HAY SHIRE COUNCIL

Circular Economy Strategy

November 2022

Contents

Our Vision, Our Future

A sustainable future for us, our children, and their children.

Acknowledgement of Country

Hay Shire acknowledges the Nari Nari, Wiradjuri and Yitha Yitha people as the traditional custodians of the land and waterways in which we live and work, and we pay our respects to Elders past, present, and emerging.

It is in their footsteps that we travel these lands and waters.

1. Introduction

There are many approaches to becoming environmentally more responsible. The Circular Economy approach is one of many and is more suitable to the Hay Shire than any other approach. This approach is where the idea to do more with less, to be frugal, to repurpose and re-use, comes easily to the dwellers in an isolated town. Through more than a century the Hay Shire population had to live with the challenges of acquiring material goods, to live sustainably in a harsh climate, and to live on a lower income than those in the cities.

The purpose of this strategy is not to be prescriptive to the people of the Hay Shire, but to provide guidelines and practical examples of where the Hay Shire Council as an organisation can make a difference, and ultimately lead by example.

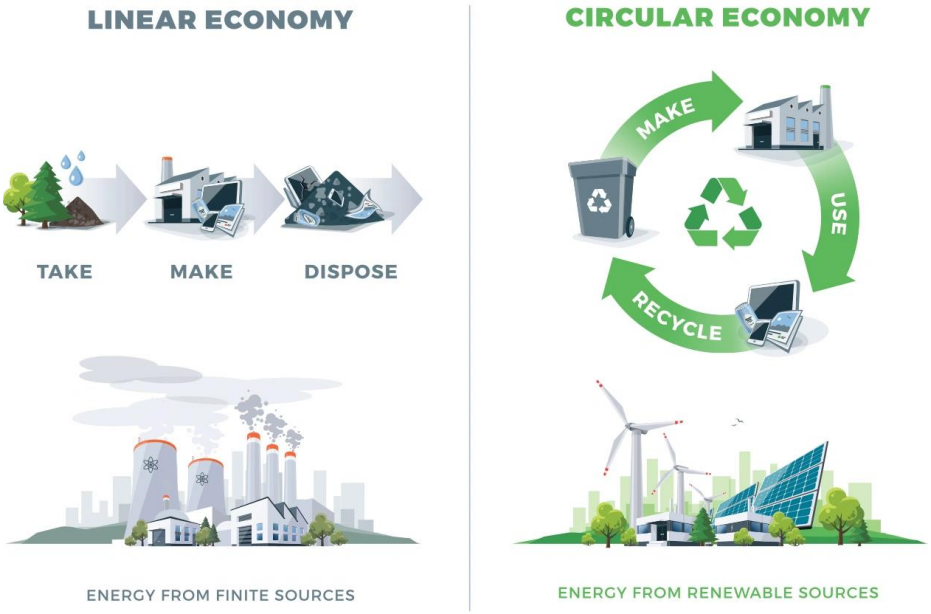
2. Background

2.1 What is the Circular Economy?

The Circular Economy is defined as "the new zero-carbon economy. It aims to redefine growth, focusing on positive society-wide benefits. Gradually decoupling economic activity from the consumption of finite resources, and designing waste out of the system. It is based on three principles:

1. Design out waste and pollution.
2. Keep products and materials in use.
3. Regenerate natural systems" (NSW Circular Strategic Plan FY2020-2023)

Simply put, the Circular Economy is the opposite of the Linear Economy, where we would manufacture an object, transport it to a point where we would buy it, we would use it, and dispose of it to landfill when it is broken or we have no other use for it. In the Circular Economy, we will manufacture an object (preferably using recyclables and renewable energy), transport it to where we purchase or lease the item (preferably with the least emissions possible), if it breaks, we will attempt to repair or refurbish the item, and when the item is unusable, we will take it apart to recycle the different components. In the Circular Economy we try to extend the lifecycle of products as much as possible.



The Linear Economy vs the Circular Economy
(Source:https://blogs.iadb.org/sostenibilidad/en/circular-economy-now-or-never/)

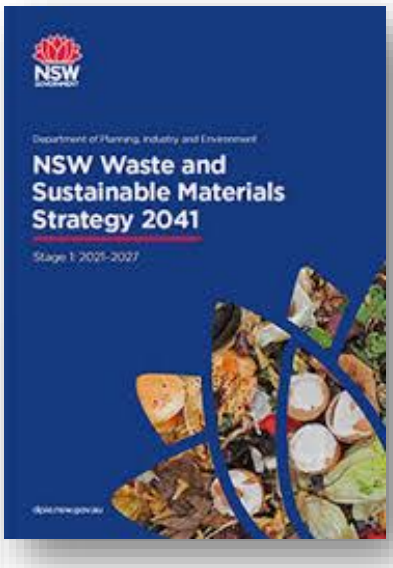
Why do we think the circular economy is a better system than the linear economy, and why would Hay Shire be interested in moving into the Circular Economy? Some reasons would be:

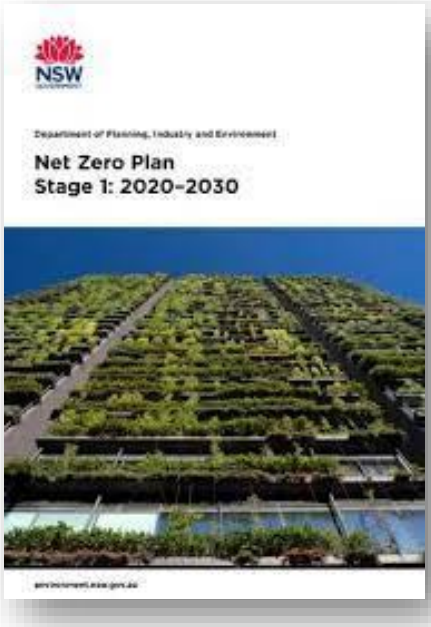
- Smaller ecological footprint - we would use less materials (such as paper, metal, plastics), which all has to be extracted and manufactured, which always leads to the disturbance of natural systems.
- Less emissions – Less manufacturing, transport and energy use leads to a smaller carbon footprint.
- Less wastage -Less landfill has less emissions, and the less we waste the more money we save in the long run.
- We are more environmentally responsible when we think of what we use, how we do things, and what we do, if we think of the next generation when we do it.

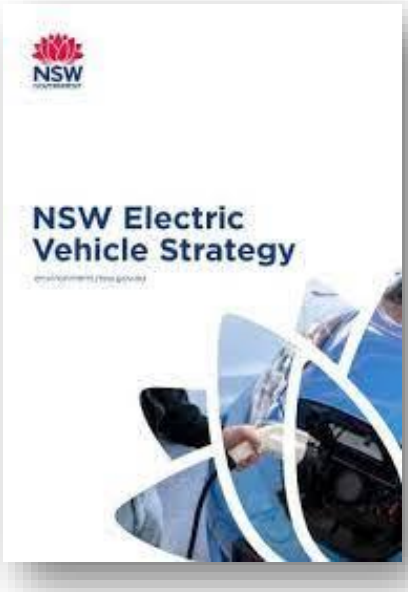
2.2 Policy Background

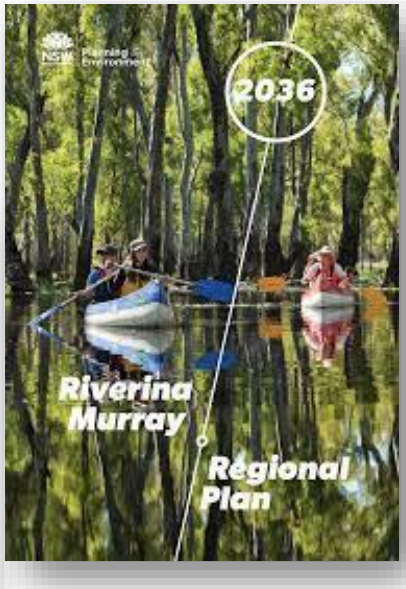
There are a number of policies on state and federal level relating to the Circular Economy, including the following:

