aqualux
LIGHTING

Landscape Lighting Guide

Contents

Why Landscape Lighting?

There are many benefits

There are many reasons to light up a landscape at night ranging from practical and safety related reasons to the pure aesthetics and greater use of outdoor areas that can be achieved.

When planning a new project, take into consideration several of these factors and identify what the overall objectives are and what is required to achieve them.

Landscape lighting design and installation is not rocket science but attention to small details and proper planning can ensure a project is successful.

Aesthetics

- Make an outdoor landscape beautiful to look at
- Access & utilise outdoor spaces after dark
- Much better 'return on investment' in a landscaping project

Security

- Reduce shadowed areas and dark spots.
- Greater awareness drawn to a garden.
- Prevent people or animals approaching unseen in the dark.

Safety

- Eliminate dark pathways & shadowed steps
- Reduce glare disability (compared to old floods)

Luminaire	Fancy word for light fitting that refers to a complete light - metal or plastic housing and light source together.

Types of Lighting

Lights for the purpose

Pathway Lighting

› Creating entrance way effects drawing a visitor along a pathway and up into a main entrance or driveway

Step Lighting

› Lighting along a stairwell or step to enhance safety and minimise glare

Up Lighting

› Uplighting trees or columns, creating effects through highlight & contrast and often using multiple beam angles.

Feature Lighting

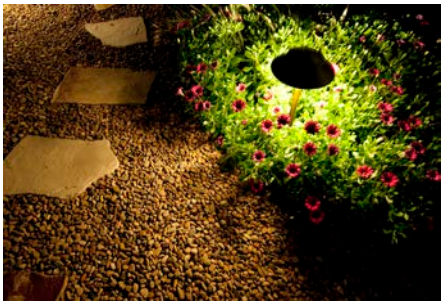
› Highlight a water feature, statue, artwork or garden feature.

Pond Lighting

› Illuminating a pond or water feature, using the movement of water as an additional effect.

Floodlighting

› Illuminate a broad area for functional or security purposes. Minimise glare by mounting high and controlling fall off.



Luminaire Types

Different Sights, Different Lights

Uplight

Inground / Recessed uplight used along walkways, decks, under features. Available with asymmetric 'wall washing' optics.

- AQL-155
- AQL-195
- AQL-530
- AUL-03-SS

Wall Lights

Includes many styles of light, both single and twin output. Highlighting columns, entrance ways and artwork / features.

- AQL-305
- AWL-03-SS
- AWL-03-CP
- AWL-06-CP

Spike Spot

Basic spike light either fixed or adjustable. For uplighting or spotlighting trees, features and general illumination.

- AQL-115
- ASL-01-BR
- AQL-503
- AUL-02-SS

Bollard / Pathway

Pathway lights that shines light downwards to illuminate the ground.

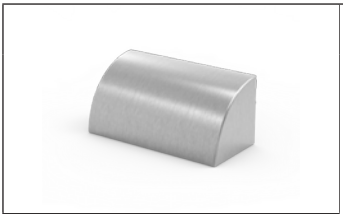
- AQL-131 / 135
- ABL-01-BR-LED

Luminaire Types

‘Runway’

Luminaire that provides a horizontal wash of light, similar to a runway effect. Can also be used as a step light. Also called a surface grazing light

- **AQL-165**
- **AQL-166**
- **AQL-565**



Step Lights

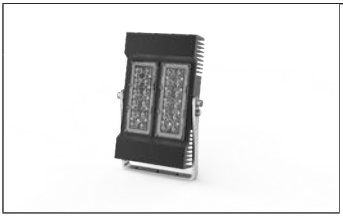
Many styles of step lights including basic bullnose fittings such as above for illuminating the ground and minimising glare.

- **AQL-510**
- **AQL-520**
- **AWL-01-BR**
- **AWL-02-BR**

Pond Light

IP68 rated adjustable spotlights usually surface mounted for placement on the bottom of water features.

- **AQL-540**
- **ASL-04-BR**



Flood Light

High-output general illumination fixtures for illuminating wide areas.

- **AQL-910**
- **AQL-910-RGBW**
- **AQL-930**
- **AQL-935v**

Column Lighting

Functional and looks good

- Narrow beams work well
- Can use single direction lights pointed up or down
- Can use in-ground uplights from below
- Avoiding glare is good, but not critical
- Surface texture of the column plays a role

AWL-05-SS

AWL-03-SS

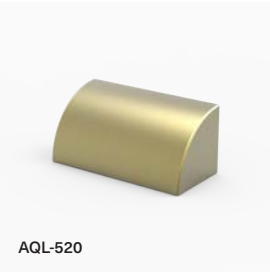
AWL-05-CP

AQL-155

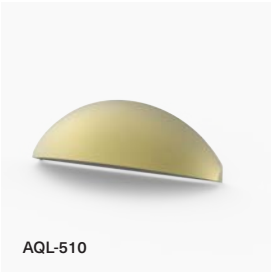
Stairway Lighting

Safety / Aesthetics

- Broad, diffuse beams work well
- Avoiding glare important for safety
- Be aware of the effect walking up and down
- Try to avoid completely dark patches in between lights



