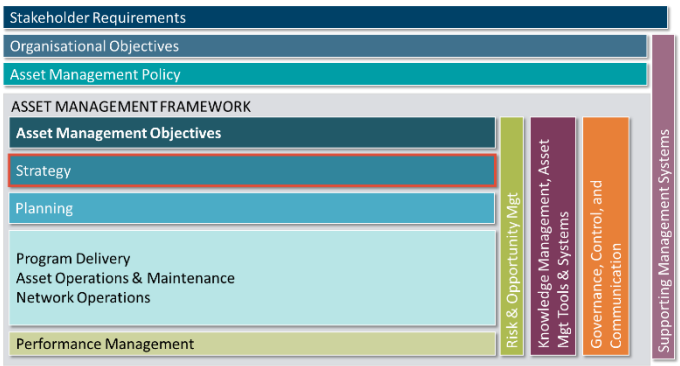
Public Lighting Asset Management Strategy

Revision: June 2024
Next review: June 2025

DOCUMENT HIERARCHY

This document resides within the Strategy component of Western Power's Asset Management System (AMS).



DOCUMENT DATE

This document was last updated in June 2024

DOCUMENT CONTROL

Please refer EDM 68794720 for record of review and approval.

RESPONSIBILITIES

Western Power's Asset Performance Function is responsible for this document.

CONTACT

Western Power welcomes comments, questions, and feedback from local governments on this document, which can be emailed to communityenquiries@westernpower.com.au. Please ensure the subject line of your email reads "Feedback on Public Lighting Strategy".

COPYRIGHT

Contents

List of Table and Figures

1. Executive Summary

Western Power owns a fleet of approximately 288,000 streetlights across the South West Interconnected Network (SWIN), that are used to provide public lighting services to Local Governments (LGs). The streetlights comprise of poles, outreach brackets, luminaires, globes, cables, fuses, and control systems.

Through Western Power's 5th Access Arrangement (AA5) determination process, many LGs and WA Local Government Association (WALGA) provided feedback about Western Power's public lighting asset management strategy. The Economic Regulation Authority (ERA) in its Final Determination[1] set a requirement for Western Power to consult the customers and annually publish the strategy through AA5.

Western Power has consulted the LGs between March – June 2024, and developed this first version of the annual AA5 public lighting asset management strategy. The consultation with the LGs has been insightful and meaningfully influenced this strategy. It is acknowledged that all matters have not been resolved yet. Western Power will continue to consult the LGs and other stakeholders (ERA, Synergy, WALGA) and take that into consideration in future versions of the strategy.

The key challenges identified through the consultation process are cost to LGs, compliance to standards and regulations including Minamata Convention, and emission reduction, while having a safe and reliable service. Specifically strong support was expressed by LGs to convert the fleet to LED luminaire as soon as practicable. Opportunities about smart streetlights and *Dark Sky* public lighting were also explored.

This strategy introduces a significant program of work to proactively replace existing non-LED luminaires to LED luminaires over the next 10 years, completing the transition by 2035. This proactive program is in addition to the LED luminaires that will be installed through reactive programs responding to failed assets. The combination of the proactive and the reactive LED luminaire replacement program offers the lowest life cycle cost for luminaire/globe components by reducing maintenance in longer term. It will also support lowering of energy consumption and gradual reduction of faulty streetlights over the next decade.

The proactive LED luminaire replacement program is expected to commence in mid-2025. The roll-out sequence will be finalised by Western Power using a fair and equitable methodology. LGs will be consulted prior to delivery of the program in their area.

This strategy also covers other aspects of management of the public lighting assets. However, there is no major change in these elements. Western Power will continue to inspect the assets, assess condition, and risk, and continue to repair, refurbish, replace to provide a safe, reliable, and affordable service. These will be delivered through existing proactive and reactive asset management programs of work.

[1] ERA - Final decision on Western Power's latest Access Arrangement (AA5),

2. Introduction

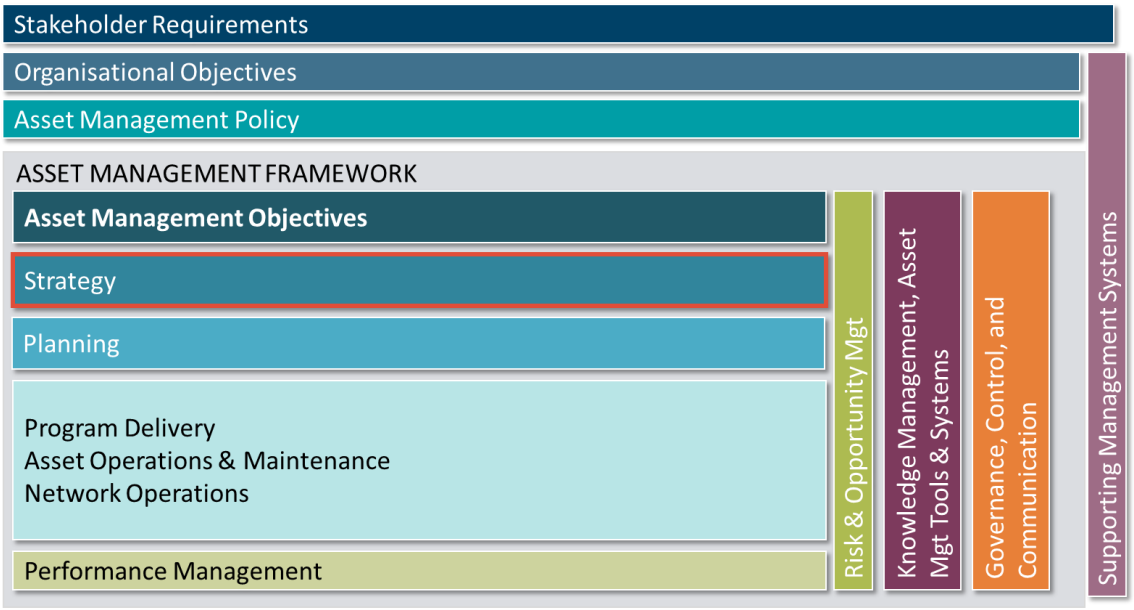
2.1 Purpose

The purpose of this document is to describe the whole of life cycle asset management strategy for public lighting assets.