- NSW Government Circular Economy Statement – Too Good to Waste
- NSW Circular Strategic Plan 2020-23
- NSW Waste and Sustainable Materials Strategy 2041
- NSW Net Zero Plan
- NSW Climate Change Adaptation Strategy
- NSW Electric Vehicle Strategy
- NSW Government Riverina Murray Regional Plan









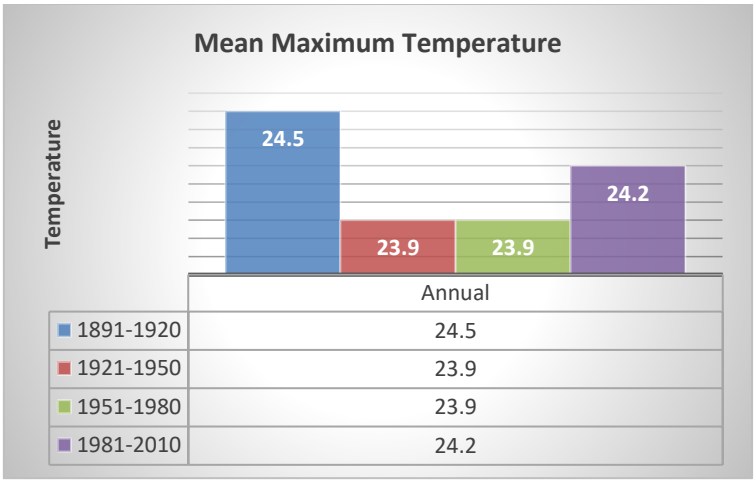
Hay Shire policies and frameworks that applies includes:

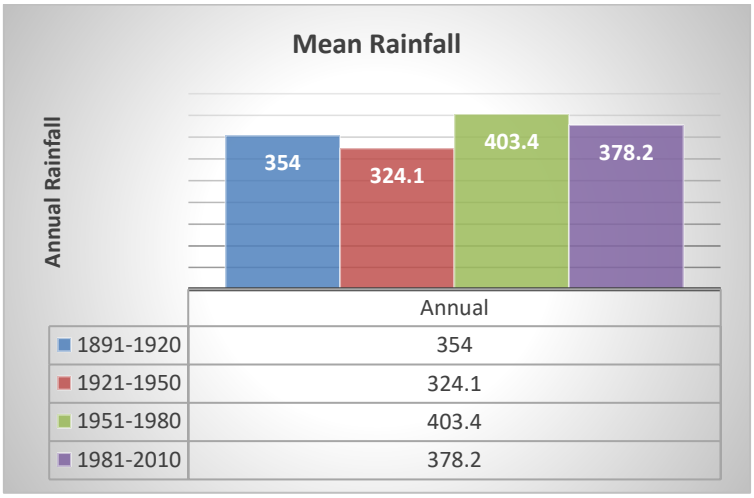
- Hay Community Strategic Plan – Setting the priorities for the Hay community.
- Hay Shire Council Open Spaces Strategy – A framework for guiding the development of open spaces in the Hay LGA, classifying all open spaces, giving future direction and standards for all individual open spaces, and prioritising spaces for future development.
- Hay Bike Plan – A plan that identifies bike riding and accessibility as a priority for the Hay Shire, and provide future direction for the development of bike paths and other related infrastructure.
- Hay Public Art Strategy – Providing guidance to the areas and themes for the development of public art installations and precincts.
- Hay Inclusion Action Plan – Providing guidance on inclusivity in facilities, movement networks and operations.
- Hay Shire Murrumbidgee River Master Plan – Guiding the development of the river frontage along the Murrumbidgee, in the urban areas of Hay.
- Hay Waste Management Strategy – Guidelines in Waste Management and Recycling for the Shire.
- Hay Local Strategic Planning Statement – Providing zoning and spatial guidelines for the future development of Hay.
- Hay Structure Plan – Giving detailed direction to the Local Strategic Planning Statement.
- Hay Shire Council Integrated Water Cycle Management Strategy Supplementary Paper.

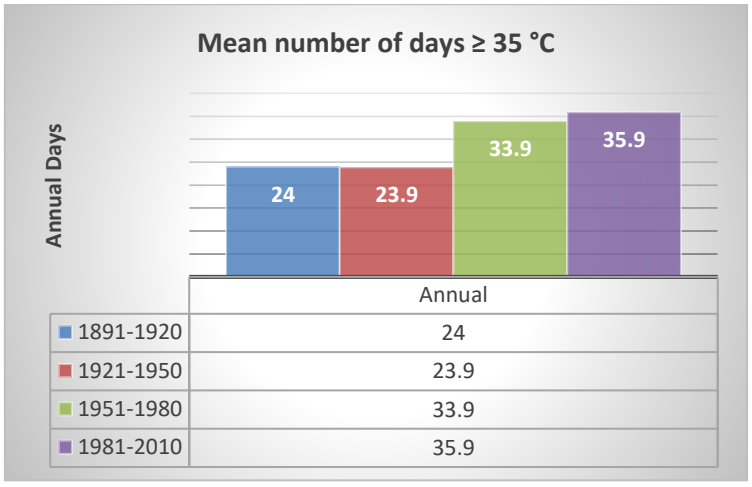
2.3 Climate Trends

2.3.1 Climate trends in Hay

The climate of Hay is temperate, with a low rainfall. Over the past 120 years there has been little change in the mean maximum temperature and mean rainfall. But there is a significant change in the mean number of days above 35 degrees C (See the graphs below).



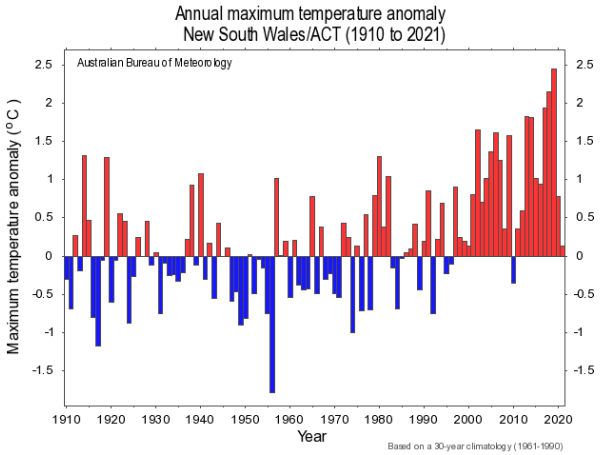


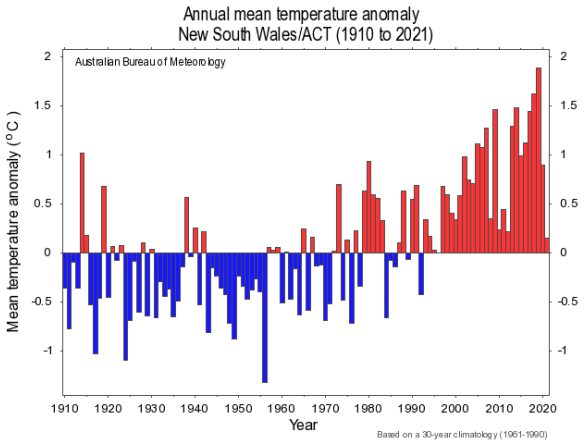


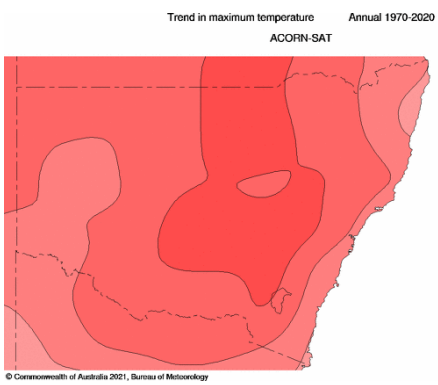
(Source: Hay LSPS)

