Inside: Brian Van Bower on Making Impressions

WaterShapes

Design • Engineering • Construction

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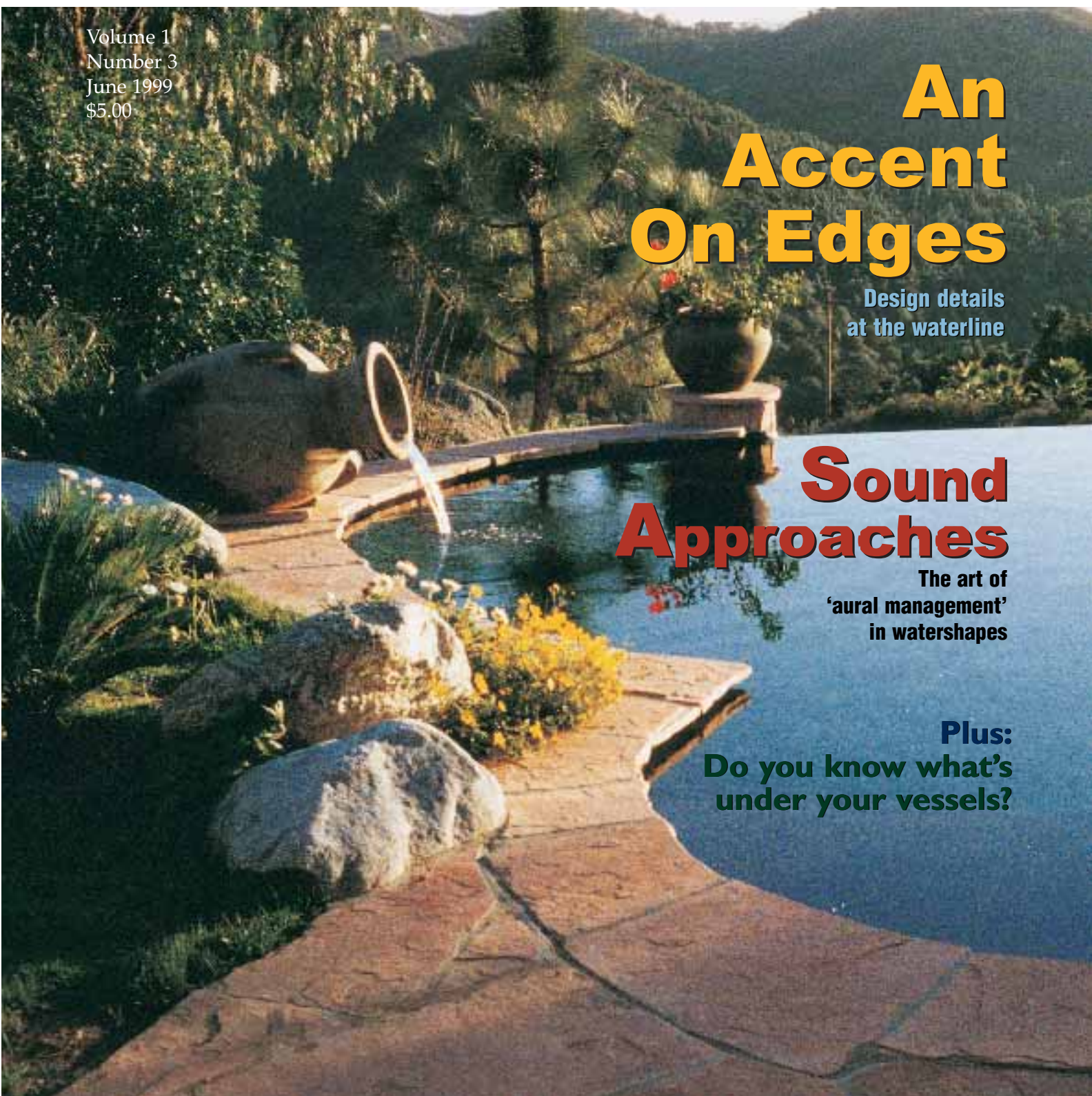

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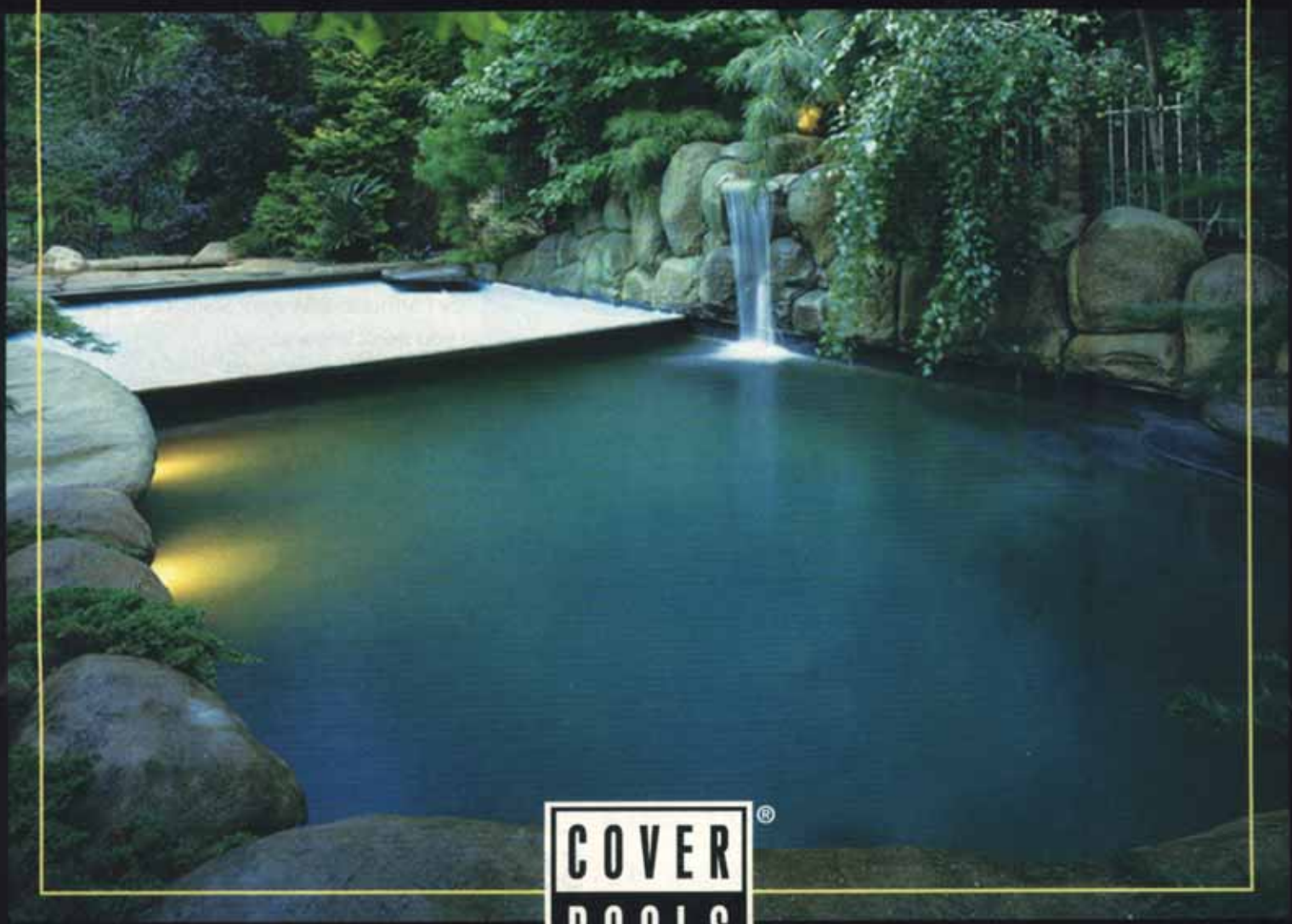

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On the cover:
Photo courtesy
Questar Pools, Escondido, Calif.

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By Eric Herman

Beginning with the Finish

Back in August 1989, I experienced my first day in a brand-new job covering pools and spas for one of the industry's trade magazines. My first assignment: attend a meeting of a small group of subcontractors calling itself "The Plasterers Council."

I didn't know much about plaster and had absolutely no idea what to expect. I was, however, extremely curious to find out just what it was that these people had to talk about. After all, what was plaster beyond the white stuff on the inside of every pool ever built?

What I thought would be an exercise in staying awake turned out to be an evening bristling with anxiety, urgency – and even anger. At the time, the plastering trade in California was facing an epidemic of gray mottling. Many businesses had gone (or were going) under in the face of lawsuits and an incredible demand for replastering of jobs just completed. The "survivors" were now banding together in hopes of finding answers to a massive problem.

As time passed, I learned that plasterers across the country – and especially in Florida — were facing similar problems. Eventually, these initial gatherings of plasterers became a collective effort to solve far-flung problems. I had witnessed the birth of what was to become the "plaster movement."

The bottom line was plain: Because customers cared enough about their finishes to sue pool builders and their subs when things didn't look right, swimming pool plaster was (and still is) very, very important.

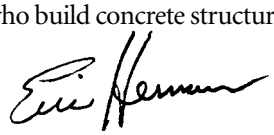
In the nearly ten years since that meeting, a great deal has happened in the plastering industry. Research projects both formal and informal have fueled debate, conjecture and more research. New products have come on the scene, each designed to provide options of form or appearance and/or greater resistance to staining, etching and mottling.

Most significant, companies that once considered themselves as "Plasterers" are now "Surface Specialists" offering an array of finish options. In short, common white plaster has changed a lot and come a long way in a fairly short time.

In this issue, we at *WaterShapes* commence our own coverage of interior surfaces with two features: In "Pebbles, Pozzolans and Polymers," Greg Garrett looks at the evolution of pool plaster and tracks the onset of new admixtures designed to improve the product (see p. 48). In "A Classic Restored," Steve Lucas expounds on the task of pulling off a massive resurfacing job using one of the industry's newer surfacing technologies.

In this pair of features, we see how the materials science behind plaster is evolving; we also explore the application of cement-based interior surfaces at the highest performance levels. And these two stories are just the beginning of what will be an ongoing look at surface technology and applications.

Although many of the questions about white plaster and its offshoots remain, there is no doubt that the examination of these questions remains among the most fascinating journeys to be taken by those who build concrete structures designed to hold water.