This strategy provides an overview of the current asset environment, performance, challenges, and associated opportunities. It facilitates meeting the required regulatory obligations and asset management objectives associated with safety, reliability, affordability and sustainability.

This strategy forms part of Western Power's Asset Management Framework (AMF) as illustrated in Figure 2.1. It is part of a suite of asset management strategies that collectively respond to stakeholder and customer expectations.

Figure 2.1: Asset Management Framework



The intended outcome of Western Power's public lighting strategy is to provide reliable public lighting service at minimum cost to customers. This document charts out the direction and the steps for Western Power to achieve the objectives of the public lighting assets.

2.2 Scope

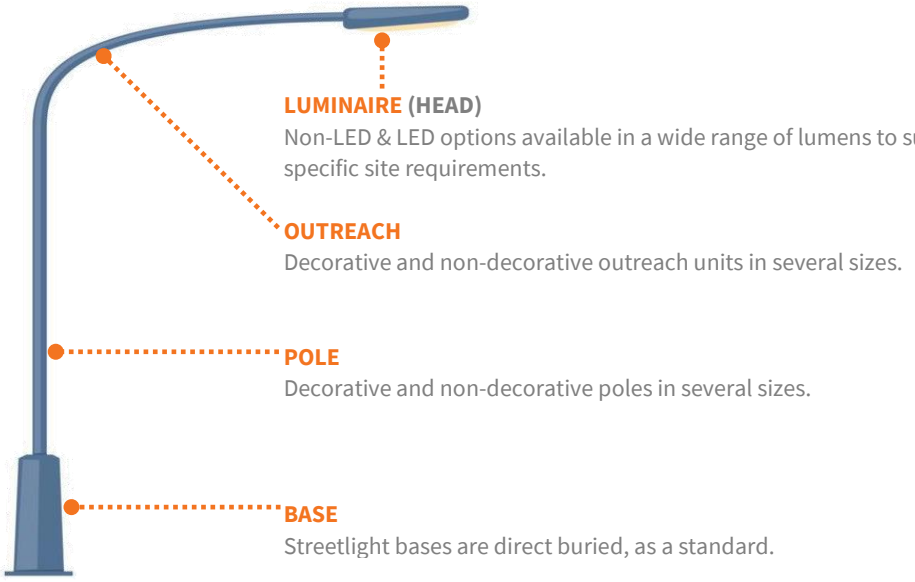
Western Power provides public lighting services within the geographical boundary of the SWIN. The services primarily include operation and maintenance of streetlights, on behalf of 112 Local Governments (LGs). The following components form part of public lighting assets that are used to provide public lighting services:

- Luminaire, including lamps and Photo Electric (PE) cells,
- Streetlight Control Box (SLCB),
- Dedicated Street Light Metal Pole (DSLMP), including base, pole, outreach, fuse cut-out, and internal wiring to luminaire,
- Brackets mounted to power poles, including fuse and internal wiring to luminaire,
- Streetlight underground cable, and

- *PowerWatch* lights

Figure 2.2 depicts the typical arrangement of a dedicated streetlight metal pole

Figure 2.2: DSLMP mounted streetlight arrangement



There are more than 288,000 streetlights owned by Western Power that are connected to Western Power's distribution network. Luminaires can be mounted on DSLMPs, or via brackets on other Western Power poles (e.g., poles that are used for electricity distribution). Luminaires mounted on DSLMPs are supplied with electricity via streetlight underground cables while luminaires on shared poles are supplied with electricity via overhead conductors. Most public lighting are controlled using PE cells. PE cells are mounted on luminaires, operating them from dusk till dawn. The remainder of luminaires are controlled using timers in SLCBs. Western Power also supplies power to more than 2,500 streetlights owned by other agencies. Public lighting assets in the SWIN are classified in three broad categories, as described in Table 2.1.

Table 2.1: Public lighting asset base categories

Category	Description
Western Power installed, and operated (Western Power owned)	Streetlights which are designed, constructed, and operated by Western Power.
Gifted to Western Power (developer or customer installed and Western Power operated) (Western Power owned)	Streetlights which are designed and constructed by developer or customer to Western Power standard, then handed over to Western Power as gifted assets. Thereafter, Western Power operates and maintains these gifted streetlights. Most streetlights on Western Power's network fit into this category.
Customer installed and operated (Other agency or privately owned)	Streetlights designed and constructed by the customer, with maintenance carried out independently by the customer or a third party. Western Power charges for distribution of electricity and is also responsible for supplying and installing the point of supply for the streetlight. All cables, fittings, and fixtures downstream of the point of supply are sole responsibility of the customer.

3. Objectives

Western Power's Asset Management Policy articulates the principles to follow that ensure asset management is undertaken in a structured, coordinated, and consistent manner. Table 3.1 captures the objectives of the public lighting strategy.

Table 3.1: Public lighting strategy objectives

Objectives	Description
Safe (safety and environment)	Maintain overall safety of public lighting assets in line with jurisdictional obligations (eliminate/reduce risk so far as is reasonably practicable), with actual performance not deteriorating below historical levels. The safety performance is measured qualitatively through risk ratings and quantitatively through public lighting asset failures and incidents.
	Manage environmental performance by maintaining current network environment risk rating.
Reliable	Maintain current service standard levels as defined by the relevant regulations. The reliability performance is measured qualitatively through risk ratings and quantitatively through the average number of days to repair faulty streetlights in Metropolitan and Regional areas.
Affordable	Deliver safe and reliable public lighting at agreed levels of service at the lowest practical cost. Whole of life cycle costs (WOLCC) is a key metric.
Compliant	Ensure no new mercury vapour or metal halide globes are procured. Ensure all new public lighting assets designed, constructed, and operated by Western Power complies with the relevant legislative and regulatory requirements. Ensure all new components replaced on gifted public lighting assets comply with relevant legislative and regulatory requirements (excludes lighting design).
Sustainable	Support reduction in energy consumption by facilitating the transition to LED luminaires.

