Conservation Strategy for Melbourne's growth corridors<br>– 1% AEP flood extents for Kororoit Creek create an approximate 40ha flood plain in eastern portion of site<br>– Kororoit Creek Upper Drainage Scheme has an upstream catchment of approximately 1.47km2 of developable land, creating large base flows entering the site<br>– There are two existing depressions within the scheme, labelled as Western and Eastern Depression. Melbourne Water has advised that these depressions will function as the two main retarding basins in the scheme<br>– Development in the existing PSPs will have a condition in their planning permits to require a free-draining outfall prior to any Statement of Compliance, with 5,000 dwellings (approx) delayed as a result of outfall not being established (south of Western Freeway)<br>– Greater Western Water no longer mandates any recycled water development areas and therefore, unless their policy changes the use of recycled water via Western Water's reticulated network will not be available for the development<br>– Four wetlands have been proposed by Spiire within the High Street Melton drainage scheme at the base of retarding basins<br>– Six wetlands have been proposed by Spiire within the Kororoit Creek Upper drainage scheme at the base of retarding basins |

# Appendix A – Desktop Review


Preliminary biodiversity conservation strategy for the wetland area.
Image by Alluvium

| TITLE | AUTHOR | DESCRIPTION | MELTON PSP OPPORTUNITY | MELTON PSP BARRIER |
|---|---|---|---|---|
| **Flora and Fauna Survey and Condition Assessment of the Paynes Road Wetland, Grangefields, Victoria** | Rakali Ecological Consulting | A flora and fauna survey and Index of Wetland Condition (IWC) assessment at the Paynes Road Wetland, located adjacent to Paynes Road at Grangefields. | – 71 flora species identified within the wetland over a number of surveys.<br>– 37 (52%) are indigenous and 34 (48%) are introduced.<br>– 19 of the indigenous species recorded are classified as wetland dependant.<br>– No threatened plant taxa were observed during the survey.<br>– 41 Fauna species observed (37 birds, 3 frog, 1 reptile)<br>– 3 species listed as vulnerable under the Victorian Advisory List | – Challenge present to ensure development is not a detriment to the existing ecological value on the site |
| **[DRAFT Report] Kororoit Creek Wetland Ecohydrology** | Alluvium | Assessment of the ecohydrology of a significant seasonal herbaceous wetland (SHW) adjacent to Kororoit Creek, with summary of modelling and investigation of the hydrologic regime of the wetland, in particular changes to the hydrology likely to occur once the catchment of the wetland is urbanised. | The final design (of the hydrology surrounding the wetland) must:<br>– Provide a hydrological regime that provides seasonal water availability to support Seasonal Herbaceous Wetland vegetation.<br>– Allow for adjustment of the water flows to respond to seasonal water requirements and/or water level monitoring information.<br>– Provide the Stormwater treatment from the catchment flows to mitigate sediment and dissolved nutrient flows to the wetland.<br>– Be maintainable within normal expenditure budgets. | – The wetland could be perceived as a barrier to further development (e.g. higher lot yield), however will provide a significant ecological asset for residents and passive recreation opportunities.<br>– Challenge present to ensure development is not a detriment to the existing ecological value on the site |

# Appendix B – Policy Review

A Policy Review was undertaken, with a focus on relevant policy with an impact on climate response outcomes for the Melton East site.

The review summarises each policy influence, and highlights this relevance alongside any relevant implementation considerations.

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **Climate Change Act 2017 (VIC)** | Victorian State Government | The Act provides Victoria with a legislative foundation to manage climate change risks and drive Victoria's transition to a net zero emissions, climate resilient community and economy.<br><br>The Act sets out a policy framework and a pathway to 2050 that is consistent with the Paris Agreement to keep global temperature rise well below 2 degrees Celsius above pre-industrial levels. | – Net zero greenhouse gas emissions by the year 2050<br>– Objective to build the resilience of the State's infrastructure, built environment and communities through effective adaptation and disaster preparedness action<br>– Objective to manage the State's natural resources, ecosystems and biodiversity to promote their resilience<br>– Objective to support vulnerable communities and promote social justice and intergenerational equity. | The Act provides basis for strong target setting in relation to stationary energy, transport and waste operational emissions, recognising that areas of significant transition (such as new precincts) will need to meet zero net emissions much earlier than 2050 to allow the staged transition of existing communities.<br><br>The Act supports a precinct which builds resilience into the built-environment and infrastructure through effective adaptation and disaster preparedness. |
| **Victoria's Climate Change Strategy (2021)** | Victorian State Government | Victoria's Climate Change Strategy sets out the state's plan for securing a net-zero emissions future, while at the same time creating new opportunities and new jobs. | – Net zero greenhouse gas emissions by the year 2050<br>– The Energy, Waste and Transport Pledge's are particularly relevant with strong 2030 targets (50% renewables/organic waste/ ZEV by 2030)<br>– Highlights the green jobs and economic development associated with climate action (i.e. high-skill labour, and lower energy costs)<br>– Supports innovation (e.g. battery storage, zero emissions vehicles etc.)<br>– Targets climate smart businesses and communities through energy efficiency and improvements to pedestrian infrastructure, in addition to resilience through adaptation and reducing barriers for implementing transformational change | The strategy supports a low carbon built-environment from the outset, based on a plan to fully transition to zero carbon by 2050 at the latest.<br><br>This will require bold target setting in relation to renewable energy, sustainable transport (active and EV transition) and avoidance of fossil fuels as part of the servicing strategy. |