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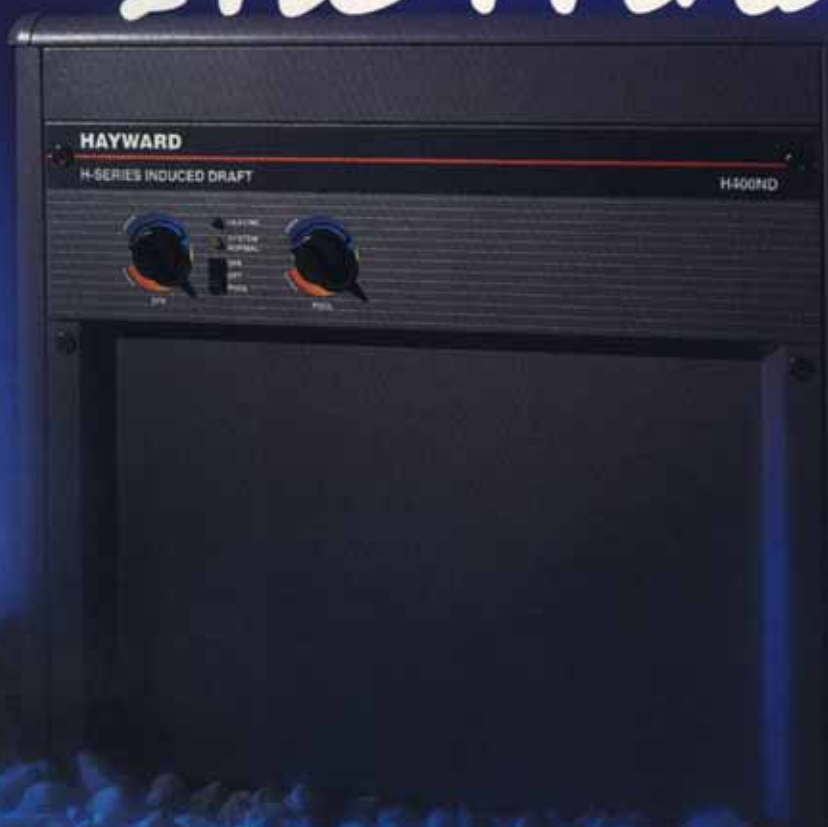

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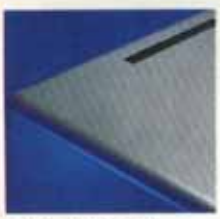

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Letters
June

Where Does It All Lead?

Your first issue contained an article on special engineering of pools by David Tisherman ("Integrity Below Grade," Feb. 1999, p. 22). We also build residential pools in Los Angeles, so this story was of particular interest to us and sparked considerable discussion in our office. Mr. Tisherman can be commended for his thorough explanation of what goes into a special engineering project and why.

It may be the sign of a good magazine article that it gives one pause to reflect on the matters involved. If so, Mr. Tisherman deserves full credit for a most thought-provoking story. Here are a few of the questions I would like to share with your readers:

1) Mr. Tisherman was hired to give expert testimony in a legal matter to obtain a settlement for his client from the builder of the first pool. Subsequently, he contracted with his client to build a new pool. Is this not a conflict of interest? If only to avoid the appearance of impropriety, would it have not been preferable for Mr. Tisherman to have been content with his fee for witness rather than to have gone on to hire himself out to build a whole new pool? What is proper behavior in this type of circumstance? When the title of your article is "Integrity Below Grade," do you not invite scrutiny of your motivations and actions?

2) Mr. Tisherman was instrumental in obtaining a settlement for his client "well in excess of $300,000" for a pool that was built originally for less than $50,000. Since this settlement was out of proportion to the cost of the project, may we assume that it was accepted by the builder's insurance company rather than the builder? The builder, after all, would have great incentive to either fight the matter in court or tear out and rebuild the pool himself – or declare bankruptcy before paying out six times the cost of the job.

3) Mr. Tisherman states that the foundations for the new pool cost almost as much as the original pool did in its entirety. Assuming demolition costs of $10,000 to $15,000, foundation costs of $50,000 and pool shell and deck costs of $60,000 (all generous amounts based upon the photographs of the original pool and topography), how is the balance of the settlement – some $200,000 – possibly justified?

4) Assuming this to be an insurance matter, who really pays for such excessive settlements? Will not the insurance companies pass these costs onto the rest of us in the form of higher premiums or cancellations? If so, won't this mean higher-priced pools and perhaps fewer pools built? Isn't it likely that higher insurance and pool prices will persuade more contractors and homeowners to circumvent the process and engage in the so-called "pool consultant/owner builder" manner of construction? Who protects the buyers' interests under those circumstances?

5) What was the original contractor's true liability for the pool failure? Mr. Tisherman tells us that poor soil conditions doomed the pool to fail. If so, why would the pool builder be at fault? Was he blameworthy because he did not force the buyer to get a soils report or because he lacked Mr. Tisherman's ability to assess the inferiority of the soil merely by looking at it? If the municipalities do not demand soils reports and jobs proceed with all required inspections and approvals only to go bad in the end, is the builder still to blame?

6) Don't all pool contractors require that the buyer represent the suitability of the soil for pool support? If this contractual proviso is emasculated, doesn't this render our agreements nothing more than spec sheets?

7) If our contracts are worthless, won't we all have to protect ourselves by requiring soils reports no matter what the site conditions are? Or perhaps such large liability settlements will prompt municipalities to demand soils reports on every job, something that is already happening. Won't this increase time and expense to pool buyers (because soils engineers invariably load up a job with costly drainage and engineering details regardless of the efficacy), resulting in a shrinking pool market?

8) Mr. Tisherman is in favor of high standards. We *all* are in the abstract. But one must be aware of the law of unintended consequences: If we raise requirements and standards so high as to make the cost of pool ownership prohibitive, who benefits? When we abet the litigious elements in our society by facilitating outrageous settlements, who benefits? I laud Mr. Tisherman's construction expertise; I even admire his efforts to educate other builders on how to improve their skills and profit margins. I can only hope that he will pause to consider the wisdom and morality of his actions in this case before he continues his crusade. After all, do we want to turn our industry into one that caters solely to the rich composed solely of those who can afford to litigate with them?

Bernard Zimring
Aquatic Pools
Mission Hills, Calif.

David Tisherman replies: Two quick points before I get to the important part of my response:

• I was brought in by the homeowner at the recommendation of geologists and engineers to evaluate the old pool and was then hired by him as an expert witness. My client eventually won a legal judgment in excess of $300,000; the builder, however, was uninsured and went bankrupt. At that point, the homeowner decided to underwrite the full cost of the reconstruction project on his own. As I had been hired as my client's expert, not as a neutral party, I was under no obligation, moral or legal, to dissolve my relationship with him. There was no conflict of interest.

• The project is costing what it is costing because of its

Continued on page 10

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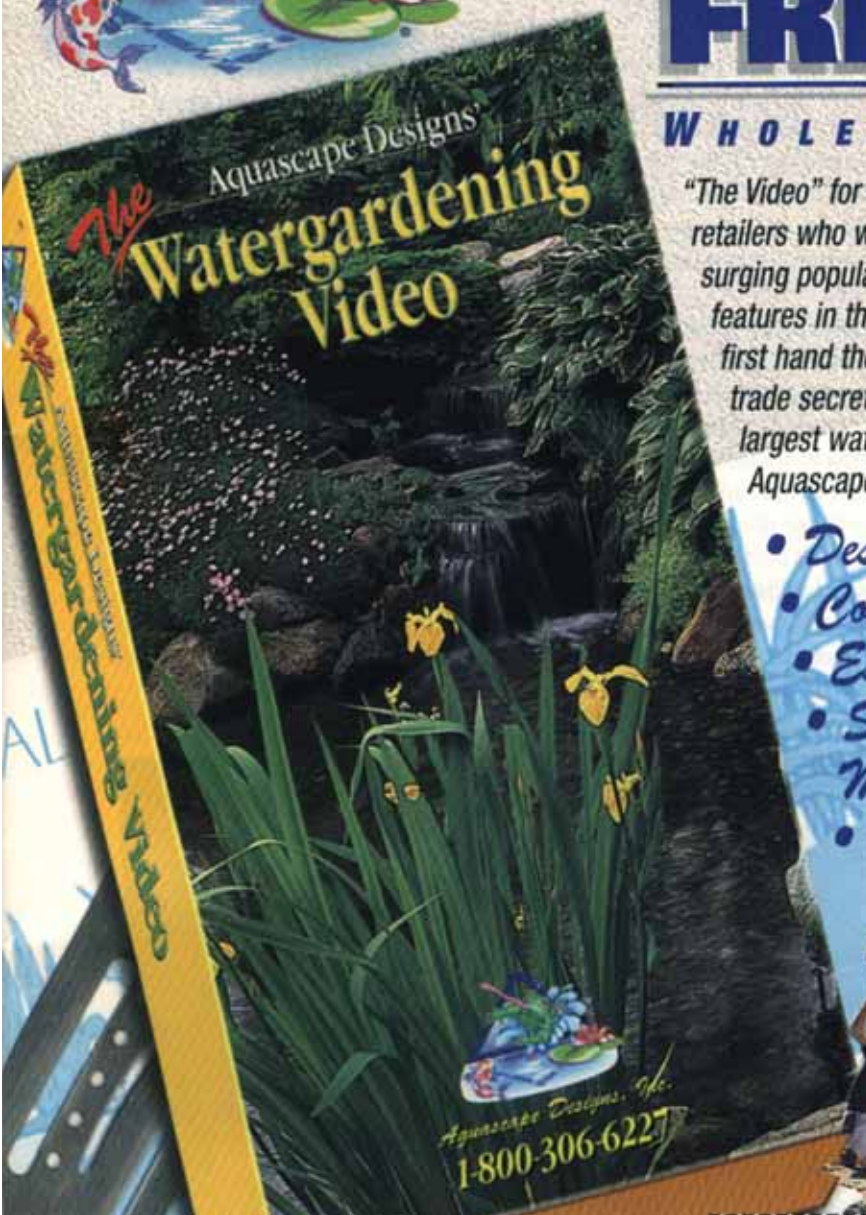

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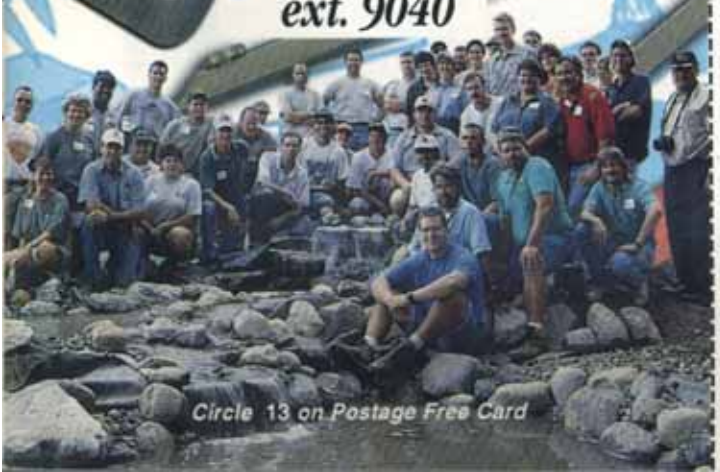

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 Continued from page 8

broad scope and terrible site conditions. As contractors, we must understand that soils come in many types – and that they don't all behave in the same way in supporting pool shells. When soil is bad, as it certainly was in this case, *it* dictates the structure and the steel and the concrete, not the contractor. To overcome the problems, we built extensive drainage systems and massive foundations for the pool, spa, structural deck and fountain as well as decks and patios, then we applied finish materials of uncompromising quality for a discerning client. From day one, every cost associated with this project has been justified to the client's complete satisfaction.