3.1 Function

Public lighting is an essential community service, aiming to provide a suitable and reliable visual environment for the public. The purpose of public lighting is to illuminate roads for pedestrians and vehicles as well as outdoor public areas, to maintain safety and security.

3.1.1 Legislative & regulatory obligations

Western Power's Access Arrangement (AA) specifies the required levels of service from the public lighting asset fleet. Western Power also has service standards reporting obligations and responsibilities as detailed in the Electricity Distribution Licence Performance Reporting Handbook issued by the ERA. Additionally, Western Power's Annual Network Safety Performance Objectives (ANSPO) published under Electricity (Network Safety) Regulations 2015 specifies the objectives to maintain a safe fleet of public lighting assets.

All new public lighting assets require to comply with the relevant legislative and regulatory requirements.

3.1.2 Measures and targets

Table 3.2 summarises the asset management measures and targets for public lighting assets through Western Power's current Access Arrangement (AA5) period.

Table 3.2: Performance measures & targets for public lighting assets

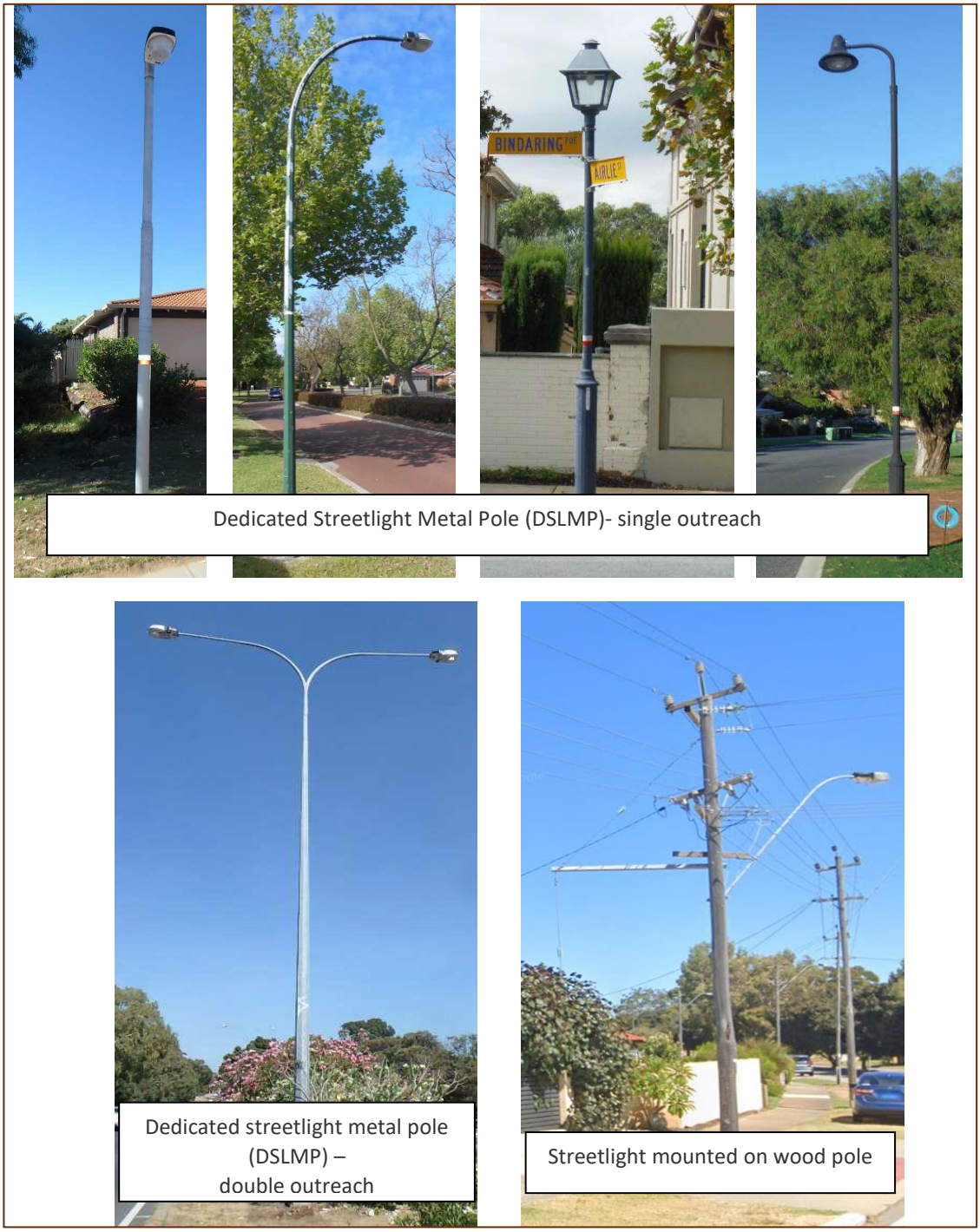
Objective	Measure	Target
Safe (safety & environment)	Risk	Maintain at historical level
Reliable	Risk	Maintain at historical level
	Average number of days to repair faulty streetlights in metropolitan areas	≤ 5
	Average number of days to repair faulty streetlights in regional areas	≤ 9
Affordable	Lowest lifecycle cost fit-for-purpose options pursued	N/A
Compliant	Mercury containing globe procured	0
	New installations are compliant as applicable	100%
Sustainable	Remaining non-LED luminaires and globes	0 by 2035

4. Analysis and forecasting

4.1 Operating context

Across the SWIN, streetlight luminaires are typically installed on either dedicated streetlight metal poles (DSLMP) or wooden poles as shown below in Figure 4.1:

Figure 4.1: Streetlight luminaires on metal and wood poles



The network features a variety of globe types which includes mercury vapour (MV), metal halide (MH), compact fluorescent (CFL), high pressure sodium (HPS) and LED screw-in globes.

Australia has ratified the Minamata Convention, which enforces a prohibition on the procurement of new mercury products, including those presently utilised in Western Power's street lighting. The two most common mercury-containing light sources are MV and MH globes, which constitute 44% of Western Power's streetlight infrastructure. Consequent to the ratification, the purchase of new MV and MH globes has already been discontinued by Western Power.

