Landscape Lighting

Well-placed low-voltage lighting circuits can make a home's surroundings useful, beautiful, and safe

by Bruce Zaretsky

As a partner in a landscaping design-build firm, I work from a broad palette of design elements. The basic forms, like walkways, patios, decks, and fences, serve as a visual and spatial frame for plantings, water features, sculptures, and other enhancements.

Lighting is often treated as just another landscape enhancement, or even as an afterthought. But for me, it's an essential tool and one of the main keys to success. My high-end clients typically work long hours, and many of them get few chances to see their properties during daylight hours. Lighting makes their outdoor spaces accessible and useful after sundown.

But the best lighting design takes things a few steps further. It does more than simply let people see. A thoughtful design can create a beautiful nighttime world that's pleasant and relaxing, or dramatic and exciting, to suit each client's taste and budget.

Nightscaping Concepts

"Nightscaping," as the industry terms it, can mean a simple enhancement like putting in a few path lights. Or it can mean a complex scheme for the whole property, with extensive illuminated scenes that involve house features, decks, paths, plants, and sculptures. Bare bones or full featured, a well-designed setup can create striking, exciting, or relaxing visual effects, even as it accomplishes the basic outdoor-lighting goals of security, safety, and convenience.

Mood, safety, and security. Three broad purposes typically anchor the design thinking for a landscape lighting plan. There is the creative value of mood lighting, or effect lighting — for example, uplighting a tree to give it a pleasing or dramatic appearance. Then there is the practical value of path lighting: For convenience and to prevent accidents, we light the ground at the entry to walkways, or wherever there's

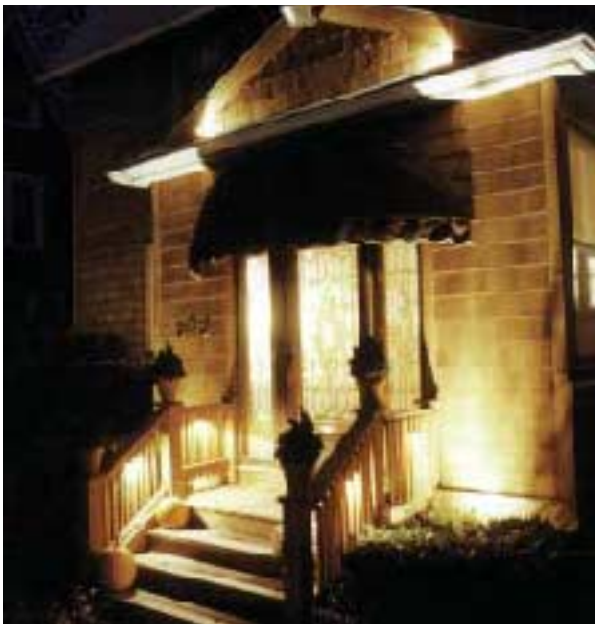

Figure 1. In the photo above right, a home's entrance is identified with canister spots that wash the base of the wall near the door, while specialty lights in the railing light the stairs. At right, recessed lights in the risers make for safer climbing.

a change in elevation like a set of steps; and we place lights near bodies of water. Finally, there's the issue of security: We light dark areas to eliminate places where burglars could hide.

A thoughtful designer can employ individual lights or groups of lights to serve more than one of these goals at the same time (see Figure 1). The main reason to create effect lighting is because it looks good; but it can also help to light walkways and dark corners. By the same token, path lighting or security lighting can be done in a way that is visually pleasing, casting interesting shadows or emphasizing a distinctive feature.

Art versus nature? In simple terms, there are two schools of thought when it comes to landscape lighting. One philosophy is to design the lighting to mimic nature. Nature supplies mostly downlighting and backlighting at night. A full moon, for instance, will cast subtle shadows of trees and plants on the ground; that's the basic idea of downlighting (we even call it "moonlighting"). But imagine a tree on the horizon minutes after sundown, silhouetted against a pale, bright sky: That's backlighting. To conform to the natural world, says the first school of thought, we should downlight and backlight our landscape.