Simply put, the facts of the matter are quite distinct from Mr. Zimring's negative interpretation.

Of far greater concern is his assertion that the customer is or should be the "responsible party" in matters of construction. The *builder* is the expert.

As I see it, we in the pool industry have two options. One is that we step up as professionals, recognize that sub-standard soil conditions are the primary cause of structural failures, and seek professional assistance in designing and building pools that will last. The status-quo alternative is to plant entry-level structures into soils with potentially catastrophic defects, then rely on the fine print of our contracts to hide from our responsibility. We can also increase our promotional efforts to compensate for the damage created by our lack of image.

In my book, building a pool that cracks is the moral equivalent of highway robbery. To turn around and then blame the customer after it cracks is adding insult to injury – and taking immorality to all new levels. Not every area has bad soil, but why risk it if there's any doubt? If there's any doubt, what can it hurt to know for certain what you're building on? Hillsides are tricky, so why take chances? My point is and has always been that pools should not be built unless they are suited to the underlying soil conditions. To build without knowledge of those conditions is the real error – one I will not make.

Further Defining Roles

I enjoyed your April issue of *WaterShapes*, but I must correct some things said about landscape architects in the *Natural Companions* column on "Defining Roles" (p. 14).

In California, landscape architects are not "licensed to do all types of retaining work." Generally, building departments want to see an engineer's calcs for anything more than 3 feet high. We are not trained to do tall retaining walls. Nor can we "operate essentially as contractors." A landscape contractor's license is a separate license in California and landscape architects cannot do the work of contractors. A contractor can design a landscape if he or she installs it, but otherwise a design/build firm must have both licenses.

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IN THIS ISSUE

JUNE'S WRITERS

PHILLIPS

Skip Phillips is president of Questar Pools, a 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.

Larry Parmelee and **Wayne Schick** are principals in Parmelee-Schick & Associates, a geotechnical services firm based in Studio City, Calif. An engineering and project geologist since 1983, Parmelee specializes in geologic and soils issues pertaining to hillside residences in the greater Los Angeles area. His work includes geologic escrow appraisals of hillside properties and structures, hillside residential tract-development consulting, construction-feasibility evaluations and expert-witness services. For his part, Schick, who also has been an engineering geologist for 16 years, prepares project proposals and conducts a variety of geologic field studies, including seismic trenching, "down-hole" examinations, the logging of borings and test pits, slope-stability analyses and preparation of formal reports for structural engineers, contractors, architects and building officials.

Rick Anderson is owner of Ston Wurks, a landscape-design firm in Columbia, S.C. A designer and artist with 21 years of professional experience, Anderson 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

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and spiritual relationships with the land. 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.

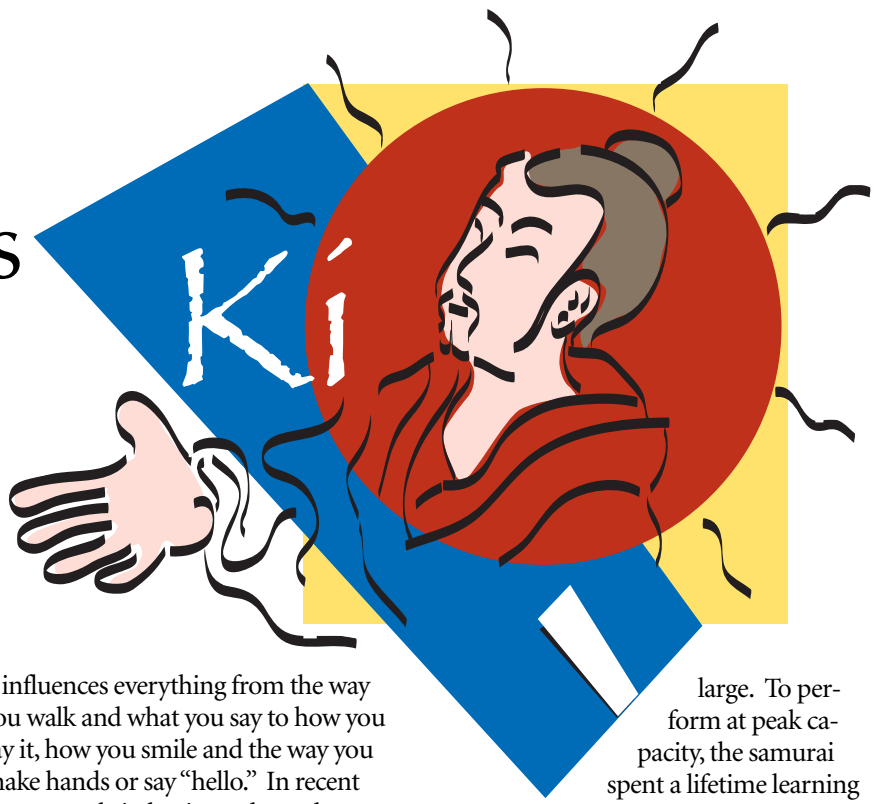
Greg Garrett is director of operations and research for Mason Mart, a distributor, blender and manufacturer of cement products based in Phoenix, Ariz. Garrett has been part of the pool industry for nearly 30 years, beginning in 1970 in his father's company, Patio Pools of Sierra Vista, Ariz. He later served as a superintendent, service supervisor and field-operations manager for Shasta Pools in Phoenix for 13 years, becoming involved in virtually every aspect of swimming pool and spa construction. Garrett is past chairman of the National Spa & Pool Institute's Builders Council (1994); he is also a past regional vice chairman for the National Plasterers Council. Garrett began studying cement and plaster science in 1983 in an effort to better understand plaster phenomena. Since then, he has read dozens of texts on the subject, conducted numerous informal experiments and lectured or written on the subject in several trade and technical journals.

Steve Lucas, president of Innovative Pool Plastering in Coral Springs, Fla., has been in the pool-construction business for more than 20 years. He is no stranger to large-scale projects: While president and owner of Aquatic Concepts, a commercial and residential construction firm, he supervised all elements of construction for the $1.5 million pool for the Marriott Hotel & Casino in San Juan, Puerto Rico. He also has worked extensively as a construction and hydraulic-design consultant and as a pool-chemistry instructor and field consultant. He also served on the supplier side of the market, working as national sales and technical-services manager for C.L. Industries, a supplier of interior surface materials, before founding Innovative Pool Plastering. Lucas has been active in both the National Spa & Pool Institute and the Construction Specifications Institute.

LUCAS

Solid Foundations

By Brian Van Bower



When it comes to just about anything that matters in life, whether personal or professional, the difference between success and failure is often your mindset and the attitude you bring to each situation, event or occasion.

That's a huge generalization, but it's something I consider each and every time I prepare myself for something important – such as meeting a prospective pool client face to face for the very first time. I know at times like this that my performance will be determined by how I feel and that how I feel will directly influence my ability to get results.

Yes, it's important to be prepared with as much information about the client as possible. Yes, it's vital to have confidence in your products and be familiar with all the options and possibilities you may want to present to your customer. All those things are important, even critical, but none of them come anywhere close to the power of your mindset.

'Ki' is Key

What I loosely refer to as "mindset" is something known for centuries to samurai masters as your "Ki." This is a big concept and may seem strange or mystical or even silly at first, but stay with me here because this is powerful and truly *practical* stuff – and I'll declare right up front that it's changed my life.

Ki (pronounced "kee") encompasses all aspects of your being. It is the blending of mind, heart and spirit, and it influences everything from the way you walk and what you say to how you say it, how you smile and the way you shake hands or say "hello." In recent years, people in business throughout the world have embraced this concept as a way to increase their chances of success in business; they've also found it works wonders in improving their personal lives and in helping them become healthier, happier people.

There are lots of ways to get acquainted with your Ki. I first learned about it through *Samurai Selling*, a book by Chuck Laughlin that does a great job of linking these concepts to the real world. He begins by making a strong case for looking to ancient cultures for ideas that can be applied today, the thought being that when you dig into concepts that have endured through hundreds or even thousands of years, you'll find that there are reasons for their staying power.

And when you look at the origins of Ki in this way, it's clear that the Japanese were onto something big.

For most people, the word *samurai* conjures images of swords and fierce combat. But the samurai were about much more than war; indeed, they trained ceaselessly to serve a single lord and his family and the community at large. To perform at peak capacity, the samurai spent a lifetime learning about and tapping into a power that flows through the universe – a power available only to those in harmony with it.

In reaching that harmony and the inexhaustible power to which it gave access, the samurai trained body and mind to focus only on what was truly important at a given moment. They practiced this until they could do it without conscious thought or strain. When body, heart and spirit were in harmony, others would sense this quiet confidence as a presence, an internal power.

What does this quiet confidence and power have to do with selling swimming pools? To my way of thinking, just about *everything*.

First Impressions

When you first walk into a client's home, you send a variety of important and powerful messages – all without even realizing it.

Have you ever noticed how some people can walk into a room and everyone takes notice? (And I'm not talking about the ones who've had expensive

surgery.) There's just something about certain people, a power, a presence, something "magnetic." What you're sensing here is these individuals' Ki. (By the same token, we all know people whose Ki is so weak they can walk into a room and actually make it seem as though somebody just left.)

Recognizing the Ki of another person is not some strange psychic skill: We all have the ability to do it, and even animals can detect your Ki. Dogs, for instance, instinctively know if you like them or if you're afraid – and they react accordingly. For those of us who started off in pools through the service industry, we know really well that this one aspect of Ki all by itself can have a significant impact on how well your day goes. Some people just don't ever have problems with dogs, while others are in danger around Chihuahuas.

In a sense, we all have a bit of the pooch's instinct about us. We react favorably to those individuals with a positive Ki and by contrast have negative reactions to those people who give off bad vibes.

Your prospective customers are no different from anyone else you meet, but it just so happens that they are paying particularly close attention to you when you show up at their door and ask them to spend tens of thousands of dollars. Obviously, you want them to have as favorable an impression of you as possible. The primary way you achieve this is through your Ki.

Let's break this business about your Ki down to more objective terms: People who study interpersonal communications have come up with some interesting numbers relating to the ways we communicate with each other. According to *Samurai Selling*, for example, only 7% of our communication occurs through words. Fully 38% of our communication is accomplished by tone of voice, our inflections and the subtle nuances in the way we speak – and a whopping 55% is *nonverbal*. In other words, we say far more with our gestures, our facial expressions, how we sit and stand and the way we carry ourselves personally and professionally than we ever will by the things we actually "say."

Knowing this, you can turn your Ki into a powerful tool.

Ki at Work

Through your Ki, you convey a tremendous amount of information about your products, your services, your company and, indeed, yourself.

All of that information is being absorbed by your customers, and the main point to recognize is that conveying it is all *under control of your subconscious mind*. In other words, you can't fake a good Ki, no matter how hard you try; the words and effort simply won't align with the spirit behind them – and your customers will sense it instantly.