# Appendix B – Policy Review


The Built Environment Climate Change Action Plan 2022-2026

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **Built Environment Climate Change Adaptation Action Plan 2022-2026** | Victorian State Government<br><br>Department of Environment, Land, Water and Planning (DELWP) | The plan is the first of a series of adaptation action plans (AAPs) for the Built Environment system, with subsequent plans prepared every 5 years on a path to a climate-resilient Victoria in 2050.<br><br>The plan aligns with the guiding principles and policy objectives of the Act and of Victoria's Climate Change Strategy and is consistent with the Victorian Government's policy in Plan Melbourne 2017–2050 to take action to adapt to climate change, reduce the likelihood and minimise the consequences of natural hazard events. | Key objectives and targets outlined in the plan:<br><br>– New precincts, growth areas and suburbs are resilient to climate change<br>– Infrastructure for new and existing suburbs incorporates climate change adaptation measures<br>– Climate change considerations incorporated into decision making about future land use planning for cities, towns, suburbs and regional areas<br>– At least 30% tree canopy coverage (along with other vegetation) is provided across the urban landscape to support cooling and greening<br>– Health, safety, liveability and community resilience | The action plan supports many of the climate resilient ambitions shared by the Melton East PSP.<br><br>Many of the actions are focused on improving and supporting planning process to acknowledge the impacts of climate change more holistically.<br><br>The plan also outlines cross-system risks and responses which will assist in articulating and resolving any governance and operational concerns for Melton East - with the climate impacts assessment (Stage 2 being guided by these risks and responses. |

# Appendix B – Policy Review


Recycling Victoria has set a target to divert 80 per cent of waste from landfill by 2030. Photography by Kim Landy

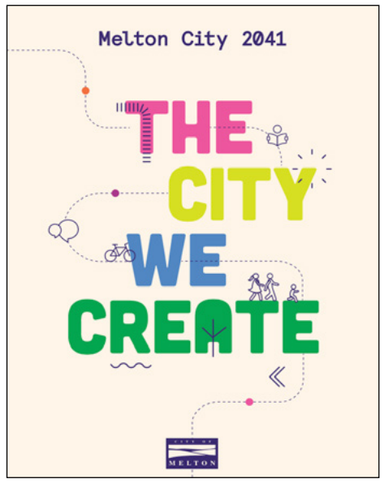
| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **Recycling Victoria: A New Economy (2021)** | Victorian State Government<br><br>Department of Environment, Land, Water and Planning (DELWP) | Recycling Victoria is the Victorian Government's 10-year policy and action plan for waste and recycling. | Four key goals including:<br>– 1. Design to last, repair and recycle<br>– 2. Use products to create more value<br>– 3. Recycle more resources<br>– 4. Reduce harm from waste and pollution<br><br>Other targets include:<br>– Circular economy and impacts across product life cycles<br>– Divert 80 per cent of waste from landfill by 2030, and an interim target of 72 per cent by 2025.<br>– Cut total waste generation by 15 per cent per capita by 2030.<br>– Halve the volume of organic material going to landfill between 2020 and 2030, with an interim target of 20 per cent reduction by 2025.<br>– Ensure every Victorian household has access to food and garden organic waste recycling services or local composting by 2030.<br>– National policy statement to significantly increase the use of recycled content by government and industry. | The Recycling Victoria strategy supports strong action relating to the circular economy,in particular:<br>– Setting up the community scale pre-conditions for meeting operational waste targets (such as diversification of waste streams in town centres)<br>– Leverage infrastructure procurement to drive increased recycled product content in materials |

# Appendix B – Policy Review

Plan Melbourne calls for a cooler and greener city. Rooftop farm at Burwood Brickworks pictured. Photography by Kim Landy.

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **Plan Melbourne 2050** | Victorian State Government | The Victorian Government Metropolitan Planning Strategy, is a long-term plan to accommodate Melbourne's future population and employment growth.<br><br>The plan provides guidance around the quantity of housing development in greenfield areas to support Melbourne's population growth. | The Plan contains nine principles to guide policies and actions, one of which is 'Environmental resilience and sustainability'. Outcomes include items relating to integrated transport, liveability, sustainability and resilience. Directions relating to sustainability include items relating to:<br><br>– Transitioning to a low-carbon city to achieve net zero by 2050<br>– Reducing likelihood and consequences of natural hazards and adapting to climate change<br>– Integrating urban development and water cycle management<br>– Making Melbourne cooler and greener<br>– Protecting and restoring natural habitats<br>– Reducing waste and improving waste management<br>– Delivery of local parks and green neighbourhoods<br>– Improving local travel options | The project offers significant opportunity for delivery against multiple sustainability objectives contained in the plan, including:<br><br>– Low carbon pathways<br>– Reducing urban heat<br>– Improving waste management<br>– Improving biodiversity and integrated water management<br>– Active and public transport integration and reduction in private vehicle use<br><br>These objectives are all drivers of sustainability for the precinct and will underpin analysis and recommendations for a climate resilient approach.<br><br>Adaptation objectives in particular, may require challenging business as usual approaches relating to road pavement widths, servicing locations, density, flood responsive design. |

# Appendix B – Policy Review




The Melton City Council Community Plan.

