Inside: Stephanie Rose on Privacy Screens

WaterShapes

Design • Engineering • Construction

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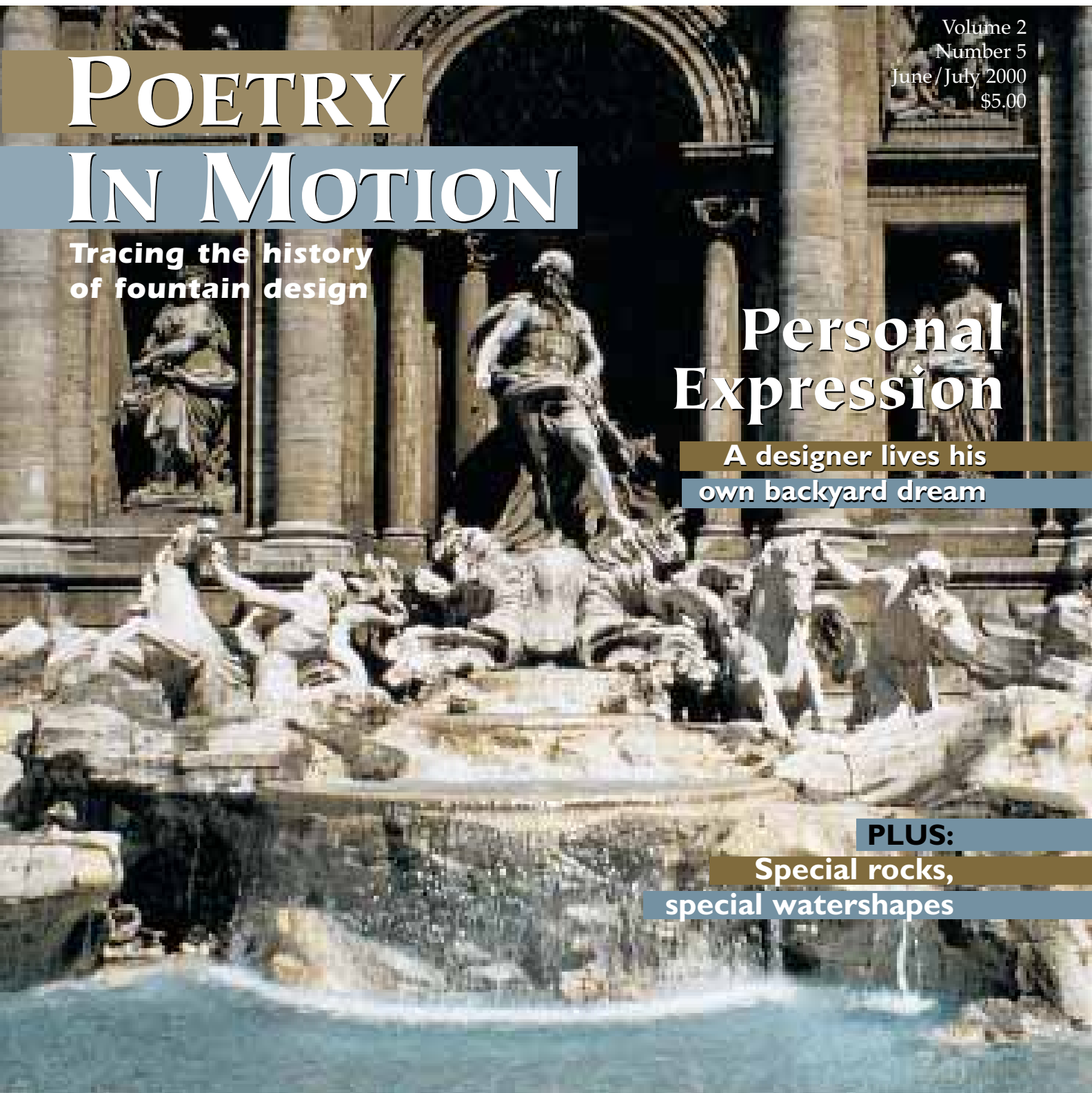

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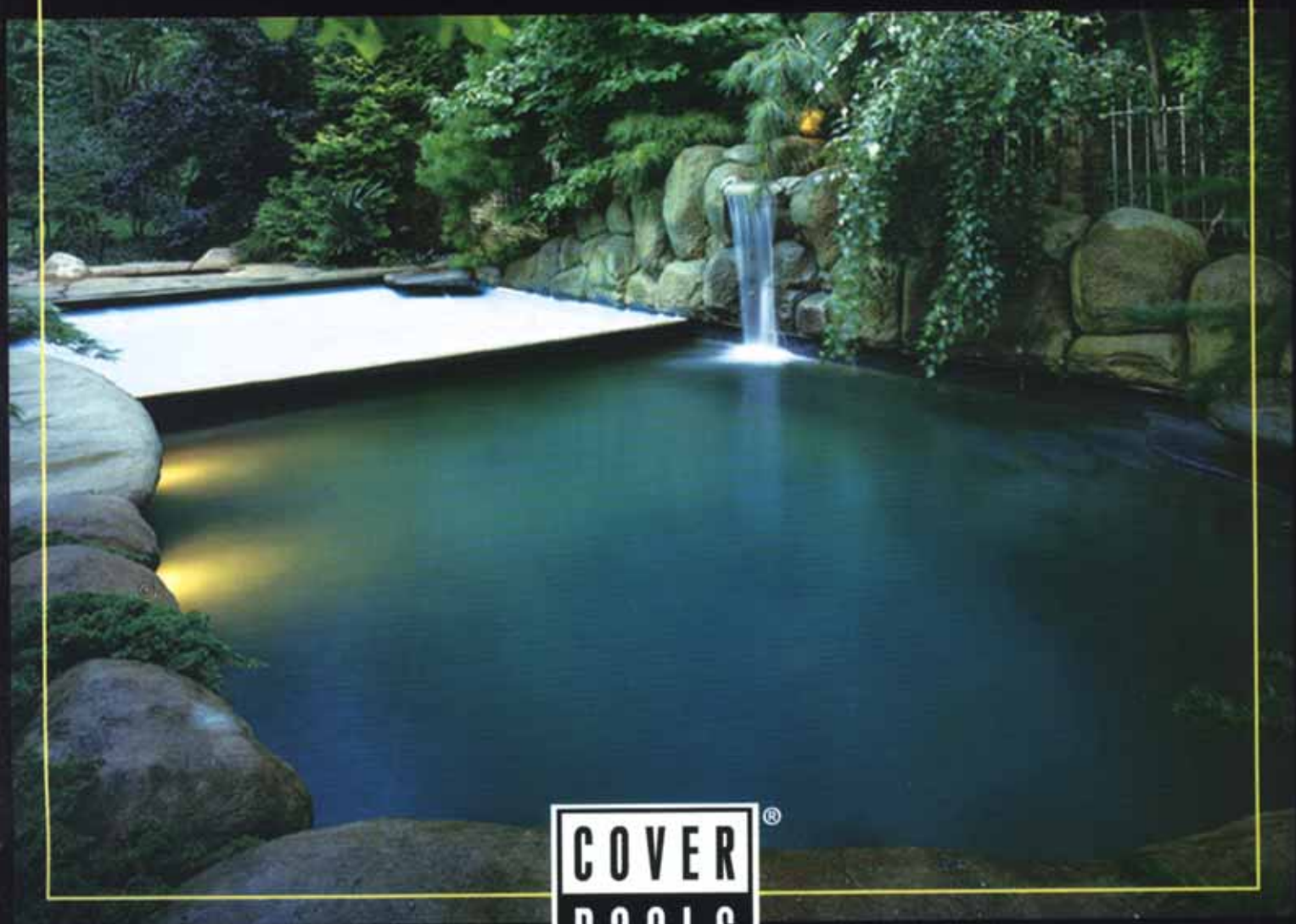

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Photo of the Trevi Fountain, Rome

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By Eric Herman

Comfort, Fun and Beauty

It's tough to keep the Big Picture in mind when the day-to-day grind seems relentless. Even so, it's important to take a step back from time to time and remind yourself of exactly what it is that you're doing. And in this industry, that equates to nothing less than delivering to your customers a trio of amazing benefits – namely *comfort, fun* and *beauty*.

Think about it for a moment: Watershapes are among a very small handful of products that are able to provide for all three sides of this triangle of value. Homes can do it, cars can do it and vacations can do it, but the effects are only temporary. The simple truth is, there's nothing quite like a well designed, engineered and installed watershape when it comes to elevating the sheer enjoyment of modern life.

There are infinite ways to slice and dice those benefits, and in this issue I think we offer some very interesting portions:

❑ **Comfort:** On an individual level, we all know that jumping into a cool pool when it's hot or that standing by a fountain's spray in the parched desert air feels really good. What you may not be aware of, however, is that watershapes have played this role in human societies going back hundreds, even thousands of years.

On page 24 of this issue, landscape architect Mark Holden covers this historic sweep, tracing today's functional and design concepts to their roots in some of the world's most famous watershapes. One of the key points he makes is that among the many virtues of these watery monuments, many served the basic function of cooling the air and raising the humidity in public spaces in the ancient desert cities of Islam, where modern principles of hydraulics first emerged centuries ago.

❑ **Fun:** Of course we all know that swimming and playing in water are fun, but a point lost on some in the trade in our day-to-day work is that they can be fun for us, too, as well as for our clients. In telling the story of the installation of his own backyard pool (page 46), watershaper Skip Phillips discusses his own rediscovery of the pleasures of pool ownership.

To be sure, the joy of executing the perfect cannonball may be the farthest thing from your mind as you wrangle with schedules and accommodate change orders, but perhaps it shouldn't be. After all, it's the joy and sheer fun that goes with swimming and water play that's probably a big part of why your clients called on you in the first place.

❑ **Beauty:** Never before has watershaping been elevated to an art form the way it has been these days. On page 38, supplier Rick Bibbero discusses the aesthetic value offered by highly mineralized rock material, while on page 10, columnist and watershaper Brian Van Bower takes us on a walking tour of the vast range of exciting materials available for use in making your projects ever more beautiful.

These discussions offer a palette of possibilities, a full range of ways you can vest your work with eye-catching details and riveting designs. And the best thing is that a watershape doesn't need to be fully lined in gold leaf to achieve this beauty: Limited use in brilliant details is all it takes to make the right impression.

It's truly an amazing set of benefits you bring to your clients. Certainly, the coming summer weeks may make you hot and tired, but you should absolutely take some consolation – no matter how hot the day – that what you're doing genuinely improves people's lives and lifestyles.

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IN THIS ISSUE

JUNE/JULY'S WRITERS

Mark Holden owns Earth Patterns in Long Beach, Calif. A landscape architect and licensed contractor, he has been designing and building watershapes for more than 15 years, specializing in creating dynamic spaces that use water as a primary feature. While his own business combines his roles as designer and builder, he believes firmly that it is important to reach past his own resources and make contact with (and consult for) other architects and builders as a means of elevating standards in both trades. That thought in mind, he is an instructor in art and architectural history for the Genesis 3 Design Schools and also teaches senior landscape-architecture students at Cal Poly-Pomona.

Rick Bibbero is vice president of business development for Western Rock & Boulder, a Fallon, Nev.-based supplier of decorative and unique rocks and boulders for a worldwide clientele. He came to the firm with more than 25 years experience in real estate development, landscape and watershape design and land use issues in Northern and Central California, most extensively in the environmentally sensitive region around Big Sur. A self-described "rock hound," part of Bibbero's job includes finding new sources of unusual rock material, an assignment that often takes him deep into hidden country and the remote back roads of the Western United States.

Skip Phillips is president of Questar Pools, a

Interested in writing for WaterShapes *on design, engineering or construction topics? Contact Eric Herman at (714) 685-1854!*

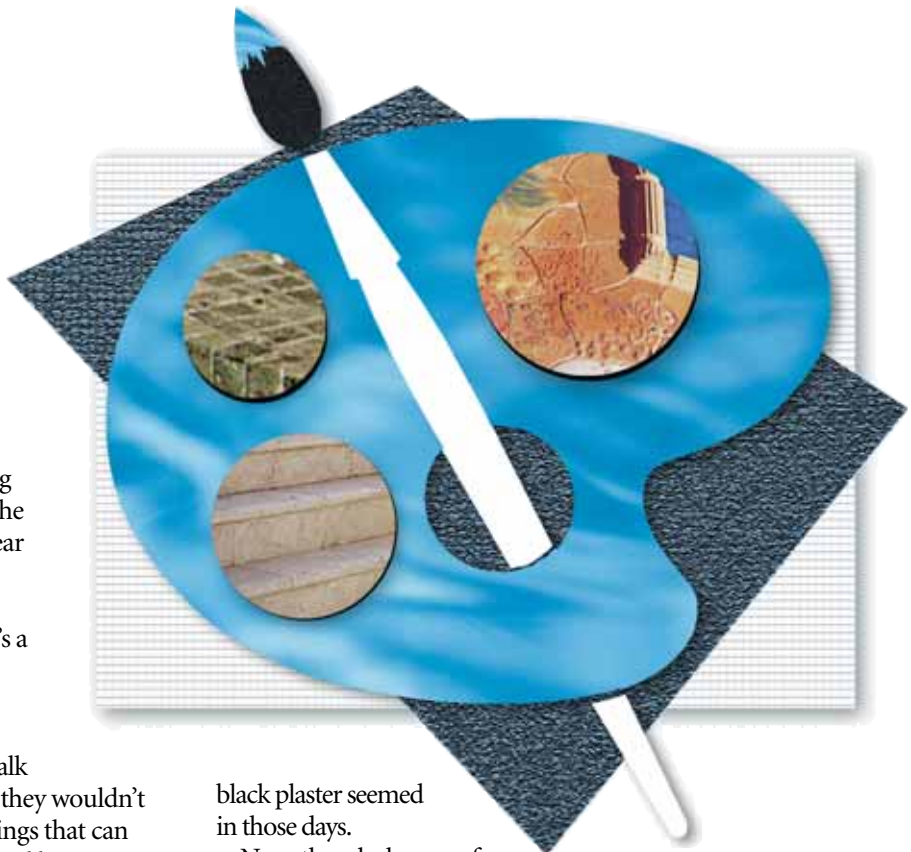
high-end swimming pool design-and-build firm based in Escondido, Calif. He started his business in 1975 as a service/supply/repair operation, moving quickly into renovations and new construction. Now a veteran designer and builder of high-end, custom swimming pools, Phillips has won more than 100 local, national and international design awards. His reputation is tied closely to hillside pools featuring vanishing-edge designs; he is one of only two U.S. instructors currently teaching classes on vanishing-edge pools and has written and participated in numerous magazine articles on the subject. Phillips is a past president of the National Spa & Pool Institute and recently co-founded the Genesis 3 Design Group.

Rick Anderson is owner of Ston Wurks, a landscape-design firm in Columbia, S.C. A designer and artist with 22 years of professional experience, Anderson's work focuses on the use of natural materials, particularly stone, in naturalistic settings. He is the founder of The Whispering Crane Institute, a landscape design "think tank" dedicated to exploring our physical, emotional and spiritual relationships with the land. The institute stages Philosophy of Design Symposia each year. Anderson is a past director of the Association of Professional Landscape Designers and has contributed numerous articles to a variety of trade and consumer magazines.

PHILLIPS

Thriving in the Material World

By Brian Van Bower



There's much to be said about this brave, new world of watershaping we're in right now – and one of the things that's most abundantly clear is that clients expect more these days: What was "good enough" before just won't cut it, and to my way of thinking, that's a very good thing!

One of the areas that most reflects this increase in expectations is the selection of the materials we use. More and more people I talk to around the country are now using things they wouldn't even have considered just five years ago – things that can add tremendous value, interest, distinction and beauty to the end product.

When you open up to the world of possibilities available to each and every one of us in the trade, what you can achieve is limitless. From tile mosaics or new interior finishes to patio furnishings, stone, glass or even wood, you get into an area where each job becomes a form of personal artistic expression, both for you and your clients.

True, these materials sometimes drive up the price tag, but often the costs are not so outrageous. What's more important is that by making an array of beautiful materials available, you empower clients to consider their watershapes in all-new ways – and to regard you in a more positive and elevated light.

On The Inside

Perhaps the most obvious place where the palette has grown in recent years is on the inside of our watershapes. Interior surfacing options have really exploded in recent years, taking what was once a "white only" marketplace and opening it up to all the colors of the rainbow.

For the longest time, white plaster ruled the roost. Beyond that, there were liners and there was paint. The 1970s saw the advent of colored plaster, and it's funny now to think about how "cutting edge" a pool with dark blue, gray or black plaster seemed in those days.

Now, the whole area of interior finishes has opened up: different colors, several types of exposed aggregate finishes, pebble finishes – all pretty dazzling, especially when you get into custom blends and colored cements. And then there is a new wave of polished aggregates. We really do live in exciting times.

And let's not forget the granddaddy of all interior finishes: *tile*. The ancient Romans used tile to line their pools and baths, and many of these installations have held up and are still beautiful more than 2,000 years later. That's a roundabout way of making an important observation: Much of what goes on with materials is cyclical. Clients respond to design trends and the flavors of the season. Things get hot, cool off and then heat up again.

The best materials will ride out these trends, improve and bounce back, and that's certainly the case with ceramic tile. Just consider mosaics. Once the realm of the artisan, fantastic tile mosaics are now available as off-the-shelf designs or can easily be custom-supplied based on a photograph or some other image.

Not too long ago, I did a project where my clients wanted something unusual in the bottom of their pool. They'd made a bundle in the tomato trade and wanted to pay homage to this most exalted of foodstuffs by way of a glass

tile mosaic in the bottom of their pool. So that's what they got. It wasn't my choice of images, but they were thrilled – and the tile supplier made it all so easy.

On the other end of the scale, handmade mosaics done by the true artisans are gaining in popularity as well. I work with an amazing local craftsperson who does absolutely stunning mosaics. If clients have an interest in a truly high-end touch, I'll refer them to him. A good guy and a true artist, he typically blows my clients away, and I find that their view of me is elevated through my association with him.

Beyond mosaics, there's been a virtual explosion in the available forms of ceramic tile. You'll see vivid colors, unusual textures, lots of sizes and sheens – anything you can imagine and then some. And when you throw today's glass tile into the mix, it gets even more amazing. There's a mind-boggling richness in color and a subtlety of hues and textures on the market today.