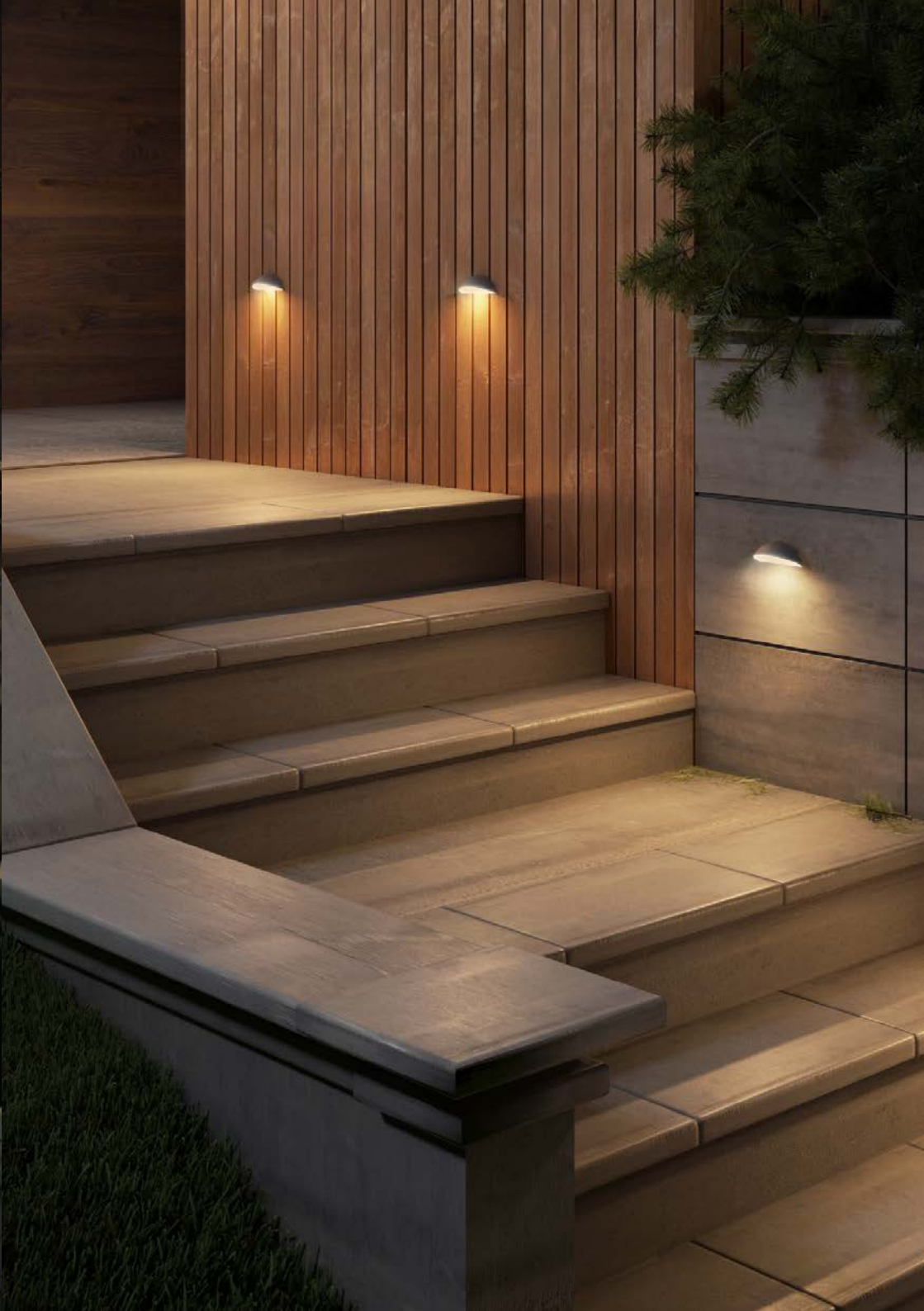
AQL-520



AQL-510

AWL-01-BR

AWL-02-BR

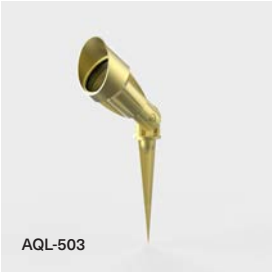


Tree Lighting

Natural born features

- Narrow beams for reach into high foliage & tall, thin trees
- Broad beams for illuminating low foliage & wide, broad trees
- Can use a combination of beams
- A rough guide:
- 500lms for small to medium trees
- 1000lms + for larger trees
- Darker trunks / foliage will need more light
- Colours can be very effective, especially amber

ASL-01-BR



AQL-503

AQL-930

AQL-115

Feature / Pond Lighting

Underwater, water features, statues and sculptures

- Feature material & colour can influence lighting choice.
- Avoiding glare important if you want to see it
- Can use a combination of beams
- RGB effect lighting possible
- Water will cut light output significantly

ASL-04-SS

AQL-540

AQL-155

AQL-115

Pathway Lighting

Entrance ways, driveways, walk ways

- Avoiding glare very important
- Navigational effect can guide people along
- Placement near steps / rough areas for safety
- Can utilise surface grazing lights on stone paths

ABL-01-BR

AQL-130

AQL-565

ASL-01-BR-SPS-60EL

Hong Kong City Lights

Lighting Technology

LEDs have come a long way

LED technology is now well established and they dominate lighting technology in most applications.

Whilst efficiency of LED chips has continued to increase, the rate of improvement will start to slow in the next few years as the physical limits are approached.

Further efficiency gains will come from other system areas such as power supply and full wallplug-to-lumen improvements.

Out with the old

- LEDs are now suitable for most general purpose lighting applications
- Halogen / CFL ancient history (Halogen 24lm / W)
- HID / Metal Halide still used for high-output flood lighting / roadway lighting
- LED can now even replace filament-effect lamps

LED Development continues

- Theoretical limit for White (Phosphor) LED 260~300lm/W
- Landscape lighting luminaires exceed 90lm/W
- LED globes now commonly above 100lm/W

More 'Watts' doesn't = more light!

- New LED tech makes more light using the same power.
- '4W' LED today bright than '8W' LED 2 years ago.
- Actual lumens per watt (lm/W) best way to compare

LED	A Light Emitting Diode (LED) is a type of semiconductor device known as a p-n junction. When electrons cross this junction, a process called 'electron-hole recombination' results in the emission of photons. Simple!

Materials

Not all lights are built the same

Aluminium (6063)

Aluminium can be grouped into two different categories with respect to outdoor lighting - Machined or Cast. Machined, 6000-series aluminum is a superior alloy and can be effectively anodized, a process which integrates a layer of extra-hard aluminium oxide into the surface of the metal and protects against corrosion.

- **Durable material (yacht masts, rock-climbing hardware etc)**
- **Minimal maintenance / good thermal conductivity**
- **Variety of colours available**

Copper

Copper is a popular option for more traditional settings and will naturally oxidize over time, turning a dark green colour as the metal reacts with oxygen in the air, unless it is continuously polished. Copper is one of the most expensive materials used in the construction of light fittings but also one of the most enduring.

- **Copper is a traditional look, will age naturally**
- **Will last the longest with minimal maintenance**
- **Variety of surface finishes available**

Brass

An alloy of tin & copper, brass is a material in common use for a wide variety of outdoor light fittings. Highly resistant to corrosion, brass will oxidize lightly over time but will generally not degrade structurally even in highly corrosive environments. Most brass fittings are generally cast and then machined.

- **Very durable material**
- **Available in different surface finishes.**

Stainless Steel

Stainless Steel is a popular choice for luminaire construction. Featuring resistance to corrosion, Stainless Steel for luminaire construction comes in two common grades, 304 & 316 (“Marine Grade”).

Stainless Steel must be maintained in order for it to retain it’s “stainless” appearance. Tea staining, dirt, salt and even rust can build up on any type of “Stainless” fitting unless it is properly maintained by wiping it down every few months with a damp cloth.