All globe types mentioned above are housed in either traditional luminaires or decorative luminaires. The streetlight network also comprises standard LED luminaires and decorative LED luminaires. Figure 4.2 serves as references for each of these.

Figure 4.2: Luminaire types

The Western Power network has approximately 2,430 km of streetlight underground cable which connects streetlight network.

4.2 Asset profile

The population and age profile for public lighting asset components are shown in Table 4.1, Table 4.2, and Figure 4.3

Table 4.1: Population of public lighting asset components as of 31 March 2024

Asset component	Population
Total luminaires (LED and non-LED)	288,304
Dedicated streetlight metal poles (DSLMP)	168,405
Luminaire brackets on network poles	105,237
DSLMP Single Insulated (Class I) wiring	47,262
Streetlight underground cable	2,431 km

Asset component	Population
Streetlight control box	1,729
Powerwatch lights	1,356

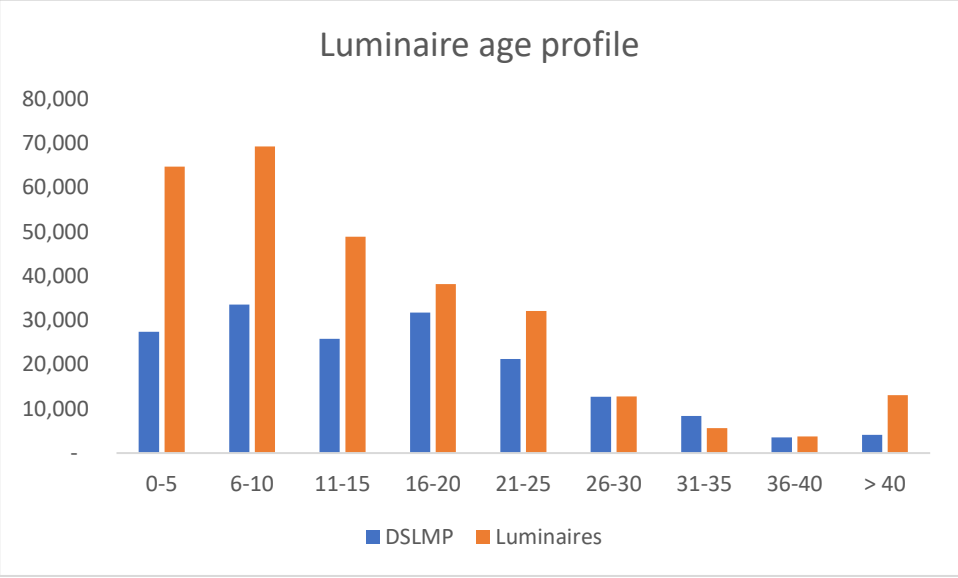
In geographical areas where distribution overhead assets are present, luminaires have been opportunistically mounted on these assets (e.g., distribution wood poles). This reduces the need for DSLMPs and the associated maintenance costs. Approximately 38% of the luminaire population are mounted on shared poles using brackets while the remaining 62% of the luminaire population are mounted on DSLMPs.

Western Power is progressively converting the distribution network in the Perth metropolitan area from the current overhead configuration to underground. This is leading to an increased population of DSLMP and the underground streetlight cable network, with a corresponding decrease in bracket-supported luminaires on distribution poles.

Table 4.2: Population of globe & luminaire types as of 31 March 2024

population by globe & luminaire types	
Mercury vapour globes	38%
High pressure sodium globes	19%
LED luminaires	17%
Compact fluorescent globes	15%
Metal halide globes	6%
LED globes (screw-in)	5%

Figure 4.3: Age profile of public lighting asset components as of 31 March 2024



Various components of the public lighting assets have different expected service lives. Table 4.3 shows the expected service lives of some of the main components.

Table 4.3: Expected service lives of public lighting asset components

Asset component	Expected Service Life (years)
DSLMP	40
Luminaire (LED & non-LED)	20
Globes (various types)	5-10

It is to be noted that actual life of individual asset or component may differ from the expected service life of the fleet.

4.3 Asset condition

Age and condition are factors that influence the performance of public lighting assets. Typical aging related conditions include:

- Diminished light output of globes over time,
- Loss of groundline structural strength on dedicated streetlight metal poles,
- Supply wiring insulation loss, and
- Component failure (e.g., globes, fuse, luminaires, or PE cells reach end of life).

Public lighting assets are installed in a wide variety of environments. Localised environmental conditions result in variable ageing, condition deterioration rates and frequency of asset failure. For example, direct buried DSLMP located in reticulated areas in suburban street verges usually deteriorate quicker than dry areas.

The locations of streetlights near roadways and public spaces mean that asset condition and failures are also affected by factors other than age, such as vehicle impact damage and vandalism. Vehicle impact damage causes the majority of DSLMP failures and a significant number of structural defects. DSLMPs are designed to absorb impact during vehicle accidents in accordance with Australian Standards[2] to reduce vehicle damage and trauma to occupants.

DSLMP utilises an underground cable network to supply electricity to streetlights. Underground cables are safer and more reliable than overhead conductors. However, they are still vulnerable to a variety of external factors such as 3rd party damage during excavation, termites, and water ingress. Additionally, the general ageing over time, can lead to failure in underground cables and cable joints.

The health of wiring within DSLMP is evaluated by examining the wiring at pole cut-outs. Wiring is subject to general aging and various localised influences like the pole itself (i.e., moisture in the cut outs) which degrades its condition. As assets age, conditions of the asset or some components may deteriorate. Conditions of an asset or a component can be identified through routine inspection or report from customers. Conditions are assessed and recorded according to their severities. Conditions and respective severities are a representation of how likely and how long before an asset or a component is expected to fail. This guides assessment of the risk and the required treatment (including timing of treatment) to address the condition. The treatment rules take into consideration the variability of conditions, their respective severities, and the potential risk they pose.