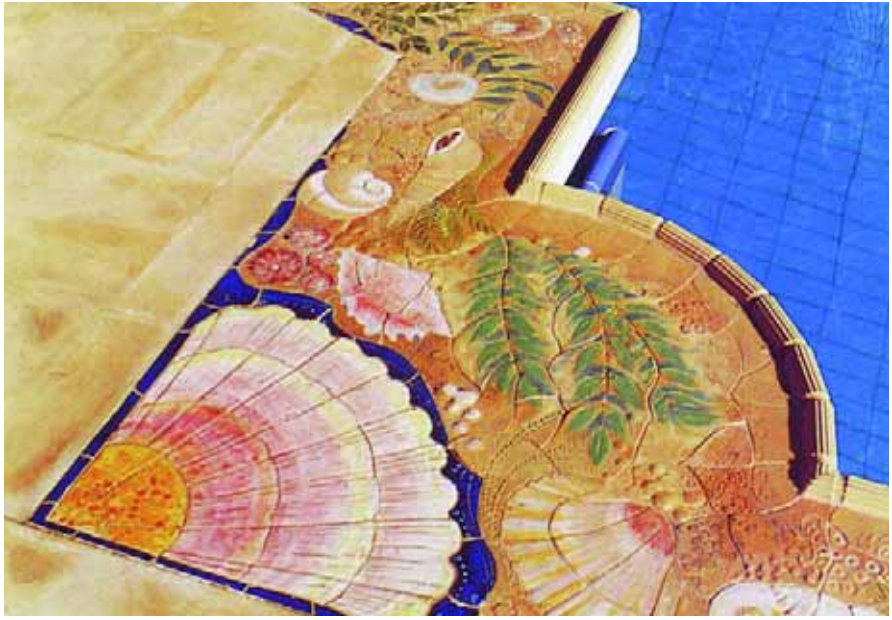


Photo courtesy Craig Bragdy Design, Tamarac, Fla.

I recently found a new line of products from a U.K. company called Craig Bragdy Design. They've been doing genuinely amazing things with textured tiles and three-dimensional tile shapes. They even have tiles that can be used as coping, and they make cornered tiles that have intricate patterns embossed on the surface. It's exquisite stuff – and I didn't even know it existed until just recently.

Rapt In Glass

Another example of the cyclical nature of product popularity and development can be found with glass block. Back in the 1970s, when we first started seeing glass block used in swimming pools, it was truly *the* cutting-edge material. I recall doing spas where the walls were mostly glass block: We'd back-light the glass and send the water

over the side into the pool, and the effects were pretty impressive to everyone.

For years, we saw pools with all sorts of glass-block details, from inset rows of glass in raised walls to accents in adjoining structures. Then, for whatever reason, the trend faded away. Part of the decline had to do with problems with things like efflorescence in the grout, but more than anything I think we all just grew kind of tired of glass blocks. They became too popular for their own good!

But now, because of several new twists with the product, blocks are coming back in some applications. There are *colored* glass blocks, *etched* glass blocks with exquisite surface patterns, *round* blocks, *frosted* blocks. My friend Skip Phillips has created deck-top columns of radiused glass blocks and lit them from beneath for a dramatic effect. It's like the whole genre has re-invented itself and is again on the cutting edge.

I've also started using acrylic in some jobs, and again this is not new. We've all seen underwater windows in pools or in displays at Seaworld and places like that, but when you get creative, there are other things that you can do with acrylic.

For example, I recently built a spa where I used a thick sheet of acrylic as the dam wall. I designed a rounded, bullnose detail on the top to provide a smooth flow of water spilling over it. And because the acrylic has no grout lines or seams of any kind, the glass is functionally invisible. The effect is that you can't really tell what's holding the water back. (It's sort of like Moses parting the waters in the pool in a small-scale sequel to *The Ten Commandments.*)

I also use tempered glass in some jobs. In one case, I built a waterfeature in the artsy South Beach area of Miami and keyed the whole design to a dramatic 10-by-30-foot panel of 3/4-inch-thick glass in an elevated wall. The whole thing is backlit with fiberoptic lighting – pretty stunning, if I do say so myself.

From The Quarry

Another classic material that's undergone a renaissance of sorts is *marble.*

Marble is typically associated with a formal look – fluted columns and classical statuary – but I've found that there's really more to it than just that. We tend to think of marble as being really shiny and glossy, and make no mistake: That's a gorgeous look, but there's a lot more going on with this material these days.

I recently completed a job, for example, where I used tumbled verde marble details at the waterline instead of tile. I also used it on the tops of stools and to finish the top of a swim-up bar (see the photo on page 14). I combined those touches with the use of a material known as saturnia (another quarried stone in the marble family), and the results were outstanding. Very, very pretty.

I also did a job where all the walls of the pool were finished in marble (See the photo on page 16). It gave the project a uniquely Mediterranean feel – and all that marble made for a dramatic pool interior, believe me.

Natural coral is another material that's readily available with its own set of unique qualities. Nowadays there are a great

Continued on page 14

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Continued from page 12

many coral deposits on dry land that are mined and sold for architectural uses. It tends to be white or cream in color, with lots of interesting fissures and swirls of brown or golden tones. You'll also find pieces with interesting bits of shell fragments or fossils. I recently inlaid coral blocks on the tops of a pool's steps and tied that detail to coral used in various places in the decking and patio area.

And let's not forget real rock. In this era in which artificial rock has gotten so good, it's easy to overlook the elegance and beauty that can be afforded by things like granite or limestone.

I'm currently working on the design of a large perimeter-overflow vessel where part of the pool is flush with the patio and the rest is raised two feet above that level. The vessel has a modern look and a trapezoidal design, and right now I'm in the process of working with the customer on the materials. If I have my way, the exterior of the riser wall will be finished in black absolute granite, which is about as black as black rock can get. If my recommendation sails, the finished product will be truly spectacular.

Black absolute granite is just one example. You also need to look at limestone, saturnia, travertine, Jerusalem stone, flagstone, slate, quartzite – the list goes on and on. There are also various volcanic rock materials, and vivid metamorphic rocks as well. Many of these are available in flat pieces for decking, or as boulders for rockwork and landscaping.

As mentioned above, artificial rocks also have come a long way in recent years. Various suppliers and local craftspeople offer products that are

formed using molds taken from natural rocks. I won't go into it here, but suffice it to say that this, too, represents another set of material options.

Broadening the Palette

As if all of this wasn't enough, there are also materials available to us that most people wouldn't immediately associate with water.

Wood, for example, is a material that you don't immediately think of when designing a watershape. I hope that some of you have seen photos of a waterwheel that David Tisherman built in conjunction with a pool at the home of a Hollywood mogul. The wheel is made of wood, and there's no problem at all with exposing it to water so long as you use a watertight finish. It's an uncommon poolside material, but it can be used to great dramatic effect.

Not long ago, I completed a waterfront project where I extended a wooden deck out from the pool over the water using wooden planks and piers. I've also used elevated wooden walkways over small streams. The results have been so positive that I'm now trying to figure out a way to create a true pier extending into a naturalistic swimming pool. Why not?

The thing to remember is that these sorts of touches aren't for every project. When used in creative and appropriate ways, however, an exotic color or an unusual tile or a wooden feature can yield results that are both visually arresting and aesthetically satisfying.

Take metal as a last example: I particularly like using stainless steel, and I've

Simplicity and Elegance

I have a theory that when it comes to achieving truly riveting designs, less can really be much more: Take a simple rectangular pool, line the interior with deep-blue tile and add coral around the edges or on the decking and what you've got looks fit for royalty.

But it's not all about going all the way: When I make use of the materials I describe in the accompanying text, I'll often use small touches or accents to set off an element or draw interest to it. If I have a raised wall in a job, for example, I'll always consider using some glass tile or a small mosaic, or capping it with tumbled marble, or using some small tile inlays. In this way, I can add million-dollar touches without breaking my clients' bank accounts.

I'll also add small, simple touches to pathways or decks. Lots of time, all it takes is rummaging through a box of leftover tiles. Take it out back, bust the stuff up with a hammer and add pieces into the finish of a small area of decking. The point is, these touches truly impress clients by tying outdoor spaces together as integrated packages. That's what good design is all about.

–B.V.B.

done some highly custom railing treatments with this material. I've also seen other designers use copper sheeting in modernistic waterfeatures. I guess my point is that there are no defined limits for what we can use or accomplish in our designs. A second point is that my clients seem happy to reward me for coming up with these unique materials used in unique ways.

None of this is to say that white plaster, blue ceramic tile and bullnose brick coping are bad things or are gone forever. The way things go, I wouldn't be surprised by a "retro" movement that resuscitates the market for kidney-shaped pools – just as leopard-skin prints and platform shoes come back every decade or so. If the folks at Volkswagen could bring back the Beetle, I'm certain someone out there can strike paydirt with a design book filled with lazy Ls.

What's so amazing to me in writing this column is that I've really only skipped lightly over the vast range of options that are available these days. You just need to go looking for them, strap on your thinking cap and present them to your clients in ways that fire their imaginations.

When you do, the creativity and value you can bring to the table have no bounds, know no trends and are subject only to your creativity. What a great place to be!

Brian Van Bower runs Aquatic Consultants and is a partner in Van Bower & Wiren, a pool-construction firm in Miami. He is also a co-founder of Genesis 3, A Design Group; dedicated to top-of-the-line performance in aquatic design and construction, this organization conducts schools for like-minded pool designers and builders.

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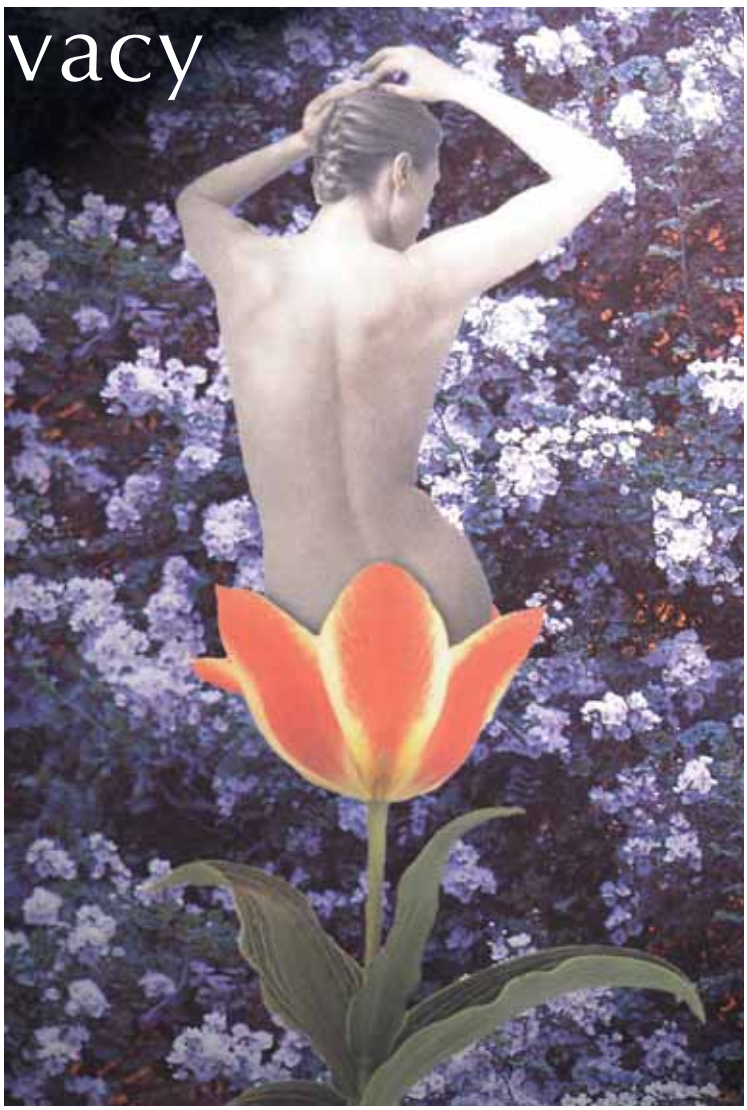
A Sense of Privacy

By Stephanie Rose



A good friend of mine once told me that his idea of the perfect yard was one where he could walk around naked – and none of his neighbors would be able to see him. What a concept!

Unfortunately, few of us can afford a yard so large that we could not be seen by neighbors under any circumstances. So what can you do to create that perfect private environment?

As we'll see here, you have a lot of choices.

Discovering Preferences

Many people go all the way in creating privacy by building structures that make them feel safe and enclosed. Others prefer a less claustrophobic approach, such as soft plantings. Either way, and particularly when you are dealing with watershapes where your clients may want to enjoy communing with nature in the buff, creating some type of barrier against neighbors' intruding eyes is essential.

Your clients' preferences may involve many variables, however, so let's start by talking about three degrees of privacy. You can:

- Build some type of solid hardscape structure (such as a fence or wall) that will completely and instantly block views
- Install a softer wall – a living screen – using a single type of plant material repeated at intervals that achieve the desired coverage
- Create a soft screen that looks "natural" by using many different types of plant material.

Any one of these choices may be acceptable for your clients. It's your first task to determine the final look they want to achieve and then create a screen that meets their needs. Their "time frame for privacy" is very important as well: A wall or fence will create an instant screen, while a soft screen may take years to fill in. Often, a combination of these suggestions is the compromise you need to achieve the right coverage.

Hardscape Screens

Most of you, I'm sure, are fully aware of how to build walls and fences and that you have a tremendous selection of materials from which to choose. Now let me give you some options for softening things up.

If your client wants to be screened instantly but doesn't want to look at a concrete block wall or wooden fence, you might suggest planting vines at the base of the screen to grow and cover it.

As you approach this option, remember that each situation is different and that water, climate and temperature may significantly affect your success. Also, each plant has different growth

habits and needs, so you'll need to consult the *Sunset Guide* for your area to determine the best placement and conditions for your selection.

Here are some possibilities:

❑ **Creeping Fig.** This is a very quick-growing vine that attaches easily to any wall or fence. It may take a year to establish roots, but then it will take off quite rapidly. If your clients want coverage that stays green all year, this is a great choice.

❑ **Boston Ivy.** This vine grows at a moderate pace and attaches very easily to any structure. It also may take a year or so to establish roots, but unlike Creeping Fig, it is deciduous and loses its leaves in the winter. Even so, the branching structure it establishes on a wall can be very attractive even when it's bare – and many people plant this vine specifically for that winter look. Lots of homes in Europe have Boston Ivy or one of its cousins growing on them. Another wonderful feature of this vine is that it turns bright crimson red in the fall just before the leaves drop off, creating a beautiful contrasting display against the rest of the green landscape.

❑ **Blood Red Trumpet Vine.** If you want quick coverage with beautiful and abundant flowers, this is your best choice. It does need support to attach to walls or fences, but once it gets going it doesn't require constant maintenance to stay attached. This vine covers chain-link fences quite effectively.

❑ **White Potato Vine.** For a soft, fast, solid enhancement at the top of the solid screen structure, this vine can be a great option. It will mainly cover the top of a wall or fence, but you can plant other plants at the base to keep the screen covered. The one problem here is that the vine gets woody underneath if it isn't cut back severely each year – meaning the wall or fence will be exposed to view for part of the year. It may be the best choice for a client who wants to see a little of their hardscape.

❑ **Hedge.** Using any of the plants listed in the next section, you can achieve moderate to quick screening by placing them in front of the wall or fence. In my experience, however, unless your client really wants to go to the expense, it's best to use either the hedge or a hardscape structure – but not both.

❑ **Soft Planting.** This may be your slowest option, but will most likely be the one that camouflages the structure most naturally, as we'll see below.

In weighing your softening options, be brave: Mixing any two or more of these ideas can create a more appealing look than you might achieve with any one type of plant by itself.

Hedge Screens

Planting a living screen or hedge is usually much less expensive than building a wall or fence, but it definitely takes a little longer to create solid blocking.

If that time frame works for your clients, you have many options to consider. For example, you can vary

the results with the placement of the plants (distances on center), the type of plant material you use and the placement of the plants relative to each other (straight line or staggered).

As you consider those possibilities, take a look at my suggestions for screening:

❑ **Osmanthus Fragrans.** Also known as Sweet Olive, this plant has medium-sized, medium-green leaves and grows at a moderate rate. It can be purchased either as a shrub or as a standard and may grow to be 10 to 15 feet tall. The best part about it, though, is that its tiny flowers send out the most powerful apricot fragrance you can imagine. I love placing it in a yard and having everyone look around and ask, "Where is that fragrance coming from?"

❑ **Ficus.** This shrub (or tree) covers quickly and looks quite attractive. But be aware that any time you plant ficus, its roots may become invasive and need to be watched carefully. I would recommend this only in a large area where they can be planted far away from any water sources or structures.

❑ **Wax-Leaf Privet.** In the west, this is a very common hedge. It covers quickly and creates a solid screen, but otherwise it is quite nondescript.

❑ **Eugenia.** This is also quite common in the west, growing up to 20 or 30 feet. Many varieties in California once were plagued with a disease called psyllids that caused the leaves to dimple and shrivel. The problem has been eradicated in the past couple of years and nurseries are now beginning to sell them again. Even existing hedges that looked quite bad are now thriving again.

❑ **Italian Cypress.** This vertical/columnar plant may grow as high as 60 feet. It was used a lot in the 1960s, when they were commonly planted quite close together. (I'm predicting they will make a comeback, as some designers tap into the "retro" look.) The main drawback of these shrubs is that they get very woody underneath and may become a haven for rodents. If you need a tall/columnar hedge, however, there is nothing that compares: These will grow mainly upright as opposed to taking up more space by growing out into the yard.

❑ **Hemlock.** This cone-producing plant has many different varieties, most of which grow very large. Talk to your nursery to see if they have a dwarf variety that would be suitable for your situation. These generally take well to pruning and shaping – ideal if you want to create a formal hedge.

❑ **Boxwood.** This is the most popular choice for formal hedges. There are many, very hardy varieties that take very well to shaping. The leaves are small and light green.

❑ **Bamboo.** There are many varieties of bamboo but just two primary categories: *Clumping* varieties are usually self-contained and will not become

invasive, while *trailing* varieties can be quite invasive – and seem to be the ones most people are familiar with and afraid of even though they can be held in check through use of a root barrier. The advantage of bamboo is that it is generally very quick to establish and grow. It's ideal if you're working on a project where the style lends itself to bamboo – and you need a fast solution. As with Italian Cypress, if contained or clumping, this plant will grow vertically instead of moving into the yard.

That point I just made about style is important: Each one of these selections should be in keeping with the overall look of the yard. I wouldn't ordinarily use bamboo with a cottage garden; similarly, I'd generally shy away from using Osmanthus in a contemporary garden.

Soft Screens

For those clients who just can't imagine looking at any type of wall, whether it be living or not, a soft screen may be the best option. Any types of plants can be used to create a screen so long as they are grouped in a way that takes their mature height and width into consideration. You might place the plants randomly or in a pattern; however you do it, they should be installed so that when they mature, they will be touching – and thereby block outside views.

Start with larger shrubs or even small trees, and be sure to plant underneath them so that when they grow, there is something to fill in at their bases. Without giving you a full lesson on landscape design, just assume that it's more interesting to vary the heights, width and depths of plants and that placing everything in a row will only create something that looks like a hedge screen.

Stephanie Rose runs Stephanie Rose Landscape Design in Encino, Calif. A specialist in residential garden design, her projects often include collaboration with custom pool builders. If you have a specific question about privacy screens (or simply want to exchange ideas), e-mail her at sroseld@earthlink.net. She also can be seen this season in four episodes of "The Surprise Gardener," airing Tuesday evenings on HGTV.