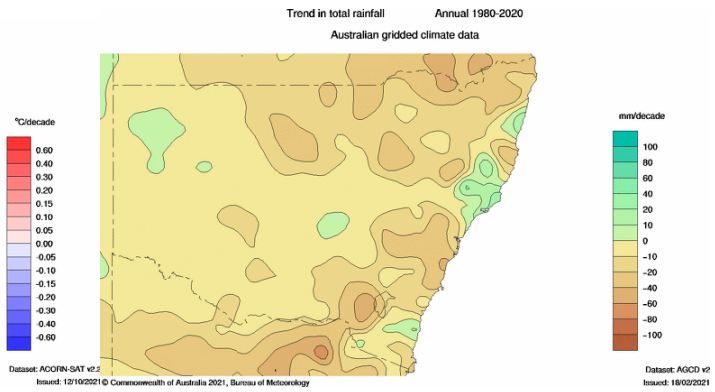
2.3.2 Climate trends in NSW

There is a gradual warming of the climate in NSW, with annual maximum and mean temperatures steadily rising, with also a lowering in rainfall. This can be seen in the below graphs (Source: BOM)



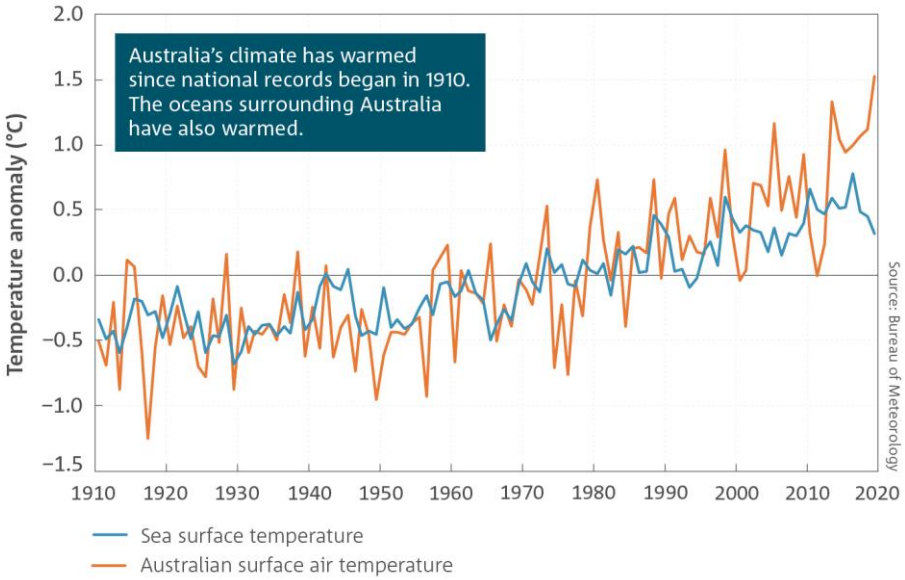






The Bureau of Meteorology has stated the following in it's State of the Climate 2020:

- *Australia's climate has warmed on average by 1.44 ± 0.24 °C since national records began in 1910, leading to an increase in the frequency of extreme heat events.*
- *There has been a decline of around 16 per cent in April to October rainfall in the southwest of Australia since 1970. Across the same region May–July rainfall has seen the largest decrease, by around 20 per cent since 1970.*
- *In the southeast of Australia there has been a decline of around 12 per cent in April to October rainfall since the late 1990s.*
- *There has been a decrease in streamflow at the majority of streamflow gauges across southern Australia since 1975.*
- *Rainfall and streamflow have increased across parts of northern Australia since the 1970s.*
- *There has been an increase in extreme fire weather, and in the length of the fire season, across large parts of the country since the 1950s, especially in southern Australia.*



- *There has been a decrease in the number of tropical cyclones observed in the Australian region since 1982.*
- *Oceans around Australia are acidifying and have warmed by around 1 °C since 1910, contributing to longer and more frequent marine heatwaves.*

- *Sea levels are rising around Australia, including more frequent extremes, that are increasing the risk of inundation and damage to coastal infrastructure and communities.*

From the above it is evident that there are severe challenges ahead for the Hay Shire, which Hay Shire can ameliorate through various actions.

2.3.3 Waste

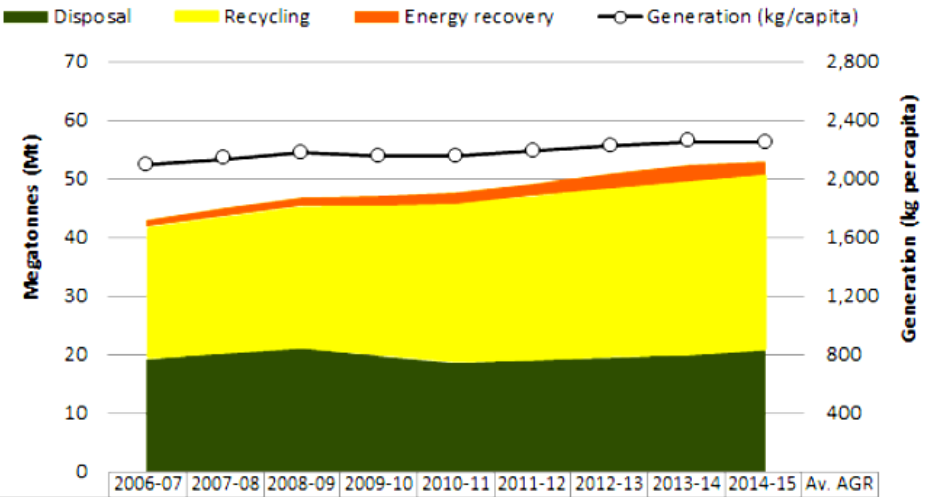
It is projected that Hay's population will continue a slow decline. The projected population trends are below:

Region	2021	2041	Change	Annual %
NSW	8,166,757	9,872,934	1,706,176	0.95
HAY	2,862	2,594	-267	-0.49

(Source: https://pp.planningportal.nsw.gov.au/populations)

The Australian National Waste Report has shown an increase in the per capita waste generation. In the 2016 report the average waste per capita was projected at 2245 tonnes per capita, which has been rising year by year (see figure below). With any future projections, it can be estimated that Hay's per capita waste generation will grow by 0.8% annually.

Figure 8 Trends in waste generation and fate excluding fly ash, Australia 2006-07 to 2014-15



	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	Av. AGR
Generation (kg/cap)	2,091	2,138	2,176	2,154	2,151	2,190	2,222	2,252	2,245	0.8%
Generation (Mt)	43	45	47	47	48	49	51	52	53	2.3%
Energy recovery (Mt)	1.4	1.4	1.5	1.7	2.0	2.3	2.6	2.9	2.3	6.0%
Recycling (Mt)	23	23	24	26	27	28	29	30	30	3.2%
Disposal (Mt)	19	20	21	20	19	19	20	20	21	0.9%
Recovery rate	55%	55%	55%	58%	61%	61%	61%	62%	61%	1.0%

Relies on interpolation for 2007-08, 2011-12, 2012-13 for all states and territories. 'Av. AGR' means average annual growth rate.

With the increase in waste per capita being more than the population decline in Hay, we can assume that there will be a per capita increase in waste. Coupled with the finite capacity of the current landfill, Shire staff had reservations about the continued capacity to handle the volumes of waste

that was generated in the LGA. This lead to the first Waste Management Strategy drafted in 2019. The actions of the plan included:

- A Reduce, Reuse, Recycle Campaign
- Targeted waste reduction, with plastic, paper and food and organic waste identified.
- Bottle refilling campaign
- Construction and Demolition waste recycling
- Tyre processing
- Glass recycling
- Metal recycling
- E-waste recycling
- Rehabilitiation of areas of the landfill

Changes that was implemented lead to dramatic results and there was also additional funding allocated for a Material Recycling Facility in Hay. The changes was summarised in a Supplement to the Hay Waste Management Strategy in December 2021.