[2] AS/NZS 1158.1.2:2010

4.4 Asset performance

Assets fail as conditions deteriorate with time. These failures are considered as unassisted failures. Assets may also fail assisted caused by factors other than condition (e.g., vandalism, vehicle impact, 3rd party damage during excavation). Assisted failures are outside of Western Power's control.

Assessment of historical performance of the public lighting assets allows Western Power to evaluate the effectiveness of the Public Lighting Asset Management Strategy against the objectives. This also guides any required changes in the strategy. Western Power's asset management strategy focuses on managing risk emanating from deteriorating conditions and unassisted failures of assets, i.e., the strategy aims to manage factors that are within Western Power's proactive control. Failures caused by factors outside of Western Power's control are managed reactively.

Unassisted DSLMP failure was a major challenge for the public lighting asset fleet during the previous decade. These failures were predominantly due to groundline corrosion, whereby DSLMP could subsequently fall across roadways. Investment in routine inspections, combined with DSLMP reinforcement and replacement over AA3 and AA4 (2012/13 - 2021/22), has resulted in about 90% reduction in unassisted DSLMP failures over last ten years. This investment and resulting performance improvement, have also allowed Western Power to reduce treatment volumes and relevant expenditure forecasts for AA5 (2022/23 – 2026/27).

However, it is to be noted that assisted failures of DSLMP far outnumber unassisted failures. During the last five years, assisted DSLMP failures per year were an order of magnitude higher than unassisted DSLMP failures. Most assisted failures of DSLMP were caused by vehicle impact.

There has been a reduction in electric shocks from DSLMP after Western Power carried out a proactive accelerated inspection program during 2020 that targeted Single Insulated (Class I) DSLMP. The program identified and treated all live Single Insulated (Class I) DSLMP as per Distribution Connections Manual[3]. Western Power regularly inspects public lighting assets including checking for any hazardous voltage on DSLMP[4] and remediates all such identified hazards promptly.

The public lighting asset fleet experiences more than 25,000 globe and luminaire failures each year. The replacement of globes and luminaires are subject to timeframes specified in the relevant Service Standard Benchmarks, being ≤5 days and ≤9days for metropolitan and regional areas respectively. Western Power has repaired faulty streetlights within the prescribed duration over the last five years where the faults were caused by faulty globes, luminaires, PE cells or fuses. However, streetlight faults resulting from underground cable failures or DSLMP damage from vehicle impact typically require extended repair duration exceeding the timeframe set in the Service Standard Benchmarks.

It is to be noted that cable failures are low in number, only a fraction (< 2%) of all public lighting asset failures.

4.5 Current challenges and opportunities

Current asset management challenges and opportunities are discussed below. These are based on key insights from asset profile, condition, performance of the public lighting asset fleet and customer consultation conducted over past months.

[3] Western Australian Distribution Connections Manual

[4] Voltage ≥6V is considered hazardous as per Electricity Regulations 1947

4.5.1 Cost, energy consumption and carbon emission

Western Power has consulted the LGs in understanding the requirement of the customers. LGs expressed strong focus in reducing their cost toward public lighting by reducing energy consumption. The LGs are also focussed on reducing their CO_2 emissions.

4.5.2 Conversion to LED luminaires

As of 31 March 2024, LED lighting (globes and luminaires) has been incorporated into 22% of luminaires. Furthermore, all new luminaires being installed on the Western Power network are LED luminaires. The number of LED luminaires will increase over coming years, through several investment drivers:

- End-of-life asset replacement.
- Underground power programs.
- Customer-funded upgrades of existing luminaires.
- Proactive LED luminaire replacement in regional areas.

Western Power is transitioning from non-LED streetlight luminaires (including MV, MH, HPS, and CFL) to LED luminaires reactively, i.e., whenever there is luminaire failure.

Western Power has conducted consultation with the LGs during March-May 2024. Participants of the consultation process expressed strong support for a proactive LED transition. During the consultation, many LGs also expressed preference for Western Power to replace all failed globes with LED luminaire. The transition from non-LED to LED luminaires is a matter of significant customer interest. Challenges and opportunities with conversion to LED luminaires are discussed in section 5.

4.5.3 Interim replacement of LED globes

The two most used mercury-containing light sources are MV and MH globes. These represent 44% of streetlights within the network. Western Power has stopped procurement of new MV and MH globes in line with Minamata Convention. The current practice is to replace failed MV and MH globes with LED screw in globes.

LED screw-in globes are often perceived as too bright, leading to complaints from the community. In response to complaints from the community, local governments have consistently asked Western Power to replace failed globes with LED luminaires. Western Power is reviewing the strategy to use LED globes which is further detailed in section 5.1.3 (Table 5.6).

4.5.4 Glare shields on LED luminaires

New LED luminaires have also resulted in complaints from some residents about light spill, with subsequent requests for glare shields to be installed as mitigation to reduce the glare. Glare shields are considered effective to reduce the intensity of light from the rear or side of the luminaire. However, the reduced light output resulting from installation of glare shields can in turn impact other residents who complain about low lighting caused by glare shields.

Additionally, Western Power needs to ascertain compliance to the relevant Australian Standard for the LED luminaire after addition of glare shield.

Thus, installation of glare shields is assessed in conjunction with LGs, on a case-by-case basis, in response to specific customer compliant.

4.5.5 Powerwatch lights

Powerwatch is a legacy product gifted to Western Power. Western Power carries out maintenance activities when faults are reported. Western Power has ceased installing new *Powerwatch* lights and upon failure, encourages customers to explore other security lighting solutions.

The cessation of new installations of traditional *Powerwatch* lights will result in fewer of these assets needing maintenance during the AA5 period.

4.5.6 Geographical spread

The geographical spread of Western Power's 288,304 public lighting assets spans a total area more than 255,000 km. The maintenance, fault response, and renewal requirements over a large area poses resourcing and cost challenge in providing reliable public lighting. Maintenance carried out in remote areas is often time-consuming and can result in higher labour, mobilisation, and travel costs.