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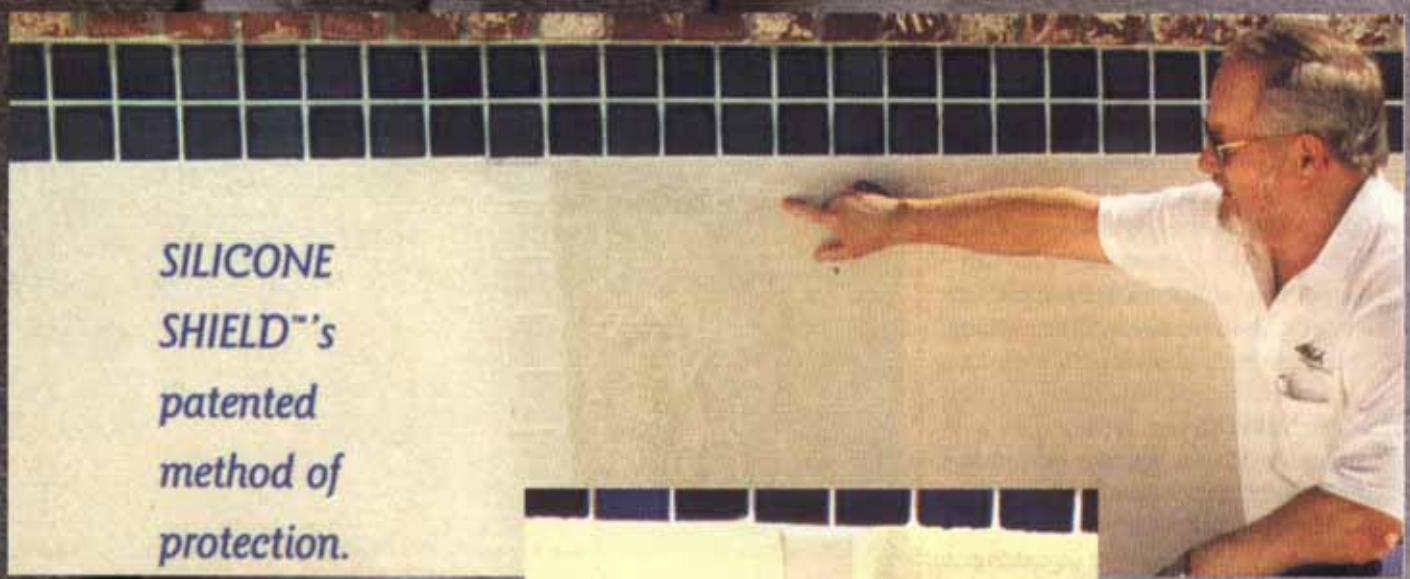

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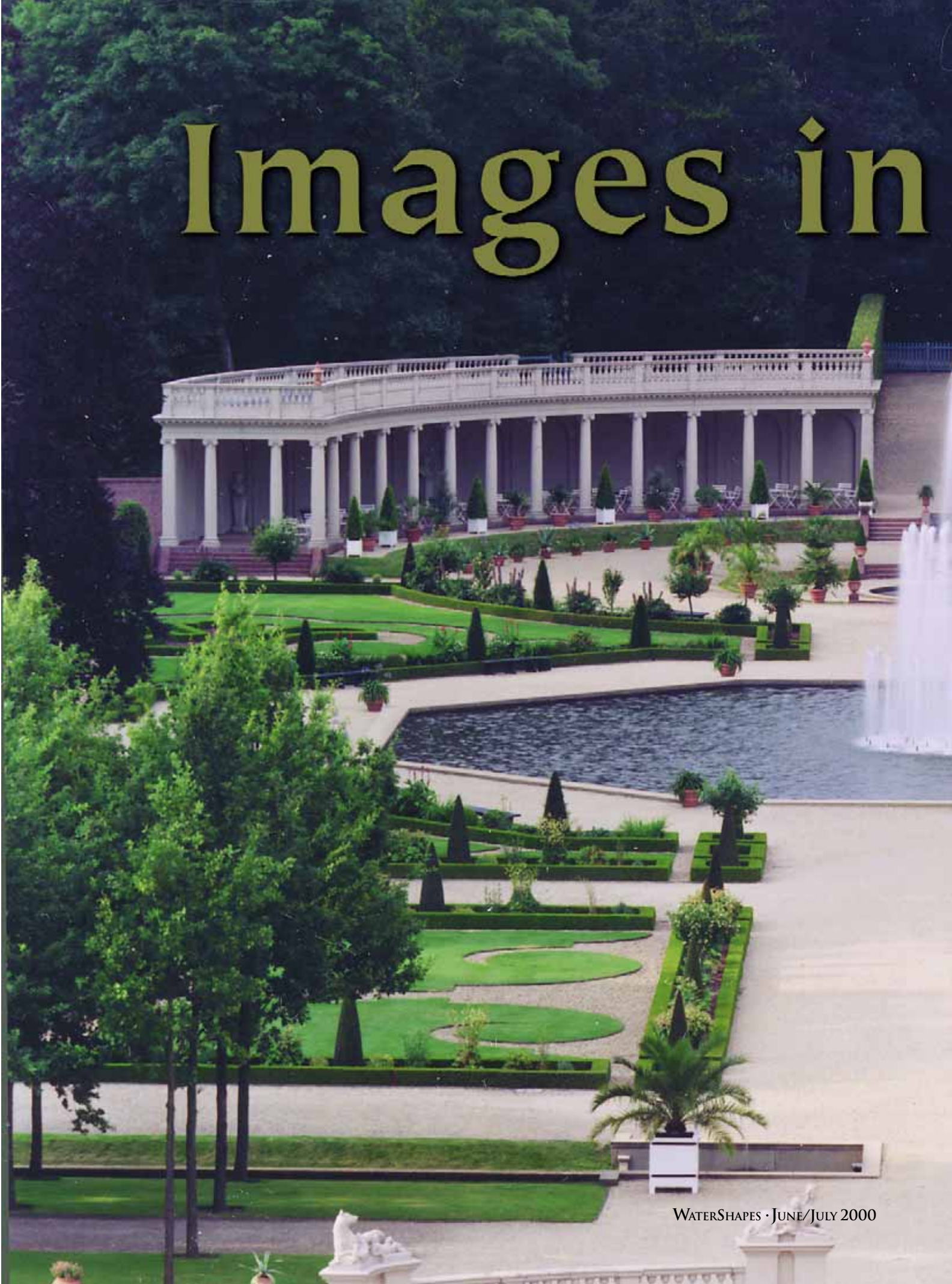


Motion

By Mark Holden

No matter the time or place, we've always had a special relationship with moving water. From the ancient Egyptians who set their calendars by the seasonal flooding of the Nile to the modern tourists who line up outside Bellagio in Las Vegas to watch its water shows, there's a fascination that can't be denied. It's also, says landscape architect/pool builder Mark Holden, a past that should be explored by all contemporary watershapers.

Please turn to page 26

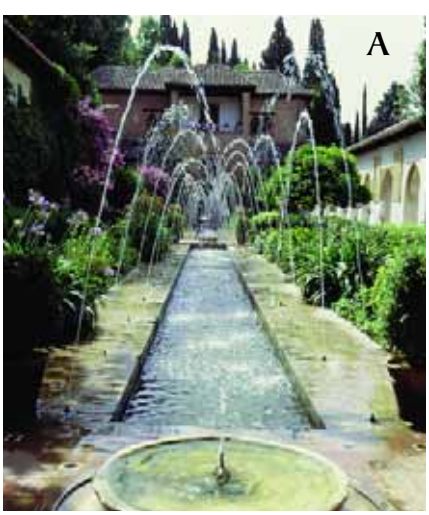
Ever since the hydraulic principles of ancient Persia were 'rediscovered' by Europeans during the Renaissance, the sky has literally been the limit for watershape designers. At the 17th-century Dutch Palace of Het Loo, for example, fountain jets that trace their developmental history at least as far back as 8th-century Persia make an emphatic statement about the power of those who commissioned them.

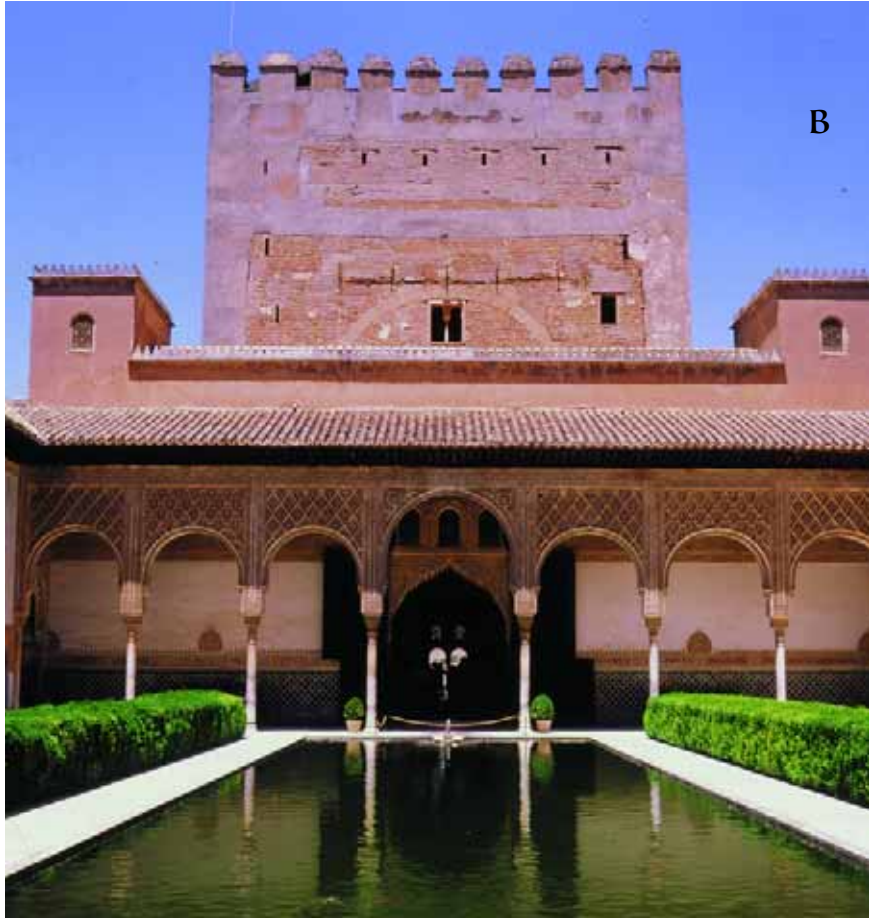
We all marvel, and rightly so, at the waterfeatures of Renaissance Italy, the pools of Versailles in France, the fountains of the Peterhoff in Russia and at dozens of other spectacular watershapes that have been created in Europe, Asia and the Americas in the last several centuries.

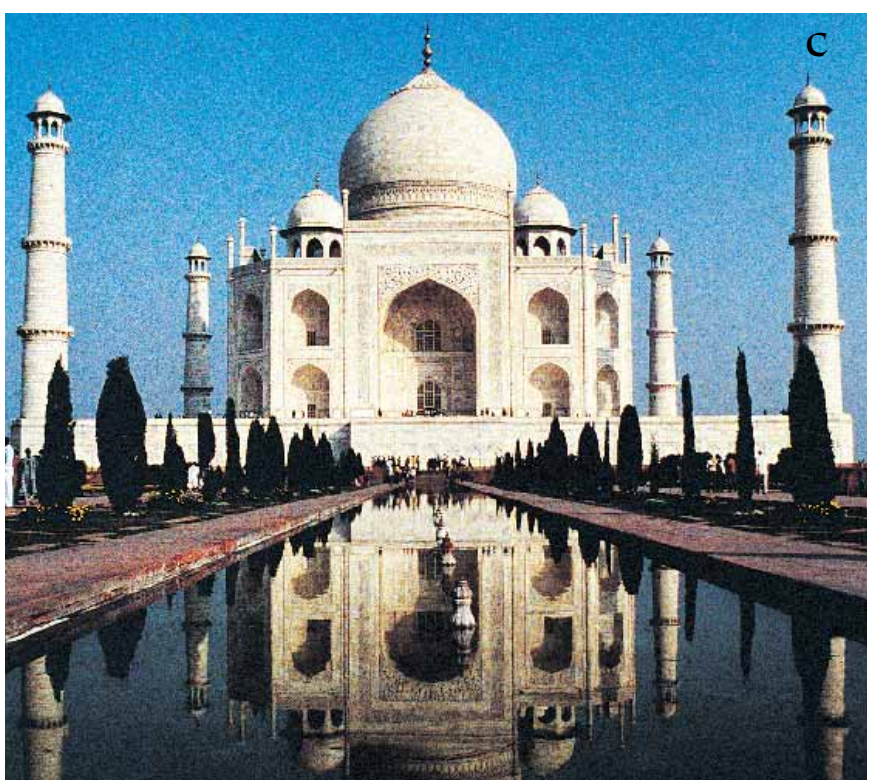
Where did most of the inspiration for these watershapes originate? As we explored in the first article in this series ("Images in Time," October 1999, page 26), most of today's aquatic designs can trace their origins to far older sources in the Greco-Roman tradition and, much more clearly in the case of moving water, to the work of Islamic designers and hydraulic engineers.

As we saw last time, Greek and Roman models defined proportions and decorative styles that carry straight through two millennia to the pools at Hearst Castle and the aquatic complex at Bellagio. We also dipped slightly into Islamic traditions as expressed through the Taj Mahal and the waterfeatures of Moorish Spain.

This time, we'll dive more deeply into the Islamic origins of contemporary design, exploring the keys to their design principles and, more important, looking at the ways in which their experimentation with hydraulics was used by designers during the Renaissance and has reached all the way into modern watershaping technology.







The Court of the Canal at Generalife is among the many watershapes of Moorish Spain that inspired designers and hydraulic engineers of Renaissance Europe (A). Prominent here is the use of water to organize outdoor spaces as quadrants – and the use of water jets to humidify and cool the surrounding air.

Also in Moorish Spain, the Court of the Lions at the Alhambra is remarkable for the fact that the water is there at all (B). Dissecting the engineering involved in bringing water to this hilltop fort led to discoveries that drove aquatic design in Europe for hundreds of years.

The Taj Mahal is perhaps the most famous Indian application of Islamic principles of hydraulic engineering – a practical feat more than matched for most onlookers by the sheer beauty of the space and the use of reflections to enhance the otherworldly quality of the tomb's architecture (C).

At the Source

The achievements of Islamic engineers certainly have their roots in earlier work in the ancient Middle East, but nothing remains today of the legendary Hanging Gardens of Babylon or of any of the waterworks that turned the region on the banks of the Tigris and Euphrates rivers into the Fertile Crescent and the cradle of modern civilization.

There can be little doubt that the arid climate forced local cultures to get creative in harnessing water for irrigation. And given what we see in later Islamic culture, it's also a fair bet that earlier Mesopotamian, Sumerian, Assyrian and Persian designers also knew a trick or two when it came to using the flow of water and the effects of evaporation to humidify and cool the air in both public and private spaces.

We can only speculate that hydraulics was a refined science before the rise of Islam in the 7th Century AD, but we're certain that by the time the Islamic culture began spreading east and west toward the end of the first millennium, its engineers had become masters of the art and had codified principles of head pressure and flow that are applied in watershape design to this very day.

But Islamic watershaping is about more than science: Water was indeed precious to cultures that emerged where there was little or none to spare, and it led them to treat water with significantly greater respect and reverence than their counterparts in Greece and Rome ever did.

While the Greeks and Romans saw water as an encompassing, metaphorical expression of nature and their deities, Islamic peoples carried the concept to new and higher levels of religious intensity. They worked with water as a spiritual medium that captured and represented the four rivers of life – a design detail that can be seen in almost every example of Islamic garden architecture including the tomb gardens of the Taj Mahal.

Water was (and is) a source for them of peacefulness and spiritual connection, a link between interior and exterior spaces and, even today, a practical tool in climate control. What you see is garden spaces flowing out from courtyards and interiors, all drawn together by water channeled through small marble channels along corridors and across plazas.

The combination of art, architecture, spirituality and practicality defined water's role in Islamic culture. We checked in on some applications of these principles last time at various locations in Moorish Spain, from the Court of the Canal at Generalife (A) to the Court of the Lions at the Alhambra (B) – and at the just-mentioned Taj Mahal in India (C).

Continued on page 29

Moving Waters

The principal hydraulic difference between a body of water at rest and one in motion is *gravity*. In that sense, watershapers are manipulating the influence of gravity upon this fluid in order to create effects that stimulate the senses, produce energy or purify the water for various purposes.

Setting aside practical considerations such as energy production or water purification, we humans find great emotional satisfaction in what can best be described as "The Splash" – an effect of gravity that has several components: *sight* and the manipulation of light, *sound* and its capacity to resonate through our bodies, and touch or *feel*, with its full range of environmental effects.

With these three important sensory influences as a guide, we have developed diverse ways to disturb the flow of water and stimulate onlookers.

❑ Sight. As light intersects water, it does two things. First, it partially reflects off the surface of the water and enters our eye. Second, it enters the water and is bounced around within the fluid (refracted), only later making its way out again to travel to the viewer.

When the second effect occurs, we see the "jelly-like" nature that water seems to have – an effect that alters our perception of immersed objects or objects set behind a veil of water. The combination of reflection and refraction, along with the prismatic effects the water has on color perception, create the magic that we see in every watershape and its movements.

❑ Sound. If you have any doubt of the ability of the sound of water to move us, go to a record shop and check out the countless recordings of the sounds of streams, fountains and oceans. Water indeed has a profound psychological effect upon our emotions and spirits; it soothes the savage breast in all of us. As important, those sounds and sensations can be altered by the designer to change the psychological effect.

The basic sound we hear, by the way, is not of water itself but of the various reactions water has to materials it intersects and contacts. When it hits a piece of metal (as opposed to masonry), it can produce a higher pitched sound and thus excite our senses. By contrast, only soothing sounds seem to come from water entering itself: Awareness and manipulation of this deep, pure sound is a factor in the success of almost all watershapes throughout history.

❑ Feel. The last in this triad of effects has to do with the way water changes the general climatic conditions within its surroundings. It has a tendency to alter the atmosphere around it to be more like itself, which typically means cooler and more humid.

For ancient Islamic designers in their arid environments, this single factor could dramatically alter peoples' states of comfort. Where water is scarce and temperatures are high, the environmental changes that water brings can be the prime reason for its ornamental use.

When we as designers decide to alter the course of water in any way, we engage in changing the environment and climatic conditions. The more we alter it – that is, the smaller the "pieces" of water we make, the greater their potential to influence the environment by changing humidity and temperature.

Awareness of how all this works is a prime asset to watershapers, and has been for thousands of years. When we want to create a place that captivates and stimulates people on a hot day, we do our part best by creating conditions that influence their emotions and responses.

– M.H.


D1


D2


D3

D4

Continued from page 27

Spreading The Word

Although conquest of foreign lands takes a horrible human toll on societies, the technologies that follow in the path of the conquerors can have enduring effects – as was certainly the case as a result of the Moorish occupation of Spain in the late Middle Ages.