The changes can be seen in the following photos, taken from the west:

Hay Landfill Site - August 2019

Hay Landfill Site - July 2020

Hay Landfill Site - November 2021

As can be seen from the photographs, the Hay Landfill Site is now significantly tidier and has more space. In August 2019 staff investigated the square metre take-up rate of the waste at the tip. Calculations showed that in 2019, with the waste practices at the time, the tip would be filled in three years. Since then, Council

have started sorting materials, and started recycling construction and demolition waste, and renewed the paper recycling. This action has extended the landfill life to approximately 11 years. If the green waste can be fully recycled, this will extend the life of the tip to approximately to approximately 14 years.

The Hay Waste Management Strategy Supplement (2021) concluded the following:

> *There has been significant improvement in the waste handling since the Waste Management Strategy has been completed. From a residual life of 3 years in 2018, the lifespan of the tip has been extended by 14+ years. If the MRF and FOGO gets implemented, this will add 50+ years to the Hay Landfill, with significant wider community and environmental benefits.*
>
> *With the isolated location of Hay, the Shire can be an example of best practice in waste management, as the town will have to be self-sufficient and proactive. But with the small rates base, this will be dependent on external funding.*

2.3.4 Environment

There are numerous environmental issues that influence the Hay Shire. In a climate of extremes, it is even more important to have ample vegetation cover, shade cover over pedestrian areas, and linkages to green spaces.

From the below Colour Infrared photo of the central precinct in Hay (below) it can be seen that there are limited vegetation, and an abundance of hardstand spaces. This has a direct impact on the liveability of residents and visitors. Green spaces in urban areas are responsible for helping regulate air quality and climate, reducing energy consumption by countering the warming effects of paved surfaces, recharging groundwater supplies, protecting rivers from polluted runoff and maintaining the environmental balance that affects physical wellbeing of all residents.

In the picture above live vegetation is almost always associated with red tones. Very intense reds indicate dense, vigorously growing vegetation. As plant vigor decreases, the vegetation appears as lighter shades of red and pink, various shades of greens, and possibly tans. Bare soils appear as shades of white, blue, or green in most agricultural regions. In general, darker shades of each color indicate moister soil. Man-made features appear in tones that relate to the materials with which they are made. Asphalt roads, for example, are dark blue or black; gravel or dirt roads are lighter colors depending on their composition; and clean concrete roads are light in tone. The colors of buildings are similarly dependent on the materials used to create them. Water appears as shades of blue, varying from nearly black (clean, clean water) to very pale

blue (increasing amounts of sediment) (https://www.usgs.gov/faqs/what-do-different-colors-color-infrared-aerial-photograph-represent)

With the abundance of grey hardstand areas in the above Colour Infrared photo, it shows a opportunity for the Hay Shire to increase the green cover in the town. As planting strategies Hay Shire has completed the following:

- Open Space Strategy
- Hay Murrumbidgee River Masterplan
- Lachlan Street Masterplan
- Landscape Designs for a range of open spaces.

3. Vision

The Vision for the Hay Shire Circular Economy is to:

- Reduce Waste and Pollution,
- Circulate Products and materials (at their highest value), and
- Regenerate Nature

through a deliberate evaluation of all our assets, functions and practices.

4. Actions

4.1 Assets

4.1.1 Buildings

4.1.1.1 Energy

Most energy for the buildings owned by Hay Shire Council is powered by grid electricity, with solar installations and batteries at the Visitor Information Centre (VIC) and the Library, and solar installations at the Council Administration Building (CAB) and Sewer Treatment Plant (STP).

On the supply side, the obvious first step is to generate solar energy on the building. This is a relatively straightforward process, with Council having success with also installing batteries, which not only stores the energy for a night-time use, but serves as a backup electricity supply.

There are a range of options to conserve energy that can be implemented:

1. Replacement of fluorescent tubes with LED.
2. Installation of internal and external solar lights.
3. Task lighting – lighting up only what is necessary.
4. Increasing ventilation by fixing windows and adding fans.
5. Landscaping, by:
    a. Planting deciduous trees with wide canopies close to the buidings, in the sun's path, but not right up against the wall. Use trees with non-invasive roots so as not to damage pipes and foundations.
    b. Planting trees such as palms, with tall bare trunks and high canopies, near the building to shade the roof but not the walls or windows.
    c. Tall, cone-shaped trees, planted in a row, will shade the building from low sun on the eastern and western sides (Queensland Government EPA. Landscaping for Energy Efficiency.)
6. Encourage energy saving behaviour, including but not limited to:
    a. Remove lights that are in useless places (e.g. next to windows).
    b. Use task lighting around room when available, rather than down lights.
    c. Clean lights and light fittings regularly to ensure light output is maximised.
    d. Fluorescent lights with magnetic ballasts- voltage reduction devices reduce start up voltage level (reduce energy by 20-30%).
    e. Investigate sensor lights for inside buildings.
    f. Switch printers off when not in use for long periods.
    g. Repair any faulty office equipment as soon as possible to ensure maximum energy efficiency is achieved.
    h. Enable energy saving mode on all electronics.
    i. In summer – using natural ventilation as a first option for cooling, then fans, then air-conditioning.
    j. In winter – keep doors closed for retaining heating.

k. If using air conditioning, rather using it on the Auto setting.

4.1.1.2 Building Maintenance and Materials

Council can implement the following actions regarding to its buildings to prevent waste and keep products and materials in use:

1. Reuse and recycle building materials where possible. Create a dedicated storage space at the Hay Shire Depot for reusable building materials. Building materials not used within a certain timeframe, can be put on auction so that it can be reused by the public.
2. Annual inspections and maintenance regimes need to be implemented, so that items can still be repaired to prevent deterioration to the point of necessary replacement.
3. Utilising sustainable building materials, such as:
    a. Eco friendly thermal insulation materials.
    b. Recycled material, such as recycled plastic.
    c. Reclaimed wood products.
    d. Structural insulated panels.
    e. Using Low or No Volatile Organic Compound (VOC) paints, sealants and adhesives.
    f. When using wood, use FSC or AFS certified products.

4.1.1.3 Priority Actions

Hay Shire Council has made some significant changes in recent years with its built assets, for example new amenities being built has been low maintenance with solar and/or LED lights. The main priorities identified for the next ten years would be:

Facility	Actions	Cost Estimate
338 Murray Street	LED Lighting Replacement	$10,000
	Solar generation	$15,000
365 Lang Street	LED Lighting Replacement	$4,000
	Solar generation	$15,000
	Additional Trees	$1,000
334 Murray Street	LED Lighting Replacement	$10,000
	Solar generation	$15,000
342 Church Street	LED Lighting Replacement	$4,000
	Solar generation	$15,000
	Additional Trees	$1,000
Community Building	LED Lighting Replacement	$7,000
	Ceiling Fans	$15,000
Council Building	Tesla Battery	$20,000
	LED Light Replacement	$12,000
	Outdoor light replacement	$5,000
	Natural Ventilation and fans	$4,000
Library	LED Light Replacement	$18,000

Myers Lane Units	LED Light Replacement	$15,000
VIC	LED Light Replacement	$3,000

4.1.2 Recreational Facilities

4.1.2.1 Principles

Australian society have moved into the North American pattern of recreating public facilities in the private sphere, such as having private pools instead of utilising public pools and having private play equipment instead of using public playgrounds. This has been known to create a range of issues, such as:

- Loss of community connections.
- Less passive observation over public facilities
- Less use of public facilities will impact the political will to create and maintain public facilities.
- More impermeable surfaces such as larger sheds, more concreted areas, and larger houses have an impact on runoff as well as contributing to the urban heat island.
- Negative impact on the streetscape, as dwellings have higher fences to protect and provide more privacy on the street frontages.