In fact, we all place a great deal of trust in non-verbal communication, whether we know it or not. The driving force behind that trust is simple: By whatever means, we've learned to accept non-verbal communication as accurate, just as we learn to distrust the words we hear, even when we don't have an immediately identifiable reason to do so.

We've all had this sort of experience. When you think, "Something here just isn't right," most of the time, it's not. That's your mind picking up on the disharmony between Ki and the immediate circumstances.

If your message and your Ki are out of alignment, you can talk all you want about the excitement of owning a pool and how great the tile will look or how much fun lounging in a beach entrance can be, but odds are it won't be understood or believed nearly as readily as it would if you were conveying positive information with your body and your presence.

In this way, Ki is power. It's a power that comes from being a competent professional, knowing your products, understanding the marketplace and, most particularly, knowing all you can about the customer. It all works together: If you know what your prospects' goals (and problems) are and you have a willingness to work with them to find answers, you'll be in a much stronger position to give them what they want.

Just like a samurai, you use your Ki to focus on what is most important at that moment. Your strength of presence is focused on your customers, allowing no distractions, no excursions, no hype. You are not worried about yesterday or concerned about tomorrow. Through your Ki, you are in the here and now – focused, listening, thinking, learning, finding ways that you can serve your customers in the here and now – just like a samurai.

Finally, Ki works because it is *passion*. More than a message, it's a *vision*. If you're passionate about your cause and have a clear vision of where

Ki is power. It's a power that comes from being a competent professional, knowing your products, understanding the marketplace and, most particularly, knowing all you can about the customer.

you and your prospects should be going, chances are better than good that your prospects will follow your lead. It's really as simple as that.

Five Goals

It's important not to fall into the trap of thinking that all this "Ki stuff" exists in some sort of spiritual superworld: In actuality, it's all about your own personal well being, and it's so grounded in reality and so powerful that it should even scare you a little. When I came onto all of this, for instance, I was amazed by how easily (and immediately) these ideas translated into real life and real situations.

A practical way to better understand and strengthen your Ki is to set some basic goals. Start by asking yourself, "Do I have personal goals that will help ensure my happiness?" In my case, I live by five important ones I found in another wonderful book, *Unlimit Your Life*, by James Fadiman.

❑ **Be willing to be happy.** This is the fundamental note to which our lives are tuned. It requires that one be unwilling to suffer passively and willing to reject defeat, limitation, weakness, stupidity or illness to the greatest extent you are able. Being "willing to be happy" means accepting the idea that you *deserve* happiness. Being "willing to be happy" is not the same as *being* happy, but it consciously establishes your happiness as a goal and supports the tree that sprouts from the seed of self-acceptance.

❑ **Increase your capacity to love.** Only those who are able to love are fully human, fully alive. Once you make the commitment to personal happiness, then a natural expression of that happiness is to take pleasure in being with other people. As happiness breeds happiness, so love and affection breed more love and affection. It's critical to improve our capacity to love: Like taking water from a bubbling well, giving love to others in abundance does not diminish the supply. Often, the more it flows, the more it flows.

❑ **Enjoy your work.** We all have to do something, and we might as well enjoy it. Two questions to ask yourself about your relationship to work: "Do I look forward to getting down to work?" and "Do I feel I've done a good job by day's end?" If your answer is yes to both, then you're succeeding in this arena. If the answer to one or the other is no, however, then you have some serious thinking to do. And it's not all about money: Indeed, research shows that there is almost no correlation between work satisfaction and wages, as long as the wages are reasonable for the job in question. What you do matters much, much more than what you make.

❑ **Be healthy.** There is nothing so central to success as the appreciation of our own physical well being. Without good health, your other goals

– personal, financial, social or professional – soon lose their appeal and zest. By contrast, when your body hums with good health, everything you are and everything you do is heightened, maximized, more exciting.

❑ **Radiate inner integrity.** What this quality gives you is a capacity to have great control over your own life without having a parallel need to change or restrict the lives of those around you. The need to control others often arises out of a fear that we will get less or not be accepted – or that we will lose love or be passed over. Inner integrity increases our capacity to achieve what we wish in this world without limiting anyone else's opportunities. Furthermore, reinforcing the inner integrity of others turns them into allies.

The Whole Package

I've personally used these goals and the power of Ki to make a better life for myself in a number of ways, professionally and personally. It doesn't mean I'm *always* successful or *always* happy, but it sure stacks the deck in my favor.

If you find your own inner strength and learn to use your own Ki, you'll find that when bad things do happen and life throws tough curves or challenges your way, you are better prepared to cope, face your troubles and ultimately solve your problems and meet your needs.

The sidebar on this page offers a short reading list, and I urge you to check out these ideas. I'd be willing to bet that you'll find that you really do have the power to have a better life – and be really successful in selling swimming pools, too.

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.

'Ki' References

If you want to learn more about Ki and similar disciplines, I suggest reading the following:

- *Samurai Selling*, Chuck Laughlin and Karen Sage. St. Martins Press, 175 Fifth Avenue, New York, NY 10010.
- *Six Great Ideas*, Mortimer J. Adler. Macmillian Publishing Company, 866 Third Avenue, New York, NY 10022.
- *Unlimit Your Life: Setting and Getting Goals*, James Fadiman, PhD. Celestial Arts, P.O. Box 7327, Berkeley, CA 94707.
- *The 7 Habits of Highly Effective People*, Stephen R. Covey. Fireside/Simon & Schuster Inc., 1230 Avenue of the Americas, New York, NY 10020.

– B.V.B

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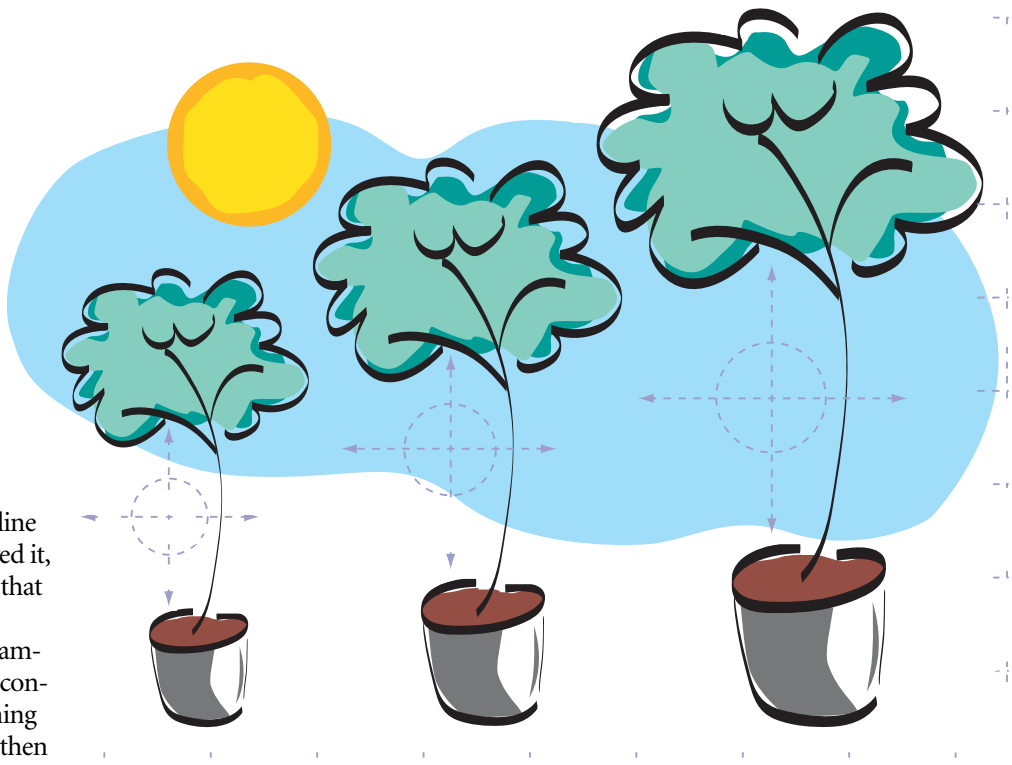
Size Does Matter

By Stephanie Rose



Surely you've heard this line before and never believed it, but I'm here to tell you that size *does* matter.

Have you ever, for example, built a pond or fountain with concrete either surrounding it or fanning out from it beneath the soil – and then had your clients say they wanted a very mature tree or shrub planted right up against the edge? There you are with six inches of soil (maximum!) to work with, and there's just no way to get a 24-inch box into the space.

Now what?

The size of the plant itself, the size of its container and the size of the hole into which it'll be placed all need to be taken into consideration from the start if you want your final product to be its best. By considering the sizes of the plants your clients want, you can better accommodate them in your overall design, eliminate problems before they arise and make yourself a hero in your clients' eyes.

Thinking About Size

Say, for instance, that your clients want a tropical look with palms, ferns and other large-leaf plants. Assume also that they don't want to wait years for the palms in particular to mature to a reasonable size – and are willing to pay for a large container.

Generally, palms are very slow growers. To get one that fits these clients' needs, you'll probably have to use a 24-inch box, or perhaps even a larger container. A 2-foot-high Phoenix roebellini (pygmy date palm), for example, will usually only be found in 24-inch (or larger) boxes. This requires a planting space at least 2 feet in depth.

If your plan provides for this space, there's no problem. If not, your clients may ask you to tear out part of the watershape to accommodate the plant – which could be *disastrous.* The clients will be unhappy because the design won't look the way they envisioned it, and you'll be upset because you have to jeopardize the integrity of your structure or plumbing to allow for something that should have been considered from the start!

That's why I make it a policy to ask, before we break ground, what types of plants my clients want in their yards and, in a general sense, where they want them. Now is the time to determine how close to the watershape the plants will be and where the planting beds will go.

But don't stop there! As I said before, if your clients know what plants they want and can clearly draw or explain it to you, you're ahead of the game. If not, it's time to bring in a landscape architect or designer.

Working With A Plan

Drawings and plans are always the best way to avoid mistakes – and having them in hand before you begin your watershaping project is the best tool you can have as you do your own designing and planning. You won't have to make "field adjustments," for example, or stop in midstream to re-coordinate with the other trades involved in the project. Distractions of these kinds can cost you lots of time and money.

Incidentally, if your clients aren't comfortable working with a plan and would rather plant "visually" later in the project, my suggestion is to avoid problems by assuming they'll want the largest, most mature plants possible right up

against the edge of your watershape. If that's *not* what they decide, you've given yourself plenty of flexibility.

When it comes to plantings, there are two main considerations: the types of plants and the sizes of their containers. Let's look at plant types first, then turn our attention to the chart that follows.

❑ **Ground cover:** These plants usually come in flats or quarts but sometimes even in 1-gallon containers. They usually require the least amount of planting space; under any circumstances, however, your safest bet is to leave at least six inches of soil depth.