(A similar story of technological development could be told of India's Hindu culture and the Far East, but in this article, the direct effects of having refined, working examples of Islamic engineering on the European continent and their influence on Renaissance designers is our focus.)

The watershapes Moorish designers created in Spain were unlike anything else seen before on the continent. Greek and Roman designers had refined the use of water with respect to proportions and reflection and utility, but what designers of the early Renaissance found in Spain was the possibility of using water in motion to make a much stronger and more enduring impression.

In fact, these Moorish water effects were the most beautiful displays of water and hydraulics Europe had seen to that point. Through this Spanish connection, the technologies of the hydraulic engineers of the ancient Middle East finally made their ways into the heart of Europe.

You don't have to look any farther than the Alhambra to see where designers of the Italian Renaissance drew technological inspiration for their work at the Villa d'Este in Tivoli (Figures D1-D4) – or where, in turn, the designers of the

Continued on page 31

Installed during the last half of the 16th Century on the site of an old monastery at Tivoli, the 11 major watershapes in the gardens of the Villa d'Este stand as direct testimony to just how influential Islamic principles of hydraulics were to designers of Renaissance Italy, including Villa d'Este's Piero Ligorio.

The Way of the Little Fountains (D1) isn't used to divide its space into quadrants as would have been the case in an Islamic garden, but the small jets of water (and the engineering driving them) are a distinctly creative adaptation of the water effects found at Generalife, for example (see A on page 26).

That attitude of creative adaptation and expanded use of hydraulic principles takes flight in Villa d'Este's other watershapes – including the Queen of Fountains (D2) and the large spout that serves as the visual terminus for a long path and grand stairway (D3).

The crowning achievement in Ligorio's aggressive adaptation of hydraulic rules is the gardens' Water Organ (D4), a device that could, through manipulation of valves that channeled jets of water through pipes and air chambers of various dimensions, fill the area with 'music.'

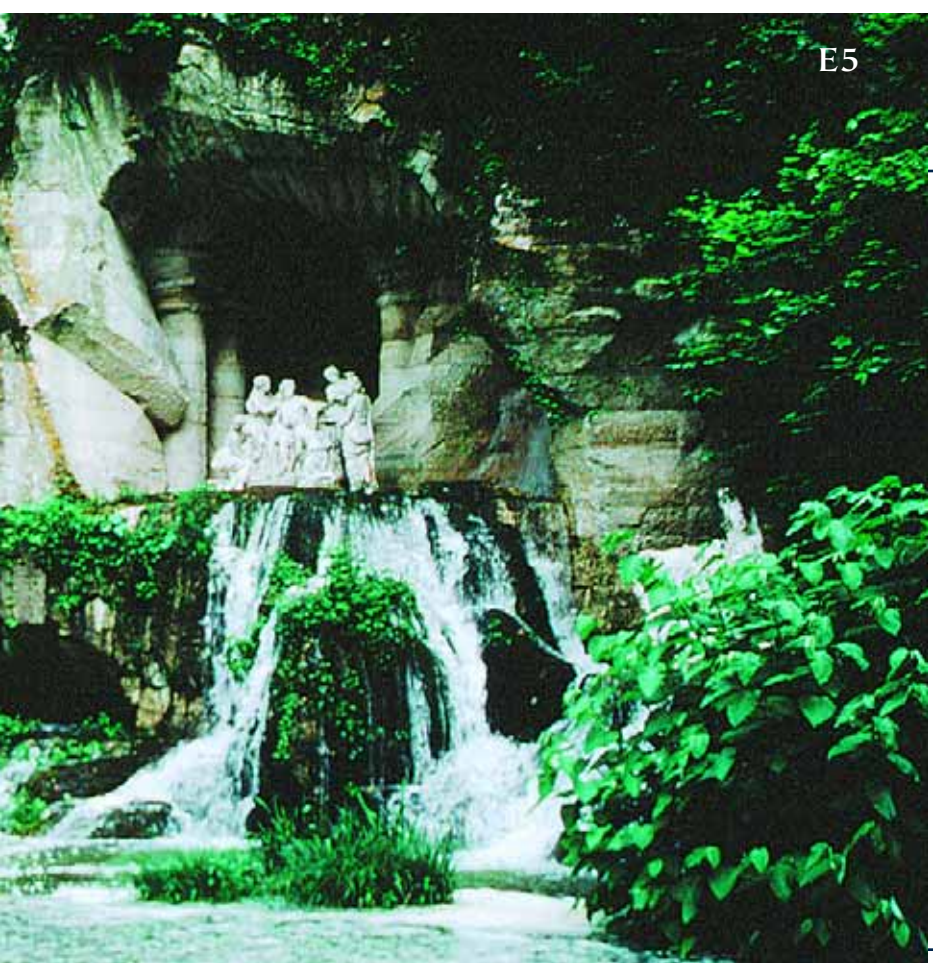

E1


E2


E3

Continued on page 25

Continued from page 29



Watergardens at Versailles (Figures E1-E5) or the Peterhoff (F1-F2 on pages 32 and 33) and the builders of the fountains of Rome (G on page 34) learned their lessons on unleashing the dynamics and drama of moving water.

The Alhambra ("red castle") was built by Mohammad ben Al-Ahmar in the 13th century and uses water in a variety of ways, but the most intriguing fact about the castle is the fact that the water is there at all. The fortress sits atop a 300-foot-high hill overlooking Cordoba, a perch that created obvious challenges in lifting water to serve its needs.

The task was simplified by the architects' understanding of hydraulics. And the fact that these artful waterworks survived for hundreds of years after the Moors were driven from Spain enabled Renaissance engineers to dissect the systems and figure out what made them tick.

The 13th-century waterworks at Generalife in Granada, Spain, served as a source of immense inspiration to Italian designers as well. This summer villa, whose name translates from the Arabic as "garden of the architect," houses the only surviving original "water stairway," a structure of importance both for its inspiring beauty as well as the technology that makes its special effects possible.

To modern eyes, these early examples of water in motion seem familiar, even simple. But if

Built for a French king with no lack of self-esteem, the watergardens at Versailles are the quintessential expression of the Baroque sensibility of the late 17th Century – an ostentatious design style that succeeded the classical themes found in Renaissance design. Elaborate and monumental in the extreme, the watershapes here were designed by Andre Le Norte to intimidate – and thereby magnify King Louis XIV's power and glory.

The Fountain of Latona, shown in views with the jets idle and actuated (E1 and E2), show the power harnessed by the Francini family through the Machines de Marly. These aren't subtle waterspouts: These are huge volumes of water moved to impress. The same impressive/intimidating objective is served by the Fountain of Apollo (E3): The jets here are so powerful that even the sun god is obscured by the torrent.

But the water show at Versailles has many elements, not all of them volcanic. The Pool of Neptune, for instance, serves as a massive reflecting pool in which the jets offer restrained accents (E4), while the Grotto of Apollo (E5) provides a setting for contemplation in much the same way the Queen of Fountains does at Villa d'Este (see D2 on page 28).

you think of achieving their effects without the use of modern pumps, you can begin to understand the fascination and enthusiasm with which these Moorish installations were treated by designers in a Europe emerging from hundreds of years of chaos and rediscovering the technological and artistic wealth of cultures that had gone before.

To Italy And Beyond

Think for a moment about the Islamic quatrefoil, a combination of square and circle that was a cen-

Continued on page 34

Borrowing a trick or two from his western European counterparts, Russian Czar Peter the Great built watergardens at his summer palace in St. Petersburg with similar objectives: to impress, intimidate and achieve an overwhelming measure of self-glorification.

Designed and built in the first half of the 18th Century by Jean Baptiste-Alexandre Le Blond (a student of Le Norte's), the Peterhof can best be classified as Rococo in style. This successor to the Baroque style took ostentation to a whole new level: Gilded sculptures call attention to the fabulous wealth of the czar – and his desire to be seen on par with his western European counterparts.

The achievements here are similar to those at Versailles: The water was brought nearly ten miles from the Baltic Sea to flow as a half-mile-long canal, terminating in the grand jets of 75 fountains cascading over stairways leading to the palace (F1 and F2). None of this makes any gesture to subtlety: The watershapes strive for grandeur – and achieve it with a balance called perfect by many architectural historians.

Where Do We Go from Here?

Acknowledgment of our watershaping ancestors' accomplishments is the first step in fulfilling our own dreams as builders.

That's the thought that stands behind the first two articles I've prepared for *WaterShapes*, but with the advent of CADD (Computer Aided Design & Drafting), it's all too easy to allow ourselves to slip into a mind-set where we feel comfortable stamping out the same basic design over and over. In that context, it will take conscious decisions by each of us to do the job we really should be doing in thoughtfully creating watershapes that complete both practical *and* spiritual missions.

We each have the resources to become great watershape designers. All it takes is curiosity about the traditions of which we all are part and an understanding of how we can work with these traditions to create modern watershapes that echo the achievements of our forebears and make the same sorts of connections with the human spirit they were able to make.

In the end, it comes down to self-perception and how you see yourself in this grand scheme of things. If you perceive yourself as a "pool builder" or "landscaper," then you will most likely be inhibited by the professions' limits. If you can see yourself as one of the world's finest providers of the finest watershapes, then you have no limits.

Decide!

– M.H.

Continued from page 32

tral design feature of basins for fountains, courtyard boundaries and even small decorative tiles all over the Middle East, across North Africa and into Spain.

To the Moors, the quatrefoil was more than the geometric merging of two basic shapes. In fact, it had deep religious and spiritual significance that was lost on Europeans – but it nonetheless provided design inspiration still seen in countless watershapes throughout the modern Western world, including the fountains of the Palace of Het Loo in Holland (H).

Architects of the Renaissance recognized the intensity and playfulness of ancient designers and, in Spain, had direct access to models they ultimately translated into some of the most famous watershapes on the planet.

So while designers such as Piero Ligorio (Villa d'Este) and Giacomo Vignola (Villa Lante) in 16th-century Italy and Andre Le Norte (Versailles) in 17th-century France were conceptualizing their future achievements, hydraulic engineers pulled apart ancient waterworks and explored the systems that made feasible everything from the grand Roman aqueducts to subtle water stairways.

Particularly important on the hydraulic side of things was the Francini family, retained to bring water over two miles to the chateau at Versailles. Through trial and error, they devised a system of 14 waterwheels and 253 pumps (collectively called the *Machine de Marly*) that carried water from the River Seine

Continued on page 36

Originally the plain, functional terminus of an ancient Roman aqueduct, the Trevi Fountain in Rome is distinguished by its scale and scope as well as for its massive incorporation of sculpture into the aquatic design (G). Primarily the work of Niccolo Salvi, the fountain was built between 1732 and 1762 as part of a grand architectural revival in Rome.

In this era, the Papal city was dotted by massive fountains fully accessible to the public – a distinct departure from the overwhelmingly exclusive watergardening programs set up for private use by Europe's monarchs and their courtiers.

Built in the same time period as the chateau at Versailles, the palace of the Dutch king and queen was not so grand as the French model – but is noteworthy in this article for one compelling reason: The Venus Fountain is a modest statement of power built on a basin shaped as a quatrefoil (H) – the dominant design element of Islamic design and an indication of just how integrated these Persian forms had become in western architectural styles.

H

Continued from page 34

up 300 feet to create the necessary head pressure to power the 1,400 fountain jets designed by Le Norte.

If there's ever a watershaping Hall of Fame, the Francini's achievements at Versailles make them a lock for charter membership: The work is magnificent in scale and scope and to this day is among the most breathtaking and inspirational of all watershapes.

As for *their* inspiration, you need look no farther than the waterworks at the Alhambra. To be sure, the fountains at Versailles bear witness to a different design sensibility and are grander and more dynamic and have a different purpose than the watershapes at the Alhambra, but the hydraulic principles driving them are identical.

Eventually, these hydraulic concepts migrated throughout Renaissance Europe to reach England in the North and Russia in the East. Finally, they reached the New World and have had immense influence in the Americas, north and south.

A Bridge To The Past

In today's world, you never need to look far to find touches of Islamic influence on watershape design.

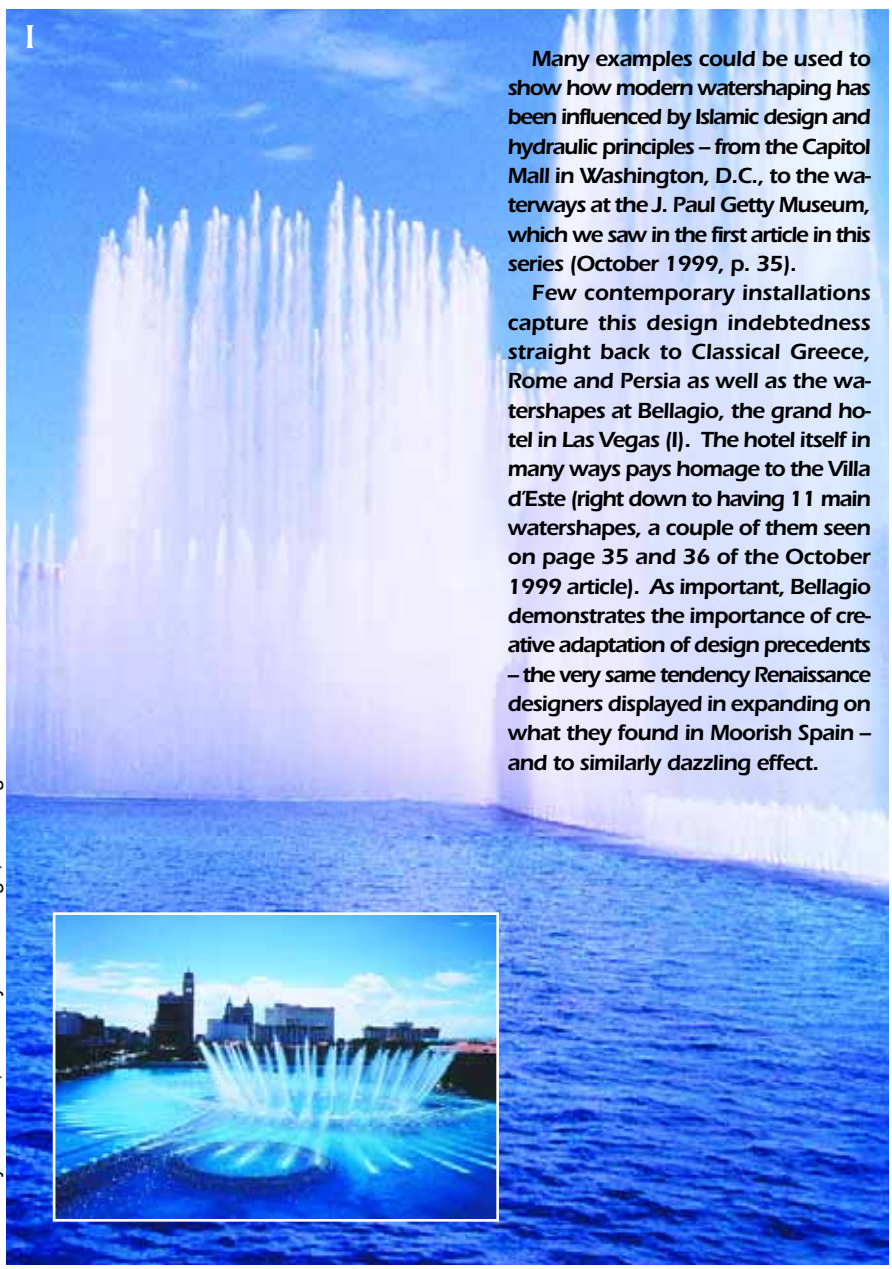
In Washington, D.C., the whole Capitol Mall complex borrows from a vernacular first expressed hundreds of years and thousands of miles away. With its axial canals and reflecting pools, the immediate sources are French, but you see the same principles at work in India at the Mughal Gardens and the Taj Mahal.

The Spanish Revival movement so prominent in California architecture similarly traces its roots to ancient sources – most directly to the design sensibility that laid out the Alhambra and Generalife. Echoes of Islamic/Persian design now also find expression in places like tract housing in East Asia.

Along with this design sense came a sophisticated approach to hydraulics. Through the years, however, the spiritual component of Islamic watershaping fell further and further away with each new translation.

This "dilution of the spirit" can be perceived both positively and negatively, depending on your perspective, but at their best, watershapes derived from Middle Eastern roots create spiritual sensations on their own as we drink in the sight, sound and feel of water in motion. This may not approach religion, as it did for the forms' originators, but it is nonetheless a special experience that all of us appreciate even in our more secular age.

We may not be thinking in spiritual terms as we watch the waters dance at Bellagio (I) or as we stroll around the grounds at Versailles or wander the pathways at Villa d'Este, but surely there's room in there to sense the mastery of those with a special feel for moving water's power and promise.



I

Many examples could be used to show how modern watershaping has been influenced by Islamic design and hydraulic principles – from the Capitol Mall in Washington, D.C., to the waterways at the J. Paul Getty Museum, which we saw in the first article in this series (October 1999, p. 35).

Few contemporary installations capture this design indebtedness straight back to Classical Greece, Rome and Persia as well as the watershapes at Bellagio, the grand hotel in Las Vegas (I). The hotel itself in many ways pays homage to the Villa d'Este (right down to having 11 main watershapes, a couple of them seen on page 35 and 36 of the October 1999 article). As important, Bellagio demonstrates the importance of creative adaptation of design precedents – the very same tendency Renaissance designers displayed in expanding on what they found in Moorish Spain – and to similarly dazzling effect.

Photos by Ira Kahn, courtesy Wet Design, Los Angeles

Getting Involved

This second installment of the "Images" series has further opened a discussion of the historical intersections of design, architecture, technology and hydraulics, but we'll leave the overviews behind in future articles, focusing instead on specific historic watershapes, how they fit into the timeline and, often more important, how they work.

If you have any requests – that is, a classic watershape on which you'd like more detailed information – please let us know by dropping a note to WaterShapes, P.O. Box 306, Woodland Hills, CA 91365 or by going electronic and sending an e-mail to edit@watershapes.com.

– M.H.