The principles for recreational facilities in the circular economy would be:

1. Creating recreational spaces that is more attractive to use, that feels safe and communal in the use thereof, and will have longer periods/seasons to use.
2. Create Third Places in the recreational sphere. Ray Oldenburg's Third Places refers to the social surroundings that are separate from the two usual social environments of home ("first place") and the workplace ("second place"). Examples of Third Places include churches, cafes, clubs, public libraries, bookstores or parks. Third Places, then, are "anchors" of community life and facilitate and foster broader, more creative interaction. In other words, "your third place is where you relax in public, where you encounter familiar faces and make new acquaintances." (White 2018).
3. Reuse materials and repair equipment where feasible, rather than replacing equipment.
4. Have items locally manufactured where possible.
5. Create as much green cover as possible.
6. Use renewable energy as much as possible.

4.1.2.2 Pool and Aquatic Facilities

The John Houston Memorial Pool complex is a significant user of resources, mainly in energy use, chemical supply, and in general maintenance. The primary focus on the environmental sustainability of the pool complex would be energy use. Energy in the pool complex would mainly be water pumps, water filtration systems in both the splash park and pool (chlorine dosing, sand filter and UV filter).

The pool currently uses approximately 340,000 kWh of electricity per annum, and this can be mitigated through source generation and upgrading filtration and pumping systems. The pool is at the end of its

operational life, and the proposed replacement will include a range of design solutions to decrease the environmental footprint and increase the use of the facility. This will include heating the water to extend the swimming season, as well as generating its own energy.

The main priorities for the next ten years would be:

Facility	Actions	Cost Estimate	Comments
John Houston Pool	Evacuated Tube Solar Heating	$250,000	Forms part of a current funding application
	Solar PV Panel Car Parking Shelters	$140,000	Forms part of a current funding application
	Solar Lighting	$30,000	
	Tesla Battery	$20,000	
	Variable Speed Drive pumps	TBC	TBC during design phase
Splash Park	Solar PV Panel Shelter	$30,000	
	Solar Lighting	$5,000	

4.1.2.3 Parks

Parks serve a multitude of purposes in a settlement:

- Aesthetical – a place that is beautiful to look at, that contributes to us recharging and being calmer.
- It contributes to the physical development and conditioning for all ages.
- It serves as a social meeting place.
- It enhances the multisensory experiences for children.
- It serves as a green space that sequesters carbon, help decrease the urban heat island effect, and is a habitat.

Parks forms a crucial part in our urban fabric, and just as other uses, we can look at designing out waste and pollution, keeping products and materials in use, and regenerating natural systems. The following are proposed:

- Reconditioning play equipment and furniture where possible, instead of simply buying new equipment. Look at sustainable materials such as recycled plastic and wood.
- Investigate locally manufactured nature play items from recycled materials.
- Using trees for shade cover rather than shade sails or other shade structures.
- Creating more urban forests in parks where vegetation is sparse. This will not only provide a shadier environment but will also help to capture and retain more stormwater as well as form a habitat.
- Adopt a standard for ten trees planted for every tree removed. Re-use removed trees by either mulching them or use them for nature play.

4.1.2.4 Reserves

Hay has numerous reserves, some which are Crown Land controlled by the Hay Shire Council. The reserves have numerous uses, including boat ramps, camping, footpaths, furniture, amenity blocks, and artworks. It should be attempted to preserve the reserves as much as practicable, with at the same time utilising the reserves for human experiences. The reserves has numerous benefits, with the most obvious being preserving green space and habitat. There is also a growing body of research on the social and developmental benefits of reserves. In his groundbreaking work "Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder", Richard Louv states the following:

> *Nature-deficit disorder describes the human costs of alienation from nature, among them: diminished use of the senses, attention difficulties, and higher rates of physical and emotional illnesses. The disorder can be detected in individuals, families, and communities.*

Although we want to attract people to use of reserves, there needs to be caution in not overdeveloping reserves. Examples can include:

- Creating all weather vehicular access, where all weather pedestrian access would suffice.
- Limiting artificial lighting. Lighting has been known to have biological impacts, such as decreased pollination and increased mosquito activity.

The following are proposed:

- Investigate locally manufactured furniture from natural or recycled materials.
- Using trees for shade cover rather than shade sails or other shade structures.
- Use recycled materials for other constructions, such as recycled wood for retaining walls.
- Use solar sensor lighting where lighting is needed.
- Continue encouraging pedestrians through the provision footpaths and seats, and limited vehicular access to only single access points.
- Implement the Hay Murrumbidgee River Master Plan.

4.1.3 Streets

Hay has an extensive road network, and a general rule of thumb would be that streets would cover 20-30% of an urban area. Streets can have a major effect on the urban heat island effect (up to 12 degree Celsius difference between a shaded and unshaded street), as well as on stormwater, the latter can increase by as much as 500% between developed and undeveloped areas (Girling & Kellett 2005:83). Given the aims of

the Hay Circular Economy Strategy being to design out waste and pollution, to keep products and materials in use, and revitalise natural systems, the following are proposed:

- Initiating a major tree planting programme for urban streets and regional roads, to combat the urban heat island effect, sequester carbon, retain and treat stormwater, and create a habitat.
- Limit impervious surfaces as much as possible.
- Experiment with permeable paving for footpaths and driveways.
- Use solar street lighting and smart poles where possible.
- Encourage non-vehicular modes of transport through continuing to expand the Hay cycle path network, and having adequate seating, bubblers, e-bike charging points and bike racks at suitable locations.
- New streets should be narrower, slowing down vehicular traffic and limiting impermeable surfaces. Limiting impermeable road surfaces help reduce urban runoff volumes, reduce solar jeating , and increase visual amenity (Earl, Terblanche & Patten 2012)
- Having a network of water bottle refill stations easily accessible via the footpath network, to combat single use water bottles.

Permeable Paving (Source: https://www.watersensitivesa.com)

4.1.4 Vehicles

Council have a range of vehicles in it's fleet, consisting mostly of construction fleet, utility and passenger vehicles. There is a growing tendency for Local Government to move into a fully EV fleet, but this is in all probability not feasible for the Hay Shire Council. Distances between towns makes fully electrical vehicles unpractical and risky, and it is recommended that Council move to hybrid vehicles in its passenger vehicles. As technology improves, the next step will be hybrid utility vehicles.

The following is proposed:

- Replacement of passenger vehicles to be hybrid vehicles
- When technology and finances permits, move towards hybrid utility vehicles.

4.1.5 Aerodrome

Hay Aerodrome is located on the western side of and adjacent to the Cobb Highway, approximately two (2) km south of the Town of Hay. The aerodrome is situated on near level ground which is typical of the terrain extending for many kilometres in all direction from the aerodrome.

Hay Aerodrome is situated on an area of land comprising approx. 194 ha which is owned by Hay Shire Council. The Aerodrome has two runways:

- 15/33 – Gravel runway, 1440m long by 30m wide, unlit.
- 04/22 – Sealed runway, 1463m long by 30m wide, Pilot Activated Lighting available.

Hay Aerodrome has a wide range of users, with agricultural related companies use mostly larger lease areas at the south of the site, and then there are smaller lease areas to the north. Users also include recreational flyers, mail services, banking services, and medical services.

The current use of the Hay Aerodrome site includes:

- Runways and Taxiways
- Refuelling facilities
- Hangar sites (mostly recreational use)
- Hangar sites (agricultural use)
- Terminal building
- Office building (Private ownership on leased land)

- RFS Water Tank and Container

Uses outside of the aerodrome fence, but in the ownership of Hay Shire Council includes the following:

- Grazing
- Quarry
- Unused land.