An alternative is to create a whole new landscape at night (Figure 2, next page). That school of thought favors techniques such as uplighting a small shrub next to the house to throw a tree-sized shadow against the high blank wall (called "shadowing"). A designer might hide a piece of sculpture in the plantings and transform it into a focal point at night with a well-placed spotlight. You can highlight interesting trees, or you can shine a spotlight across a waterfall to cast moving shadows onto the stone work.

No law says those two schools of thought can't be combined (Figure 3, page 4). To take either philosophy too literally could stifle your creativity. I prefer to change the night landscape with my lighting design; but I'm also known to climb into trees to hang downlight fixtures, just for the effect of moonlighting the branches onto the ground (this looks especially striking after a snowfall).

Lighting water features. Nothing looks more dramatic in the landscape than illuminated moving water. Special underwater low-voltage lights are available for lighting a waterfall or casting a glow throughout a pond.

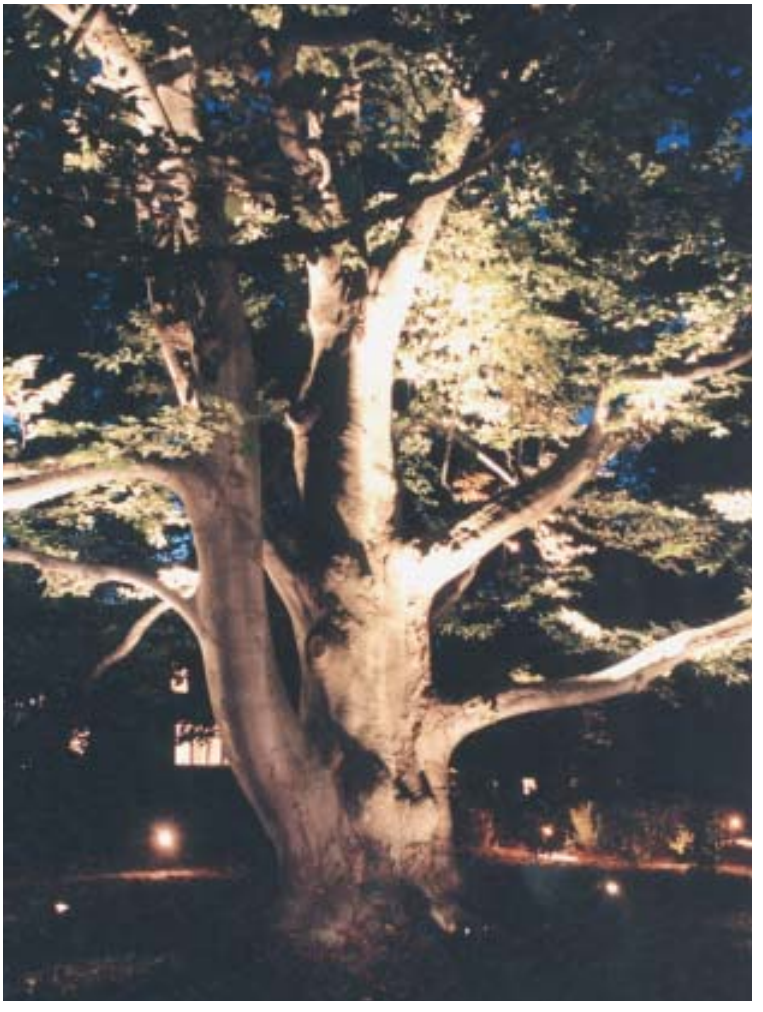

Figure 2. Rather than restrict his lighting effects to a simple mimicry of nature's backlighting (evening sky) or downlighting (moonlight), the author uses lights to change the character of a home's surroundings at night. Tricks such as highlighting a statue (above) or hanging downlights in an interesting tree (left) stimulate the imagination. A designer can even create entire lit and decorated scenes as a suitable backdrop for entertainment and celebrations (below).

These are simple. You can also light the surrounding landscape to highlight the water: Use spotlights to cast light across the stone work in a pond or across a waterfall to shadow the moving water on the rocks beyond. If you have a still water surface, you can light a tree behind the pond to create a reflection of it in the water. Or you can shine a spotlight up a creek, or use a sharp beam spotlight to light a night-blooming water lily. Water features are truly an artist's canvas — the choices go on and on.