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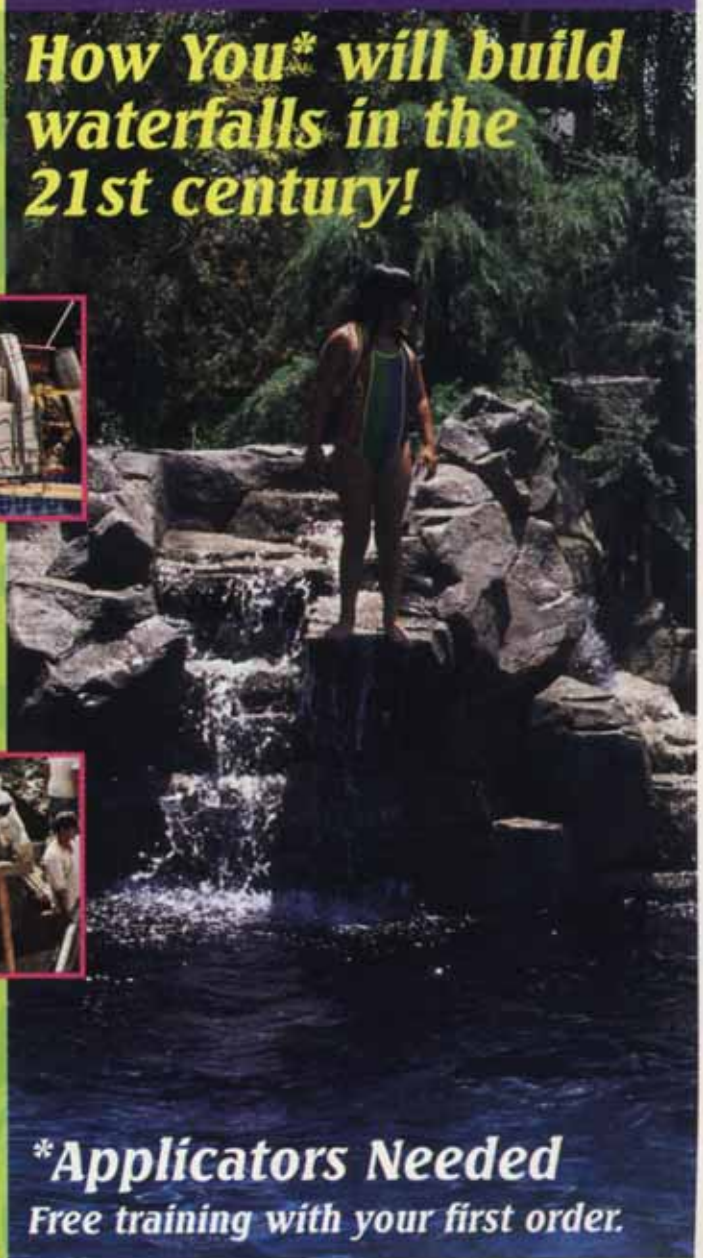

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by Rick Bibbero

Every Boulder Tells a Story

No two rocks are exactly the same: Like snowflakes, each is a unique object of geological art and beauty, and, even better, they come in an infinite range of colors and textures. This variety makes them ideal for use in naturalistic watershapes and landscapes, says rock and boulder supplier Rick Bibbero, and gives discerning designers and builders the opportunity to use objects of timeless grandeur to enhance the value of the work they do.

For some time now, watershapers have exploited the fact that naturally occurring rocks and boulders can enhance the appearance of their work. Whether used in conjunction with artificial rock or alone, you appreciate the fact that rock comes in a never-ending variety of shapes, sizes and textures – and that they can be used to add both surprise and individuality to designs.

For the most part, however, designers and builders have tended to work with common local stones – fieldstone, granite or river rock – that limit their palettes when it comes to color, visual appeal and expressiveness.

Gray Jasperoid

It can indeed be an epiphany for those who've used common stones to come across material that includes complex mineral and crystalline structures or fascinating patterns of stratification that are the product of eons of metamorphic activity within the earth's crust. With this awareness comes the realization that the palette is virtually limitless and that rockwork can now easily be found to echo the colors and exceptional nuances found in decking, interior finishes and plantings.

Digging Deep

Our company is in the business of supplying unique and beautiful rocks to professionals who want to increase the individuality and value of their work.

One of my functions at Western Rock & Boulder is to seek out new sources, a job that takes me to various sites around the country in search of natural beauty. What I'm after are architectural gemstones, materials that work perfectly in high-design watershape and landscape settings. Basically, they're waiting to be put on display, ready to tell the story of millennia spent under the most extreme influences of our planet.

Let me say right up front that many of these rocks are expensive – definitely *not* for every installation. But when they find their ways into projects where clients want something truly special, the effect can be dazzling.

In a design sense, the sort of colorful rocks pictured with this article can be used to complement and create specific feels or styles. In fact, many rocks are synonymous with certain geographic locations and design modes, such as lava used in tropical designs, reddish, iron-

laden boulders in Southwestern/desert designs or marble for a classical or neo-classical touch. If you use any rockwork at all, it has to fit the picture or it will detract from the intended effect.

There's also a "trend factor" here: Just as the jewelry business has been led in recent years to add literally dozens of unconventional, brightly colored gemstones to contrast or complement diamonds in response to customer demand, some of those same customers are pressing architects, landscape professionals and pool builders to expand what they've conventionally offered in terms of color, character and texture when it comes to rocks and boulders.

This trend has staying power, however, because the emotional appeal and nuance of these materials is tremendous. When you see large boulders flecked or striated by colorful mineral content, the impact can be awesome – especially when you think in terms of ten-ton boulders, which are pretty impressive on their own. And when you season the composition by setting up contrasts with smaller pieces of more ordinary or even artificial rock, the entire setting takes on a new life and energy.

To many in the trade, in fact, these special rocks present a whole new aesthetic dimension, a new medium with which to create.

Continued on page 42

Project photos by Linda Svendsen, Linda Svendson Photography, Concord, Calif.

Figure 1: This project was completed for a modest residence in Northern California. We acted as consultants in selection and placement of the stones and carefully chose some outstanding specimens to mix in with more run-of-the-mill stones. We also made certain the best of the rocks would get wet and show off the shimmering depth and mineral-rich colors.

Massive White Calcite

Origins and Species

When you use interesting rock material in your work, it helps to know a thing or two about geological history. You can share this information with clients – and at times use it as a way to express and capture the value of the material in the design.

Here are some examples of the rock types we're familiar with at Western Rock & Boulder, along with geologic histories presented in brief:

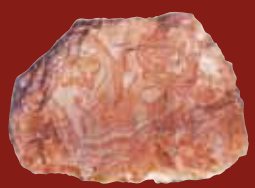
❑ **Massive White Calcite.** This coarse, crystalline rock is almost entirely composed of the mineral calcite (calcium carbonate, or $CaCo_3$). The principle constituent of limestone, calcite is one of the most common rock-forming minerals found in nature.

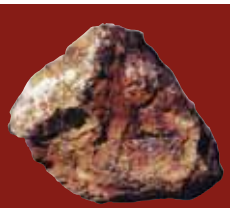
Most limestone is composed of particles and fragments of calcite that were originally the hard portions of marine invertebrates such as clams, brachiopods, snails and coral. Eons ago, this material accumulated on the ocean floor in the shallow portions of warm, tropical seas. With burial and compaction, this material became limestone.

Heat generated by volcanic centers can attack and alter the limestone, as seen here. The unusual patterns result from vein calcite that was deposited in fractures within the host limestone. The yellow, pink and orange stains are from various iron oxides derived from pyrite, or "fool's gold."

❑ **Gray Jasperoid**. *Jasperoid* is the term used by geologists to describe a fine-grained, dense, hard rock consisting mostly of quartz. Jasper, as it is more commonly known, is a precious/semi-precious stone – a cryptocrystalline quartz typically seen in red, yellow or brown shades.

The specimen seen here was derived from a Devonian-age carbonate parent called Devil's Gate limestone that originally formed


Gray Jasperoid


Devonian Limestone


Skarn


Hornfels


Vein Quartz

in a shallow marine environment some 360 million years ago. At a much later date, hot mineral-bearing solutions attacked the limestone and replaced the calcite particles with finely crystallized quartz. The resulting rock is much harder than the original and quite susceptible to brittle fracturing.

This rock probably derives its color from the original limestone material: The white crystalline calcite acts as a kind of cement gluing together pieces of jasperoid together. The pink tint is derived from the iron oxide mineral known as hematite (Fe_2O_3) created by the oxidation of iron sulfide, also known as iron pyrite or FeS_2.

❑ **Devonian Limestone**. Seen here is a typical example of fine-grained marine limestone. The color of this rock is a mixture of pink imparted by hematite and the oxidation of iron pyrite and a white/gray crystalline material that is basically calcite – but which has been altered in the process of gold formation.

The pyrite was deposited from hydrothermal solutions; in the process, fine (micron-sized) particles of gold were deposited on the surface of the pyrite grains. The slabby nature of some of the limestone pieces is a result of material accumulating in flat beds of debris. These flat surfaces are former bedding planes.

❑ **Skarn**. This laminated, crystalline specimen is an excellent example of so-called "contact metamorphic" rock. The term refers to rock that has undergone significant changes as a result of heat and pressure. In this case, the original was a sedimentary rock, predominately bedded shale (or mudstone) interleaved with limestone.

This sedimentary sequence took place during the Cambrian period, hundreds of millions of years ago, in an ancient shallow sea. Later, the section from which the pictured rock was taken was penetrated by granitic rocks during the Cretaceous period – the time of the dinosaurs – about 105 million years ago. Heat and fluids from molten granite "baked" the adjacent shales and limestone, converting them to a crystalline metamorphic rock.

Skarn is a Swedish mining term referring to replaced limestone and dolomite, a combination referred to as carbonate rocks that includes large amounts of iron, silicon and magnesium as well as minor amounts of silver, copper, zinc and gold. Immense heat combined with some of these introduced elements changed the carbonate rocks into new silicate minerals, including garnets, pyroxenes and wollastonite. These new minerals are much harder and more durable than the original parent limestone.

❑ **Hornfels**. Like skarn, hornfels is an example of contact metamorphic rock. The word *contact* here means that the rock formed in the contact zone between an older sedimentary section and intruding granitic rocks.

Hornfels is a German term meaning "horn rock" and calls to mind the hard, fine-grained, flinty nature of the material. Hornfels, skarn and marbles differ in appearance, but they are all examples of contact metamorphism. Marble is a heated and recrystallized limestone or dolomite; hornfels are formed in much the same way, but from fine-grained carbonates or shale.

The green and gray colors of hornfels result from fine crystalline intergrowth of pyroxene, feldspar and quartz. These minerals were created by heating the sedimentary particles of clay grains, fine siliceous mud and silt along with fine detrital fragments of calcite. At the high temperatures, these mixtures became chemically and structurally unstable and re-combine to form more stable substances. The result is a rock that is both hard and dense – and among the most durable rock types in the world.

❑ **Vein Quartz**. These spectacular masses of quartz were found in the foothills of the Sierra Nevada range in Central California near the famed Mother Lode, which drew thousands of prospectors to its hardrock goldmines in the years after gold was discovered in 1849 at Sutter's Mill.

Blocks of this sort of inter-grown quartz crystal represent barren "footwall" material found in areas rich in gold ore. Truly large quartz crystals such as the ones shown here are somewhat rare, however, and can only form where they have adequate room to grow.

This growth occurs where mineral-laden, silica-rich hot waters known as hydrothermal solutions have deposited their mineral constituents in deep fissures within the earth's crust. These fissures are found in "cut" slate of the Paleozoic and Mesozoic ages and extend to depths of thousands of feet. The form of these crystals is a surface manifestation caused by the rock's internal atomic structure, which governs the manner in which constituent silicon and oxygen atoms are bonded together.

This only scratches the surface when it comes to rock types available for use in watershapes and landscapes. Exotic stones are available in places around the world – every one of them useful in accentuating the beauty of a built environment.

– R.B.

Continued from page 40

History In Plain View

Beyond the immediate visual impact, there's something special about a material that has a history reaching back millions of years.

Indeed, when you link the immediate beauty of these rocks with an appreciation and understanding of their origins, the value they bring to a watershape can be even more considerable. I discuss geological basics in the sidebar on page 44; here, suffice it to say there's a value in the pride a client will find both in owning an impressive boulder and in being able to share some of its story with friends and visitors.

It's fascinating to think that our most impressive rocks were formed as a result of ancient volcanic activity – periods of incredible heat followed by extended periods of cooling and settling. And that volcanic past is just part of the tale: In eons since, tectonic movement has pushed and prodded the earth's crust with brutal force, breaking and interleaving layers and introducing an array of ores and minerals to sedimentary beds. The resulting rock is laced with vivid color, crystalline veining and highly individual character.

The rest of the story involves the fact that such material is not often found on the surface.

Rather, for the most part it is embedded deep within the earth, and great effort and expense has been involved in extracting the material and bringing it to light. Much of this material is now available because of mineral exploration and extraction efforts of the 19th and 20th centuries, particularly in the Western United States.

Continued on page 44

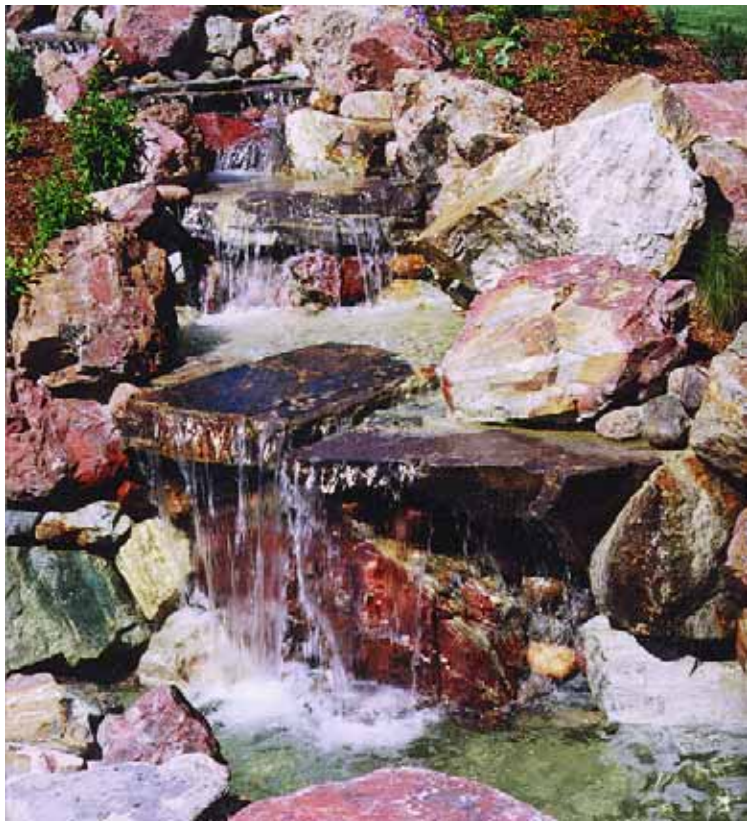


Figure 2: These rocks were installed as part of a grand program for a Northern California estate. In this case, we were able to use more outstanding rocks with a greater palette of colors. The effects here were achieved in coordination with two contractors: Hacienda Pools and Marker Masonry, both based in Pleasanton, Calif. The rocks and boulders were supplied by Morgan's Masonry Supply (San Ramon, Calif.) and Western Rock & Boulder.

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Continued from page 42

Some of the rocks are quarried, but a large portion of them have simply been left behind in the wake of exploration ventures. Interestingly, in many cases those boulders interlaced with colors and crystals were discarded because processing them to extract their mineral content would have been too difficult and costly.

Now, many years later, these are the specific artifacts that companies like ours are seeking. It's living proof of the old adage, "One person's trash is another person's treasure."

The Eye of the Beholder

Because these fantastic rocks are more expensive than more ordinary types of natural stone, questions about their overall value in a watershape or landscape naturally arise.

Yes, there are budget issues to be addressed, and because of the weight often involved, the considerations go well past the cost of the stone itself to include the costs of transport and of the structures needed to support them. In many cases, this is why we see use of special stones as highlights or focal points.

This is also why we often see projects in which a mix of natural and artificial rock is used. If a project is particularly large or tall, for instance, faux material reduces the support needed for structural integrity. This is a common strategy in big theme parks: The mountain may be constructed of lightweight material and visitors will never get close enough to scrutinize it. Where visitors get close enough to touch the stone, however, natural rock is commonly used.

Mixing large and small stones is another option. Where weight isn't a primary consideration, we'll often see large specimen boulders, perhaps 20 tons in weight, placed among less expensive, more common material to achieve a dramatic effect.

However they're used, the relevant issue here is whether or not the use of the more expensive material is justified by the value it adds to the work. To a large extent, that's a subjective issue, but I'd suggest that what we're talking about here is the place where geology meets art and that it's a possibility limited only by the imagination. On those terms, it's an option that should be introduced to a discriminating clientele as a means of adding something truly special to their projects.

At that level, it's all about artful use of highly colored and featured boulders and how they can be used to enhance a setting. If the surroundings are right, if the plantings are right, if the design lends itself to natural touches and if the budget has room, the designer or builder who is aware of the possibilities has a distinct advantage.

Now it's a matter of selecting the right rock and placing it in the most effective, dramatic context – and very often, that context involves *water*.

Awash In Awe

Many of the world's most enduring design philosophies embrace an interaction of rock and water. Renaissance fountains, Japanese gardens and modern public spaces all feature sublime combinations of water and stone. Whether your work draws directly from these "schools" or is based on your own intuitive use of rock and water, the power of the combination is undeniable.

In one watershape seen here, for example, several different types of rock of various shapes, sizes and colors have been used in the same composition (Figure 1 on page 40), creating a set of visual relationships between the different types of stone and the water itself. There's a harmony here, and careful placement of the large boulders allows viewers to contemplate the geological story of the rock as they take in the scene.

It's an unfolding pleasure: The viewer is invited to approach the water by various flat-sided boulders that create bridges and seating areas at water's edge. In turn, these areas create spaces for intimate viewing as the eye is drawn to large, dramatic boulders strategically placed in view.

In design terms, the architect has used the stone to exploit water in three ways: as a *dynamic* element, falling over the larger boulders; as a *passive* element, collected in reflecting ponds; and as a *soothing* element, meandering in a rocky brook. In all of these spaces in the composition, the water leads the eye to explore the rocks that create and/or frame the effects.

It's also possible to broaden the experience of rocks and watershapes by introducing other design elements to the composition, including lighting and plantings (Figure 2 on page 42). Here, the designer accentuated the featured waterfall with fiberoptic backlighting to create an extraordinary nighttime centerpiece, while landscaping with various types of exotic and indigenous plants has been used to complete the vision, day or night.

The rocks and boulders that surround the watershape don't dominate the composition. Rather, they serve to highlight the foliage while informing the entire project with a natural feel.

Finding, relocating and placing boulders like these is a special job with special rewards: The right rocks highlight a setting, extend its impact on viewers and weave beautifully into the overall effect created by a watershape or surrounding landscape.

Placed in a greater setting of geological history, the shaping of the earth and the movements of its crust, these rocks and boulders not only are beautiful, but they also become conversation pieces, points of pride and yet another way to build emotional connections between clients and their watershapes.

Sharpness of Line

The boulders we commonly work with have been fractured and forcibly removed from the ground, so their surfaces have not been weathered by wind, rain or chemical erosion. This leaves them with sharp lines that are quite geometrical, almost faceted.

This characteristic opens them to a wide range of creative placements – just the sort of touch that can highlight a watershape and accentuate its features.

Crisp lines, sharp angles and flat surfaces can, for example, make these stones useful as weirs or in channels – or in echoing the geometry of a watershape, pathway or structure. They also can be used to contrast softer-looking materials, causing the stone to stand out against its surroundings. That same sharpness can be softened and made to recede through use of plantings to create even more dramatic contrasts and tensions.

The possibilities, it seems, are limited only by the designer's imagination and creativity.

– R.B.