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **Melton City 2041: The City We Create (2021)** | Melton City Council | The plan builds on the original community vision 2036, focussing around 5 key themes: Our socially connected city, Our thriving natural environment, Our well-built city, Our strong local economy, and Our actively engaged people. | The Community vision elevates the following outcomes:<br>1. Socially connected: clean welcoming, inclusive, and diverse community. Improved through connections, CPTED and social programming/ activities to create interactions<br>2. Thriving environment: green city with wildlife, sustainable planning and design, sustainable use of water sources. Improved through increased material reuse, reduced GHG emissions,and satisfaction with development in new growth areas.<br>3. Well-built city: well planned and connected communities, open space network, public transport and accessible amenities. Improved through active transport links, pedestrian network linked with amenity and employment.<br>4. Strong local economy: opportunities for education, job training and lifelong learning, mix of local employment and fun and interesting places for residents and visitors. Improved through creation of new/diverse jobs.<br>5. Actively Engaged: fair, equitable and open dialogue with Council, and transparent governance processes. Improved through active communication and advocacy, level of participation and community engagement. | The community vision supports the development of a precinct that embraces and elevates environmental outcomes and delivers a built-form that is energy efficient and creates walkable, cohesive neighbourhoods with a mix of employment, education and amenity for a strong local economy.<br><br>The promotion of social connection as a key theme highlights the need for social resilience to be a key facet of the response to climate change impacts. A community with high levels of social capital is best able to cope with extreme weather events as well as other shocks and stresses. |

# Appendix B – Policy Review

Beyond energy and water efficiency, the Environment Plan calls for a natural environment that supports life and provides ecosystem services (such as stormwater and urban heat mitigation). Photography by Adam Gibson.

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **City of Melton Environment Plan 2017-2027** | Melton City Council | The Environment Plan 2017-2027 demonstrates how Melton City Council will work to improve environmental outcomes in the municipality over the next decade and beyond. It is the key document for guiding Council planning, decision-making and activities that impact on the local environment. | Three key themes / principles underpinning the strategy:<br>1. Built Environment supports people and society (planning & land use, ESD, open space, roads, built form)<br>2. Natural Environment supports life and provides ecosystem services and resources (biodiversity, climate, air, waterways, soil etc.)<br>3. Resources are used to create Built Environment for people and society (Energy and water use, efficiency, pollution/waste, non-renewable/renewable) | The plan seeks to specifically incorporate environmental sustainability improvements in requirements and guidelines in Precinct Structure Plans (PSPs).<br><br>A greater level of ambition for energy efficiency, ESD, WSUD, ecology and open space are all supported in various forms throughout the plan, and may support development outcomes that deviate from business as usual.<br><br>Additionally, the Plan directs Council infrastructure (and indirectly infrastructure built by others and handed over to Council) to embed integrated water management with a strong focus on water sensitive urban design. |

# Appendix B – Policy Review


The City of Melton Open Space Plan 2016-2026

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **City of Melton Open Space Plan 2016-2026 (2015)** | Melton City Council & ROSS Planning | The plan considers strategic issues such as population growth, compact living and sustainability alongside the municipalities existing and desired open space network. | Some of the key guiding principles for open space:<br>– The open space network is adaptable to future recreation needs<br>– Open space is accessible by all. It is available to and encourages people of all ages, abilities, gender and cultural backgrounds to recreate<br>– Open space is developed as a linked network with appropriate pedestrian and cycling connections<br>– Open space is co-located with other community facilities where possible<br>– Multiple use of open space is encouraged to provide cost effective options for Council while still providing community health and well-being benefits<br>– Open space design considers environmentally sustainable design principles and practices<br>– Open space protects, enhances and manages indigenous vegetation and waterways to provide habitat and movement corridors for native fauna<br>– (min) Total core open space provision desired standard of service: 2.2ha/1,000 people | There is strong alignment and support for open space in Melton to be designed and co-located alongside other community facilities to maximise access and use, with indoor facilities championing ESD outcomes, and outdoor sporting facilities taking a considered approach to water use and maintenance.<br>Passive / informal recreation opportunities existing along Kororoit Creek, and may help form connections beyond the precinct.<br>A key question for the PSP will be the degree to which active and passive open space can play a drainage role during extreme weather events. Some of the land in Melton East has quite significant drainage challenges and may promote some open space to fulfil a hybrid function. |

# Appendix B – Policy Review


Melton City Council already provides three waste streams (including FOGO) with a fourth bin for glass to be introduced in 2027. Photography by Kim Landy.

| TITLE | AUTHOR | DESCRIPTION | RELEVANCE TO MELTON PSP | IMPLEMENTATION CONSIDERATIONS |
|---|---|---|---|---|
| **City of Melton Waste Diversion & Education Strategy 2020-2025 (2018)** | Melton City Council & EnviroCom Australia | The Strategy provides an overarching framework that guides waste management within the municipality, sets targets for reducing waste to landfill and outlines a number of education programs, social marketing, advertising and training. | The plan aims to:<br>– Develop a strategic and targeted approach to education and engagement, to maximise waste diversion opportunities across the waste streams / services and minimise litter<br>– Promote and encourage waste avoidance and resource recovery behaviours as a community goal and social norm<br>In addition:<br>– City of Melton Council currently provides residents with three waste streams; Garbage, Recycling and FOGO Waste<br>– A fourth bin for glass to be introduced in 2027 in line with Recycling Victoria Policy | The Waste Diversion & Education Strategy is relatively consistent with the Recycling Victoria Strategy and its timeline may not align with the delivery of the Melton PSP to provide value (i.e. it does not bring Recycling Victoria targets any closer), however clarifies existing 3-bin scenario and timeline for fourth bin to be introduced.<br>The plan does support behaviour change programs, which would be supported by the operational sustainability phase. This will be crucial for improving current land fill diversion rates of less than 50% to align with State and Local targets. |