Low-Voltage Fixtures

We accomplish these goals with low-voltage lighting systems that are easy to shop for, and that you don't need an electrician's license to install. The systems use 12-volt direct-current power, supplied by a transformer that

Figure 3. Simple lighting that imitates natural moonlight or sky light can be blended with more conscious effect lighting for a satisfying total result. At left, simple path lights shine down on the walk, and uplights next to the outbuilding create a lit background for small plantings that's similar to the pale sky behind the nearby trees. Spotlights on smaller trees in the foreground create perspective-shifting large shadows for added dramatic effect. The scene at right has similar backlighting created with canister lights next to the house wall, but for added visual interest includes spotlights trained upwards onto the small tree. The illuminated tree also helps to light the path in this case.

plugs in to an ordinary GFCI-protected 120-volt house outlet. (We do ask for dedicated outlets to serve our transformers, and of course those circuits have to be run by a licensed electrician.)

We'll get to transformers in a moment; first, let's take a look at lights. The business end of the system starts with the fixtures. These fit into three broad categories: path lights, spotlights, and specialty lights (Figure 4, next page).

Most path lights are mounted on short, vertical stems and are designed to cast light down onto a small section of walkway or path. These fixtures usually receive a bayonet-style lamp, like the old taillight lamps that cars used to have. Dozens of lighting companies offer many minor variations on the classic path light theme, and some offer more elaborate or decorative fixtures that set the hardware into a small statue or other object. Simple fixtures work fine, but it's worth placing them with care. I avoid lining up the fixtures, which can create a "runway effect," unless the client happens to like that.

Spotlights can be used for almost any application, including uplighting, downlighting, backlighting, and highlighting. They are typically applied for the visual effect, but a spotlight placed as a downlight in a tree or other elevated spot can also be used to light pathways.

Specialty lights are really a variation of the path light or spotlight idea, refined for a particular location or use. Some fixtures are designed for mounting into steps or walls; we use those as path lights or spotlights. We also have fixtures that we can mount under deck railings or recess into the railing. These highlight the railing detail, as well as shrubs or sculptures below them, and they cast a subdued light into the nearby walking or sitting areas. Other available options include strip lighting (similar to holiday lights) and underwater lights.

We can flexibly mix and match all these broad fixture types in various designs, to meet the needs of the particular case. The only rule is to choose what works: To get the look and function I want, I use spotlights to light pathways, path lights to highlight plants and sculptures, and rail and step lights to do either.

Low-Voltage Lamps

The core components in any system are the lamps (the bulbs that go into the fixtures). Twelve-volt lamps are more powerful than you might think: On average, a 12-volt lamp will put out as much light as a 120-volt lamp of three times the wattage. So for example, a 25-watt 12-volt lamp will throw as much light as a 75-watt 120-volt lamp.

Certain lamps fit certain types of

Figure 4. Most elements of a nightscaping design are accomplished with a combination of path lights and spotlights. At left, the author has blended both fixture types into his arrangement of stone terraces, walls, steps, and walkways. Specialty lights allow subtle custom touches in every kind of space. Above, a deck is lit by fixtures recessed into railings.

fixtures (Figure 5, next page), so your choice of lamp will actually dictate the type of fixture you can use. You start the design by considering which of several main lamp types will best achieve the intended effect in each location you intend to light.

Par-36 lamps are the same as your car's headlights: They will throw a beam a long way and are great for uplighting trees. Available wattages range from 15 to 50 or more watts, with beam spreads ranging from 5x5 degrees up to 69x69 degrees. They are extremely versatile for use as spotlighting, highlighting, path lighting (when hung in a tree), and shadowing. Par-36 lamps are maintenance friendly and last quite a long time if they're not over powered. Their one drawback is that they don't last as long as halogen lamps.

MR-16 lamps are high-intensity tungsten halogen lamps, which give a truer white light. These are excellent for highlighting bricks and other colors at night. We use MR-16s on occasion in all the same situations where we use Par-36 lamps. Smaller MR-11 and MR-8 lamps are also available and are useful when the application calls for a compact fixture. One of the advantages of an MR-16 is that they are small and easy to conceal. These lamps must be in a watertight fixture, and it's worth choosing high-quality fixtures that won't corrode shut and make access impossible when it's time to replace a lamp.