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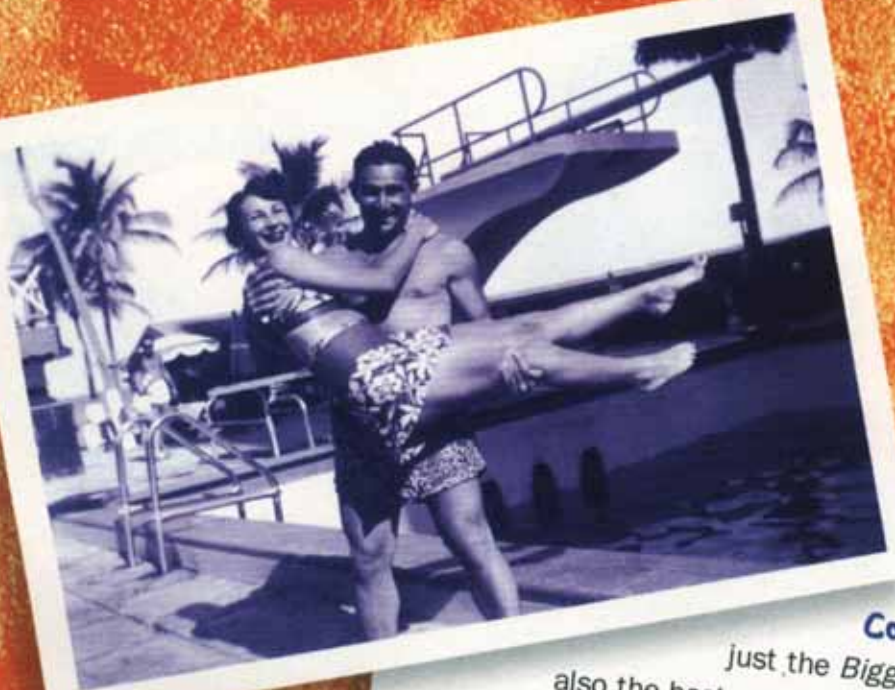

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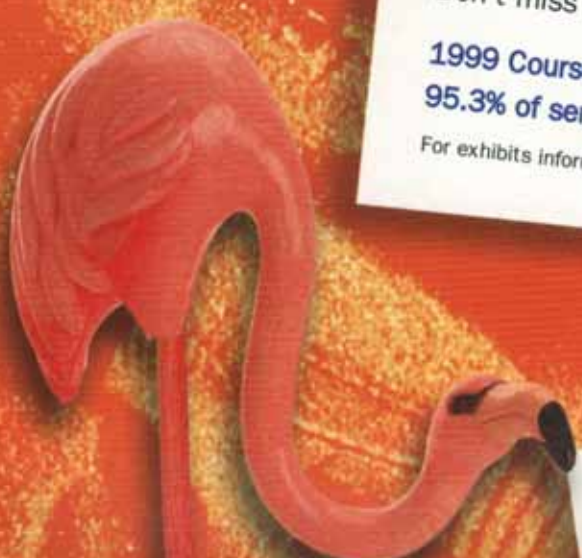

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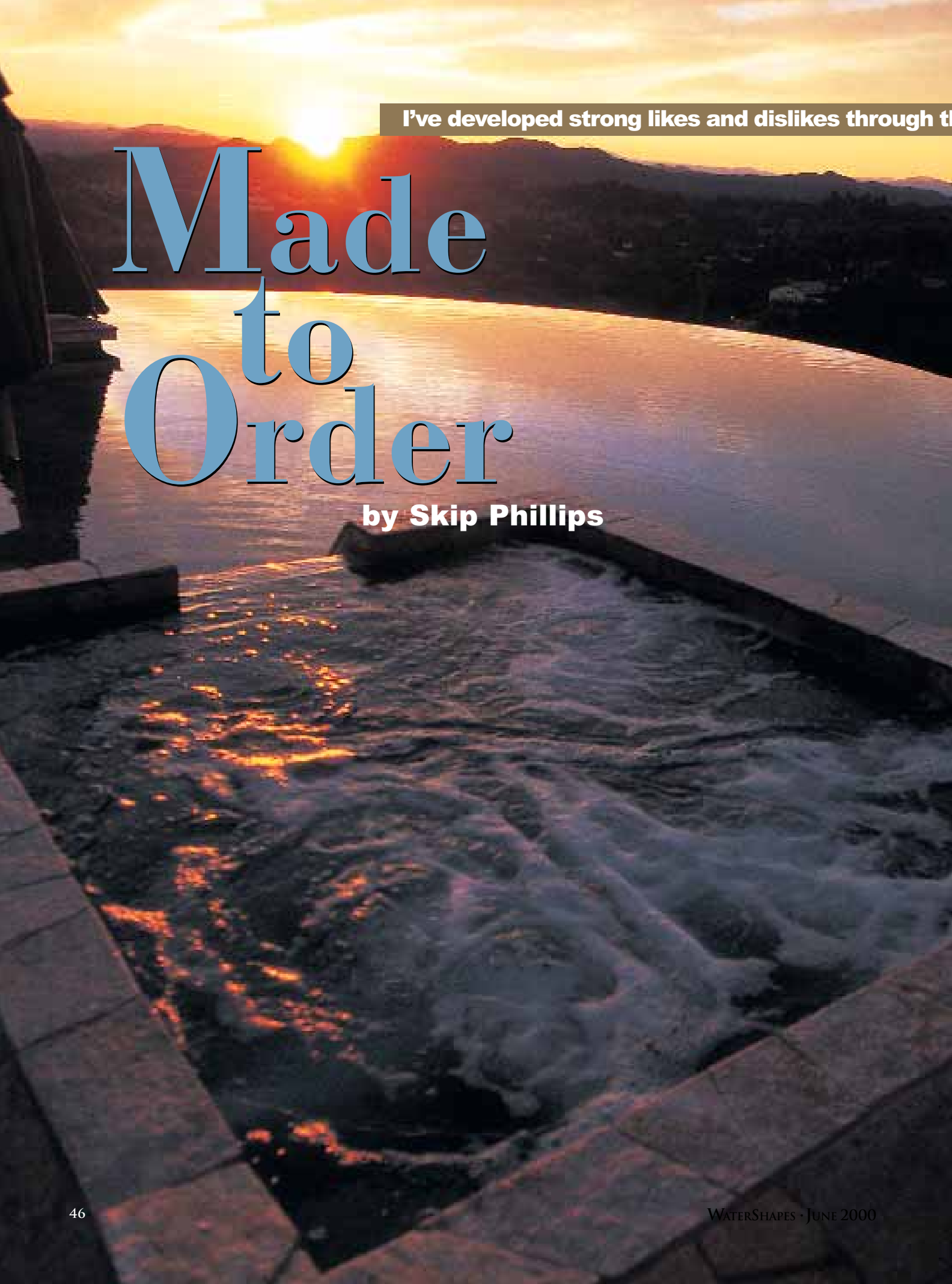
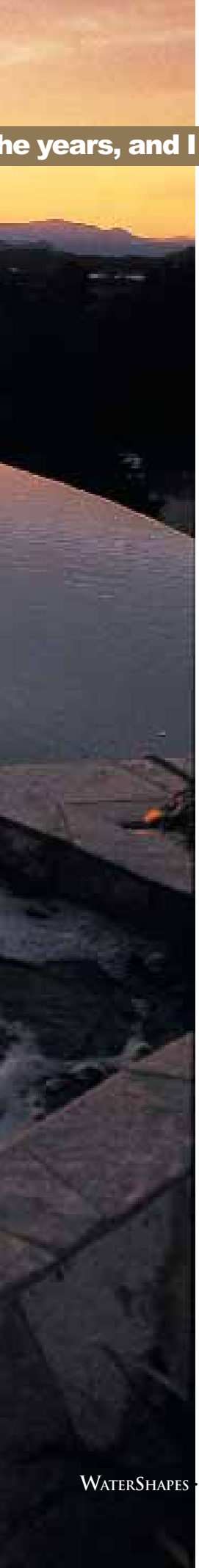


I've developed strong likes and dislikes through t

Made to Order

by Skip Phillips



he years, and I knew with good degree of certainty that our pool would have a vanishing edge, an attached spa, interesting lighting and an array of beautiful finish materials.

For years, designer/builder Skip Phillips has applied himself to creating elegant, finely detailed watershapes for a discerning, upscale clientele. Recently, the experience of constructing a pool and spa for his own backyard led him to explore the essence of what pools and spas are really all about on a personal level – and discover a thing or two along the way about the connections between watershapes and family fun.

When you design and build custom swimming pools for a living, I'd guess you're always thinking somewhere in the back of your mind about what your own pool would be like if you ever got the chance to build it.

In my case, when I finally did have the opportunity to design and build one for my home, I knew it had to be a complete extension of my own design philosophy, standards of construction and product choices. That was a no-brainer. What surprised me was just how much excitement and pleasure I derived from the process of seeing my own backyard take shape.

I had a pretty good idea of what I wanted going in. I've developed strong likes and dislikes through the years, and I knew with good degree of certainty that our pool would have a vanishing edge, an attached spa, interesting lighting and an array of beautiful finish materials.

Even with all that in mind, however, landing on the perfect design that expressed all of those elements wasn't automatic by any means. As with any custom watershape, each facet of the project required consideration and a weighing of the options.

This forced me to step back and decide what I thought was most important in terms of design features, aesthetics and functions. The process was challenging at times, but extremely rewarding – mostly because it helped me get in touch with why I'm in this business in the first place: Swimming pools are fun!

The Right Place And Time

The fact is, whether you own one for purely aesthetic reasons, for exercise or for splashing around with the kids, pools are about enjoying the finer things in life – or at least they *should* be. Whenever I'm working with clients these days, I try to make them aware that what they're really doing is investing in a portion of their lifestyle and that the decisions they make about their pool today will reflect their own tastes and attitudes for years to come.

This was certainly true in our case.

In many ways, in fact, our pool represented a major step in establishing our "dream home." My wife and I had moved into the Mediterranean-style house in the hills above Escondido in 1996. It's on a big lot and gave us plenty of room to spread out and put down our roots. My offices for Questar Pools are located in a wing of the home with a separate entrance. All in all, it's fair to say that this is where we plan to stay, maybe for the rest of our lives.

Our first decision, of course, was about where to put the pool. This was pretty easy: We'd lived in the place for a while and knew where it made the most sense to place it.

The spot we choose was on a downslope adjacent to a southwest-facing patio. Doors from our family room open onto that space, giving us great access and a beautiful view of the surrounding area. And the sunsets are really something to behold.

As a bonus, the view of the vanishing edge from the downhill side rises dramatically above the street that wraps around the front of the property. The backside of the pool is the first thing you see as you come onto the road, and it's already become a useful landmark in giving people directions to the house.

Most of the design decisions came as a result of applying my preferences and experience in a way that's appropriate to the setting. For example, the square, seven-by-seven-foot spa is tucked away among some rocks on one end of the pool for a sense of privacy. On the other end of the pool is a barbecue area on a deck that's set about four feet below the waterline and nestled among some granite boulders and artificial rocks. Between these points, which together lend the pool a sense of visual balance, stretches a gently arced, 55-foot vanishing edge.

On the house side, a broad beach entrance gently transitions from the patio into the pool, which reaches its maximum depth of six feet at the base of the outer wall. The pool's exterior walls and the surrounding deck areas are finished in a shimmering gold quartzite, perfect against the amber-grass-covered hills beyond. The interior of the pool is finished in Pebble Tec's subtle Tahoe Blue.

A Group Effort

In terms of the physical location, layout, shape and orientation of the pool, I really think it's just about perfect – simple, elegant and very accessible – and a beautiful accent for our home's exterior. It was also a team effort.

My wife, kids and I had talked about the pool from the beginning – a process that made the project even more fun for all of us. Early on, in fact, my daughter, who was nine at the time, came up to me and said, "I'm going to help you draw the pool."

"Sure," I said. "What do you think it should look like?"

Being the custom designer I am, I've grown to detest traditional dimensions – 15-by-30, 16-by-32, 20-by-40. I even hate the sound of them. I was in for a shock when my daughter said, "The pool should be 20-by-40, ten-feet deep, with a diving board and a slide."

I was dumbfounded. I wanted to ask her, "Where did you hear that? Have they

Continued on page 50

Picking a spot for the pool was easy. With its slope and long view toward the horizon, this slice of the yard was ideal for a vanishing-edge pool of the type I often build for my clients.

The site had lots of advantages compared to many hillside spots. We were working on competent soil and had complete control of how the fill beneath the pool was graded and compacted in preparation for the footings and keys that now hold the structure seven feet above grade.

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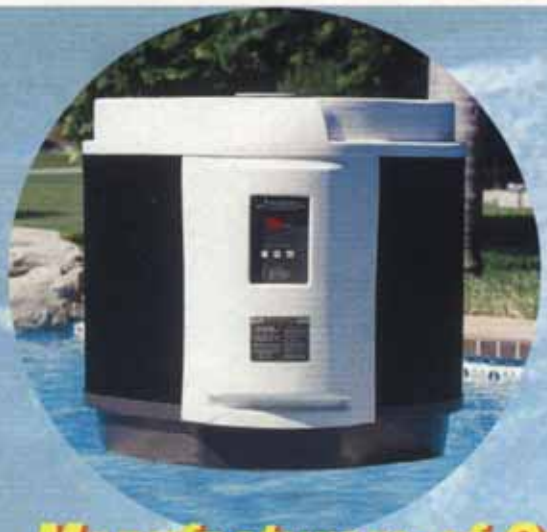

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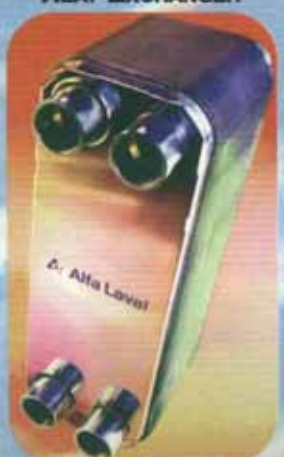

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Continued from page 48

been teaching bad things at school?" But having more patience with her than I do with most of my clients, I decided not to stamp out her early enthusiasm for pool design – even though there were a couple of fatal flaws in her design, including the diving board in the spa.

With that kind of instinctive input and my own practical experience, I did the first drawings and came up with the set of features we wanted.

Once I established the basic positioning of the beach entrance off the patio and had placed the spa and barbecue on opposite ends of the pool, it all came together pretty easily. I gave some thought to more complex edge designs, but they didn't really fit the contour of the hillside, so I stuck with a simple arc for the vanishing edge. I'm glad I did: The whole thing has a very nice fan-shaped symmetry and balance to it – and it fits the surroundings perfectly.

When I finished, the overall dimensions ended up being almost exactly 20-by-40. My kid has talent!

Above Grade

We began construction in February 1999, and the process took quite a while because we fit work on this pool into narrow time frames that fell between other projects. Working with all the same crews and the same suppliers I do business with normally, we slowly pulled things together in a ten-month period.

The first step involved some fairly heavy-duty site preparation, because the pool was to sit about seven feet above grade.

We brought in fill material, compacted it and then dug the footings and keys (on the house side and down the slope, respectively). We were working on competent soil, so despite the hillside setting, there was no need for piles or grade beams. Still, we knew the fill-and-compaction phase would be critical for the long-term stability of the vessel.

We went through about 150 cubic yards of material in building up the floor as much as three feet deep under the downslope side of the shell. After we raised the floor, we then had to dig back through the compacted surface material into the original material to cut the keys at both ends. The half-circle footprint of the edge and catch basin are vertical extensions of the outer key.

The gunite shoot went smoothly in every detail and at every key dimension – especially critical in the spa, where I had designed a beveled edge detail that literally knocks the edge off the elevation change.

Next, we built the cage and set the plumbing. This was a non-expansive application, so we probably could have gotten away with using a lot less steel – but that's not the way I work. Rather, I see steel as cheap insurance against structural failures, so I used plenty of it here and in every other job we do.

In this case, we used all #4 bars in both inside and outside cages. The grid on the inside cage is set at six inches on center, with 12-inch centers on the outside.

The plumbing is two- and three-inch schedule 40 PVC. We set returns in the floor for the vanishing edge, traditional returns in the wall for the primary system, and a skimmer and separate floor suction. I used three pumps, one for primary circulation, a second for the vanishing edge and a third as a booster for the spa.

At this point, we also ran the necessary conduit for the lighting and placed special sleeves in the structure to accept umbrellas – something I discuss in the sidebar on page 53.

Forming The Shell

With the steel and plumbing in, we set our forms in preparation for the gunite.

In terms of pool industry standards, the level of construction for our forms is pretty good – but as you can see in the photographs, it's not up to the level of what my good friend (and Genesis 3 co-founder) David Tisherman does with his

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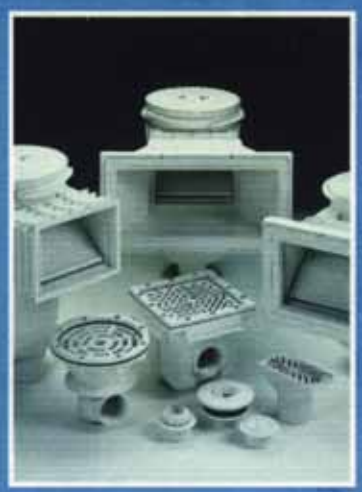

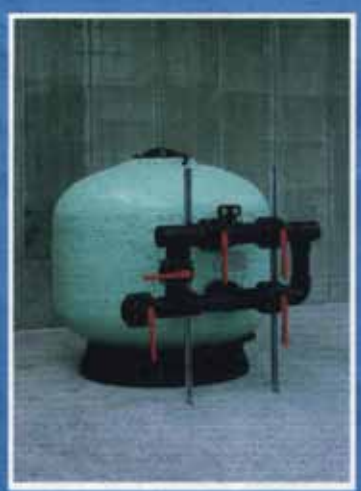

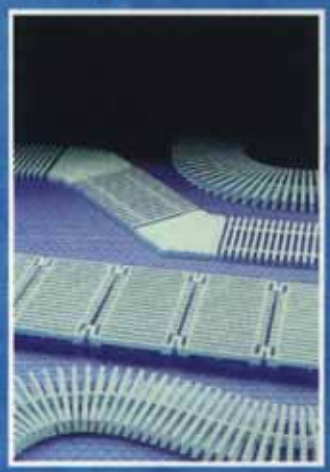

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forms. His forms always look as though they're meant to be permanent structures – which makes sense when you look at the kind of weight he's supporting.

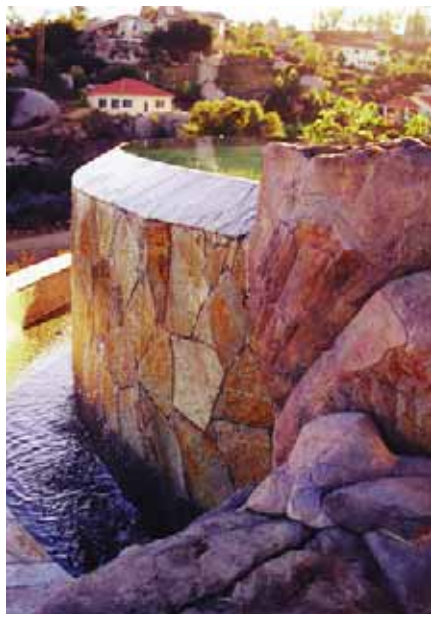
No matter how you do it, the key to good forming is getting the important dimensions just right. If anything's off here, everything that follows will be off as well, rolling downhill as mistakes that echo through the rest of the construction. Having good elevations and good, accurate dimensions in your forms is critical in avoiding problems later on.