- **Reasonably durable material**
- **Requires maintenance to avoid tea-staining**
- **Can be electro-polished to improve corrosion resistance**

System Voltage Selection

24V is the way to go

12V Systems

- When halogen was dominant 12V made sense
- Current is higher for a given voltage = larger conductor size required.

24V Systems

- Higher voltage = lower current = smaller cable size = lower cost
- Reduced voltage drop, longer runs on given cable size
- Aqualux LED systems all 24V compatible

AC or DC?

- Not much difference in voltage drop between AC / DC
- Constant Voltage DC supplies (slightly) more efficient than toroidal AC supplies
- AC is still ultra-reliable and cheaper than switch-mode DC supplies

Series or Parallel

- Some LED lighting systems require series wiring, can be a big hassle
- All Aqualux LED lighting is parallel, similar to halogen, easy and no polarity.

Series Wiring

A circuit wired in series will have the same current flowing through all connected components. The circuit forward voltage will be the sum of the voltage drop across each component. If one component fails, current will stop flowing.

Parallel Wiring

A parallel circuit is one where the voltage is the same through all components and the current is the sum of the current flowing through each component. If one component fails, current will continue to flow through the remaining components.

AC (Alternating Current)

AC current reverses direction periodically and is the main form of electrical energy used for power transmission, audio and radio signals carried on electrical wires. It ‘alternates’ direction at a given frequency, typically 50Hz or 60Hz for power transmission and much higher frequencies for audio and radio.

DC (Direct Current)

In contrast to AC current, DC flows in one direction only. Batteries are a source of DC and AC sources can be converted to DC through the use of a rectifier. DC devices generally require the polarity of connection to be correctly observed.

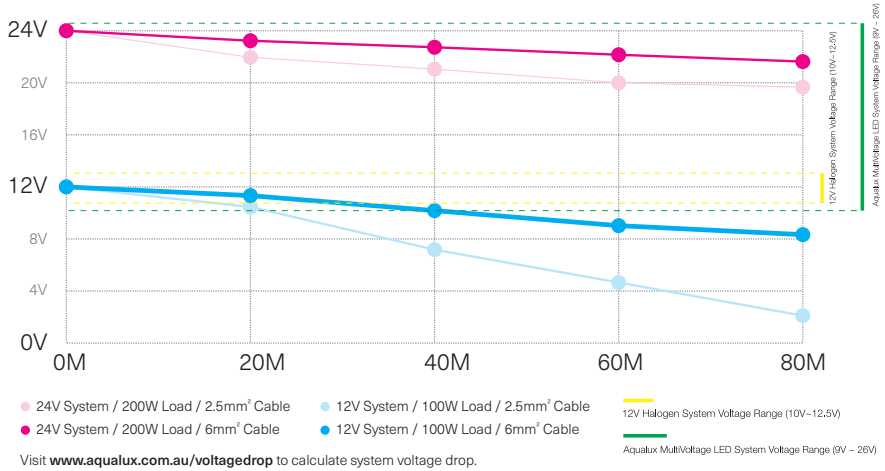
Voltage Drop

Something to avoid, but not always a show-stopper.

Voltage drop is caused by electrical resistance in a conductor and is determined by the nominal system voltage, electrical load and cable length.

The graph below shows that at the same current (8.3A) a higher system voltage (24V) will result in less voltage drop over the same size cable.

For the best performance, design your lighting system using Aqualux LED lighting products and a 24V Aquatran Power Supply



Visit **www.aqualux.com.au/voltagedrop** to calculate system voltage drop.

24V

AC or DC
Constant Voltage

We recommend for new and upgraded systems where all fittings are compatible.

SELV

Safety Extra Low Voltage

Under 50V AC or 120V DC
Isolated from mains or line voltage
AS/NZS 3000:2000

Cable Joins

Critical to a successful, reliable installation

There is nothing as critical to determining long-term performance than the quality of the cable join.

Time and again the reason we see for light fitting failure is that moisture has traveled up the cable and into the fitting, eventually corroding the electronics inside.

Achieving a IP67 or IP68 level of cable join is essential.

Several different methods are possible

- Adhesive lined heatshrink tube
- Adhesive lined heatshrink end-caps
- Gel-filled capsules
- Silicon + Heatshrink
- Self-amalgamating tape

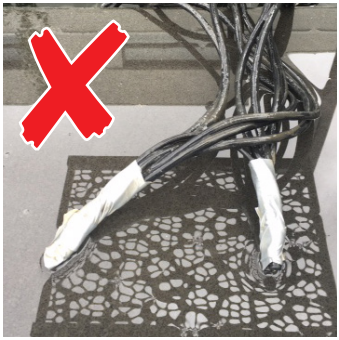
DO NOT JUST USE ELECTRICAL TAPE

Cable Siphoning	Water moisture that enters a light fitting via the cable due to a combination of capillary action and suction. When a lamp is turned off, the cooling inside the fitting forms a vacuum.
IP68 Cable Joins	All cable joins need to be to IP68 standard, ensuring a full seal to prevent both liquid water and water vapour or moisture from siphoning up the cable into the body.
AqualuxPLUS+	AqualuxPLUS+ is an option available on a range of Aqualux fittings. It includes a quick -connect cable harness that reduces siphoning and extends the warranty by up to 3 additional years.
GORE Creative Technologies Worldwide	Aqualux uses ePTFE vents from Gore in select fittings, which rapidly equalises pressure within the fitting before siphoning can occur. These vents also reduce strain on glands and seals when internal and external pressure is unequal.

Cable Join Example Images

Hall of Shame

Laziness



Solder & Gel-filled heatshrink applied

LED Control & Dimming

From go to woe.

Dimming LEDs can be difficult, basically because it's not as simple as just varying the voltage, like it used to be with halogen.

LEDs are constant current devices and it's the average current that must change in order to control the brightness. While this can be done directly, usually there is an intermediate control system that takes an input signal and then changes the output current or generates a PWM signal to modify the current over time.

There are several ways to do this, with the best way depending on the individual system and installation requirements.

1-10V

CBUS PWM

DMX512 DALI

0-10V **DSI**

TRIAC

Dimming - Direct Drive

External Constant Current Driver

Drive the LEDs in the lights directly via an external constant current driver that has a dimming control option. This solutions requires the lighting circuit to be wired in series and an additional control solution.

Dimming control options are generally 0-10V or 1-10V analog inputs, fixed resistance (10Kohm, 50Kohm etc) or PWM signal.