Bayonet lamps are used mostly for path lighting, but they can also be used for low-level spotlighting (on a sculpture, for instance). One problem with these lamps is that they're not intended to be sealed into a fixture; the heat generated will make them fail prematurely. We specify halogen and gas-filled (xenon) lamps because of their longer life and brighter light. T-series lamps such as T-3 and T-5 are either wedge-base or bi-pin and come in a large wattage range.

Fiber optics. Recently, there has been a movement toward using fiber optics for landscape lighting. The technology brings two major advantages: First, the emitting fixtures are extremely small and easy to hide. This works especially well with waterfalls. Second, there is only one source lamp to worry about. The illuminating unit houses a powerful halogen lamp (typically either 150 or 250 watts), and the fibers are run off of that. You can run virtually unlimited fibers from the illuminator, as long as you can fit them in front of the lamp.

But there are disadvantages. The illuminator is a sealed unit with a very hot lamp. All units incorporate a cooling fan, and because the fans make noise, you need to isolate them from gathering spaces. Also, if you cut a fiber, you can't make a splice that will completely restore the fiber's light transmission ability — you need to

replace the entire fiber. (Low-voltage wire, by contrast, can be spliced at the point of damage.) Finally, fiber-optic systems cost quite a bit more than ordinary low-voltage systems. Don't let cost deter you from giving them a try, however, especially in wet areas. Fiber optics are a safe way to run lighting to pools and ponds.

There has been a lot of recent hype about LED lighting for landscapes. We've been flooded with advertising emphasizing LED technology's extremely low power usage. One flyer I received claimed that a 1-watt LED lamp would provide as much light as an 18-watt bayonet lamp. I was intrigued enough to order some lamps and test them in our display gardens. After experimenting with multiple lamps in various configurations and color combinations, and after many discussions with the manufacturer, I concluded that LED products have a long way to go before they will be effective for my kind of work.

Figure 5. The Kichler fixtures shown above — two specialty deck fixtures (top row), two downlights (second row, left), and two spike-mounted spotlights (second row, right) — are just a sampling of the huge variety offered by manufacturers. Different fixtures accept different types of lamps, so the author first decides which kind of lamp is best for a particular case before choosing the fixtures for that location. The largest lamp in the group at left is a PAR-36 parabolic reflector lamp, the workhorse for flood and spot applications. The smaller lamps next to it are, top, a two-pin (or bi-pin) MR-16 mirrored reflector halogen lamp, which throws a bright white beam for good color rendition and works well for precision spotlighting; middle, a bayonet-base lamp; and bottom, a wedge-base lamp.

Transformers and Circuits

The power plant of any low-voltage lighting system is the transformer (Figure 6, next page), which steps the home's 120-volt alternating current down to 12-volt direct current. Transformers are rated in watts, and units are available with capacities ranging from less than 100 watts up to 1,000 watts or more. The 500-watt, 600-watt, and bigger units are really banks of 250-watt or 300-watt transformer cores racked together in one box, with multiple taps you can use to supply multiple circuits. Most units now have optional taps available with slightly boosted voltage, giving you 13-volt, 14-volt, or 15-volt power when you need it to serve a particularly long run of cable.

Transformer boxes come with knockouts and brackets designed to let the installer include manual switches, timers, and photocell controls. I prefer to set up systems so that a photocell switch turns them on at dusk and a timer turns them off at a preset time.

We almost always put our transformers on the outside of the house, mounting the photocell switch device right on the transformer box. But the photos here show a job where we put the transformer on the wall inside a garage, and I had to drill through the wall to run my lighting circuits. In such cases, we mount the photocell on the junction box on the outside wall face (Figure 7, page 8).

We bury cables 6 to 12 inches deep and bury canister lights roughly flush with the surface of the ground. Spotlights typically mount on a spike; most suppliers have one or two spike types that will work with their whole range of spotlights (Figure 8, page 9).