# Appendix C – Framework and Tool Review

**A review of relevant frameworks and tools was undertaken, including a preliminary evaluation of the tool or framework with respect to the Melton East context.**

| TOOL | SCALE | DESCRIPTION | PROS | CONS | APPLICATION TO MELTON PSP |
|---|---|---|---|---|---|
| **Green Star Communities** | Community | Green Star is a national voluntary sustainability rating system developed by the Green Building Council of Australia. A Green Star - Communities rating assesses the planning, design and construction<br><br>of large scale development projects at a precinct, neighbourhood and/or community scale. It provides a rigorous and holistic rating across five categories.<br><br>The tool has four Minimum/Conditional Requirements that must be achieved by all projects to achieve a Green Star rating. Ratings available include 4 Star (Best Practice), 5 Star Rating (Australian Excellence) and 6 Star Rating (World Leadership). | – GBCA rating tools well established methods for achieving sustainable outcomes in the built environment<br>– Provide a rigorous means of achieving sustainability goals<br>– Strong market acceptance<br>– High level of support available from the GBCA<br>– Robust governance process, which oversees maintenance and updates aligned with best practice, including technical reference groups and strong collaboration with industry in Australia<br>– A minimum number of credits are required in each category, meaning that triple bottom line outcomes are delivered and a proponent cannot target a specific area of benefit exclusively | – Ongoing consultancy costs for the collation of evidence across the 10 to 15 year development time-frame to maintain rating | Green Star - Communities can provide an implementation pathway (or guidance on targets) for the achievement of objectives of the Melton East PSP.<br><br>Credit 04 'Adaptation and Resilience' specifically relates to the assessment of climate impacts and adaptation planning. To the extent possible within a PSP context (much larger and at an earlier phase than a standard GS certified community) the process delivered will align with the GS methodology.<br><br>A number of other credits within the tool are considered relevant for the Melton East PSP, including:<br><br>– Urban heat reduction (Definitions and targets)<br>– Greenhouse gas reduction (Definitions and targets)<br>– Embodied carbon reduction (Process) |
| **EnviroDevelopment** | Community | EnviroDevelopment is a national assessment scheme which provides independent verification of development projects and has been designed to assist potential purchasers to recognise and select more sustainable developments and lifestyles.<br><br>Developments may receive EnviroDevelopment certification across six defined categories (elements) of sustainability. | – Accreditation is available for individual categories which provides flexibility<br>– High level of industry recognition for master planned new suburbs in outer growth areas | – Accreditation for individual categories undermines the need for a comprehensive approach<br>– Although most environmental criteria are covered, management and indoor environmental quality are not addressed<br>– Although supported technically by significant industry support the tool is relatively untested at higher densities | Given that the tool is 'objective' rather than target or standard based, there are potential limitations for this tool for direct application in Melton East, in terms of setting clear requirements for developers to respond to during the implementation phase.<br><br>The tool may provide useful guidance for setting objectives for the PSP. |

# Appendix C – Framework and Tool Review

| TOOL | SCALE | DESCRIPTION | PROS | CONS | APPLICATION TO MELTON PSP |
|---|---|---|---|---|---|
| One Planet Living | Community | One Planet Living is an international sustainability framework based on ten principles which guide sustainable development. These principles form a framework to assist organisations plan for, deliver and communicate sustainable development, addressing key sustainability challenges.<br><br>It takes a holistic approach to development that focuses on providing a high quality, sustainable built environment as well as infrastructure and services that make it easy and affordable for people to live more sustainable lives. | – Strong principle basis<br>– Unique combination of categories that go beyond typical rating tools offers a holistic approach to sustainability<br>– Highly flexible and adaptable to a range of project scales<br>– Globally leading framework in terms of breadth of sustainability categories covered, integrating building and construction with lifestyle choices, public health, transit options | – Not a rating/certification tool<br>– Limited technical resourcing in Australia<br>– Additionally, Bioregional Australia (who manage the framework) is struggling for traction in Australia at present | As an output of the work a Climate Resilience Report & Action Plan will include a suite of site-specific sustainability initiatives, with objectives and targets.<br><br>Some of the metrics used in the One Planet Living (OPL) Framework will be useful for this process, however there is limited value in separately pursuing an OPL Action Plan for the precinct. |
| Sustainable Subdivisions Framework | Community | The Sustainable Subdivisions Framework (SSF) is a framework that seeks to provide statutory planners with a basis for measuring and achieving stronger sustainability outcomes in residential subdivisions, while also providing information on how sustainability interventions can be integrated into residential subdivisions.<br><br>The SSF identifies seven categories that can assist in creating sustainable subdivisions:<br><br>– Site Layout and Liveability<br>– Streets and Public Realm<br>– Energy<br>– Ecology<br>– Integrated Water Management (IWM)<br>– Urban Heat<br>– Circular Economy (Materials and Waste) | – Embeds sustainability into the foundations of community development<br>– Strong pilot phase with 31 regional councils currently trailing the framework with support from CASBE (of which Melton City Council is one)<br>– Is a useful tool in elevating sustainability knowledge within Council departments<br>– Can also be used a design guidance tool (not purely a planning assessment framework) for developers<br>– Consolidates a number of best-practice metrics/outcomes as opposed to reinventing the wheel (i.e. cl. 56). | – Is NOT a certification scheme<br>– Currently in a voluntary trial-phase<br>– Is primarily focused on the subdivision stage (but some metrics and objectives are suitable for elevation to PSP stage and scale) | The SSF assists in creating a robust foundation for sustainable and climate resilient communities at the subdivision stage. The SSF can be used both as a guiding framework for the PSP and in its intended form as a planning assessment tool for Melton City Council.<br><br>The combination of metrics in the GS Communities and the SSF will be useful in particular for the target setting phase for the project. |