The gunite shoot was also pretty standard. With vanishing-edge pools, however, there's always a question of how to shoot the edge wall. The crew I use decided at some point in their history that they like to shoot the catch basin first, inside out, then shoot the wall from the outside. Next, they strip off the forms from the inside of the wall and flash the pool's interior. You can, of course, do this the exact opposite way, but I have enough confidence in the crew I use to let them do as they prefer.

The trough for the vanishing edge is three feet wide and two feet deep. (The broader-than-usual width is due to the six-foot height differential between the edge and the top of the surge tank.) The vanishing-edge wall itself is a full 12 inches thick, while the basin wall is eight inches thick.

A couple of key details: There's a double-wall structure at the transition between the pool and barbecue that helps support the countertop for the bar. Also, I'm not really a fan of big elevation changes in my designs, so I raised the spa a mere 12 inches – just enough to accommodate the beveled contour of the spa walls. That's a detail I've really grown to love.

Finally, we set up a continuous bench instead of individual barstools for in-pool seating along a bar area on the left side of the pool; we did so mainly to accommodate the lighting system. An important point to make here is that we use absolutely no rebound in our pools: We don't use it for benches, we don't use it for steps, we don't use it anywhere – *period*.



The pool's perimeter is ringed with rock, much of it natural granite boulders we found on the property, some of it manufactured on site. In forming the artificial rocks, we used epoxy-coated steel to prevent any future problems with rust caused by water migration.

We pride ourselves on precision execution, and that extends to everything we do – including an equipment pad that's neat as a pin and provides easy access for routine monitoring and maintenance.

Custom Touches

One of the things that really distinguish high-end custom pools from the run of the mill is the selection of materials used for finishing.

Key to the design here was the use of the aforementioned gold quartzite. As it turned out, our desire to use this material slowed our progress down quite a bit, because during the time that we were building this pool there was a shortage of the material in my area. I'm really glad we were able to wait: It's pretty dazzling stuff.

Another key was tying the new waterfeature in with the existing structures and patio. Here, we saw-cut and removed small portions of deck and replaced them with some of the gold quartzite. We also put some quartzite in the courtyard area on the opposite side of the house by the front door and also at the entrance to the business. It was a lot of extra material and effort, but we did it to justify and ease the presence of such outstanding material in and around the pool itself.

We also used this rock sheeting on the edge – a challenge because it presents a distinctly irregular surface for operation of a vanishing-edge detail at just three gpm per foot. We ended up filling the pool early so that we could identify all the high points and grind them down. The flow over the edge is now quite uniform.

Lighting is also a big factor in the impression a watershape makes. In this case, we used two lighting systems in the job: a set of three fiberoptic boxes – one for the vanishing edge, one for the spa and one for the rest of the pool – and a household-voltage halogen system to provide more traditional illumination.

As for the equipment set, I used the components I install with most of my projects. The chlorine-generation system comes from Autopilot (Fort Lauderdale, Fla.), the heater, lighting and valves from Laars/Jandy Pool Products (Novato, Calif.) and the filters and pumps from PacFab (Sanford, N.C.). Clearwater Tech (San Luis Obispo, Calif.) provided the corona-discharge ozonator.

For installing the equipment, we approach the task with the same level of care that goes into the rest of our pools: very logical and orderly, all level and square, with an efficient plumbing layout and plenty of space for access to all the valves and other controls.

Finally, we ringed the perimeter of the pool with several outcroppings of artificial rock mixed in with natural granite boulders we found on the property. Through the years, we've found that most simulated-rock failures happen as a result of water migration. To beat the problem, we use epoxy-coated steel in the rocks to help seal the ties and dodge the rust problems often associated with artificial rock.

Pride Of Ownership

The pool was finished on December 1 and filled shortly thereafter. We heated it for Christmas and everybody went swimming. So far, that's the only time that I've been in the pool itself – but everything works as intended, the pool looks great and the equipment set purrs like a kitten.

The one thing I really wasn't prepared for was just how much fun this pool has brought us even though (at this writing) summer is still more than three months away. Even when it's been cold, we've managed to have a good time. We use the spa a lot, and the pool has played host to three remote-control boats my daughters and I play with. We'll heat the spa, sit in there and operate the boats as they drive around in the pool. It's a blast – and even when we're not actually using the pool, we've found that it provides a wonderful backdrop for relaxation, entertaining, dining and conversation.

It's been good for business, too: The pool is so representative of my work, it serves as a perfect showroom.

I'll have clients over and we'll sit out on the patio with glasses of wine and talk about possibilities. They get to hear the water spilling over the edge, watch the sun set over the edge and get a good sense of the beauty and tranquility you can have just by being next to a beautiful body of water. I've had some really cerebral conversations about pool design and how we can apply these ideas in their homes. It's very productive time – and it sure doesn't feel like work.

The bottom line is that I'm really proud of this swimming pool. And it's funny: No matter how many of these things you build for other people, there's always something new and exciting on just about every job. When it came down to building my own, well, in a lot of ways it really drove home the point that pools provide a kind of excitement and pleasure that never changes.

One of my favorite finishing touches in this project is the stanchions I included in the pool's floor to receive big market umbrellas. They add a festive touch – and provide lots of much-appreciated shade.

In Pursuit of Shade

One of the things I now try to factor into all of my swimming pool designs is *shade*.

In fact, I'm of the opinion that shade structures are rarely given their due – and I was determined that my own pool would take this factor into full (and creative) consideration.

For me, the choice was easy. I wanted umbrellas – big, happy umbrellas that invite you to cool off beneath them. I love the way they look in architectural terms, and I also like the fact that they seem so festive. To that end, I picked up four market umbrellas and worked them into the design.

As we worked, I moved the umbrellas around to different locations, hoping to find optimum placements based on the sun and where I wanted them to be. As it turns out, the two in the beach and the others over the bar are in a straight line, which makes it look like I planned it that way. The umbrellas can easily be removed and stored or put in place and raised quickly.

I really like what this does for the beach entrance. Rather than simply use that area as a means to enter and leave the pool, the umbrellas create a perfect place for lounging in the shallow water. And although we haven't done this yet, when we're not using the umbrellas at night, the receptacles can be used to hold torches.

As I mentioned in the adjoining story, pools need to be fun, and I think the umbrellas really add a vacation-like element to the whole setting.

– S.P.

For all of the aesthetic considerations that come with crafting a stream, the fact is that man-made waterways must function properly. Here, in the second installment of a series on the art of stream construction, landscape designer Rick Anderson addresses this practical/technical part of the picture, guiding us through liner placement, plumbing and equipment installation – all with an eye toward ensuring an end product that meanders steadily, cleanly and beautifully.

Stream-Lin

by Rick Anderson

As is the case with a stream's aesthetics, the functionality of any multi-level, gravity-driven waterway must be considered from the outset of any project. After all, no matter how natural and beguiling a stream may be in appearance, if it doesn't hold water, work properly in terms of hydraulics and filtration or provide ecological balance, the whole thing can and will become a nightmare.

Fortunately, making streams work isn't all that difficult – as long as you keep your eye on a critical set of fundamentals.

Last time, we laid out the stream course, created height transitions and dug both the channel and the pond at the bottom of a large stream/pond combination (see "Cutting a Channel," April 2000, page 34). Now let's move beyond that initial, design-oriented phase and get to the nuts and bolts of installing the liner, equipment and plumbing – each operation critical to making a stream function at its very best.

Transitions

First, let's recapture the scene: We're looking at a 95-foot-long earthen channel that flows downslope into a 25-by-35-foot pond. We've cut the streambed, dug the pond and established the major points of the stream's elevation transitions, all the while working against the backdrop of what I define as the underlying structure of the site and its contours.

ed Effects

The last step in this shaping process is the important one – that is, the point of entry of the stream into the pond. This is a particularly critical transition in terms of aesthetics for some people and probably will draw the most attention of any stretch of the installation. It must look and even *feel* natural.

I achieve this in one of two ways: For small projects – those with waterfalls measuring two feet or less or streams that are less than six feet in length – I'll often set up a vertical transition with a narrow channel and boulders, creating falls that cascade into the pond. In larger installations such as the one we're discussing here, I'll usually take a different approach, flaring the stream out wide and slowing down the flow so the water meanders into the pond.

Here, I began by widening the stream just below the last major height transition (about 25 feet upstream). I pushed the channel out to approximately six-and-a-half feet, then put a gentle bend (or *meander*) in the path. Observed from the prime viewpoint, the stream now sweeps toward the viewer and rolls into the pond in a sort of "lazy river" effect.

Once I'm satisfied that these details are just right, I put aesthetic considerations aside and get to work with the liner, equipment and plumbing.

Basically, I use a bottom-up approach, starting with the pond, its liner and skim-

Laying out the liner for the pond is a straightforward process once the excavation is done and you've set the location of the skimmer – but it gets more complicated when you need to work a square or rectangular liner around existing structures, as was the case where we butted up against the patio and steps in making our L-shaped pond.

mer. (We in the pond and landscape business call these things skimmers, but they're different from the devices installed by pool and fountain people. Our skimmers are all-in-one units that skim surface debris and also house filters, debris baskets and the pumps that drive our recirculating systems.)

The skimmer, or "mechanical filter" as it's also known for reasons I'll explain later, serves as the terminus for the stream's flow. In this case, I set the skimmer exactly opposite the above-mentioned stream/pond transition point. That way, I make best use of the system's direction of flow in collecting debris. More important is that the skimmer should be as far away from the stream falls as possible to enhance the total circulation of water in the pond.

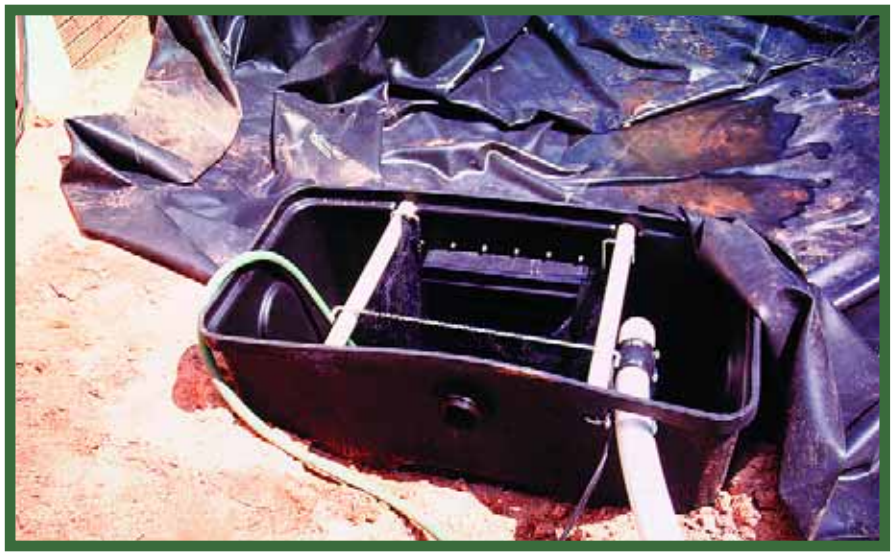
In the vast majority of the streams and ponds I build, the skimmer is the only suction or collection point in the circulation system. Many pondmakers also install main drains in their systems, and there are good arguments for doing so. For a variety of reasons, however, I fall into the camp that believes a well-designed gravel-bottom pond can form its own ecosystem and can function perfectly well without a main drain.

In The Pond

These combined skimmer units can be bought as kits, but if your system requires it, you also can buy pumps and skimmers separately. Either way, you have to assemble them according to manufacturer instructions and make sure they're compatible.

Several companies make these devices and they're all pretty easy to put together. The key is selecting a system according to the size and length of the stream, the flow you want to achieve and the configuration of the skimmer and pump. As with any hydraulic system, there are some key interrelationships at work. The flow of the pump determines the skimmer opening size, and both flow and aperture size should be congruent with requirements dictated by the volume of water in the system and by the feet of head created by the falls and the plumbing.

In this case, I used a skimmer with a 15.3-inch opening combined with a 1/2-horsepower pump rated to provide a flow of 4,200 gallons per hour. With an eight-foot rise to the top of the stream and a 100-plus-foot run of two-inch plumbing, the flow will actually work out to be about 3,500 gph as it emerges from the reservoir box at the top of the stream. Our project carries 11,000 gallons of water in all; the system will turn that volume over every three hours.



After the liner was placed, we attached it to the skimmer's face and stubbed out the plumbing that eventually would run about 100 feet to the reservoir at the top of the stream.

The skimmer's hole is dug according to the dimensions of the unit. In this case, the unit is 25 inches tall and 16-by-20 inches across the top. If the soil is soft, moist or loose, we compact it to ensure a stable base for the skimmer. In this case, however, we were lucky to find hard, dry, competent soil throughout the site.

We set the skimmer elevation with a simple rule of thumb: We want the waterline to rise to two-thirds the height of the skimmer's mouth when the unit is in operation and the stream is flowing. This raises a key point: The capacity of the pond itself must be large enough to contain all of the water in transit from the reservoir and stream when the system is turned off for maintenance or repair. (For most projects, we also recommend using a check valve on the pump. This way, when we shut off the system the water will not drain down into the pond from the reservoir box and the plumbing.)

The plumbing connects directly to the back at the top of a pond skimmer. I install the plumbing line in a shallow trench just below the surface adjacent the stream, using ribbed flex plumbing of a diameter determined by the flow rate. (I have the good fortune in my area of working in stable soil, so laying out and burying the plumbing runs is pretty straightforward. If the situation demands it, I'd advise wider trenching and setting the plumbing in a gravel base to protect it against ground movement.)

The pump motor runs on 120-volt current and must be protected by a ground-fault circuit interrupter (GFCI). I always have a licensed electrician do the power installation: The extra cost is cheap insurance against the potential liability associated with electrical mishaps. Generally, they set up a junction box near the skimmer, then I simply plug in the pump. In some areas, however, hardwiring of the pump to a remote power connection may be required.

A good tip here is be sure the electrician installs a watertight cover on junction boxes for plug-in applications.

Working the Vinyl

Now that the mechanicals are all in place, it's time to start working with the liner. With any stream/pond combination, I always start with the pond first – and for a very simple reason: The stream liner must eventually overlap the pond liner in order to prevent leaks.

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I use 45-mil, "fish-safe" EPDM as my liners. I'm not sure what the differences are in chemistry between fish-safe liners and what you might use in roofing a house, but setting aside my ignorance, if you're going to have fish in the system it makes sense to use a fish-safe liner.

Of critical importance here is proper liner sizing – or *over*sizing, as the case may be. The basic calculation is really quite simple: Just take the pond's length and width and multiply each by twice the depth of the pond at its deepest point. In this case, the basic calculation gave me a size of approximately 25-by-33 feet. The liners I buy come in five-foot increments, so I ordered a 30-by-35-foot liner. This upsizing ensures that I'll have plenty of extra to play with around the edges.

Many pondmakers install some form of underlayment before the primary liner goes in – often a thinner (4-6 mil) liner placed to protect the thicker liner from sharp pebbles or even roots – and most of the large national suppliers will be happy to sell you material to get the job done. Again, it has a lot to do with where I work, but I've never really had problems with liner leaks caused by material being punctured from underneath, so I generally don't use underlayments.

I start the installation by dragging the folded liner into the pond and then pulling it open on each side, always leaving a little slack in the bottom. When I'm satisfied that we've got it in the right position, I'll attach it to the skimmer face. Each skimmer manufacturer has a different method for making this connection, some using screws and faceplates, others using two-sided tape. Most that I've used work well enough – provided I've followed directions!

Now it's time to get into the stream and ascend toward its source. As I mentioned last time, I use 10-foot wide liners for my streams. With the widest portions spanning just over six feet, this gives me plenty of excess to play with along the edges, in the curves and in the channels of the height transitions.

On this job, we went for two 50-foot runs of liner, knowing through experience that the sheer weight of a single 100-foot run would have been unwieldy. This is at least a two-person job. I actually used

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The laying of the stream liner takes time and patience. We started by lapping about four feet of the liner over the pond then moved upslope, draping the liner pretty casually over spillways, the channel and some outlying stones (A). When we reached the first waterfall, we moved some stones to positions atop the liner (B), keeping such placements to a minimum as we created the right aesthetics. Notice the large amount of excess liner beyond the stone stream-channel markers (C): We leave the excess in place until we're absolutely certain it won't be needed.

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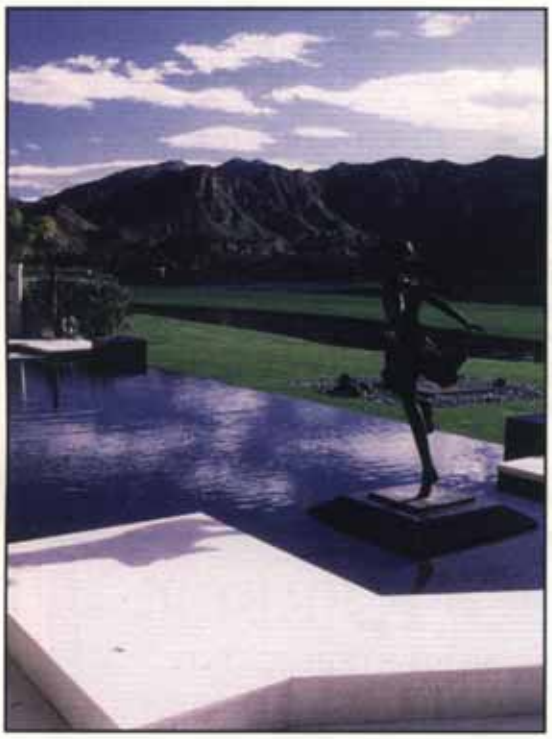

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Further upslope, you can see where we've brought in and compacted some fill (left foreground) to help define the edge.

three people for this stream project – and four for the pond. Using many hands divides the load in terms of weight, and the liner can be spread evenly in multiple directions at the same time.

I worked on the lower portion first, overlapping the pond liner by about four feet to prevent any chance of water leaking. Without that kind of overlap, I've seen situations where water will migrate uphill via a wicking action created by its surface tension in a process known as *transpiration*. I may be using a little overkill at four feet, but I don't like to come back and fix leaks!

We then pulled the stream liner up into the channel and spread it across the bottom and up the sides as we went. When we reached transition points, I took care to tuck the liner carefully in and around the contours of the large, structural boulders I placed during the excavation. Later on, I'll place the weir stones and their companions on top of the liner to set the waterfalls and lock the liner more firmly in place.

At this point, I lay the excess liner up and over the sides, where I'll eventually place rocks and create other edge treatments. I don't usually trim the liner until the end of the job – and certainly not before the system is full of water. And where the two stream liners meet, I again made sure I had plenty of overlap between the upper and lower pieces.