Constant exposure to rain and ground moisture is a given with landscape lighting, so water-resistant details are important (Figure 9, page 10). For wire connections, I rely on Blazing Wire Connectors from Blazing Products (877/304-2111, www.blazingproducts.com). These connectors resemble ordinary wire nuts, but they have a tube filled with silicone sealant and a locking cap. I've never known one to fail.

I also use lamp assemblies with a glass shield, which protect the lamp itself, not from rainwater — the

Figure 6. This 550-watt transformer box holds two 275-watt transformer banks, which the author can set independently to supply 12, 13, 14, or 15 volts. The author's control circuits typically use both a timer and a light-sensitive switch. At top left, he strips one of the wires that will link a timer mounted in the transformer box to an exterior-mounted light-sensitive switch, then mounts the timer into the box (top). After connecting the lighting circuits (above left), he runs a voltage check (above right).

fixtures keep that out pretty well — but from condensation on the inside of the fixture lens. We've had individual lamps fail in the past because small amounts of moisture got vaporized inside the fixture, condensed on the underside of the lens, and dripped back onto the lamp. The secondary glass shield keeps those drips away from the bulb.

Accounting for Voltage Drop

Choosing an appropriate transformer, and determining the length and total wattage of the individual lighting circuits it will have to serve, is complicated by a fact of life called voltage drop. With low-voltage systems, power is lost in the wiring, in proportion to the distance the electricity must travel. The farther down a run of cable a light is located, the lower the voltage supplied to that light; but the thicker the wire, the less voltage drop occurs over a given cable length. Low-voltage cable is specified in gauges — the lower the gauge, the thicker the wire — and there is a published "cable constant" for each gauge of wire that lets the user calculate voltage drop for that gauge. We typically use heavy 12-2 (12-gauge, two-wire) cable, but we sometimes run 18-2 cable for lights mounted in trees, because the thinner wires are less noticeable. It's

Figure 7. The author drills a hole at the base of the garage wall (above), then pulls 12-volt power supply and control wires through a watertight junction box (above right), and mounts a light-sensitive control switch on the box (right). The individual red, white, and black wires serve the photocell switch; the larger black cables entering the underside of the box carry power for the light circuits.

important to calculate the voltage drop in each circuit, factoring in the cable constant and the distance the power must travel, to make sure all the installed lights will be supplied with adequate voltage.

Lamps manufactured for 12-volt systems will work fine at 10 or 11 volts — they'll shine brightly, and will in fact last much longer than they would at the full 12 volts. But go much below 10 volts, and you'll notice dim lights at the end of the wiring run. I've seen cases (not on my jobs, thankfully) where lights that should have been throwing a brilliant white flood of light were giving off only a feeble orange glow. That's what happens if you lay out circuits that involve too many watts' worth of fixtures, or use too long a run of cable.

When you have a distant load to deal with — a long driveway, for example, or a group of trees far away from the house — you do have options. Heavier cable may help, but it can be stiff and awkward to work with; you might prefer to hook that circuit to a higher-voltage tap on a multiple-tap transformer. In extreme cases, you may need heavier wire *and* higher voltage. You may even need to have an electrician run a new 120-volt circuit out from the house so you can locate a transformer closer to the spot. A good lighting supplier can help you figure out a solution. Once you run through the calculations for different transformer and cable options a few times, you'll quickly get a feel for what the choices imply; with experience, it gets easier to take unusual cases in stride.

For routine layout of simple circuits, however, rules of thumb are a good starting point. During the design phase, we strive to limit the length of runs to 100 feet or less, and to keep the total wattage of lights served by each transformer at 80% or less of the transformer's power rating.

We also avoid straight runs involving many lights in series — instead, we try to lay out the circuits in a "star" or radial pattern, running one wire to a central point and then branching out to individual fixture loads. That works better, because voltage drop depends on the distance between the load and the source. Adding more lights doesn't create more voltage drop as long as the power doesn't have to travel more feet to get to each one. So if I have a 50-foot run to a branch point, and five lights at the end of five 10-foot branch wires, my voltage drop for each light is based on 60 feet of cable. If I string those five lights in series, with 10 feet of wire running from each light to the next, the last one will be at the end of a 100-foot run and will experience more voltage drop as a result.