# Appendix C – Framework and Tool Review

| TOOL | SCALE | DESCRIPTION | PROS | CONS | APPLICATION TO MELTON PSP |
|---|---|---|---|---|---|
| **Infrastructure Sustainability (IS) Rating Scheme** | Infrastructure Projects | A national rating system for evaluating economic, social and environmental performance of infrastructure across the planning, design, construction and operational phases of infrastructure assets.<br><br>Criteria across 15 categories ranging from procurement to carbon to heritage. Types of infrastructure include rail, ports, roads and airports, with well known local examples including the Victorian Level Crossing Removal projects. | – Australia and New Zealand's only comprehensive rating system for evaluating economic, social and environmental performance of infrastructure across the planning, design, construction and operational phases of infrastructure assets<br>– Provides a common national benchmark for sustainability in infrastructure<br>– Helps proponents and practitioners apply and evaluate sustainability outcomes consistently in tendering processes.<br>– Scope whole-of-life sustainability risks for projects and assets<br>– Fosters efficiency and reduces waste to reduce costs.<br>– Builds an organisation's credentials and a reputation for taking sustainability seriously. | – Projects <$2m require negotiation for certification fees<br>– Only focussed on infrastructure<br>– Costly if certifying design, as built and operation | Given that the IS Rating Scheme assesses the economic, social and environmental performance of infrastructure – there may be an opportunity to adapt evidence requirements and processes to the Melton East context.<br><br>The next phase of the project will identify key focus areas of climate response (carbon, flooding risk etc), at which point the IS Rating Scheme will be reviewed further for potential alignment with outcomes sought. |

# Appendix D – Case Studies

A number of case studies were reviewed for their environmental performance and approach to climate resilience - with an assessment of each against the outcomes being pursued at Melton East.

The exemplars highlight a variety of strategies that can be incorporated into new greenfield developments to ensure they're set up for success from day one - from the location and connectivity of housing and broader amenity to create compact neighbourhoods, to increased vegetation and canopy cover to allow safe pedestrian movements during heatwave events.

The six case studies reviewed include:

- Northern and Western Geelong Growth Areas
- Ecco Ripley
- The Cape
- Warrarlily
- Alkimos Beach
- Ginninderry

Landscaping at The Cape. Photography by Kim Landy.

# Appendix D – Case Studies: North and West Geelong Growth Areas (Victoria)

**NWGGA represents two residential development growth pockets to the north and west of Geelong. The sustainability vision for the sites was developed using the One Planet Living principles.**

## KEY PROJECT STATS

### Site Area

Two parcels - 2,217 Ha & 3,240 Ha

### Development Yield

Residential (112,000 people population) and community infrastructure

### Key Sustainability Initiatives

- Urban development will adopt 20-minute neighbourhood design principles.
- Medium density housing within 400 metres of neighbourhood activity centres and locations on the Clever and Creative Corridor that offer employment, public transport access and community hubs
- High tree canopy coverage on public and private land at a minimum of 25%
- Neighbourhood layout and orientation will reduce energy consumption and create comfortable buildings and resilient communities
- Innovation in the design of waste collection, transfer, treatment and disposal systems will be necessitated by large-scale urban development.

### Application in Melton East

NWGGA is one of the larger land development precincts being delivered currently, with a key principal to be ‘zero carbon’, achieved through energy efficient buildings, and renewable energy generation and procurement.

The adoption of an Action Plan at Framework Plan stage was a key feature of the planning process - allowing objectives, standards and targets to cascade down to the subsequent (PSP) planning phase.


The North and West Geelong Growth Areas in relation to Greater Geelong. Photography by Greater City of Geelong.

# Appendix D – Case Studies: Ecco Ripley (Queensland)

**Ecco Ripley is a certified 5-star GS Communities residential development 43km SW of Brisbane.**

**The community is an exemplar for its approach to Site Layout and Liveability.**

## KEY PROJECT STATS

**Site Area**

194 Ha

**Development Yield**

Residential (4000 dwellings) and community infrastructure

**Key Sustainability Initiatives**

- Bikeways and walking paths which aim to link residents to green spaces, communal spaces and the town centre
- A transit hub which will connect the community to other city centres via proposed buses and trains
- A compact town centre increasing access to facilities and services
- More than 500,000 trees, plants and ground coverings have been planted at Ecco Ripley since 2009, while 20 per cent of the community is dedicated to green open space, with all homes located within 400 metres of parklands

**Application in Melton East**

Ecco Ripley demonstrates an approach to open space provision, landscape design and connectivity that supports happy and healthy communities now and during climate (i.e. heat) events.

The precinct has been designed with an extensive pedestrian network connecting residents to local amenity, including natural systems.

Retained and new vegetation integrated to ensure each home is within 400m of parklands. Photography by Ecco Ripley.