Pros	Robust, reliable & predictable when setup properly.
Cons	Requires DC-series wiring, more complex setup, open circuit voltage may exceed SELV DC limits.
Example Fittings	Aqualux Lumena / Phoenix fittings configured without internal drivers.
Example PSU	Meanwell LCM Series / ELG-C / HLG-C
Example Controls	Analog 1-10V module, Fixed Resistor, PWM Module

Dimming - Phase Cut

Aqualux has developed a phase-cut dimmable internal LED driver.

With this approach, a circuit of LED lights can be wired in parallel and powered by a standard 24V AC PSU (our Aquatran AQO).

A standard Universal phase-cut dimming module can then be used to dim the LED lights.

Pros	Simple setup, reliable magnetic power supplies, common control gear
Cons	Load needs to be ~80% or greater of the rated PSU, performance can vary based on local power conditions, some flicker during dimming is possible.
Example Fittings	Aqualux Lumena / Phoenix fittings configured with our dimmable driver.
Example PSU	Aquatran AQO
Example Controls	Clipsal Universal Dimmer Module, C-BUS Modules, Dynalite Modules etc

Dimming - LED Flex

AC and DC options

LED Flex Dimming - AC

Aqualux has developed what we believe to be the only 24V AC LED strip on the market, our AQS-260. There are several advantages to this strip including ease of integration with existing 24V AC projects and straight forward phase-cut dimming.

For example, you can be planning a landscape lighting installation with a mixture of fittings (Aqualux integrated drivers, AGL-250 series drop-in LED lamps etc) all of which can utilise 24V AC. If you need to add a section of LED strip, then the AQS-260 can be included without having to run a separate DC-only circuit.

Alternatively, you can have a circuit with both Aqualux Integrated Dimmable Drivers (in Lumena or Phoenix fittings) and also sections of AQS-260, and dim them all via single phase-cut Universal dimmer.

Pros	Very simple setup, AQO + Universal dimmer.
Cons	Load needs to be reasonably well matched to the PSU, ~60% or greater generally. 24V only.
Example Flex	AQS-260
Example PSU	Aquatran AQO 24V AC
Example Controls	Clipsal Universal Dimming Module

LED Flex Dimming - DC

Dimming LED Flex is a more straightforward because it is generally designed to accept a constant voltage input of 12V or 24V DC.

Integrated PSU dimming options in this case will work (which modulate the output signal to reduce the voltage) and so can low-voltage PWM based control modules that do the same thing but are separate to the PSU and can offer more flexible control options (eg. RF remote control, DMX/DALI integration etc).

Pros	Fairly simple for most LED strip
Cons	Access to PSU for using the on-board dimming can be inconvenient, so remote options should be considered.
Example Flex	Aqualux AQS-130/160 & AQS-500
Example PSU	Aquatran AQD / Meanwell HLG Series
Example Controls	AQD-400 Controllers, 1-10V module, PWM Controller

Tips & Tricks

Make the light last

Maintenance Tips

- Brass and Copper require minimal to no maintenance and are ideal materials. They will change colour but generally not degrade structurally.
- Anodised Aluminium will hold up well in almost all conditions, except in some heavily chlorinated environments. In salt-spray conditions it should be wiped / cleaned 1x/2x per year.
- Stainless Steel, especially in salt spray and coastal locations, should be wiped down every month or so to prevent tea-staining.

Install Tips

- Don't use electronic transformers that are designed for halogen. They won't play nice with internal LED drivers especially over the longer term.
- Best to double check wiring before going live and avoid short-circuits which even on SELV systems can be a hassle.

Lighting Terms & Definitions

Common lighting terms

Luminous Intensity (candela, cd)
1 cd = 1 lm / sr.

Luminous intensity is the light emitted in a given direction by a source. It is measured in candela (cd). The candela is an SI base unit from which other lighting related units are derived. The candela is defined as “the luminous intensity, in a given direction, of a source that emits monochromatic radiation of frequency 540 x 1012 Hz and that has a radiant intensity in that direction of 1⁄683 W per steradian.”

Luminous Flux (lumen, lm)
1 lm = 1cd . 1 sr

Luminous flux is the total amount of light emitted from a source in all directions. It can be used to approximate the “brightness” of a source, given that it is an average of the visible portion of the spectra emitted by a light source weighted by a function known as ‘v-lambda’ that describes the human visual systems sensitivity to light of different wavelengths. The lumen is a derived unit defined as 1 candela emitted in 1 unit solid angle, or steradian.

Radiant Flux (W)

The radiant flux of a light source is a measure of the total power emitted by a source across the entire electromagnetic spectrum, including non-visible portions such as UV and IR. In lighting, radiant flux is used in order to determine the luminous efficacy of a light source.

Luminous Efficacy (lm/W)

The luminous efficacy of a light source is determined by dividing the luminous flux by the radiant flux. The resulting fraction or coefficient describes the degree to which a source emits radiation in the visible or ‘useful’ part of the spectrum for lighting purposes. Energy emitted in wavelengths outside the visible portion of the spectrum reduces the overall luminous efficacy of a light source.

Illuminance (lux, lx)
1 lx = 1 lm/m2

Illuminance is the light incident on the surface of a plane. It is a derivative unit where 1 lux = 1 lumen spread over 1 square meter. Illuminance can be further classified as perpendicular or horizontal illuminance, when needing to differentiate in the analysis of a lit environment. The inverse square law can be used to calculate the lux incident on a plane with a known source intensity and distance.

Luminance (cd/m2)

Luminance is the light emitted from or reflected from a surface and approximates the brightness. It is dependant on the luminance of incident light and the reflectance of the surface. It is also commonly used to measure the brightness of a monitor or display.

Color Rendering

The colour rendering ability of a light source is the degree to which the source alters the appearance of an illuminated object relative to the appearance of the object under a reference illuminant. The most commonly used system for measuring this is the Colour Rendering Index (CRI). A series of coloured patches are evaluated under the source illuminant and an average calculated and indexed to a score (Ra) out of 100. Although in widespread use, there are several issues with the CRI system. An improved standard is TM-30 which is now available.

Correlated Colour Temperature (CCT)

The colour temperature of a light source is a measure used to describe the appearance of a white-light source. 'Cool' sources are said to have a higher CCT (above 5000K) whilst 'Warm' sources have lower temperatures (below 3000K). It it referred to as correlated colour temperature because the appearance of the light source is being compared to that of an 'ideal' black-body radiator with a similar surface temperature measured in kelvin (K).

Beam Angle (FWHM)

Full Width Half Maximum (FWHM) is an expression often found in the specification of LED optical systems. It refers to the width of the beam where the intensity is 50% of the maximum. This is typically measured by a goniophotometer during standard photometric testing. Some manufacturers may use different systems for specifying optical beam performance.