❑ **Shrubs, perennials and annuals:** This category constitutes the largest group of plants. They may come in every sort of container from flats to 24-inch boxes; generally, however, herbaceous perennials and annuals come in quarts and one- or five-gallon containers. The smaller plants will require the minimum six-inch soil depth.

❑ **Trees:** The smallest containers in which most trees are sold are 15 gallons. If your clients tell you they want a tree, it's safe to assume you'll need space for a container of at least that size in your plan. But I suggest it's better to be safe than sorry: Leave room for at least a 24-inch box.

It's also important beforehand to determine whether or not the selected plants have invasive root systems. It would be a shame, after all, if the roots of the ficus you planted up against your clients' pond ended up cracking the shell in two! Bottom line: If you know what types of plants you'll be installing and where, you can allow for enough planting space, please your clients and avoid headaches later on.

What Size Do You Need?

So what size planting spaces do different plants need? Basically, it's all determined by the size of the containers they come in, and here's a handy chart to help you in your planning.

Container Type	Container Size (in inches)
Flat	N/A
Quart	5 x 4
One Gallon	7 x 7-1/2
Five Gallons	11 x 12
15 Gallons	16 x 17
24-Inch Box	24 x 24
36-Inch Box	36 x 36
48-Inch Box	48 x 42
60-Inch Box	60 x 44

(In each case, the first number refers to the diameter or width of the container, and the second refers to its depth. The dimensions indicate at a minimum the size of the hole you need to dig.)

Some plants come with the root ball wrapped in burlap. In these cases, check with the nursery, because the required planting space will vary with the size and height of the plant.

In the Trenches

As you think about planting space, it's

also important to remember that the plants will have to cohabitate with all of your plumbing. How deep are your lines and how does their space align with plantings? You don't need me to tell you what the codes say about burying your lines; I will suggest that you need to think things through if they are to be buried beneath planting beds.

Lines buried 18 inches below grade may meet the plumbing codes but won't give you room to plant anything larger than a five-gallon plant above them. Knowing where the planting beds will be ahead of time can help you direct your plumbing under lawns or other expanses that only need shallow planting spaces.

Now is the time, by the way, to consult with the landscape contractor to see if your lines and theirs can go in the same trenches. Bringing in these contractors while other plumbing is being installed will make your job easier and, more important, will let them see exactly what's in the ground and where. Pick axes and shovels have an interesting way of divining where pool plumbing lines are buried. Coordination of trades here is crucial.

Dealing With Details

Another problem we've encountered is when plumbing and electrical lines are set right up against a house or other structure. Having a plan (or at the very least a discussion with the clients) will tell you whether a vine or some other large plant will need to be planted to cover an unsightly wall, for example. Frequently, plants used to cover these large areas come in (minimum) 15-gallon containers.

This is often an issue right around equipment pads. Most clients simply don't know that the enclosure may have a 3-by-3 footing and that you won't be able to plant anything bigger than a 1-gallon plant against it.

Of course, you have the option of moving the pad to a less conspicuous space or working with the clients to redesign the area so you can plant 15-gallon shrubs in front of the concrete-block wall. If you have no choice other than the original spot and your clients still want you to hide the wall, you might want to consider a lattice or a bamboo enclosure – whichever will work better in the overall design.

The key here is to get creative and show your clients that you can work with them to resolve the problem. Indeed, creativity can be your best ally in keeping your clients happy and setting yourself up for future referrals.

So as you can see, size *does* matter. And knowing that simple fact can make everything fit better.

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. She may be reached via e-mail at sroseld@aol.com.

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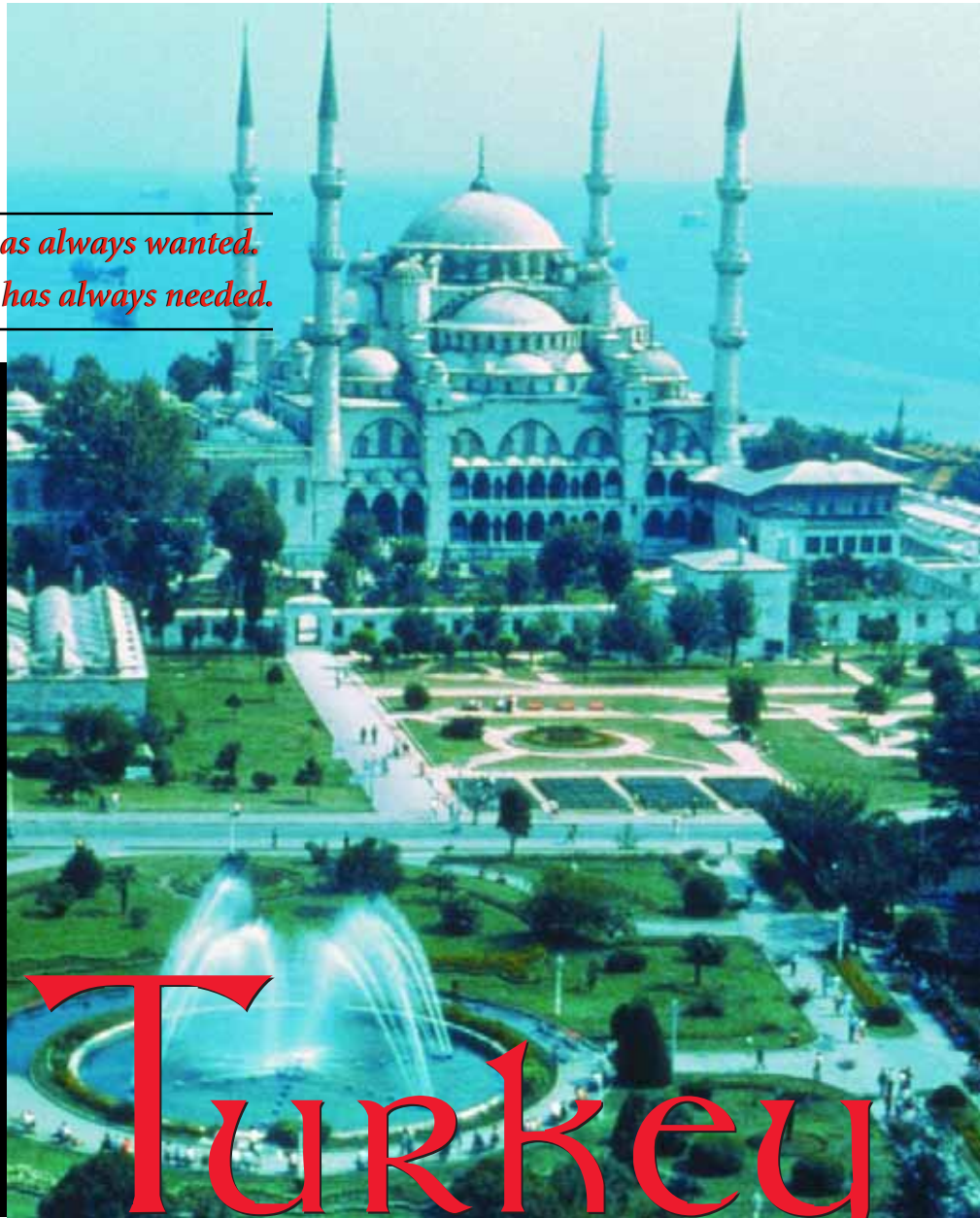

Turkey

November 3, 1999 to November 14, 1999

The echoes of classical aquatic design still reverberate in modern pools, spas and waterfeatures. They inspire today's designers and builders to consider scale and to master an eye-pleasing sense of balance and proportion.

As designers and builders, we all still respond to these ancient principles — and so do our clients, which is why Genesis 3's first-ever Travel Tour will be visiting sites in Turkey where classic Greco-Roman concepts have found their most enduring expression.

It's a fantastic opportunity to visit classical sites from Istanbul to Pergamon in the company of experts who will help you understand what you are seeing. It's also an opportunity to learn while having fun and enjoying four- and five-star accommodations, fine food and great company.

Don't delay: Space in the tour is strictly limited, and many seats have been reserved by designers and builders who want to start making historic ripples of their own!

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Those interested may extend their visit by three days and see classical sites in Greece, including the Acropolis in Athens and the Temple Precinct at Delphi. For Genesis students and graduates, the cost of the extension is $785 per person, double occupancy. For all others, the cost is $957 per person, double occupancy.

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Gaining

Among the most critical considerations in watershape design, says Skip Phillips, is establishing the relationship between the water and the structure that surrounds it. In other words, it's all about edges – edges that vanish, edges on angles, recessed edges and more. And whether his purpose is to accentuate the edge or make it disappear, the effects he strives for at these boundaries are the true hallmark of his recent work.

I've spent a lot of time in the past few years thinking about the things that generate the most interest in what we do as pool builders – and even more time turning those thoughts into designs and effects that meet my customers' desires.

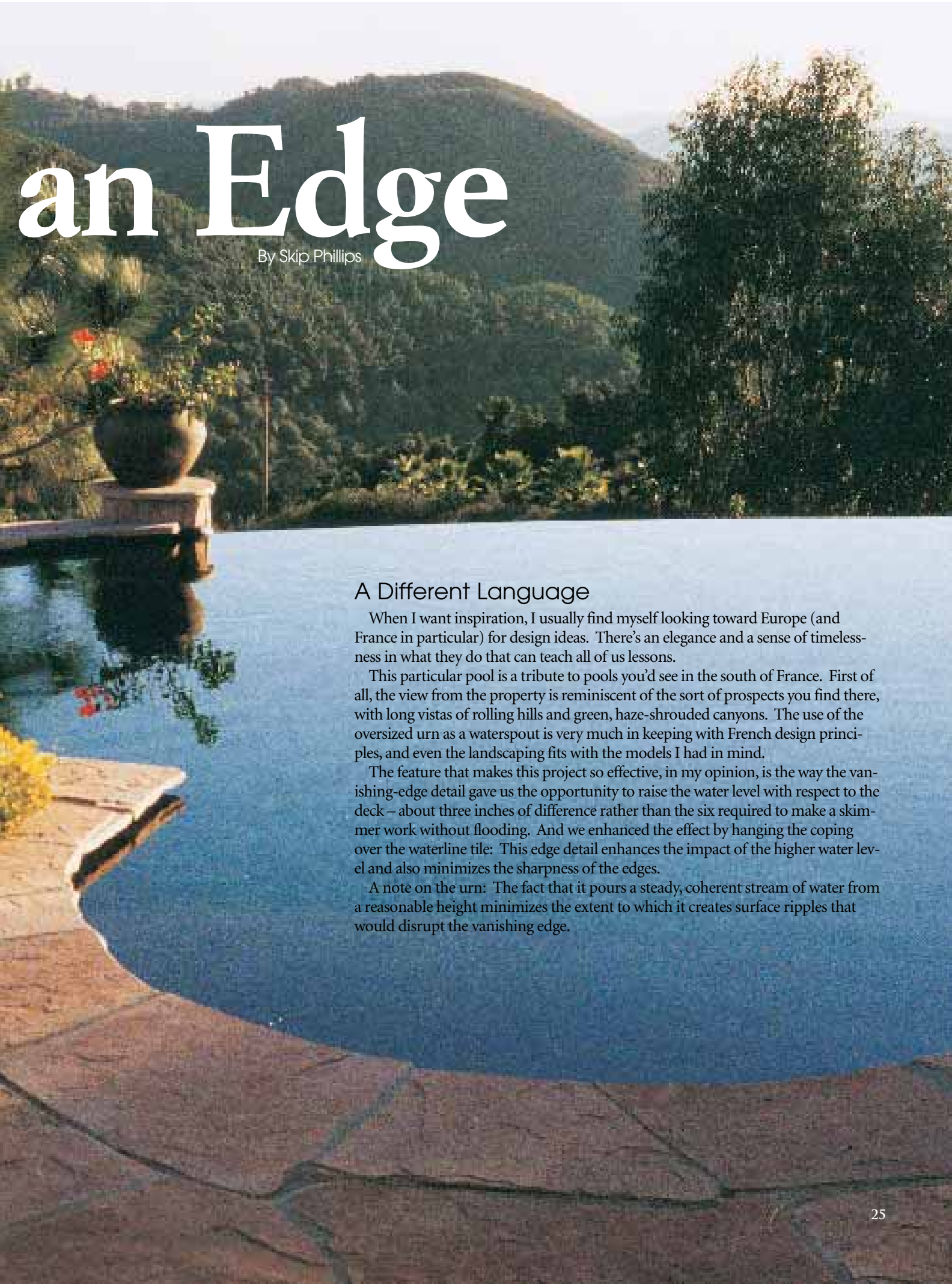
Once I started down this path, there was no way to turn back: There's a market out there at the high end that most pool builders never even approach, and breaking through with these clients takes persistence, skill and talent. As important, it also takes a willingness to stop looking at pools, spas and waterfeatures in the context of traditions and conventions that just don't line up with the needs or expectations that these customers at the highest levels have these days.