# Appendix D – Case Studies: The Cape (Victoria)

**The Cape is a sustainable community approximately 144km SE of Melbourne at Cape Patterson.**

**The community is an exemplar for many reasons, particularly its approach to energy.**

## KEY PROJECT STATS

### Site Area

40.5 Ha

### Development Yield

Residential (230 dwellings) and community infrastructure

### Key Sustainability Initiatives

- As a minimum, each house is to have a NatHERS rating of 7.5 stars and a 2.5 kilowatt solar photovoltaic power system and be all-electric.
- Each house will feature at least 10,000 litres of rainwater storage for garden irrigation and to assist with toilet flushing
- Solar powered electric vehicle charge stations and electric vehicle charge points accessible in the community
- The site will also feature a 5000 m2 community garden supported by a 230,000 litre rainwater tank for landscape irrigation

### Application in Melton East

The Cape provides some excellent examples of energy efficient building and service design, with a minimum NatHERS rating of 7.5 and a 2.5kW rooftop solar PV system.

The all-electric precinct uses design guidelines to inform siting, orientation, setbacks and dwelling size to reduce energy demand. The approach to landscaping and streetscape design will also ensure the future residents will be protected from urban heat through improved canopy cover.

One of the flagship initiatives that will deliver community resilience, is the 5,000 sqm community garden with a 230,000 litre rainwater tank for irrigation. The garden is expected to increase health and well-being outcomes, with increased exercise, social contact and improved food security.

From siting and orientation, to balancing daylight and thermal mass, the buildings at the Cape achieve exceptional outcomes in terms of energy efficiency. Photography by The Cape.

# Appendix D – Case Studies: Warralily (Victoria)

**Warralily is a residential development located approximately 98km SW of Melbourne in Geelong.**

**The community is an exemplar for its approach to ecology and vegetation restoration.**

## KEY PROJECT STATS

**Site Area**

380 Ha

**Development Yield**

Residential (4000 dwellings) and community infrastructure

**Key Sustainability Initiatives**

- 82 hectares of parklands and waterways
- 3.36 hectares of native grassland re-establishments
- Three dedicated conservation zones
- Wetlands and creekline restoration of Armstrong Creek
- Planting over 1 million plants in the creek corridor
- Preservation and incorporation of remnant vegetation including the relocation of stags within the creek and wetland areas

**Application in Melton East**

The ecological restoration conducted at Warralily has been a feature of the development, preserving and elevating the quality of the surrounding environmental assets to not only support ecology, but provide high quality ecosystem services (such as air and water filtration) and canopy cover associated with urban cooling.

Once established, residents of Warralily can expect to make low-risk pedestrian movements during climate and heat events. Warralily also highlights the importance of retaining existing vegetation to ensure mature canopy cover from day one.

Creekline restoration at Armstrong Creek within the Warralily precinct. Photography by Warralily.

# Appendix D – Case Studies: Alkimos Beach (Western Australia)

**Alkimos Beach is a residential development approximately 40km N of Perth.**

**The coastal community is an exemplar in terms of urban heat and mitigation techniques.**

**KEY PROJECT STATS**

**Site Area**

224 Ha

**Development Yield**

Residential (2200 dwellings) and community infrastructure

**Key Sustainability Initiatives**

- Maintaining minimum 30% of developable area dedicated to parks and open space
- Roof colour requirements in the Residential Design Guidelines outlining minimum Solar Absorptance (SA) values and colour options (e.g. no black roofs)
- A complimentary 'front landscaping package' provided, with: 20% site area permeable, at least 85% plants indigenous, at least 1 mature tree with turf limited to 80% of planted area
- All dwellings equipped with $4,150 Energy Smart Home package with: 1.5kW PV system, gas/electric boosted HWS or heat pump, energy efficient AC system and energy monitoring device

**Application in Melton East**

Alkimos Beach is a particularly useful case study for its approach to urban heat mitigation.

Through additional (and considered) landscaping requirements and design guidelines specifying light-coloured external finishes, Alkimos Beach is fostering a new neighbourhood character, one that is focused on climate adaptation over legacy aesthetic requirements.

Resilience is further supported through the 1.1MWh community battery, which enables residents to generate solar credits to use in off-peak times.

Light coloured roofing at Alkimos Beach to assist with urban cooling. Photography by Lendlease.

# Appendix D – Case Studies: Ginninderry (ACT)

**Ginninderry is a collaborative project between the ACT Government and Riverview Developments that includes a 577 hectare conservation corridor and is an accredited 6-star Green Star Community.**

## KEY PROJECT STATS

### Site Area

1,600 Ha

### Development Yield

Residential (11,500 dwellings) and community infrastructure

### Key Sustainability Initiatives

- Committed to reducing household energy use (GHG intensity reduced 85-100%) with all-electric dwellings (Stage 1 confirmed)
- Rooftop solar PV system (according to house size);
- Home energy management systems (to allow integration into future micro- grid, or distributed renewable solutions)
- A range of housing typologies, down to a Flexi-living Home series for households under $120k/annum
- 4,200 tonnes of Reconophalt used in infrastructure delivery, (3 million plastic bags, 600k glass bottles and 75,600 printer cartridges recycled)
- 80% of trees retained in Strathnairn, and 92% in Macnamara (both suburbs within Ginniderry)

### Application in Melton East

Ginninderry is an exemplar on many fronts, particularly its approach to nature conservation. However, it was the Territory Plan waiver which allowed gas-free dwellings in stage 1, and sets up the development for an all-electric approach. This means that as energy supply predictably transitions to all electric, residents can avoid the future cost of upgrading appliances.

While Ginninderry doesn't claim an official net-zero target, it promises GHG intensity reductions of 85-100% through energy efficiency, 4-star reverse cycle HVAC, rooftop solar and electric heat pumps for HWS. The precinct has also developed a Climate Adaptation & Community Resilience Plan, identifying building and precinct wide risks and mitigation strategies.

Stage 1 earthworks at Ginninderry show the retention of mature vegetation, in addition to the 577 hectare conservation corridor. Photography by HUON.