4.5.7 Asset age and condition

Ground line corrosion and vehicle impact damage are the most common causes of structural deterioration in DSLMP. While ground line corrosion is predominantly age-related, localised environmental conditions such as reticulated grass can result in accelerated deterioration rates of ground line corrosion. The earliest point in time where ground line corrosion is observed is from eight years of age. The rate of deterioration thereafter varies depending on local conditions. Age of the DSLMP does not work well as a pointer to the actual condition of the asset.

Luminaires, wiring, and other components are also exposed to weather conditions and general aging, which result in dim and faulty luminaires.

4.5.8 Legacy standards

Prior to 2006, the Western Power standard for DSLMP wiring was single insulated. This was updated in 2006 to double insulated wiring to improve safety. Western Power subsequently improved the design of wiring during AA4 as part of the release of the LED luminaire product range. Any new luminaires are installed with Class II wiring and single insulated luminaires are upgraded to Class II wiring when they reach end of life. A requirement of this upgrade is to reconfigure the DSLMP supply wiring when a new LED luminaire is installed.

With an aging asset base, it is estimated that the installation per legacy standards including the internal wiring within DSLMP and underground cabling will be upgraded over a period as new luminaires are installed. However, in the interim, these assets are continually managed to achieve safety objectives. Western Power regularly inspects public lighting assets including checking for any hazardous voltage on DSLMP and remediates all such identified hazards promptly.

4.5.9 Decorative DSLMP and luminaires

Transitioning from non-LED decorative luminaires to standard LED luminaires as opposed to equivalent LED decorative luminaires, is considered advantageous for cost and energy efficiency. An additional advantage of standard LED luminaire over a decorative LED luminaire is also from expeditious procurement.

Western Power will continue consultation with LGs on decorative luminaire and DSLMP fleet to explore opportunity for rationalisation. A rationalisation is expected to benefit any proactive bulk LED luminaire replacement program.

4.6 Future challenges and opportunities

4.6.1 Future use

The following potential future requirements are expected to influence the profile and function of public lighting assets:

- Smart LED streetlights – The opportunity to install and operate smart LED streetlights are currently under review. Some of the LGs have shown interest in these lights and had been part of trials in the past. Western Power currently does not have a product to support installation and operation of smart streetlights.
- Dark Sky Initiative[5] – There is increasing interest from several LGs, predominantly regional LGs, to promote Astro-tourism, enabling stargazing opportunities and thus promoting tourism in their respective jurisdictions. Western Power currently does not have a product that complies to Dark Sky requirements.

Western Power will continue to explore these future opportunities.

[5] WA Government Position Statement: *Dark sky and astrotourism Position Statement*

5. Asset management life cycle strategy

5.1 Optioneering

Asset management lifecycle strategies are developed considering the objectives, the challenges and opportunities and the options to address them. This section describes applicable options considered for various stages of the asset life cycle.

Strategy options are summarised in tables, with qualitative ratings applied to demonstrate comparison between options. Ratings are defined as per Table 5.1.

Table 5.1: Strategy option rating definitions

Rating	Definition
Green	Relatively good outcome in comparison with other options
Amber	Relatively worse outcome than green, better outcome than red
Red	Relatively poor outcome in comparison with other options

5.1.1 Create

Public lighting design and construction standards are outlined in the Underground Distribution Schemes (UDS) Manual[6]. Gifted public lighting assets are also required to meet Western Power standards. This ensures assets are constructed to a uniform standard and that Western Power's requirement to hold new and replacement inventory items is minimised.

The analysis of options for new installation underpins the guidance provided in the Underground Distribution Schemes (UDS) Manual and are considered in development and update of the manual.

Any exception is subject to approval by Western Power on a case-by-case basis.

5.1.2 Operate

Streetlights are currently operated using the PE cell of the luminaire (dusk to dawn), or via streetlight control boxes.

Smart-enabled streetlights, in future, may offer additional options for operation of luminaires. More details are included in section 4.6.

5.1.3 Maintain and renew

Options for the planned or emergency maintenance/replacement and renewal of public lighting assets are considered in all strategy rules. This section describes option analysis for the following salient topics:

- DSLMP inspection.
- Condition assessment of streetlight underground cables.
- DSLMP replacement or reinforcement.
- Proactive or reactive conversion to LED.

[6] Western Power Underground Distribution Schemes Manual incorporates relevant Australian Standards.

DSLMP inspection

As previously explained, DSLMP develops ground line corrosion over its service life and if untreated can fail, at times catastrophically. Historical performance has demonstrated that these failures can pose public safety risk. Western Power has obligation under the relevant regulation to maintain a safe network, as well as limit the number of unassisted failures to the limits published within ANSPO. Western Power will not meet its compliance requirements if the DSLMP assets are run to fail. Inspecting the assets during their service life allows Western Power to carry out risk and condition-based treatment before the asset fails or presents a hazard. Table 5.2 details this further.

Table 5.2: Options analysis for DSLMP inspection

Option	Meets customer requirements	Performance	WOLCC	Compliance	Comments	Rank
No inspection	Amber	Red	**Low**	Red	• Increases safety risk • Non-compliant	2
Inspect at an appropriate frequency to enable condition-based treatment	Green	Green	**High**	Green	• Maintains safety risk. • Compliant	1 ✓

Historical performance has established that corrosion at ground line starts appearing after eight years of installation. It is thus recommended to carry out the first inspection eight years after installation of the DSLMP.

The inspection frequency after the first inspection is recommended to be four years based on historical defect find rates and deterioration of previously identified conditions.

Condition assessment of streetlight globes and luminaires

Western Power has assessed the prudency of routine inspection of all globes and luminaires to establish if they are working to the required performance level. Essentially this can only be undertaken during nighttime. It has been assessed that it is not efficient to proactively inspect all streetlights to assess illumination performance through a regular program. The cost is significant and the intended outcome of such an inspection can be achieved more efficiently by members of community or LGs reporting a failed or underperforming globe/luminaire.

Western Power however conducts ad hoc night audit on specific request of LGs to check general illumination of a street or an area (not for individual streetlight fault or performance).