These are customers who won't settle for the ordinary. They won't accept plans that stick spas up 18 inches above the pool for no reason, then back it up with big piles of rock with water spitting out of the top. These are fatally flawed designs, no matter how well you build pools or what you're able to charge for them, and these customers won't give you a second look.

In my case, initial access to this high-grade market came through the work I'd done with vanishing-edge designs of all sizes and descriptions. I've long been a firm believer in the possibilities presented by vanishing edges – and I've built lots of them all over the world. Recently and in ways that have made my customers happy, I've found that some of the characteristics of these pools are leading me in new design directions – and, as you'll see in this article, to rethinking the way I treat edges in my watershapes.

an Edge

By Skip Phillips



A Different Language

When I want inspiration, I usually find myself looking toward Europe (and France in particular) for design ideas. There's an elegance and a sense of timelessness in what they do that can teach all of us lessons.

This particular pool is a tribute to pools you'd see in the south of France. First of all, the view from the property is reminiscent of the sort of prospects you find there, with long vistas of rolling hills and green, haze-shrouded canyons. The use of the oversized urn as a waterspout is very much in keeping with French design principles, and even the landscaping fits with the models I had in mind.

The feature that makes this project so effective, in my opinion, is the way the vanishing-edge detail gave us the opportunity to raise the water level with respect to the deck – about three inches of difference rather than the six required to make a skimmer work without flooding. And we enhanced the effect by hanging the coping over the waterline tile: This edge detail enhances the impact of the higher water level and also minimizes the sharpness of the edges.

A note on the urn: The fact that it pours a steady, coherent stream of water from a reasonable height minimizes the extent to which it creates surface ripples that would disrupt the vanishing edge.

Double Delight

In this case, the use of vanishing edges on both long sides of the pool – one facing the house, the other disappearing over the golf course – enabled us to bring the water level basically even with the decking leading out from the home. In addition, it let us lower the profile of the raised decking we used to frame the spa at one end and the pedestal at the other.

This is a key to a lot of what we're doing with edges: If a vanishing-edge detail frees you of the need to install a skimmer (and that's not always the case!), there's no good reason to think in terms of placing decks the standard six inches above the waterline. In this case, we've also pushed the coping out over a dark waterline tile in a way that masks the profile of deck and waterline.

Maybe it had to do with the El Niño storms and the fact that the downpours filled pools up way over the usual level, but I've found that my customers truly love this look – and I find myself looking for new ways to deliver it to them.

Zero-Depth Access

Beach entries are among the most popular of all edge details, which is interesting because what they really do is break down the edge and make it disappear completely – in a way, the ultimate extension of the water/deck-level relationships I've been exploring lately.

This is a case where the materials you use have to be part of an overall program, because certain materials simply don't work when exposed to pool water for an extended period. For example, most common sandstones don't hold up well. What you need is a material that is basically impermeable, like granite or quartzite.

These edge treatments add a whole new dimension to the uses my customers make of their pools, usually as a space for sunning. But most important from my perspective is that it funnels access to the pool where you most want that access to occur.

In this case, there is no defined access point on the opposite side of the pool, where we set the vanishing edge detail: The sweep of the deck leads bathers around to the beach entry or to the spa – where they can see the vanishing edge to best effect – and we've set things up deliberately to limit access at other points. In this case, we totally blocked access to one side of the pool by putting up a barrier of rocks and plantings. The objective here was to create the impression of a duck pond – and that just wouldn't have worked if the pool had been surrounded entirely by the standard ribbon of decking six inches above the waterline.

A New Angle

I'm not certain why pool designers have felt so limited by a sense that pool edges are supposed to be vertical, but I've taken to working with beveled edges on several of our pools and spas. I love the look – and so do my customers.

All of the work I do takes precision – especially recently, because I've been getting away from "naturalistic" shapes and working more with sharp lines, angles and defined radiuses. But these beveled edges take special care and have forced me to think and work things through in three dimensions in sharper terms than I ever did before.

In this case, the Sedona sandstone wouldn't hold up under water, so the spillway is lined with granite and the bevels stand several inches above the waterline. In other cases, the materials chosen by the customer will allow the bevels to reach below the waterline, producing remarkable edge effects. (See page 31 for an example.)

This project is in the backyard of a Santa Fe-style house, and I based the pool's perimeter on shapes, contours and textures the owners put into their house and its furnishings. I do this a lot: I try to make my pools a direct extension of the house and the interior space. The last thing I'd want to do is put a kidney or a lazy L in this space. (See the sidebar on page 33 for more on this subject.)

This is a case where the deck and water levels are at the conventional six-inch difference, but I've done what I can to change the vertical profile by projecting the coping stones over a waterline I've made as dark as I can.

Breaking Down Barriers

This is a case where form and function come together beautifully. The owner, a former competitive swimmer, wanted a lap pool – but with something special besides.

The site was bordered by a low retaining wall. By raising the water level above the deck level in the pool and creating what is basically a full-perimeter spillway over a granite beam, the retaining wall has been completely masked from view and the pool, spa and swim-up bar all seem like free-flowing extensions of the house and patio. Everything is sharp and angular, but the edge treatment softens the lines – and the white noise from the spillover and spa dam adds a nice touch.

With an edge like this, it's obviously critical to get things right, including the slight tilting of the top surfaces of the granite toward the pool to keep the entire edge wet and the flow even. In this case, the surge is handled by the space set up as a swim-up bar, so the gutter around the rest of the raised edge is narrow and basically hidden.

Set Like a Jewel

This is a renovation project where the customer's desire lined up perfectly with what we wanted to do.

The original pool had been completely conventional. By setting a new shell inside the old one, we were able to create a full-perimeter vanishing edge that brings the water level right up to the original deck level.

The old pool had walls that sloped fairly dramatically toward the floor. We used this to our advantage, raising the water level above the old pool's walls and making the V-shaped notch between old and new walls into a gutter system for the vanishing edge. We simply moved the new wall in a little at one end to create a surge tank capable of handling the flow.

This project doesn't seem all that spectacular, but it's led us to take the full-perimeter concept a couple steps farther in the project seen on page 32.

Elevations with Style

I've long advised other builders to avoid elevations unless there's a good reason to design one. I also believe that we can all stand to be more subtle and try to get away from sharp, vertical elevations.

In my own work, for example, I've been using pyramids more and more often as a way to soften edges. I've never seen this edge detail in anyone else's work. Besides offering a nice visual effect from outside the pool, I'm convinced that this approach helps to eliminate the sense of claustrophobia some people get in normal pools where they're hemmed in by six-inch-high vertical barriers. A lot of that feeling evaporates when you rethink the angles of the walls – or fold them back completely.

Obviously, the degree of difficulty starts going up, but it's not necessarily because doing this is hard. Instead, it's just *different*, and everyone has to be re-schooled – your steel crew, your plumbers, your guniters, your tilers. If you don't have a vision and can't be responsible for keeping everything straight, these sorts of special edge treatments can turn into butchered-up messes.

But despite the fact that doing things this way is more complicated, I think it's a wonderful way to handle elevation changes.

This is a good example of the pyramid detail: The water line is right at the base of the elevation change. In this case, the material is San Francisco granite, and it can stand up under water without deteriorating.

Changing Perspectives

This recently completed project carries all of the concepts I've described here about playing with the relationships between water and deck level to a logical conclusion. In fact, I think it takes the discussion about as far as it can go.

In this case, the water level of this full perimeter, vanishing edge pool is right at deck level, with the water spilling over into a one-inch-wide slot stretching all the way around the pool. To reach the slot, the water flows across a slightly submerged band of "coping" – a highly unusual frame-like break between the span of dry decking and the body of water.

This approach called for an extraordinarily high degree of precision in layout and execution – in both aesthetic and hydraulic terms. The aesthetic challenge comes from the way this particular edge treatment calls attention to itself and would reflect any significant errors of alignment. And given the narrowness of the slot, keeping the entire perimeter wet isn't so much a matter of adjusting the flow, but rather of a balanced hydraulic system matched up with some impressively precise masonry work.

It's a killer look, and another case in which playing with the relationship between deck and water levels creates

Inside Out

Among my customers, designs that really work are the ones that have continuity with their surroundings. In other words, it's not enough to use a pyramid detail or raise the water level or draw up a vanishing edge: What you do in a customer's backyard must fit in with its surroundings and make sense as part of an overall design for the home.

When I do a pool design, the first question I ask myself is, "Are there elements on the exterior of this home that I need to pick up in the pool design?" If there's nothing there – say you're called to a simple tract house – you need to look at the interior and how the owners have decorated it to see which elements you can carry outside to your pool design. That's what we want to do: Make the pool an extension of the house rather than a random set of afterthoughts.

This sort of design continuity is too often overlooked in pool design. With a custom home, the owners have generally used architects, builders and landscape architects whose work they admire – so why would they call in a pool salesperson who comes in and does the pool design free of charge? Customer expectations of pool builders are rising higher and higher all the time.