Hay Shire is in the process of completing a Master Plan for the Aerodrome, which incorporates the extension of the sealed runway, the inclusion of a freight hub, and the rehabilitation of old quarry sites. Given the aims of the Hay Circular Economy Strategy being to design out waste and pollution, to keep products and materials in use, and revitalise natural systems, the following are proposed:

- Redeveloping of the Aerodrome to include extensive revegetation of degraded areas. This should be with native scrubland species, as trees may intrude into the Obstacle Limitation Zones.
- Upgrade runway and taxiway lighting to LED lighting, and including an UPS system to guarantee lighting during blackouts. The UPS can be a small solar system on the Terminal building roof charging a Tesla battery. Upgrading to LED lights will reduce ongoing maintenance costs, as LED can last up to 100 times as long as halogen lamps. LED's can reduce up to 50% of lighting emissions and operational costs (CEFC 2020).

4.1.6 Depot

The Hay Shire Council depot is located on the corner of Dunera Way and Murray Street, and consists of the following:

- Several sheds, workshops and lean-to's.
- Several containers and other storage units for equipment and documents.
- An Amenity Block and offices.
- A SES building.
- Storage areas for mulch, gravel, sand, stone, and emulsion.
- Storage areas for used timber, old vehicles, and other scrapped items.
- Parks and Gardens storage area for plants.
- Animal Pound.

Given the aims of the Hay Circular Economy Strategy being to design out waste and pollution, to keep products and materials in use, and revitalise natural systems, the following are proposed:

- Separate materials as much as possible for potential reuse. Materials that can be reused include rock, bridge timber, fencing, and furniture.
- Continue with the Parks and Gardens actions of creating our own potting soil, propagating plants, and reusing natural materials for landscaping. There is room to build a greenhouse facility.

- Create areas for separation of materials for recycling, such as soft and hard plastics.
- Repair items where possible.
- Investigate the feasibility of solar panels on the workshop and amenity block.
- Plant native trees on the perimeter of the depot.

4.2 Operations

4.2.1 Administration

One of the Hay Shire Council's main functions is administration, which includes mostly the financial administration and corporate governance, but also include Health, Town Planning, Engineering, Building Surveying and several community services. The resources that are used mostly in administration are:

- Energy (Computers, air conditioning, lighting)
- Paper (General administration, newsletters, notices)
- Equipment (Computers, printers, stationery, technical equipment)

Given the aims of the Hay Circular Economy Strategy being to design out waste and pollution, to keep products and materials in use, and revitalise natural systems, the following are proposed:

- Implement a paper recycling system, where paper is shredded and re-used as mulch.
- Cut down on paper use by having electronic newsletters, using email as preferred method of contact, and investigating reusable paper. Continue implementing the Electronic Document System.
- Implement flexible work arrangements where possible and feasible, so that there is an emission reduction in travel to work trips.
- Give preference to Australian products in procurement, as the freight emissions will be less in local products.
- Implement the building energy savings actions as per Section 4.1.1.

4.2.2 Road Construction and Maintenance

There has been numerous studies with using recycled materials in road construction. In the 2020 LGNSW report "Recycled Materials in Roads and Pavements: A Technical Review" there were six waste streams identified for the incorporation of roads and pavements:

- Glass
- Plastics
- Rubber
- Reclaimed Asphalt
- Crushed Rock, Masonry and Concrete
- Fly Ash.

Hay Shire Council can experiment with the first five materials.

4.2.2.1 Glass

Hay Shire Council plans to recycle and crush glass at its proposed Material Recycling Facility. Glass makes up 8% of the Hay Shire domestic waste stream. Glass is not biodegradable and is easy to separate, and as such it is easier to reuse in construction. There are however some concerns in cross contamination.

The 2020 LGNSW report "Recycled Materials in Roads and Pavements: A Technical Review" states the following:

> *The feasibility of using glass as a cement replacement in concrete has been demonstrated by various studies. Due to its high silica content, allowing it to function as a pozzolanic material, it is able to react with Portlandite in hydrated cement, forming C-S-H bonds, increasing the strength and durability of the concrete (Ling et al., 2013). According to a review of crushed waste glass (CWG) in construction materials, there are still barriers preventing widespread use in concrete and asphalt applications (Mohajerani et al.,2017). These include alkali-silica reaction (ASR) expansions within the concrete, which limit the amount that can be replaced with glass.*
>
> *Other studies investigating the use of recycled waste as a fine aggregate replacement in cementitious materials, found that glass sand increased mixture workability and bleeding, whilst decreasing density and mechanical strength. Despite these effects, glass was also found to increase chemical and fire resistance. These challenges and benefits highlight the potential for further optimisation of waste glass incorporation into roads and pavements. There are many types and variations of glass, such as colour, particle size and degree of contamination. These variations may affect its suitability for reuse in roads and pavements, making it difficult to apply a single approach. However, there are still opportunities for reuse as low-order mixed glass, when colour is not considered an issue, being crushed down to form aggregate with uniform particle size (typically 4-5mm for recycled glass sand).*

It is recommended that Council start doing limited trials with crushed glass.

4.2.2.2 Plastics

Plastic comprises about 19% of Hay Shire's waste stream and there is currently limited separation. In the longer term the Shire is looking at recycling the plastics by shredding and reusing it.

The 2020 LGNSW report "Recycled Materials in Roads and Pavements: A Technical Review" states the following:

> *Studies testing the use of plastics have demonstrated improvement in deformation and fracture resistance as well as an increase in structural contribution of the asphalt, with the addition of waste plastic (White and Reid, 2018).*
>
> *However, these studies have also demonstrated the importance of properties such as low melt-temperature of plastics, which will determine its use, through its digestion into the asphalt. Plastics*

with melt-temperatures higher than the typical bituminous binder and asphalt, would be used as an asphalt mixture or aggregate extender (White and Reid, 2018).

Current concerns of waste plastic use in roads and pavements are mainly regarding the microplastics issue, due to its leachability into waterways. Trial studies have explained that both soft and hard plastics additive melts as part of the 5% bituminous binder in asphalt, making it unable to be released into the environment (Sustainability Victoria, 2018b, Redland City Council trial (Crick, 2019)).

It is recommended that Council start doing limited trials with shredded or granulated plastics.

4.2.2.3 Rubber

It was estimated that there are approximately 1500m3 of tyres in the Hay Landfill, with this number steadily growing. In the longer term, the Hay Shire plans to shred tyres to either reduce the landfill volume or reuse the shredded product, although the current MRF licence does not cover this activity.

The 2020 LGNSW report "Recycled Materials in Roads and Pavements: A Technical Review" states the following:

Rubber is a waste stream of interest due to the enhanced properties it provides to roads and pavements. The addition of rubber into concrete has been found to increase ductility and impact resistance. Rubberised concrete is suitable in applications subject to dynamic loading, such as concrete pavements with moving vehicles or people. Properties such as size and distribution of rubber particles and aggregate type are important as they affect the compressive strength and workability of the concrete (Moustafa and ElGawady, 2015).

An example of current technology is Recycled Tyre Rubber Modified Bitumens (RTR-MBs), which is used in the "wet-process" and have been demonstrated to enhance road pavement performance (Lo Presti, 2013). Crumbed rubber are also well tested products, which act as polymer modified binders (Tyre Stewardship Australia). These allow greater reflection cracking resistance in aged or cracked pavements, due to a thicker bituminous membrane (Austroads, 2009).

It is recommended that Council start doing limited trials with shredded rubber, and if found feasible, apply for the inclusion of rubber recycling within its EPL for the Hay MRF.

4.2.2.4 Reclaimed Asphalt

All asphalt is currently being reclaimed by the Hay Shire Council as road base.

4.2.2.5 Crushed Rock, Masonry and Concrete

All Construction and Demolition (C&D) waste is currently sorted, and all concrete and rock is being crushed and used as road base.