These rules of thumb give generally

Figure 8. After pulling wire through a mounting stake and threading on the fixture (below), a worker sets the spotlight in the ground, angling it slightly to create shadows on a stone wall face.

satisfactory results, pretty reliably. Even so, I always calculate the voltage drop for every circuit and note what the voltage should be at each fixture. As we hook up each light, we check the voltage at the fixture. This reveals any problems with the wiring and assures us that each light will perform as intended. I'd rather get it right today than have to come back and fix it next month.

Plan of Attack

It's always possible to put lighting into a property as an afterthought. But for optimum effect, it should be designed in advance. It helps to have an advance plan that accounts for practical requirements such as locating the transformers and running wires below paving. I typically add the lighting specifications to the overall landscape plan that I've drawn. The final installation may be different from the original lighting plan; ideas change, and something that looked perfect on paper might need adjustment when plantings and other features are installed. Also, we may discover other features that we would like to highlight (for example, a boulder that we've unearthed on the site). But the plan is useful for keeping track of things that probably will not change, like the transformer location and the wiring layout. And a plan drawn to scale is helpful in laying out the individual circuits, so as to keep the total wattage and cable length for each circuit within the limits of the transformer's capacity.

The plan also reminds you to think ahead. If you are landscaping from scratch and installing a paved element such as a walkway, driveway, or patio, place a piece of conduit under the paving. If it only has to contain lighting wires, 1-inch-diameter conduit should be large enough. If you are adding lighting to a landscape, existing paving can be a hindrance; you'll have to decide whether you would rather bore under the paving (assuming it's solid), remove and replace it, or run the wires around it.

Learning by Doing

Nightlighting has become an accepted part of landscape design,

Figure 9. Landscape lighting circuits and fixtures are constantly exposed to weather and have to be able to withstand moisture. To protect wire splices, the author uses a two-piece fitting from Blazing Products (left) that uses an O-ring and a silicone-filled cap to seal out moisture. The author chooses MR ("metallic reflector") lamps equipped with glass shields that protect the lamp from any drips of condensation that may form inside the weather-sealed lighting fixture. At right, he taps on a lamp's glass protector shield.

almost as common as trees and shrubs. It doesn't have to be a large part of the budget, however — the first rule of nightscaping is "Less is more," so you might as well start with less. One of the best things about low-voltage lighting is that you don't have to do it all at once.

If you're new to landscape lighting, start slowly and experiment. Try one angle, then another; put a light here, then move it over there. Try a path light, then hang a light in a tree to see the difference. Learn what works by trying anything that strikes your fancy. In the end, you'll have a landscape that your client doesn't need a day off to appreciate.

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Shopping for Products

Landscape lighting is a wide-open market with lots of suppliers, and it's easy to research and buy products on the Internet. I have my own favorites, of course. For path lighting, three suppliers I rate highly are Escort (for fun fixtures), Kichler (for architectural fixtures), and Hanover. For spotlights, I generally choose Vista — it makes a high-quality product with a price that doesn't scare away clients. Aurora, a new company, recently sent me a good-quality sample fixture — worth looking into but a bit expensive. Lumiere, Kim, and B-K Lighting all make great fixtures, too, but again, they can be a bit pricey. The list here is by no means exhaustive — shopping around won't be a waste of your time.

— B.Z.

Auroralight Industries
San Diego, Calif.
877/942-1179
www.auroralight.cc

B-K Lighting
Madera, Calif.
559/438-5800
www.bklighting.com

Escort Lighting
Wernersville, Pa.
800/856-7948
www.escortlighting.com

Hanover Lantern
Hanover, Pa.
717/632-6464
www.hanoverlantern.com

Kichler Lighting
Cleveland, Ohio
www.kichler.com

Kim Lighting
City of Industry, Calif.
626/968-5666
www.kimlighting.com

Lumiere (part of Cooper Lighting)
Peachtree City, Ga.
770/486-4800
www.cooperlighting.com

Vista
Simi Valley, Calif.
800/766-8478
www.vistapro.com