Condition assessment of streetlight underground cables

Western Power has assessed historical performance of streetlight underground cables. Underground cable failure numbers are low when compared to other types of failures (e.g., globes failure, luminaire failures). Proactive assessment of condition of streetlight cables is expensive and it is not economically prudent to conduct a regular cable condition assessment program for the number of failures experienced.

A summary of options to assess the condition of streetlight underground cables is provided in Table 5.3.

Table 5.3: Options to assess the condition of streetlight underground cables

Option	Meets customer requirements	Performance	WOLCC	Compliance	Comments	Rank
Proactive inspection	Green	Green	**High**	Green	• Highest cost.	2
Reactive response to failure	Amber	Amber	**Low**	Green	• Lowest cost.	1 ✓

DSLMP replacement or reinforcement

Based on the outcome of inspections, DSLMP may be replaced or reinforced depending on the type and severity of any identified conditions. Reinforcement is only a suitable treatment for some groundline corrosion conditions (low severity), while replacement addresses all severities of structural and electrical conditions. It is also to be noted that different severities under a condition may have different treatments and different timelines of treatment.

A summary of treatment options is provided in Table 5.4 and Table 5.5.

Table 5.4: Treatment options analysis for DSLMP with ground-line corrosion

Option	Meets customer requirements	Performance	WOLCC	Compliance	Comments	Rank
Reactive replacement only	Red	Red	**Low**	Red	• Increased safety risk • Non-compliant	3
Reinforce DSLMP on condition at an appropriate time	Green	Green	**Mid**	Green	• Lower cost than replacement. • Addresses some ground-line corrosion condition. • Does not address other conditions.	1 ✓
Proactively replace DSLMP on condition at an appropriate time	Green	Green	**High**	Green	• Higher cost than reinforcement. • Addresses all corrosion conditions. • Addresses other conditions.	2 ✓

Table 5.5: Treatment options analysis for DSLMP with conditions other than ground-line corrosion

Option	Meets customer requirements	Performance	WOLCC	Compliance	Comments	Rank
Reactive replacement only	Red	Red	**Low**	Red	• Increased safety risk • Non-compliant	2
Proactively replace DSLMP on condition at an appropriate time	Green	Green	**High**	Green	• Compliant option. • Addresses all conditions.	1 ✓

Proactive & reactive conversion to LED luminaires

Western Power assessed various options for transitioning to LED luminaires during maintenance, both reactively and proactively, as shown in Table 5.6 and Table 5.7.

There have been significant improvements in LED technology and affordability in recent times. LED luminaires has emerged to be more cost effective than traditional options, with the market now established.

Benefits of installing LED luminaires over conventional globes or LED globes include:

- Alignment to LG expectations.
- Lower energy consumption.
- Improved illumination performance.
- Longer lifespan resulting in lower long term maintenance costs.
- Potential reduction in CO2 emission through lower energy consumption. However, it is acknowledged that any carbon emission underpinning the energy consumption is highly dependent on generation mix which is largely outside of Western Power's control.
- Future proofing by installing smart capable luminaires.

Table 5.6: Options for reactive replacement of public lighting luminaires and globes

Option	Meets customer requirements	SSB (Performance)	WOLCC	Compliance	Comments	Rank
Replace MV and MH globes with LED screw in globes as they fail. Replace non-compliant combination MV with LED luminaire. Replace HPS and CFL globes like-for-like.	Red	Green	**High**	Green	• Does not meet customer requirements. • Slower transition to LED. • Slower reduction to the carbon footprint. • Negligible SSB impact.	2 ✓

Option	Meets customer requirements	SSB (Performance)	WOLCC	Compliance	Comments	Rank
Replace all globe failures with LED luminaire reactively.	Green	Red	**Low**	Green	• Meets customer requirements. • Accelerates the goal of LED transition. • Faster reduction to the carbon footprint. • Extends SSB (fault response time).	1

While replacing all failed globes with LED luminaires is a better option, it is expected that the existing Service Standard Benchmarks (SSB): Metro ≤ 5 days, Regional ≤ 9 days to repair a reported streetlight fault will be breached if Western Power adopts this option. Any adjustments to the SSB must receive approval from the ERA.

Western Power is currently assessing the impact of this option and will work with LGs and ERA to arrive at an agreed position on the SSB before implementing this option.

Table 5.7: Options for proactive replacement of public lighting luminaires and globes

Option	Meets customer requirements	SSB (Performance)	WOLCC	Compliance	Comments	Rank
Proactive replacement of all traditional luminaires with LED luminaires over 10-year period.	Green	N/A	**Low**	Green	• Lowest Net Present Cost. • Meets customer requirements. • Meets the goal of LED transition. • Slower reduction in carbon footprint. • Less challenges around program resourcing.	1 ✓
Proactive replacement of all traditional luminaires with LED luminaires over 5-year period.	Green	N/A	**High**	Green	• Meets customer requirements. • Highest Net Present Cost. • Accelerates the goal of LED transition. • Faster reduction to the carbon footprint. • More challenges around program resourcing.	2

Western Power is currently planning the implementation of the 10-year proactive LED luminaire transition option.

5.2 Life cycle asset management strategies

5.2.1 Create

- All new public lighting assets shall be designed and installed to the requirements of Underground Distribution Schemes (UDS) Manual.

- Any exception shall be subject to approval by Western Power on a case-by-case basis.

5.2.2 Operate

- Continue to operate streetlights using the PE cell of the luminaire (dusk to dawn), or via streetlight control boxes.

5.2.3 Maintain

Dedicated streetlight metal pole (DSLMP)

- DSLMP assets shall be inspected every four years with the first inspection being in eighth year after installation of the new asset. Any condition or failure observed during inspection shall be recorded for appropriate further action.
- Repair DSLMP or components therein for conditions that are repairable, prioritised on risk.
- Reinforce DSLMP for groundline corrosion condition of low severity, prioritised on risk. It is imperative to ensure that the asset does not have another co-occurring condition that requires replacement of the asset.
- Replace DSLMP for groundline corrosion condition of high severity, prioritised on risk.
- Replace DSLMP for conditions other than groundline corrosion that cannot be repaired, prioritised on risk.
- Replace DSLMP like-for-like on failure.