The 2020 LGNSW report "Recycled Materials in Roads and Pavements: A Technical Review" states the following:

> *The use of crushed concrete in applications such as low-grade roads and in pavement sub-bases are key growing markets for this waste stream. These masonry products offer a substitute for virgin crushed rock, decreasing the use of raw material. It was found that recycled crushed concrete increased the overall product volume, in comparison to crushed quarry rock of the same weight (DSEWPaC, 2012). Additionally, due to the cement presentin recycled concrete, the aggregate forms a more stable hardstand compared to virgin aggregate (Pickin et al., 2018). TfNSW/RMS allow 100% crushed concrete and a maximum of 20% crushed brick to be blended to be used as road base aggregates (2019b).*

4.2.3 Waste Management

Hay Shire Council has implemented a range of actions since it commenced to do proactive planning in the waste management. There has been a raft of changes in the waste field since 2018:

Maude :

- Closed community landfill and turned it into a Waste Transfer Station – serviced once per week by Shire staff attending site and collecting waste and transport back to Hay.

Booligal:

- Closed community tip and turned it into a Waste Transfer Station – serviced once per week by Shire staff attending site and collecting waste and transport back to Hay.

Hay:

- Closed the back of the tip to the public, now pay per entry to site
- Introduced fees for tire disposal
- Introduced fees for Asbestos disposal

- Household waste bunker at transfer station, now has a trailer to eliminate backhoe and truck driver to clear bunker, trailer is emptied when full by waste operator
- Scrap metal trailer was introduced to eliminate backhoe and truck driver to clear pile; trailer is emptied when full by waste operator
- Recycling introduced, glass, cans, soft plastics, e-waste, hard plastics.

- Plastics and e-waste go to Kurrajong Waste in Wagga Wagga for recycling
- Mattress cage was introduced, mattresses go to Gunnedah for recycling
- Turf Maker purchased to cover waste with a powder glue mixture to eliminate the use of dirt and soil. Instead, dirt and soil are now only used as a final capping on household waste.
- Purchase of neighbouring land for FOGO processing.

Hay Shire Council is planning to implement a weekly kerbside green waste and food organics collection service (FOGO). New mobile garbage bins and kitchen caddies will be provided to all included households and Council will provide instructions and education on the correct use of the new systems. This service aims to reduce the number of organics going to landfill, instead converting it into compost for the community and Council.

This project involves the construction of an Organics Processing Facility (OPF) at Hay Shire Councils main landfill site in Hay. This facility will be key to ensuring the financial viability of the FOGO kerbside service in the Hay Shire and will deliver diversion from landfill, compost production, council cost saving and landscaping improvements. It will provide the community with a sense of empowerment through participation in waste reduction and 'keeping up' with the state's urban areas. It will deliver education, training and jobs to community members.

Council have been investigating strategies to divert material from landfill; both for the extension of the life-span of the current landfill and for the improvement of environment impacts. As a small Council the idea of a FOGO kerbside service and an OPF has been attractive but limited by the establishment cost and the restricted capacity to generate the income to fund such a project.

Apart from the OPF, Council is in the planning stages of constructing a Material Recycling Facility (MRF). This will be a facility that aims to recover and reprocess waste from municipal, as well as domestic waste collection, targeting waste streams such as glass, plastics, tyres, paper, cardboard as well as Food Organics/Garden Organics (FOGO).

The facility would also process Construction and Demolition Waste and take waste from the surrounding neighbouring Councils which also do not undertake any recycling.

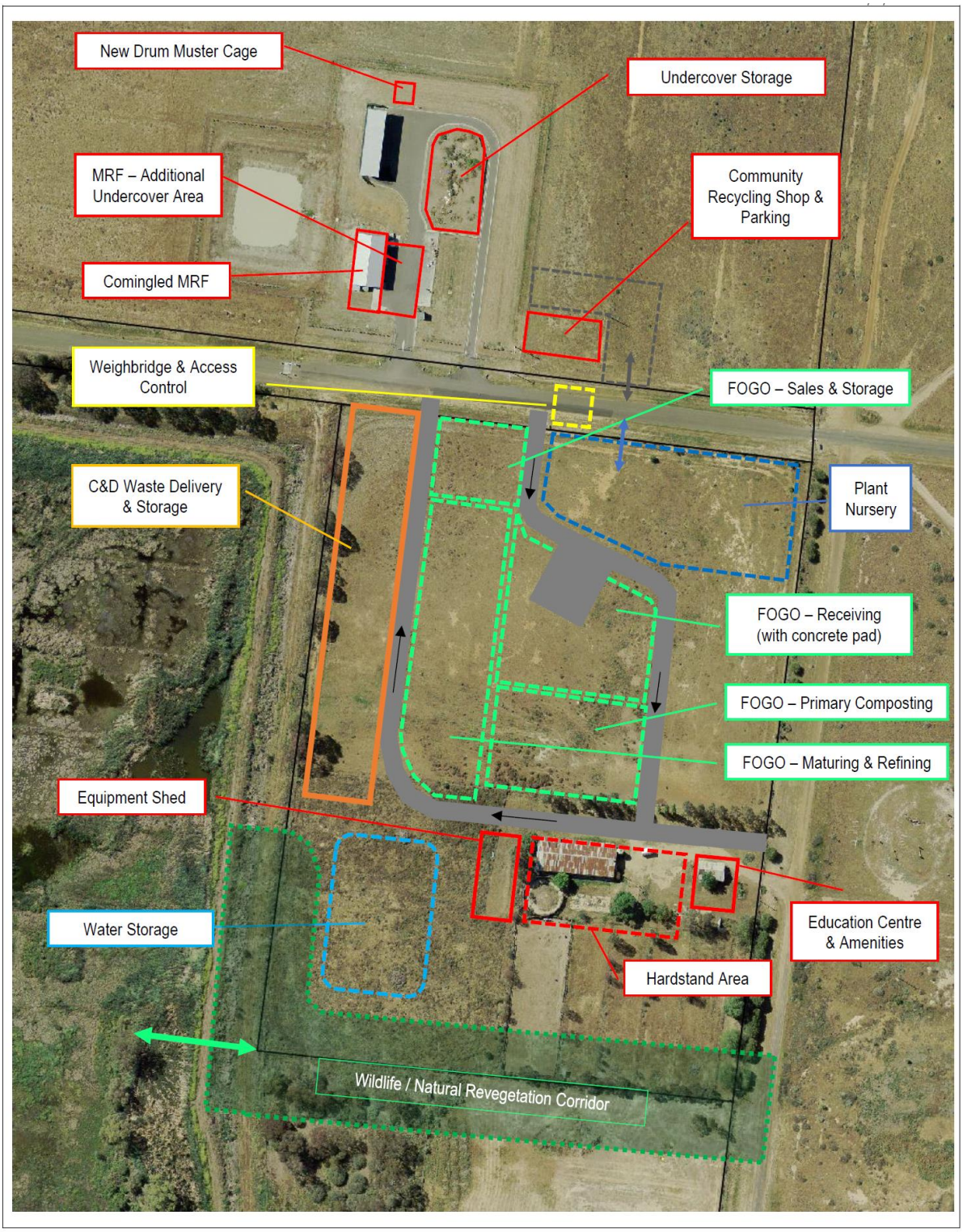
It is envisaged that the recycling facility can produce the following:

	Current	6 Month Forecast	3 Year Forecast	10 Year Forecast
	2021	2022	2024	2031
Polypropylene (PP) plastic pellets		100	350	500
Mixed crushed glass		200	600	800
Glass fines		50	150	300

Rubber crumb		100	300	600
30 mesh				
Beneficiated paper		100	300	500
E Waste	68	100	300	300
Mulch/Shredded Products/Compost		200	200	500
Textiles/Cloth		100	300	500
Plastics - soft		100	300	500

The facility will be costly, with the following costs envisaged:

Hay Materials & Organics Recovery Facility (MRF)			
	Unit Cost ($)	**Unit**	**Cost ($)**
Hay MRF and Composting Facility:			
DA Approval & EPA Licencing	15,000	1	15000
Facility Design	14,000	1	14000
		Sub-Total:	**29000**
Comingle Recycling			
Sorting and Processing Equipment	909,800	1	909800
3 Phase Power provision	90,000	1	90000
Shed Extension (including concrete slab)	81,527	1	81527
Misc - drainage, move tank, other	15,000	1	15000
		Sub-Total:	**1096327**
FOGO/Composting			
Trommel	349,000	1	349000
Pre-Shredder	410,000	1	410000
Windrow Turner + Water Wagon	85,000	1	85000
Tractor - Kubota M100GX	90,500	1	90500
Concrete Pad	110	625	68750
Crushed Concrete Pad	8	2500	20000
Clay Pads and Water Runoff Storage for windrows	4	5000	20000
Misc - signage, fencing, water provisions	20,000	1	20000
Training of Staff	50,000	1	In Kind
		Sub-Total:	**1063250**
Hay MRF and Composting Facility- Phase 2:			
Polystyrene Baler	0	1	0
Undercover Public Area	88,568	1	88568
Storage Shed	190,900	1	190900
Bins/Trolleys & Kerbside Recycling Bins	89,375	1	89375
Drum Muster Cage	5,000	1	5000
Secondary Shredder	211,400	1	211400
Gate House, including civil works	35,000	1	35000
Misc- including signage, power and water	40,000	1	40000
Weighbridge	125,267	1	125267
		Sub-Total:	**785510**
Total Project Value			**2,974,087**



Proposed Actions at Waste Transfer Station and FOGO site

The proposed developments in waste will have a significant impact on emissions, will cut down on landfill, and extend the life of the Hay Landfill site.

4.2.4 Water and Sewer

The township of Hay has a dual water supply system, supplying both treated (potable) and raw water (non-potable) to the town. Treated water is extracted from a weir pool on the Murrumbidgee River and then treated in Council's water treatment plant located adjacent to the river in north-east Hay (see aerial photo right). The treatment plant is 30 years old, is in good condition (subject to recommended upgrades) and currently operates at approximately 60-70% capacity.

Council owns and maintains a considerable underground water main network. This network consists of pipes varying from 50mm to 300mm in diameter. The condition of the network is fair with a sustainable mains replacement program currently in place.

Similar to the treated water system, raw water is extracted from the Murrumbidgee River via a pump-station. The water is chlorinated and pumped through a network of underground water mains. The raw water system covers a similar area to that of the treated water system but extends further into the outlying areas.

Council holds a Water Access Licence (WAL6457) to extract from the Murrumbidgee River and has an annual entitlement of 2,805ML per year. Current usage rates are well below this entitlement (650ML/year for raw water and 201ML/year for potable water), however the IWCMS Supplementary Paper has identified that Council is averaging an annual water loss (via leakages and other losses) of approximately 30% and 35% for both the raw water and potable water systems.

The IWCMS Supplementary Paper has however identified that the capacity of the existing water treatment plant will be exceeded at 67% of the ultimate development recommended in the LSPS (Figures 15-18).

The main urban Hay township is serviced via a gravity mains sewerage system, which covers the urban area. The reticulated sewerage scheme consists of approximately 30km of mostly vitreous clay sewer gravity mains and 4km of rising mains, some sections of which date back to 1905. The Hay Sewerage Treatment Plant (STP) located off Rye Lane was newly built in 2018(see aerial photo right). It replaced an old trickling filter type treatment plant that was designed in the 1940s. The newly constructed plant consists of an Intermittent Decanted Extended Aeration (IDEA) tank with a design capacity of 3,000 Equivalent Persons based on a hydraulic allowance of 240 L/EP/d.

The Hay STP operates under Environment Protection Licence (EPL) No. 3520. Under this licence there are no load or concentration limits required as effluent is discharged to evaporation ponds on site and not to any receiving waters, however monitoring for groundwater contamination is required.

Given the aims of the Hay Circular Economy Strategy being to design out waste and pollution, to keep products and materials in use, and revitalise natural systems, the following are proposed:

- Reuse the biosolids produced at the STP for mixing with the FOGO fertiliser, or as standalone fertiliser for the rehabilitation and revegetation of the landfill site. Regarding the biosolids from the Hay STP, Public Works Advisory (2022) stated that "The biosolids produced at the sewage treatment plant will comply with Grade B requirements that will allow for different land application uses based on the contaminant grade. Sampling and testing should be undertaken to determine the contaminant grade before deciding on the appropriate land use application for disposal."
- Utilise the surplus land at the Sewer Treatment Plant for solar energy generation. Although the STP has already a solar system, there is surplus land available for the installation of a potential solar generation facility with batteries. Council has already had interest from developers for this type of development at the STP.
- Add solar energy generation at the Water Treatment Plant, with and approximate costing of $120,000.
- Install a recycled water system at the STP to irrigate passive recreational areas such as the Showgrounds.

4.2.5 Other Operations

The Hay Shire Council has also the following services:

- Community Services
- Library Services
- Visitor Information Services
- Museums

It is recommended that the services follow the same guidelines as in Section 4.2.1.

5. The Way Forward

Hay Shire Council has implemented a range of actions mentioned in this strategy as a matter of normal business practice, many actions as a necessity of living in an isolated town. The way forward for the Hay Shire Council is to commit to a circular economy approach, rather to a linear economy approach.

Actions in this report can be divided into three categories:

- Actions that will require simply doing things differently.
- Actions that will require upgrading our assets, which will need to be externally funded.
- Actions that will require Hay Shire Council making different decisions regarding our assets.

None of the actions proposed in the Hay Shire Circular Economy is overly complicated, and it is hoped that the Hay Shire Council can operate more sustainably into the future, and have some operational savings in the process.

6. Bibliography

Australian Government, BOM: State of the Climate, http://www.bom.gov.au/state-of-the-climate/

Borse, Prof. Nitin. (2015). Importance of Vegetation in Urban Environment. International Journal of Scientific and Research Publications 2250-3153. 5. 1.

Castilla–La Mancha, Estrategia Economia Circular 2030

Clean Energy Finance Corporation (2020), Clean energy and infrastructure: Pathway to airport sustainability - Transitioning Australia's airports to lower emissions with 15 best practice initiatives, https://www.cefc.com.au/media/402338/cefc-pathway-to-airport-sustainability.pdf

Earl, C; Terblanche, J & Patten, E (2012) "Health and the Living Environment" in Liamputtong et al, "Health, Illness and Well-being: Perspectives and Social Determinants"

Girling, C & Kellett, R (2005). Skinny Streets and Green Neighbourhoods

Hay Shire Council (2016) Energy Audit: Council Chambers

Hay Shire Council (2020) Local Strategic Planning Statement

Hay Shire Council (2022) Draft Hay Aerodrome Master Plan

Hay Shire Council (2022). Hay Structure Plan

https://www.usgs.gov/faqs/what-do-different-colors-color-infrared-aerial-photograph-represent

Inter-American Development Bank, https://blogs.iadb.org/sostenibilidad/en/

LGNSW (2020) Recycled Materials in Roads and Pavements: A Guide for Local Councils. https://www.lgnsw.org.au/common/Uploaded%20files/PDF/Guide_to_Recycled_Materials_in_Roads_and_Pavements.pdf

LGNSW (2020) Recycled Materials in Roads and Pavements: A Technical Review. https://www.lgnsw.org.au/common/Uploaded%20files/PDF/Technical_Review_Recycled_Materials_in_Roads-Pavements.pdf

Louv, Richard (2005) Last Child in the Woods: Saving Our Children From Nature-Deficit Disorder

NSW Government, NSW Circular Strategic Plan FY2020-2023

Oldenburg, Ray (1989). The Great Good Place: Cafes, Coffee Shops, Community Centers, Beauty Parlors, General Stores, Bars, Hangouts, and How They Get You Through the Day

Public Works Advisory (2022) Hay Shire Council Integrated Water Cycle Management Strategy Supplementary Paper

Queensland Government EPA. (2002) Landscaping for Energy Efficiency. https://hopeaustralia.org.au/uploads/media/landscaping_for_energy_efficiency.pdf

Sokol, Joshua (2022). “Saving the Night Sky”. Scientific American October 2022

White, Rebekah (July–August 2018). "A third place". New Zealand Geographic (152): 6.