Voltage Drop

Voltage drop in landscape lighting is the degree to which the starting voltage decreases over a given length of cable as a function of both the current load (A) and the resistance (Ω) of the cable. If the proper cable is not selected, voltage drop can produce faults such as low output or flickering lights. Selecting luminaires with the Aqualux MultiVoltage™ internal driver and using a 24V power supply can mitigate many of these issues, allowing for cheaper and more flexible installation.

LM-80

The LM-80 standard is the IESNA approved method for determining lumen maintenance of LED light sources, e.g. how quickly the light output of an LED source degrades over time. It deals with actual measurements only.

TM-21

TM-21 is a way of taking LM-80 data and making useful extrapolations in order to calculate longer LED lifetimes, given that testing for more than 10,000 hours is impractical. It is the TM-21 method that lets LED manufacturers determined the L70 and L80 lifetime expectancies of their LEDs.

TM-30

TM-30 is the official replacement for the previous system (CRI) of determining the ability of a light source to accurately render colour in comparison to a reference source. Although not widely spread, TM-30 measurement is expected to be the future of CRI standards.

LM-79

The LM-79 test report provides details about the performance of a total luminaire package, including wall-to-lumen efficacy, luminous flux, luminous intensity distribution and CCT / CRI details. It is the most common "lighting test report" available for many light fittings.

IES File

An IES file is a digital representation of the zonal luminous intensity distribution of a light source. This file can be used by lighting software to accurately render the spread of light from a source to determine if the fitting provides the required illumination.

Integrating Sphere

An integrating sphere is a device used to measure to total luminous flux of a source. Comprised of a spherical housing the inner surface is coated with a highly diffuse paint. When a light is shone in through the aperture, the internal surface "integrates" the light into an average which a calibrated sensor can then use to determine the total flux.

SPD

The Spectral Power Distribution "SPD" of a source represents the distribution of the radiant power throughout the visible spectrum. Usually defined in 5nm increments it can be used to determine the luminous efficacy of a light source and it's colour rendering properties.

IP / IK Ratings

Ingress & Impact Protection Ratings

The IP (Ingress Protection) rating system provides a means of classifying the degrees of protection from foreign bodies and liquids afforded by electrical equipment and enclosures.

The degrees of protection against the ingress of foreign bodies and liquids are indicated by the first two numerals as detailed in the table below.

IP_X	Protection against objects
0	None
1	Objects => 50mm in diameter.
2	Objects => 12.5mm in diameter.
3	Objects => 2.5mm in diameter.
4	Objects => 1mm in diameter.
5	Dust Protected
6	Dust Tight

IPX_	Protection against water
0	None
1	Vertically falling drops of water.
2	Drops of water, when enclosure tilted 15 degrees.
3	Spraying water.
4	Splashing water.
5	Water jets.
6	Powerful water jets.
7	Temporary immersion in water.
8	Continuous immersion in water.

IK Ratings

The IK rating system was introduced in October 1995 as EN62262. It describes the degree to which an electrical enclosure can protect the internal equipment from the effects of mechanical impact.

IK00	Not protected
IK01	**Protected against 0.14 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 56 mm above impacted surface.
IK02	**Protected against 0.2 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 80 mm above impacted surface.
IK03	**Protected against 0.35 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 140 mm above impacted surface.
IK04	**Protected against 0.5 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 200 mm above impacted surface.
IK05	**Protected against 0.7 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 280 mm above impacted surface.
IK06	**Protected against 1 joules impact.** Equivalent to impact of 0.25 kg mass dropped from 400 mm above impacted surface.
IK07	**Protected against 2 joules impact.** Equivalent to impact of 0.5 kg mass dropped from 400 mm above impacted surface.
IK08	**Protected against 5 joules impact.** Equivalent to impact of 1.7 kg mass dropped from 300 mm above impacted surface.
IK09	**Protected against 10 joules impact.** Equivalent to impact of 5 kg mass dropped from 200 mm above impacted surface.
IK10	**Protected against 20 joules impact.** Equivalent to impact of 5 kg mass dropped from 400 mm above impacted surface.

Galvanic Corrosion

Some metals don't mix

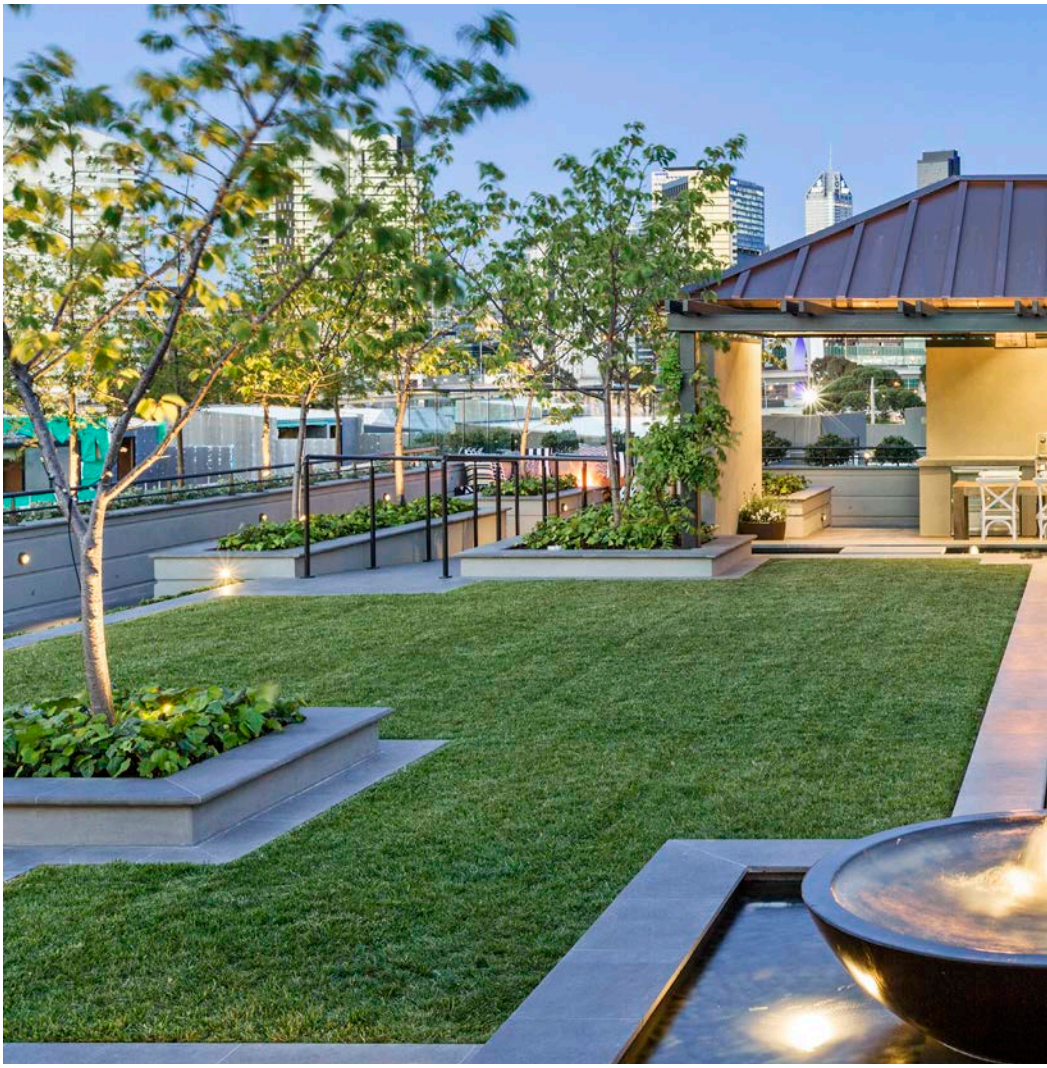
The Galvanic Table lists metals in the order of their relative activity in a sea water environment. The further apart two metals on the list are, the more reactive they will be and the greater the corrosion.