Reservoir In A Box

With the streambed liner in place, I moved up to install the reservoir box. These units go by a variety of names – source box or water box or spill box – and sometimes are simply known by brand names. I often use a product called Biofalls, which is sold by Aquascape Designs of Batavia, Ill.; many others are available.

Like the pond skimmer, a reservoir box is a hybrid device. It provides the stream's only "return" point or source and houses its *biological* filter (as opposed to the *mechanical* filter in the skimmer). This biological filter is extremely important for the health of the stream.

At this point in time, this is the cutting edge approach in residential water features of this kind: a mechanical filter (housing the pump), a biological filter housed in the reservoir box, bacteria treatments during the growing season – all combined with gravel and rock as coverings for the liner's bottom and sides. These elements, used in conjunction with a healthy combination of plants and fish, make for a clean, inviting and vibrant stream and/or pond.

The two-inch plumbing connects to the bottom of the reservoir box. Using flow provided by the pump in the pond skimmer, the water is forced through several layers of a material known as "bio mat." This is a basic filtration medium that captures particulates far too small to be caught in the skimmer below.

In setting the waterfalls, we use a good bit of expanding foam to seal the bottoms and backs of the stones. The idea here is to make as much of the water as possible flow over the stones rather than around or under them. When this foam dries, we simply cut the excess with a razor knife, being careful not to nick or cut the liner!

The water then flows through multiple mesh bags filled with lava rocks. Depending on size, the biofilter will have one to four bags, each containing approximately 30 pounds of lava rocks of the sort you can buy at any garden-supply store. (When you buy a reservoir box, you get the bags empty: It's up to you to fill them with one- to two-inch rocks.)

In the porous structure of these lava rocks, bacteria set up shop and consume organic nutrients in the water that would otherwise fuel algae growth. This natural process enables "living" streams and ponds to remain relatively algae-free without the use of chemicals (such as chlorine or algaecides) that can be harmful to fish and other residents of the watershape.

By the time we're finished with the stream, all of the falls, turns and transitions have been set, reset and brought into line in achieving just the effects we're after. Experience accelerates the process somewhat, but it still takes time and patience.

(The care and feeding of a living watershape is a special subject well beyond the scope of this discussion.)

After you install the reservoir box and fill the stream with water, you need to charge it with bacteria. These bacteria are widely available and consist of tablets or powders that contain billions of certain beneficial bacteria.

As was the case for the skimmer down in the pond, the reservoir box is rated for a certain flow rate. (You also need to consider total gallons in relation to the capacity of the system's biological filter.) On this job, I used a box that provided up to 4,000 gph, as required by the pump in the pond skimmer, the plumbing run and the grade differences. The opening (or weir) from which the water emerges is 23 inches wide.

I bury these boxes in the ground. This allows me to bring soil up to the top of the sides and the back, thus allowing for planting right up to the water's edge. This means that only the front of the box requires the proper amount of stone needed to create a natural look, thus allowing me to use less stone and get away from the pillar or "volcano" look.

Most manufacturers sell a faux stone for the weir, but I strongly recommend using a compatible flagstone for this all-important visual and functional component of the system. I seal this decorative rock with silicone sealant. Again, the liner connection depends on the preferences of the box's manufacturer: All I do is follow directions.

Back To The Falls

Now that the pond skimmer is in place and has been plumbed with a single line to the reservoir box, now that the liners are set in the pond and the stream and have been connected to the skimmer and reservoir box and tucked among the large boulders of the height transitions, it's time

to get back to the project's aesthetics.

The next step is the placement of the weir stones mentioned above – stones I selected for their special characteristics in the first phase of the project. Good weir stones are flat with clean edges. I surround these with companion stones that create channels in which the water flow is contained.

Once everything is ready, I place these boulders right on top of the liner, carefully placing them at the transition sections. I inspect each boulder before placing it; if I see a sharp edge, I'll use a piece of scrap liner to protect the original liner.

This is a point where intuition and extensive experience in observing natural waterways kicks in and dictates placements. I make an effort to select and include the rocks and boulders that have the most color and interesting features in and around the transitions, knowing that these are the sections of the stream that ultimately attract the most attention. And when I have a *particularly* colorful or interesting boulder, I'll be sure to place it where it will be wet when the system is running, a trick that further enhances the colors and textures of the project.

Up on top of the stream, we hide the reservoir and its weir with rocks and plantings. Now it's time to move onto the project's next phase.

I want the water to flow *over* the weir boulders and not *under* them, so I seal the backsides and bottoms of the boulders with plumber's insulation material or a bead of silicon. I know that many of us use a product known as Great Stuff, an expanding foam insulation. With the weir boulders in place, the second phase of the stream-construction process is complete – and phase three is about to begin.

Next, we'll cover boulder placement along the edges as well as other edge treatments you can set up with the excess liner. We'll also get into plantings, laying gravel, trimming the liner and stocking the stream with fish and aquatic plants.

The following information has been provided to WaterShapes by product suppliers. To find out how to contact these companies, look for the Product Information Card located on page 68.

DETAILS ON HANDMADE CERAMIC TILES

Circle 100 on Reader Service Card

CRAIG BRAGDY DESIGN has released a brochure on its capabilities with handmade, ceramic-tile murals for aquatic settings. Employing a variety of *trompe l'oeil* techniques using high-relief, textured and non-slip tiles, the company has been designing and installing murals for 40 years. The possibilities range from Persian-carpet effects and aquatic scenes to beautiful abstractions. **Craig Bragdy Design**, Tamarac, FL.

POLYURETHANE ROCK SYSTEMS

Circle 101 on Reader Service Card

FUTURA COATINGS has introduced Futura-Rock, a system that uses fast-setting polyurethane materials sprayed into molds of natural formations to produce realistic water-features. The lightweight material – up to 80% lighter than natural materials – is colored using polymer stains and is then sealed with an automotive-quality clear coat for a finish that resists fading, water stains and chlorine. **Futura Coatings**, St. Louis, MO.

FOUNTAIN PRODUCTS CATALOG

Circle 102 on Reader Service Card

CRYSTAL FOUNTAINS has published a 100-page, full-color catalog on its Defo line of waterfeature products. After defining the basic requirements for a quality waterfeature installation, the catalog covers spray jets, lighting, electrical systems, drains, inlets and accessories. Dimensions and performance data are provided, as is a table for converting from metric to standard U.S. measures. **Crystal Fountains**, Concord, Ontario, Canada.

COMMERCIAL POOL SUPPLIES

Circle 103 on Reader Service Card

BROCK ENTERPRISES offers a full line of products for use with commercial swimming pools. The company's 2000 Catalog includes everything from kickboards and safety equipment to chlorinators and pumps – with a special emphasis on automatic and manual vacuums from a range of leading manufacturers. Also offered is a wide selection of disability-access equipment, including ramps and transfer chairs. **Brock Enterprises**, Hamden, CT.

Depth Markers for Pools

Circle 104 on Reader Service Card

INLAYS offers a complete line of depth markers. For new pools, the company makes permanent, frost-proof ceramics – skid resistant for installation in decks, smooth for use at the waterline. For renovations or old pools, the company offers industrial-grade, slip-resistant vinyl tiles for deck applications and thin, beveled, tempered-glass overlays for use at the waterline over old tiles, fiberglass or paint. **Inlays**, Green Bay, WI.

Pond-Maintenance System

Circle 105 on Reader Service Card

ADVANCED AQUACULTURE SYSTEMS offers the Aquacube, a complete, maintenance-free aeration, degassing, biological filtration, circulation and foam fractionation system for any size pond. The system needs no pump, submerged wiring, chemicals or replacement parts. All units are backed by the company's free system-design services and technical support staff, with the emphasis on delivering turnkey systems to contractors. **Advanced Aquaculture Systems**, Brandon, FL.

New Shotcrete Pump

Circle 106 on Reader Service Card

REED MFG. Introduces the B50 Shotcrete Pump, designed to output up to 50 yards with a concrete pressure of 1,361 psi – a high pressure and high output that make the machine ideal for applying shotcrete. Powered by an 84-hp, liquid-cooled, turbocharged diesel engine, the machines incorporate the company's proven technologies for smooth, fast, reliable pump cycling. The frame features an integrated, locking toolbox. **Reed Mfg.**, Chino, CA.

Concrete Decking Products

Circle 107 on Reader Service Card

MORTEX MFG. has published information on its full line of concrete decking products. The 76-page catalog covers the company's Keystone Kool Deck and Marquee decking systems along with application and maintenance tools and materials. Coverage also includes the company's deck-drainage and control-joint/expansion-joint systems as well as a variety of deck and coping forms. **Mortex Mfg.**, Tucson, AZ.

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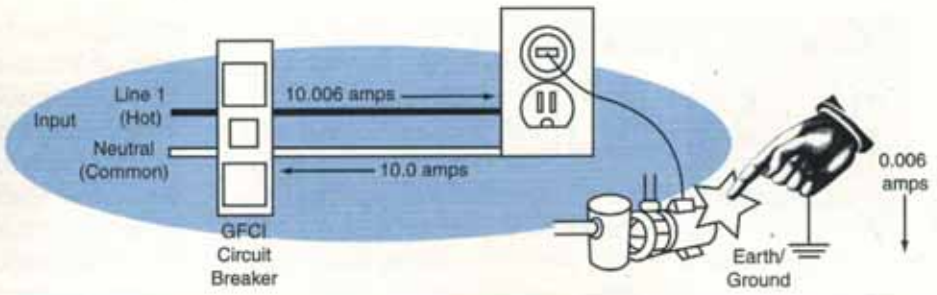
Figure 1: A pump defective grounding connection and an internal short circuit to its metal motor housing.



The shortcomings of fuses were overcome by the development of relatively inexpensive *circuit breakers*. The most common type of circuit breakers still rely upon the heat generated by the current flowing through them to do their jobs, but in a significantly different manner than a fuse.

The heart of a thermal circuit breaker is an item called a *bimetallic strip*. It is a lamination of two different metals that causes it to bend a predetermined amount depending upon temperature. The electric current passing through the circuit breaker heats the strip as it flows through it, causing the strip to bend in relation to the amount of current flowing.

When the flow of current exceeds the rating of the circuit breaker, the strip will bend far enough to release a latching mechanism that allows powerful springs to force the current-carrying contacts to open, thus "breaking the circuit." After the circuit breaker has cooled down a bit, moving its operating handle from OFF to ON will close the contacts and reset the latching mechanism. (You can feel the tension of the springs when you reset the breaker. It's much liking cocking a gun.)

Personal Protection

While there is no doubt that the circuit breaker's ability to be reset makes it a far more desirable product to live with than throw-away fuses, it must be remembered that their primary missions are the same – to prevent fires in a building's wiring and in any appliances connected to them. *Neither of these devices provides any protection against electric shock to people.*

The problem with people and all things electric is simply a matter of dosage. We people can take electricity only in very, very small doses. We surround ourselves with appliances and devices requiring many amperes to operate, yet when we talk about the human being and electricity, we must talk in miniscule fractions of an ampere. In fact, we must deal in *thousandths* of an ampere to be on the safe side.

Several tables have been published through the years showing the effects of various amounts of electric current passing through the human body. A sampling: For men, a tingling sensation starts at 0.0011 amps; for women, it starts at 0.0007 amps. For men, a painful shock from which they can still let go begins at 0.009 amps; for women, that's 0.006 amps. For men, a severe, painful shock from which they can't let go and which causes breathing to stop starts at 0.023 amps; for women, it commences at 0.015 amps.

(I have often wondered where in the world they find the volunteers for these

The problem with people and all things electric is simply a matter of dosage. We people can take electricity only in very, very small doses.

studies. What possible inducement could there be that would entice someone to have their breathing stopped?)

There's general agreement that an average, healthy adult will survive a short-duration electric shock not exceeding 0.006 amps. He or she certainly will know what's happened, but it's possible to walk away from this level of exposure with no lasting trauma.

Now think back to the 20-ampere fuse or circuit breaker protecting the wiring in a house: That's over *three thousand times* the amperage required to hurt the human being!

Fortunately, we now have a device whose primary mission is to protect people from electric shock: the *ground-fault circuit interrupter* (GFCI). That name requires a bit of explanation: a "ground-fault" exists any time the electrons flowing in a hot conductor find a path to earth/ground. That path is called a "circuit," thus "ground-fault circuit." This device will sense the existence of a ground fault circuit and "interrupt" (or *open*) the circuit to stop the flow of current.

Generally, it takes two failures in a product to set the stage for a ground fault that may be hazardous to people: an electrically hot conductor inside the product must be touching the metal housing of the product, and the grounding conductor normally connected to that metal housing must be broken or missing – or its connector is so loose that the grounding connection is no longer adequate.

In The Field

These potentially life-threatening failures can be brought about by a defective installation, negligent repair techniques, abuse of the product – or reasonable wear and tear, in the case of the internal circuit conductors.

Let's take a look at what happens when a failure occurs (Figure 1 on page 66). Here we see a person getting a mild shock from a defective pump. The ground-fault circuit starts where the person's hand is touching the pump and continues through his body to his foot, which is in contact with earth/ground.

The numbers in the figure indicate that the pump is drawing 10.0 amps.

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Product Information Card

For more information on advertisers and/or products featured in this issue's Of Interest *section, circle the corresponding Product Information Number on the postage-free card opposite this page.*

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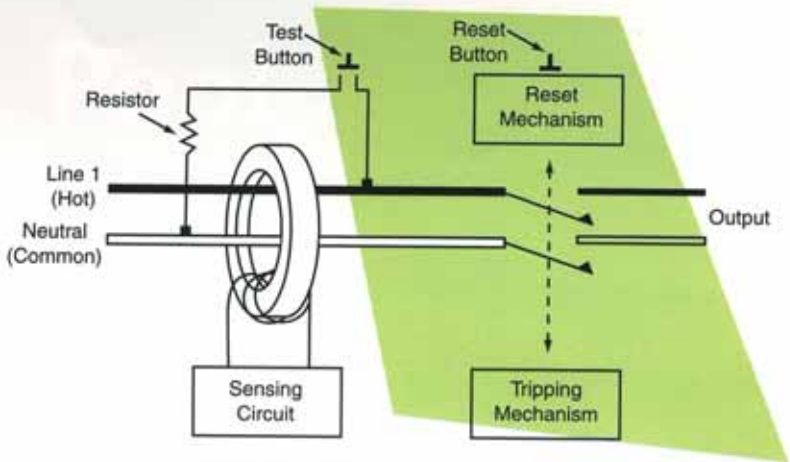
Figure 2: A 120-volt GFCI, shown tripped.



The laws of physics tell us that if there are 10.0 amps of current flowing into the pump motor, then there must be 10.0 amps flowing back to the source at any given instant in time. Because of the ground fault, however, we see that 0.006 amps are flowing through the person to earth ground, so we have a situation where 10.006 amps are flowing *into* the motor, and only 10.0 are flowing *back* to the source.

It is the job of the GFCI to monitor the amount of current flowing from the source to the appliance and back to the source, and to *interrupt* the flow of current any time an imbalance is detected that exceeds 0.006 amperes.

Now let's look at a typical GFCI (Figure 2). Note that the Line 1 conductor and the neutral conductor both pass through the hole in the donut-shaped differential transformer. Any time an electric current flows through a conductor, a magnetic field is generated around that conductor.

That magnetic field would be sensed by the transformer, and a voltage would be generated that would be sent to the sensing circuit. But because both the Line 1 and neutral conductors are passing through the transformer together and their normal voltages are exactly the same, the two magnetic fields cancel each other out and no voltage is generated to be sent to the sensing circuit.

In a ground fault condition such as that depicted in Figure 1 on page 66, the Line 1 and neutral voltages will *not* be exactly the same: They will differ one from the other by the 0.006 amps of ground-fault current flowing through our person. The two magnetic fields will *not* cancel each other out, and a small voltage will be generated by the transformer and sent to the sensing circuit.

There the voltage is amplified and sent to the electromagnet in the tripping mechanism. The energized magnet pulls in a latch that allows spring pressure to open the contacts in both lines, shutting off all current flow. All this happens in less than 0.05 seconds.

All GFCIs are equipped with a test circuit to allow the user to be assured that the unit will work properly when needed. When the test button is pushed, it causes a small amount of current to flow through the transformer on one conductor only, thus simulating an imbalance such as would be caused during a ground-fault condition. It is a good practice to test GFCIs frequently.

For some years now the combination GFCI/circuit breaker has been available. These devices replace regular circuit breakers in panel boards and sub-panels, providing us with the best features of each unit in one convenient package.

In a future article, I will address specific uses of GFCIs as required by the National Electrical Code – with an emphasis on their use around watershapes of all types.

Jim McNicol is a technical consultant to the swimming pool, jetted bath and spa industries. He works from a base in Orange, Calif.

Shocking Truths

By Jim McNicol

In the spring of 1941, my mom and dad, my sister and I moved into our brand-new house on Ardmore Avenue in one of northwest Detroit's real estate developments. It was a thoroughly modern house, with all of the latest high-tech features – the garage door moved upward to open, instead of swinging left and right like barn doors, and the furnace in the basement was operated by natural gas, eliminating forever the need to shovel coal. The house cost $5,550.

From an electrical standpoint, the house was up to the codes and standards of its day – albeit a far cry from what is required today. The wiring was a two-wire system with no ground. All of the receptacles had two equal-size slots, and that was just fine because anything we wished to plug into these receptacles had a two-pronged plug at the end of its cord.

A fuse panel in a bedroom closet contained four 15-amp fuses. That was it: four fuses to protect the entire house. When considered from today's viewpoint, it sounds totally inadequate. In retrospect, however, I must admit that our family, as most in that era, probably didn't own enough electric appliances to overload those fused circuits, even if we had plugged everything in at the same time.

Safety Factors

The primary goal of those four fuses was to prevent fires due to overloaded wiring. That's a legitimate concern: Any time a defective appliance causes too much current to flow, the wiring in the walls of the house can become hot enough to start a fire. Or, if there's a breakdown in the insulation of the house wiring, a heat-producing short-circuit can start a fire. In either case, the fuse on the associated circuit will blow and stop the flow of electricity.

"Melt" might be a better word than "blow," as is indicated by the Latin root for the word *fuse* – that is, *fusus,* meaning "to melt or pour." That is actually what takes place within the fuse: All of the electric current running through a fuse passes through a short link of metal that has a relatively low melting point.

The fuse manufacturer uses links of various melting points and different thickness to create fuses that will melt at different amperage levels. If the amount of current flowing through the fuse exceeds the fuse's amp rating for a predetermined length of time, the fusible link will melt, stopping the flow of electricity.

Unfortunately, a fuse is a one-time device. Once the fusible link has melted, the fuse must be replaced – a substantial drawback, because if you don't have a spare close at hand, you're going to be left in the dark. Horror stories abound about quick-fix schemes to repair a blown fuse.

Putting a penny in the fuse socket and screwing the blown fuse on top of it to hold it in place is a favorite. I don't know if anyone has ever calculated the current-carrying capacity of a penny, but my guess would be more than 100 amperes. Frightening.

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