As I've worked my way into this higher-end market, I've learned first-hand that credibility is the key when it comes to meshing with other design trades. I may be arrogant when it comes to my pool designs, but I have the talent and skill to back it up, and I've earned the respect of those other trades. I now work with architects and landscape firms that are at the top of their fields, and they defer to me when it comes to my ideas and designs because they know I can answer questions they can't. And that's usually true of the best people in any trade: They know when to ask questions, and they know when to accept the answers they get.

Once you have that sort of skill and the confidence to press the limits, you open things up and find yourself with lots of options. You find yourself wondering why we all tend to think in terms of 15-by-30 pools, 20-by-40 pools, kidney-shaped pools – and you start to break down the conventional thinking in creative, innovative ways. Why, for instance, do we drop so many freeform pools into square backyards behind linear houses?

And as long as what you do fits in with the surroundings – the style of the house, the look of the interiors – then you can start to play with the possibilities. One thing we do without exception is play with angles and how the pool aligns with the house. Why are so many set up with a long axis parallel to the back of the house?

We've gotten past these questions, and now we focus on how we make the transition from the home to the pool. We do it with materials, we do it with balance – and we do it as much as possible by forgetting about the way most pools look. The unusual angles of the Sedona pool on page 28, for example, are an expression of the shapes we found with the home.

All those angles may seem strange out of context, but they're just right in that backyard – and they work much better than would a 20-by-40 pool with standard coping, a raised spa and a three-foot ribbon of deck.

– S.P

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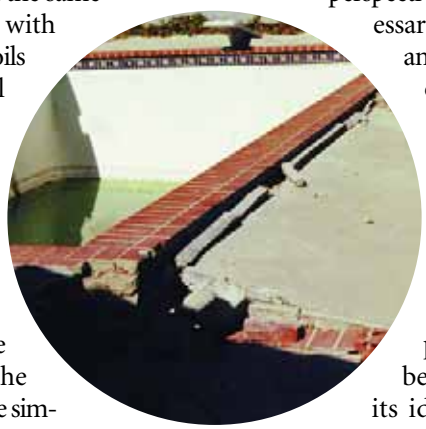
Powerful Grounds

By Larry Parmelee & Wayne Schick

It's often said that what you don't know can hurt you – and that's seldom truer than when the unknown in question has to do with the soil and geologic conditions that underlie watershapes. On hillsides in particular but even on certain flatlands, says this pair of prominent engineering geologists, accommodating the forces at work beneath the surface is critical for professionals working to maximize the integrity and longevity of their installations.

Knowing what you're up against with respect to soil and geologic conditions is the key to success in hillside pool construction. In this case, the collapse of an inadequately engineered retaining wall led to failure of the fill behind the wall — and ultimately to the rotation of the pool and the sinking and cracking of its decking.

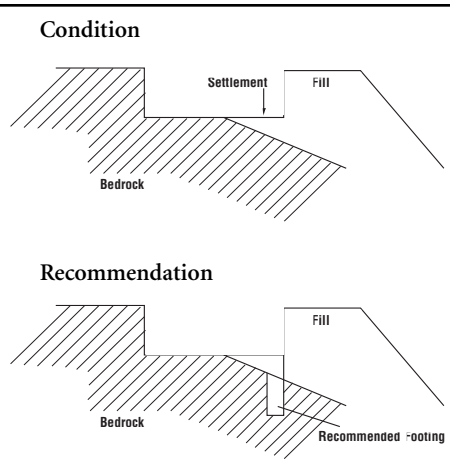
If you're in the business of digging holes, lining them with steel and concrete and then filling them with water, you need to know that the ground will support the structures. That's particularly true of hillside areas, but the same can be said of areas with high water tables, expansive soils or improperly compacted fill – to name just a few.



We've all heard the horror stories of distressed vessels, including pools and spas out of level, significant structural shell cracks and differential movement between the decking and the shell. As we see it, part of the problem is that many pools are simply built with too low a structural tolerance for the stresses to which they are subjected. Another part has to do with the fact that too many builders are willing to fly blind when it comes to knowing about prevailing geological conditions and hazards.

All too often, the upshot in these cases is the failure of the watershape, usually after work delays and extensions as the builder tries to "backwards engineer" a solution once problems are observed. More often than not, the result is a problem leading to costly litigation. From our perspective, none of this trauma is necessary. As we'll discuss in the examples that follow, soil and geologic conditions can generally be overcome – provided you know what you're up against and have a customer who understands what is at stake.

Please note: These examples do not represent all possible problems that can be encountered; each site has its idiosyncrasies and must be evaluated individually. Please note as well: The remedies offered here are contingent on having a valid geologic and soils report; without a full understanding of the specific geologic and soil conditions, it's difficult if not impossible to build a structure that will perform well.



Cut/Fill Transitions

Condition: A portion of the pool is founded on bedrock, while the rest of the structure is located over fill or topsoil. (This is a common problem encountered on hillsides.)

Potential Hazard: The portion of the excavation on bedrock won't experience settlement, but the portion located on fill or topsoil will experience differential settlement, resulting in an out-of-level shell and/or significant structural cracks.

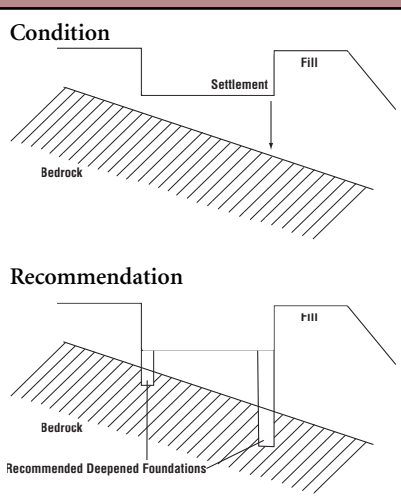
Recommendation: Determine the depth to bedrock and provide deepened footings to found the entire pool shell in bedrock. Use a free-standing shell design (see the sidebar on p. 38 for an explantion of this and other shell designs). Rule of thumb: Once you find any bedrock, the whole pool must be founded into it.

Fill Wedges

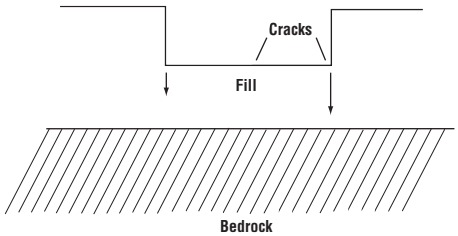
Condition: The pool excavation is located on a "wedge" of properly compacted (*certified*) fill created during site development. This results in a thin fill layer under one end of the pool and deeper fill under the other. (Note: This problem often goes unnoticed without a soils report.)

Potential Hazard: The fill will experience differential settlement, resulting in an out-of-level-shell and, possibly, structural cracking.

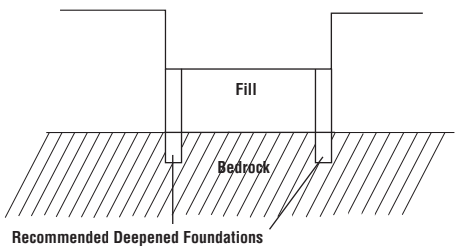
Recommendation: Determine the depth to bedrock on both sides of the pool, then use a free-standing pool shell design and support the entire shell on piles founded into competent bedrock.



Condition



Recommendation



Bad Fill

Condition: The fill underlying the pool has not been properly compacted (that is, to 90% of maximum density) per modern standards.

Potential Hazard: Differential settlement will result in an out-of-level shell and cracking.

Recommendation: Determine the depth to bedrock and support the entire shell and decking on deepened foundations into competent material. This is a case where a free-standing pool design and structural decking supported by deepened foundations should be used.

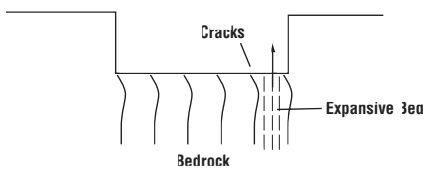
Expansive Bedrock

Condition: This problem is rare and poorly understood. Here, portions of the bedrock contain a mineral that oxidizes and then expands. Once excavated, the mineral oxidizes in the presence of moisture and air; gypsum crystals grow, causing the bedrock to expand significantly, while portions of the bedrock low in mineral content do not expand.

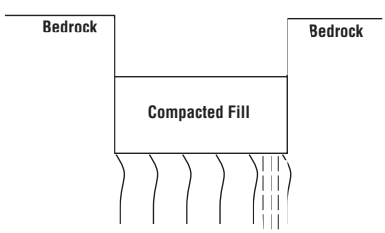
Potential Hazard: Moderate to severe cracking and possible uplift of the pool can occur at the areas experiencing oxidation, requiring complete replacement of the pool.

Recommendation: Determine which portions of the bedrock have a potential for expansion by performing chemical testing. Remove and re-compact six to eight feet, then use a floating-shell design (see the sidebar below) and notify the owner of the potential problem in writing.

Condition



Recommendation



Shell Design Basics

Using the proper shell design relative to geologic and soil conditions is the key to preventing distress. For purposes of discussion, let's consider four basic shell designs and how they relate to forces at work below grade.

❑ Conventional design. This is the most common type of pool construction, used mostly in flatlands and areas where ground conditions are considered stable. A conventional shell cannot fully support the weight of the water it holds and relies on the surrounding soil for lateral support. For such a shell to succeed, the earth materials must posses favorable engineering characteristics. Specifically, the soil must not be subject to excessive consolidation (or vertical compression), downhill creep or expansiveness. Also, the earth materials used to support a conventional shell must not be within the "active wedge" of any nearby retaining wall. (The active wedge is defined by a 45-degree plane projected from the base of the wall. Earth materials within this wedge are subject to vertical and lateral movement.) Conventional designs are acceptable when the earth materials are competent. In addition, the site must not be subject to the influence of slopes or the presence of dissimilar materials beneath the pool shell.

❑ Expansive-soil design. As the name implies, this type of shell design is applied in areas underlaid by expansive soils. These shells are typically thicker and provided with additional steel reinforcement. Note, however, that an expansive-soil design is *not* appropriate in areas underlaid by expansive bedrock, in areas within the backfill zone of retaining walls, in areas underlaid with dissimilar earth materials, or in areas near descending slopes.

❑ Free-standing design. This type of pool shell is the most typical style used for hillside installations. It does *not* rely on surrounding materials for lateral support and is completely self-contained. These pools are typically supported on a deepened foundation system consisting of caissons or friction piles and grade beams. Free-standing shells are typically required for pools located close to or over descending slopes, in areas of dissimilar earth materials, and in areas where suitable load-bearing materials are located some depth below the pool bottom.

❑ Floating design. This is a special type of free-standing shell. The floating design is stronger than a free-standing design by virtue of increased shell thickness and additional steel reinforcement. This design is used in areas susceptible to differential vertical consolidation (but without any concerns about slope stability!). It is assumed that this pool will eventually become out of level, but that it nonetheless will resist cracking. (Home-owners should be notified in writing of these site conditions and possible results.)

– L.P. & W.S.