Luminaires and globes

- Failures are to be reported by Western Power workforce, members of community, and LGs.
- Replace all non-LED luminaire on failure with equivalent LED luminaire.
- Replace traditional luminaire with appropriate LED luminaire on failure of MV globe where a screw-in LED globe replacement will result in non-compliant combination of traditional luminaire and LED screw-in globe. The non-compliant combination is 18W screw-in LED globe (equivalent to 80W MV) in round type luminaire.
- Replace MV globe on failure with appropriate LED screw-in globe if the traditional luminaire has not failed concurrently. Do not apply this rule where the new screw-in LED globe and traditional luminaire combination is non-compliant (refer above).
- Replace MH globe on failure with appropriate LED screw-in globe if the traditional luminaire has not failed concurrently.
- Replace HPS and CFL globes on failure with like-for-like replacement if the traditional luminaire has not failed concurrently.
- Proactively replace traditional luminaire with appropriate LED luminaire through bulk replacement program. This will include replacing existing traditional luminaire with residual life. Prioritise the roll-out sequence on average age of luminaires in each suburb/LG with oldest replaced first.
- Install luminaires with 3000K colour temperature except for locations specified by Main Roads Western Australia[7], where luminaires with 4000K colour temperature shall be installed.

[7] Roadway and PSP Lighting – Specific requirements for design and Maintenance replacements

- Replace globe, PE cell and wiring on failure for *Powerwatch* lights with like-for-like replacement. In case of luminaire failure, inform customers to explore alternative arrangement.
- Replace decorative non-LED luminaire on failure with decorative LED luminaire. It is noted that decorative LED luminaires are long-lead items. A standard LED luminaire may be installed in the interim if appropriate.

Streetlight underground cable

- Failures are to be reported by Western Power crew responding to failed globe or luminaire.
- Repair the failed cable where it is repairable. Replace in case it is not repairable.

Streetlight brackets attached to distribution and transmission poles

- Inspect streetlight brackets attached to poles through regular proactive network inspection.
- Replace brackets like-for-like with severe condition degradation reported by inspector.
- Replace failed brackets like-for-like when reported by inspector and/or customer.

Streetlight control box

- Failures are to be reported by Western Power crew responding to failed globe or luminaire.
- Replace luminaire with LED luminaire (not requiring SLCB) on SLCB failure.

Spares management

Spares for public lighting assets are maintained based on the average annual consumption of parts, procurement lead time, minimisation of unnecessary additional inventory, allowance for contingency beyond the planned program, and average fault or emergency response. These are combined in an algorithm to identify spares.

Spare parts for components, including standard LED luminaires, globes, PE cells, fuses, DSLMP, and cables are to be maintained.

However, spares for decorative items such as decorative DSLMP, decorative brackets and decorative luminaires are not maintained as these are low turnover, custom-made items.

5.2.4 End of life

Public lighting assets shall be disposed in a responsible manner and in line with safe handling and hazardous materials disposal requirements that comply with all statutory and regulatory requirements.

Globes containing mercury are disposed according to the requirement of controlled waste category D120.

6. Asset Management Strategy Implementation

This strategy shall be implemented through various work programs. Many of these work programs are ongoing (annual). A new work program to proactively replace of LED luminaires needs to be initiated. The following section provides detail of key programs of work.

6.1 Key Programs

The key programs for public lighting are summarised in Table 6.1.

Table 6.1: Public Lighting Expenditure Programs

Opex Programs	Assets in Scope	Description
Metal Pole Inspections	DSLMP	Preventive routine inspection of all DSLMP over 8 years old. Minor wiring rectification work for metal streetlight pole. Rust treatment (i.e., sealing/painting) of corroding poles with the aim of life extension. Recording of conditions. Escalation of emergency conditions (e.g., structural, or electrical failure).
Streetlight Maintenance	All public lighting	Rectification of DSLMP wiring conditions that are not remediated during minor works at inspection.
Streetlight Fault Repair	Luminaires, DSLMP, brackets, streetlight control boxes	Response and rectification of failures and emergency conditions found.
Streetlight Underground Fault Repair	Streetlight underground cables	Response and rectification of emergency conditions found. Typically cable fault repairs.
Capex Programs		
DSLMP Replacement	DSLMP	Replacement of DSLMP based on inspected condition. Replacement of DSLMP on failure.
DSLMP Reinforcement	DSLMP	Reinforcement of defective DSLMP based on inspected condition.
Proactive LED Luminaire Replacement (new)	LED luminaires	Proactive bulk replacement of non-LED luminaires with LED luminaires.

6.2 Prioritisation and optimisation

Prioritisation and optimisation are critical activities in achieving Asset Management Objectives.

The programs detailed in Table 6.1 are scheduled for delivery, considering prioritisation and optimisation.

- Regular proactive inspections are time-based.

- Reactive response including any replacement are prioritised on risk. In case of a significant network emergency (e.g., major weather event affecting distribution and/or transmission network) response to streetlight faults may be delayed unless the risk is higher from the failed streetlight.
- All proactive repair, reinforcement, replacement program of works is prioritised on risk and optimised by geographic proximity for efficiency in delivering the work.
- The proactive LED luminaire replacement program is proposed to be prioritised on average age of existing luminaires by suburb/LG, with oldest replaced first. The sequence will be finalised through the planning process for the new program of work. LGs will be consulted prior to delivery of the program in their area.

7. Strategy deployment

Deployment of this strategy will include the following actions.

- Development of relevant business cases to support the investment required to implement the strategy.
- Development of a new work program to implement proactive LED luminaires replacement.

8. Review and improvement

This strategy will be reviewed annually through AA5 and the next version will be published latest by 30th June 2025.

The performance of the streetlight assets will be reviewed periodically against the objectives stated earlier. Deployment of the strategy, especially for the new proactive LED luminaires program will also be monitored. Western Power's routine asset and business performance monitoring mechanism will be used to review and monitor.

The ongoing consultation on various aspects of the public lighting strategy will continue and will be incorporated in the future version(s) when the relevant topic is finalised through the consultation process.