A barrier or film that prevent direct contact between the two can effectively mitigate the galvanic effect.

This includes the oxidative layer in anodised aluminium components and also washers, gaskets and other physical, non-conductive barriers.

Note that galvanic corrosion is different from oxidation (rust), which can be accelerated by the presence of oxidative agents such as chlorine.

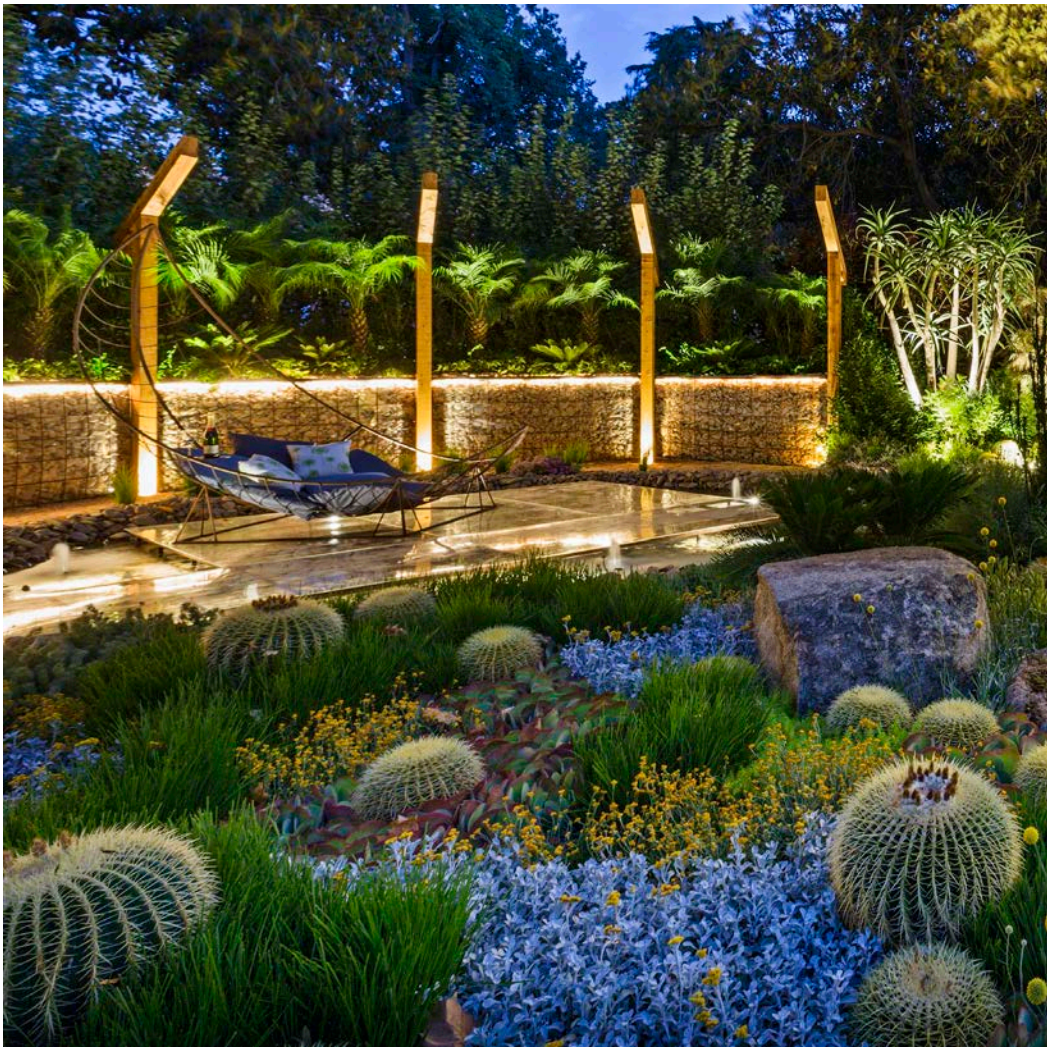
Active (Anodic)
Magnesium
Mg alloy AZ-31B
Mg alloy HK-31A
Zinc (hot-dip, die cast, or plated)
Beryllium (hot pressed)
Al 7072 clad on 7075
Al 7079-T6
Cadmium (plated)
Uranium
Al 218 (die cast)
Al 5052-0
Al 5052-H12
Al 5456-0, H353
Al 5052-H32
Al 1100-0
Al 3003-H25
Al 6061-T6
Al A360 (die cast)
Al 7075-T6
Al 6061-0
Indium
Al 2014-0
Tin (plated)
Stainless steel 430 (active)
Lead
Steel 1010
Iron (cast)
Stainless steel 410 (active)
Copper (plated, cast, or wrought)
Nickel (plated)
Chromium (Plated)
Tantalum
AM350 (active)
Stainless steel 310 (active)
Stainless steel 301 (active)
Stainless steel 304 (active)
Stainless steel 430 (active)
Stainless steel 410 (active)
Stainless steel 17-7PH (active)
Tungsten
Niobium (columbium) 1% Zr
Brass, Yellow, 268
Uranium 8% Mo.
Brass, Naval, 464
Yellow Brass
Muntz Metal 280
Brass (plated)
Nickel-silver (18% Ni)
Stainless steel 316L (active)
Bronze 220
Copper 110
Red Brass
Stainless steel 347 (active)
Molybdenum, Commercial pure
Copper-nickel 715
Admiralty brass
Stainless steel 202 (active)
Bronze, Phosphor 534 (B-1)
Monel 400
Stainless steel 201 (active)
Carpenter 20 (active)
Stainless steel 321 (active)
Stainless steel 316 (active)
Stainless steel 309 (active)
Stainless steel 17-7PH (passive)
Silicone Bronze 655
Stainless steel 304 (passive)
Stainless steel 301 (passive)
Stainless steel 321 (passive)
Stainless steel 201 (passive)
Stainless steel 286 (passive)
Stainless steel 316L (passive)
AM355 (active)
Stainless steel 202 (passive)
Carpenter 20 (passive)
AM355 (passive)
A286 (passive)
Titanium 5A1, 2.5 Sn
Titanium 13V, 11Cr 3Al
Titanium 75A
AM350 (passive)
Silver
Gold
Graphite
Noble (Cathodic)