# Appendix E – Flood Risk and Terminology

## TYPES OF FLOODING[24]

There are three types of flooding, with each having varying levels of warning, intensity and duration.

1. Coastal Flooding – from storm surges, where sea water is pushed up into rivers and creeks and through stormwater drainage. Warning can be given hours or days prior, intensity varies and they can last for hours to days depending on severity.
2. Rainfall 'Pluvial' Flooding – is localised rainfall that causes flash flooding due to drainage system being inundated. They can occur with little or no warning, are often high intensity and have shorter durations.
3. River 'Fluvial' Flooding – is when rivers and creeks burst their banks and surge into flood plains. Wanring can come hours or days prior, with intensity varying depending on rainfall and can last for days.

The Melton East PSP area currently experiences River 'Fluvial' Flooding from the Kororoit Creek.

## FLOOD RISK AND TERMINOLOGY

### Traditional Terminology and Climate Change[22]

Traditionally we have referred to floods as '1-in-50' or '1-in-100' year events – which still underpins the definition of Average Recurrence Interval (ARI) (discussed below).

Climate change, with rising sea levels and increased rainfall intensities, is influencing flood behaviour and the associated intervals we have traditionally used to describe flood events. This is evident with the recent flooding in South East Queensland and Northern NSW, where two '1-in-100' year floods occurred 30 days apart. The table to the right shows the potential change in ARI caused by climate change.

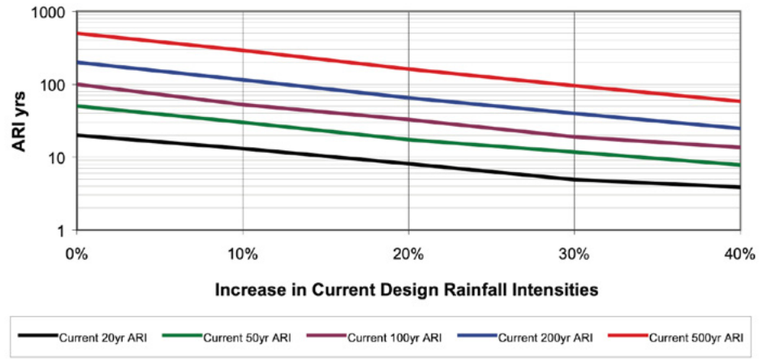
### Annual Exceedance Probability (AEP)

AEP is expressed as a percentage (%) – relating to the *chance* of a flood occurring, and is correlative with ARI. For example, if a flood event has an AEP of 5%, it means that there is a 1-in-20 chance of the flood event occurring in any one year.[1]

AEP is the preferred terminology according to the Department of Environment, Land, Water and Planning (DELWP)[23].

### Average Recurrence Interval (ARI)

ARI is more aligned to the traditional terminology, in that it is the *likelihood* of occurrence over a number of years between flood events equal or larger in size. For example, a flood event with a 100:1 ARI is essentially a '1-in-100' year flood – however as discussed above this can be problematic.




Potential changes in current ARIs due to increases in rainfall caused by climate change. The red line shows how a 500:1 ARI flood event could become a 100:1 event if rainfall intensities increase by 40%. Image by NSW Department of Environment & Climate Change (using data from McLuckie et al, 2005).

### Flood Risk and modelling in Melton

The flood modelling shown on page 17 (using data provided by the Victorian Planning Authority) shows a 1% AEP or 100:1 ARI flood event – i.e. that there is a 1% chance every year that flooding to that extent will occur.

# Appendix F – Carbon Model Assumptions

**HIP V. HYPE has developed a basic baseline emissions profile and associated model for a future 2040 Melton East community, based on full roll out of the precinct comprising 35,000 residents and 4,000 workers.**

**The emissions profile accounts for the following emissions sources:**

**Stationary Energy**

- **Residential buildings**
- **Commercial and other non-residential buildings**

**Transportation**

- **On-road**
- **Public transport**

**Waste**

- **Solid waste disposal**

**Other emissions exist, however they are either negligible or not controllable by stakeholders in this process (e.g. aviation fuel).**

## KEY CARBON MODEL ASSUMPTIONS

### Built form and Demographics

We have assumed the following in terms of ultimate built form and demographics for the precinct.

| | | |
|---|---|---|
| Assumed no. of workers | 4000 | # |
| Assumed no. of people | 35,000 | # |
| Class 1 - Domestic and Residential Buildings | 13,720 | # |
| Single Dwelling | 11,200 | # |
| Class 1a - Townhome / Townhouse | 2,520 | # |
| Class 2 - Domestic apartment buildings | 280 | # |
| Class 3 - Other Residential Buildings | - | # |
| Class 4 - Dwelling within non-res building | - | # |
| COMMERCIAL | | |
| Class 5 - Office | 20,000 | m² |
| Class 6 - Retail | 50,000 | m² |
| INDUSTRIAL | | |
| Class 7 - Car parks, warehouses, storage | 10,000 | m² |
| Class 8 - Factories | - | m² |
| MUNICIPAL | | |
| Class 9 - Public Buildings | 30,000 | m² |
| Class 10 - Non-Habitable Structure | - | m² |
| RESIDENTIAL | | |
| Single Dwelling (size) | 250 | m² |
| Class 1a - Townhome / Townhouse (size) | 170 | m² |
| Class 2 - Domestic apartment buildings (size) | 90 | m² |

### Stationary Energy Assumptions

The key assumptions for Stationary Energy are outlined below:

- Standard energy intensity assumptions drawn from a range of sources primarily on NABERS benchmarking, and the Sustainability Victoria zero carbon homes tool
- Renewables projections are based on the Victorian Renewable Energy Target 2020/21 Progress Report
- Gas and electricity emissions factors are drawn from the latest National Greenhouse Accounts Factors (2021)
- Electricity generation per kWp of solar PV is 3.7kWh per day

### Transport Assumptions

The key assumptions for transport are outlined below:

- The efficiency of internal combustion engine vehicles is drawn from the Australian Motor Vehicle Survey
- The efficiency of electric vehicles is based on a Hyundai Ioniq
- Electric trains and buses are assumed to run on 100% renewable electricity in 2040
- The remainder of the Melton line is assumed to have been electrified by 2040
- Aviation was excluded from the analysis
- Energy content factors and emissions factors of fuels are drawn from the latest National Greenhouse Accounts Factors (2021)
- The baseline trajectory for penetration of electric vehicles is based on the Australian Electric Vehicle Market Study by Energeia for CEFC and ARENA
- The accelerated EV scenario is based on the moderate scenario of the same study
- Emissions are fully counted for trips entirely within the precinct boundary
- 50% of emissions are counted for trips which originate within but cross the precinct boundary
- Baseline mode share is extrapolated from the VISTA data set for 2018 for outer Melbourne
- Active travel and land use optimisation scenarios are based on estimated improvements to mode share

# Appendix F – Carbon Model Assumptions

**Transport Assumptions (cont.)**

Baseline proportions of fuel types by vehicle types are below:

| FUEL TYPE | PASSEN-GER | LIGHT COM-MERCIAL | RIGID TRUCK | TRAIN | BUS |
|---|---|---|---|---|---|
| Petrol | 59.5% | 23% | 0% | 0% | 0% |
| Diesel | 9.1% | 55% | 85% | 0% | 50% |
| LPG | 1.4% | 2% | 0% | 0% | 0% |
| EV | 30% | 20% | 15% | 100% | 50% |
| Total | 100% | 100% | 100% | 100% | 100% |

**Waste Assumptions**

The key assumptions for waste are outlined below:

- The emissions factors for waste types are outlined below taken from the latest National Greenhouse Accounts Factors (2021) (see table to the right)
- Waste densities are derived from NABERS Waste – List of Waste Streams
- Waste treatment generation rates are by land use type, sourced from City of Melbourne Waste Generation Rates
- Impact of long term waste program estimated at an improvement from 70% diversion of FOGO and Paper and Cardboard collected to 90% diversion from land fill


The waste program is expected to increase landfill diversion from 70% to 90%. Photography by Kim Landy.

| WASTE TYPE | CONVERSION FACTOR C02-e |
|---|---|
| Food | 2.10 |
| Paper and Cardboard | 3.30 |
| Garden and Green | 1.60 |
| Wood | 0.70 |
| Textiles | 2.00 |
| Sludge | 0.40 |
| Nappies | 2.00 |
| Rubber and Leather | 3.30 |
| Inert waste (concrete, metal, plastics) | 0.00 |
| Alternative waste residues | 0.08 |

# Appendix G – References


1. Bureau of Meteorology (2022) Climate Statistics for Australian locations [online]
2. EVC Benchmark for Vegetation Quality Assessment – Department of Sustainability and Environment
3. Soils of Victorian Horticulture Regions – Agriculture Victoria
4. Low Carbon Living CRC (2017) Guide to Urban Cooling Strategies
5. Bureau of Meteorology (2022) Climate Statistics for Australian locations [online]
6. IPCC (2014) Assessment Report (AR5) [Summary for Policymakers]
7. Accessing VCP19 Datasets – Australian Government and CSIRO
8. Climate Data Online – Australia Government, Bureau of Meteorology
9. Forum for the Future (n.d) The Five Capitals – A framework for sustainability
10. AS5334-2013: Climate change adaptation for settlements and infrastructure— A risk based approach
11. https://www.goodkarmaeffect.com/about/good-karma-effect
12. https://greenleafcommunities.org/
13. Climate Change Act (2017) Victorian State Government
14. Victoria's Climate Change Strategy (2021) Victorian State Government
15. Recycling Victoria: A New Economy (2021) Victorian State Government
16. Plan Melbourne 2050 (2017) Victorian State Government
17. Melton City 2041 (2021) City of Melton
18. Open Space Plan 2016-2026 (2015) City of Melton
19. Waste Diversion & Education Strategy 2020-2025 (2018) City of Melton
20. Built Environment Climate Change Adaptation Action Plan 2022-2026 (2022) Victorian State Government
21. Sustainable Subdivisions Framework (2021) CASBE + others
22. Glossary of Terms – Flood Victoria
23. Victorian Flood Data and Mapping Guidelines – DELWP
24. Flooding and Defences – City of Melbourne
25. All-Electric New Homes Cost Assessment (2022) DELWP and GHD
26. [Draft Report] Kororoit Creek Wetland Ecohydrology (2018) Alluvium


Landscaping at The Cape. Image by Kim Landy

We respectfully acknowledge that every project enabled or assisted by HIP V. HYPE in Australia exists on traditional Aboriginal lands which have been sustained for thousands of years.

We honour their ongoing connection to these lands, and seek to respectfully acknowledge the Traditional Custodians in our work.

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For additional information, questions unturned, collaboration opportunities and project enquiries please get in touch.

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HIP V. HYPE is Equal Assurance ISO 9001, ISO 14001 and ISO 45001 certified.

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