Project Highlight - VIC

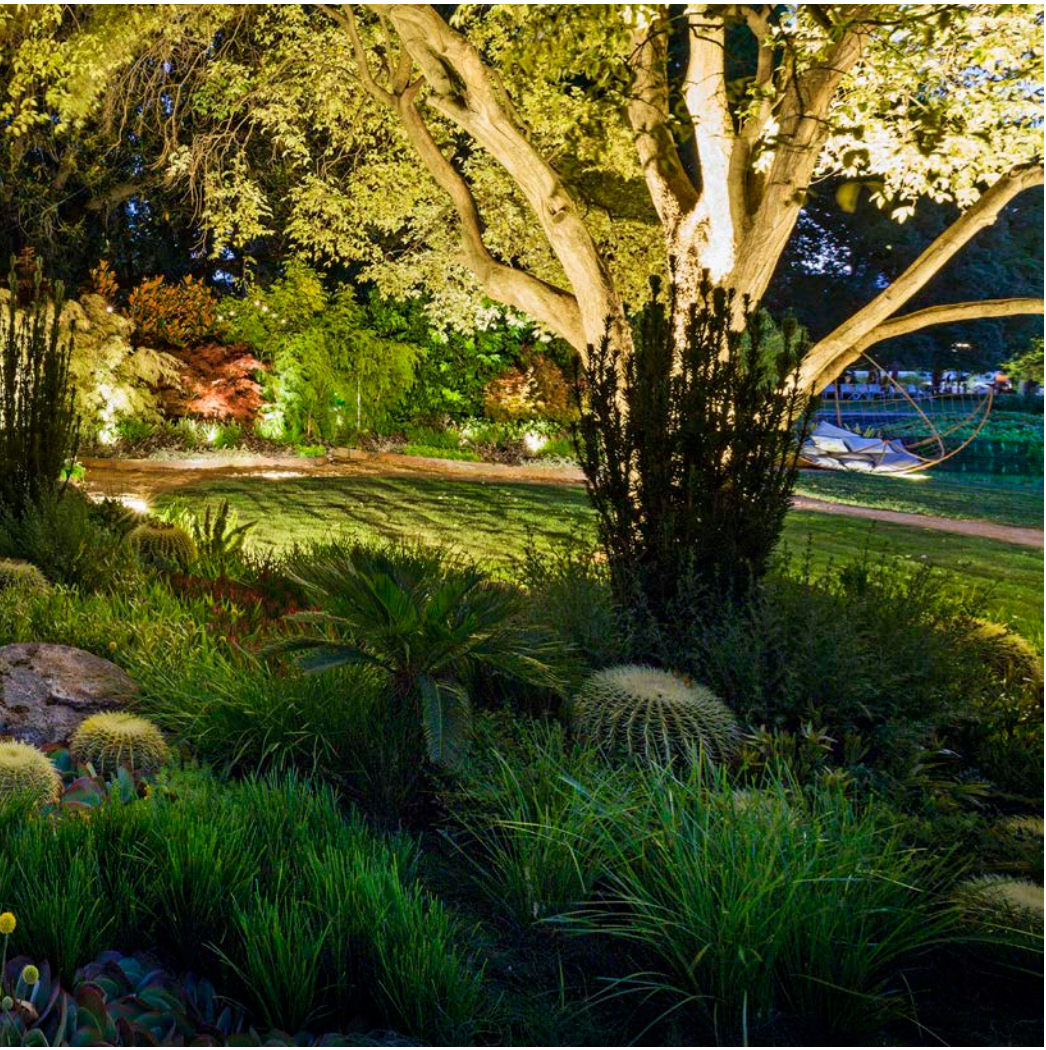
The Block 2016, Melbourne

1	Pathway Lighting
2	Water Feature lighting
3	Tree Uplighting

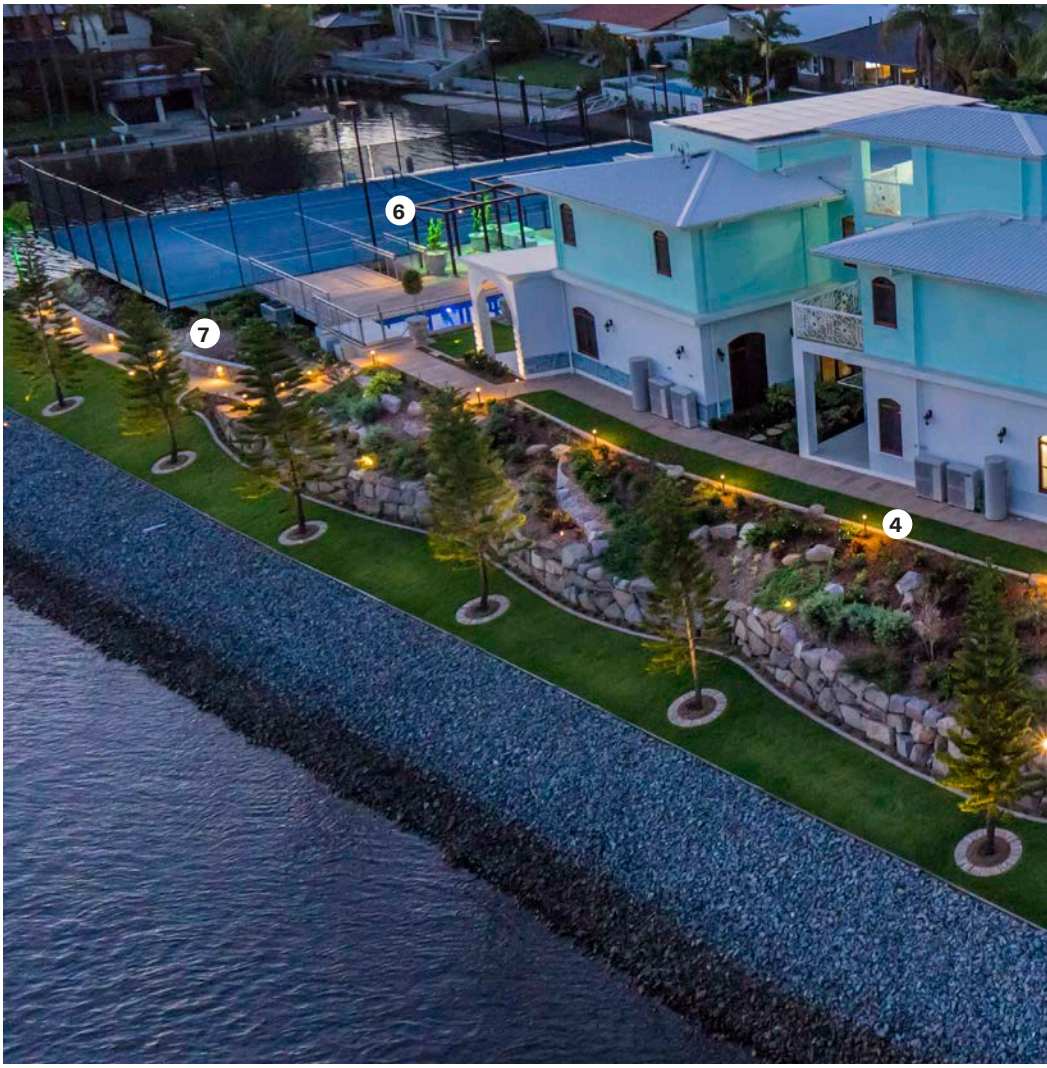


Project Highlight - MIFGS

MIFGS 2018, Melbourne

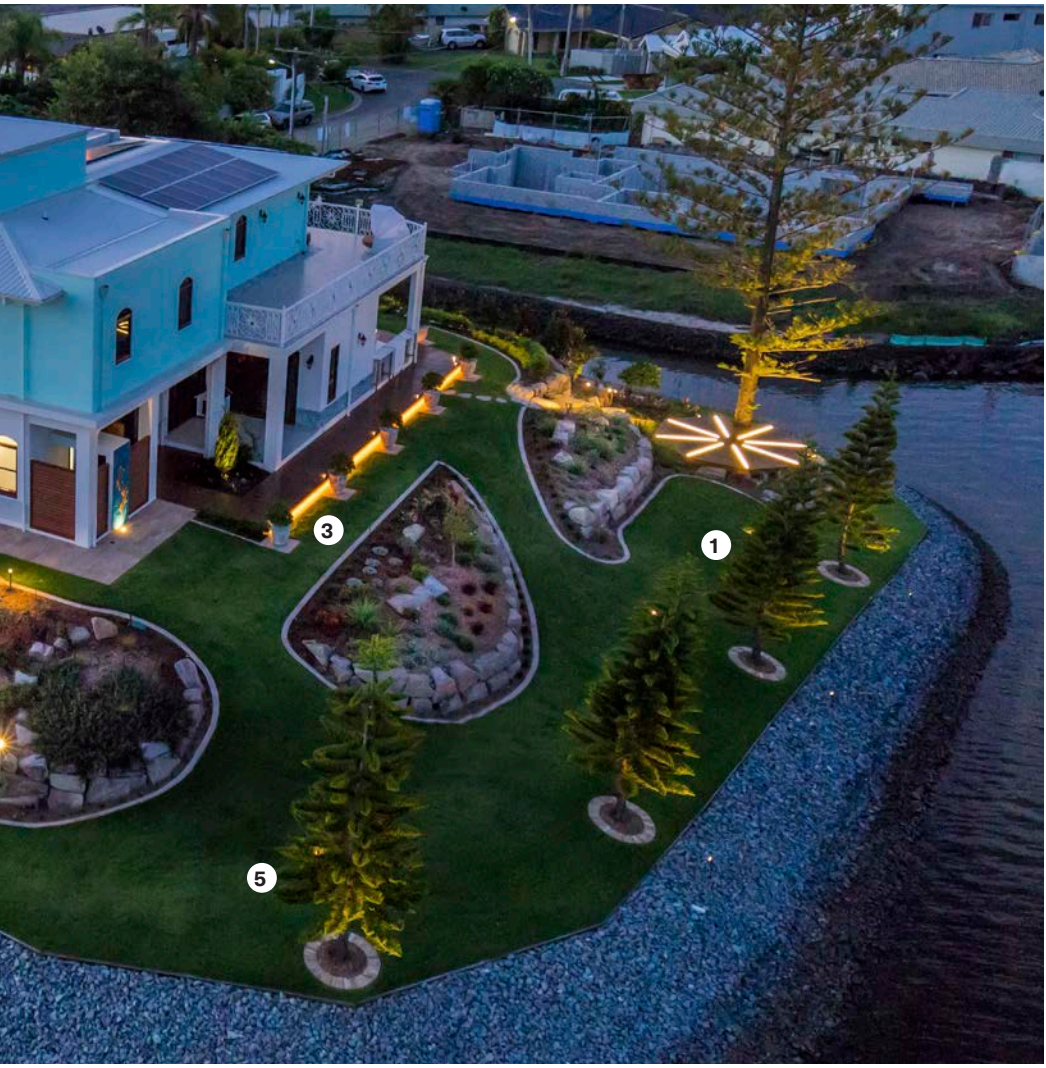


1	Tree Uplighting
2	Strip Lighting washing the stone retaining wall
3	Pathway grazing
4	Post uplighting



Project Highlight - Brisbane

Brisbane, Queensland



1	AQL-530	Tree uplighting with the AQL-530-X12
2	AQS-260	LED Flex uplighting in a fan arrangement. This is putting out over 8000 lumens.
3	AQS-500	Under-deck lighting with AQS-500 Neon Flex.
4	AQL-130	Garden edge illumination with the AQL-130 series bollards
5	AQL-115	Additional tree lighting for house-side viewing
6	AQL-910	Entertainment lighting with RGBW lights and iPad control systems
7	AQL-510	Pathway lighting with the AQL-510 steplight.

aqualux
LIGHTING

Landscape Lighting Guide

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