Causes for Concern

Soils engineers and geologists are concerned with the engineering characteristics of underlying materials as they affect the performance of any future structures. Conditions that may cause problems include:

❑ Uncertified fill. If the fill that underlies the area of proposed construction has not been properly compacted to 90% of the maximum density, consolidation may occur and can cause cracking and the failure of inadequately designed pool shells.

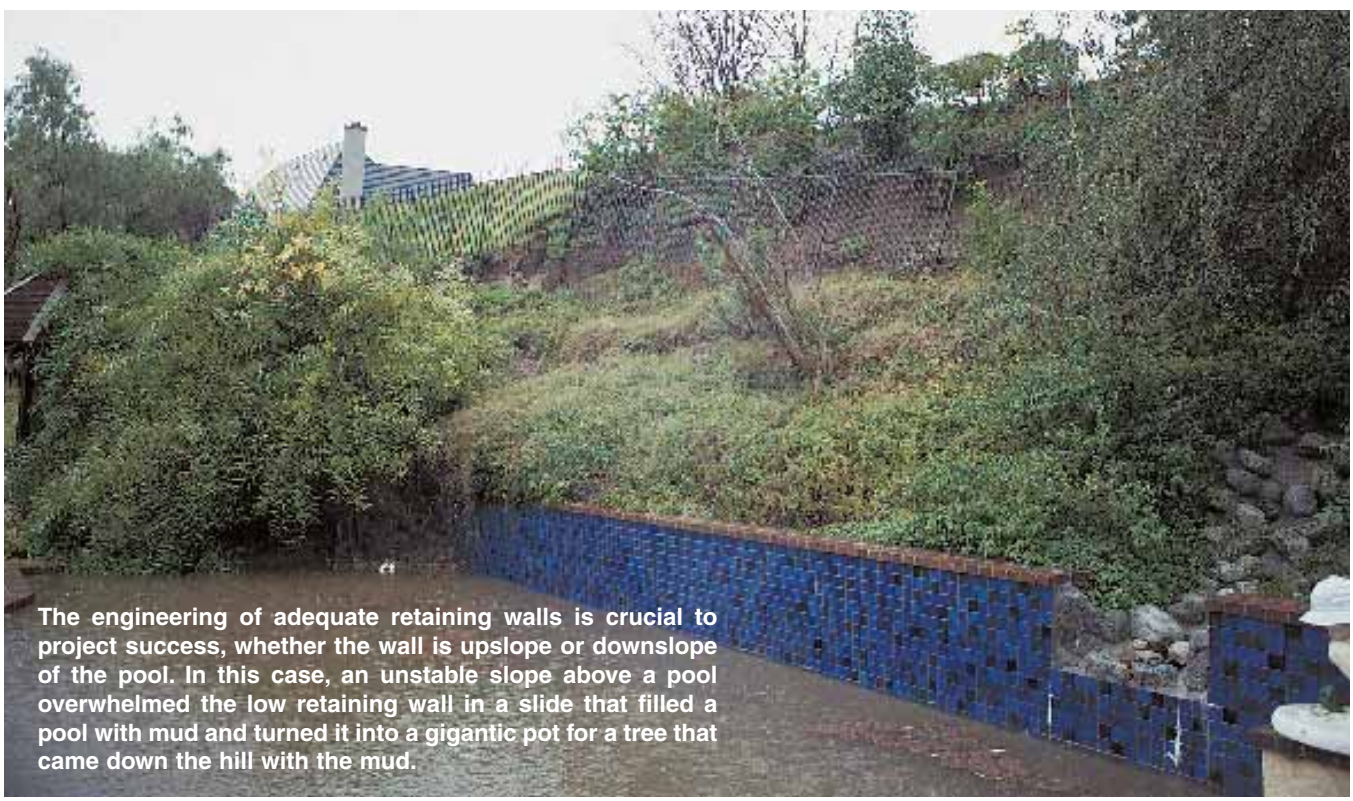
❑ Proximity of downhill slopes. Certain conditions present in subsurface materials at the top of descending slopes can cause downhill creep (especially in the presence of poorly compacted fill).

❑ Expansive soils. Many areas are underlaid by clay-rich soil that can exert excessive forces on a shell and decking. Proper identification of the expansion capacity will allow the structural engineer to design the structure to resist the force of expanding soils.

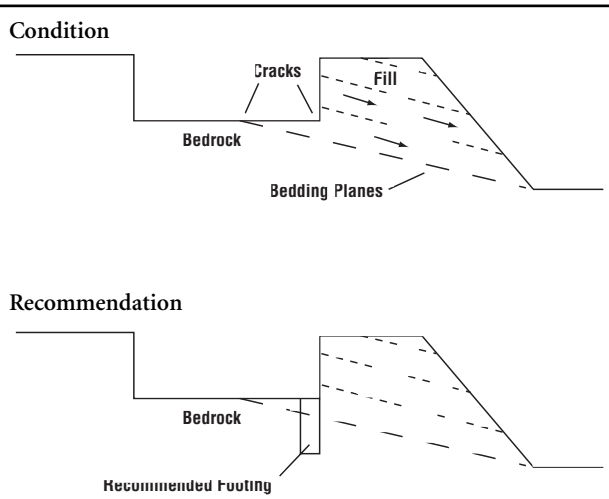
❑ Dissimilar earth materials. When a pool is located in different types of earth materials, there is likely to be differential settlement, expansion or creep.

❑ Groundwater. One of the most familiar and spectacular problems associated with pool construction is the phenomenon of "popped" shells. Hydrostatic relief valves are useful – but may not be enough. In some cases, a gravel base below the pool along with a perforated drain-pipe system provides a more effective solution.

– L.P. & W.S.



The engineering of adequate retaining walls is crucial to project success, whether the wall is upslope or downslope of the pool. In this case, an unstable slope above a pool overwhelmed the low retaining wall in a slide that filled a pool with mud and turned it into a gigantic pot for a tree that came down the hill with the mud.



Bedding Planes

Condition: A portion of the excavation is located on a wedge of bedrock with planes of weakness or layering known as *bedding planes*.

Potential Hazard: The wedge of bedrock may fail and slide downhill along the bedding planes, resulting in significant distress or destruction of the pool.

Recommendation: Use a free-standing shell design and found the pool below the lower-most unsupported bedding plane with a deepened footing.

What's a Soils Report?

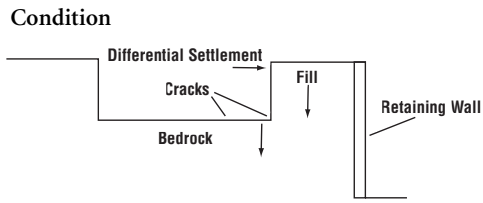
If you suspect that the soil you've been asked to build upon might have problems, your best bet is to call in the experts and have them prepare a report on conditions that prevail in the job site.

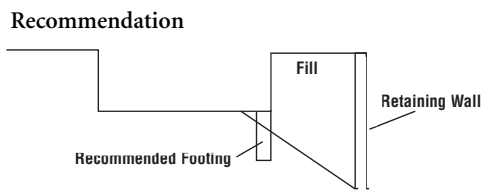
The reporting process involves two stages: one in the field, the other in the lab. First, test pits or borings are dug in the area of the proposed construction to determine the sub-surface conditions. This exploration sometimes reaches down just a few feet but can also entail deep borings, typically 24 inches in diameter and up to 50 feet in depth. (In many situations, use of a drilling rig is not possible as a result of access restrictions – which means these pits must be excavated by hand!)

Once dug, the pits are inspected by the geologist to determine the condition and structure of the earth materials. Concluding the preliminary work, the geologist collects samples for laboratory analysis. The engineering characteristics of the subsurface earth materials are fully evaluated with respect to construction of the pool, decking and other associated structures.

Following completion of the field exploration and laboratory testing, the geologic and soil engineer prepares a comprehensive report with recommendations for shell, foundation and deck design as well as drainage control. In addition, the report may cover slope stability as well as foundation and setback requirements. These recommendations may then be used by a structural engineer in properly designing the pool for a specific site's conditions.

– L.P & W.S.



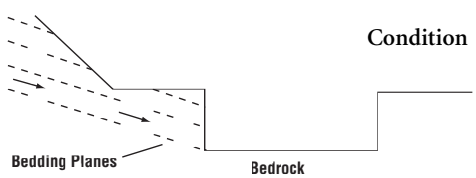


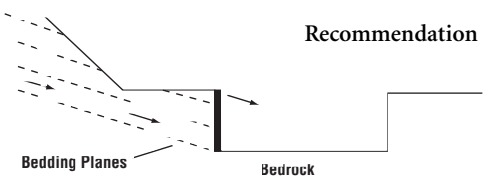
Retaining Wall Backfill

Condition: The pool shell is placed in backfill behind a retaining wall; deflection of the wall occurs, allowing the pool to move.

Potential Hazard: Shell may rotate and crack.

Recommendation: Install a free standing shell and place a footing that extends below a 1:1 plane projected up from the base of the wall.





Bedding Plane Surcharge

Condition: The up-slope side of the pool excavation is *surcharged* by adversely oriented bedding planes.

Potential Hazard: The surcharge from the bedding planes may result in deflection and cracking of the pool wall.

Recommendation: Design the surcharged pool wall as a retaining wall.

How Bad is Bad?

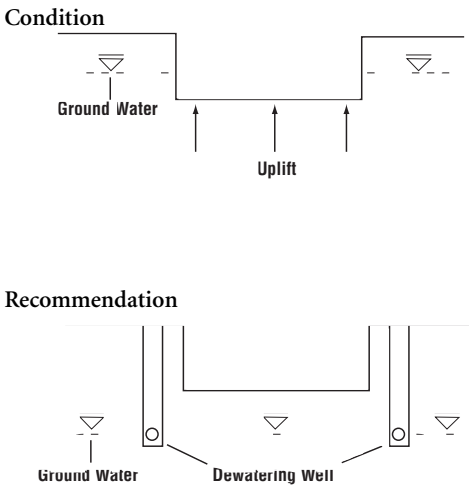
Geologists and soils engineers are often retained after the fact to evaluate the cause of distress to pools and spas – and to provide recommendations for permanent repairs. Unfortunately, this frequently occurs after litigation has already started against those involved in the pool's construction.

The most common form of distress involves structural cracks within the pool shell. (These structural cracks are distinct from cosmetic cracks that only involve plaster.) Of particular concern are cracks that permit saturation of underlying soils and can affect the stability of a nearby slope. In other words, leaks within a pool shell must be repaired immediately!

Epoxy injection is often recommended to seal cracks, whether they're leaking or not. But epoxy injection is only a temporary measure and will do nothing to prevent further damage.

Commonly, shell cracks caused by ongoing external factors require more substantial repairs – everything up to and including demolition and replacement of all or a portion of the shell or placement of a new shell within the existing shell. These are obviously serious and costly repairs, but the alternative – and the damage to be done through continued deterioration of a failed shell – can be even more serious and far more costly (should a whole hillside fail, for instance).

– L.P. & W.S.

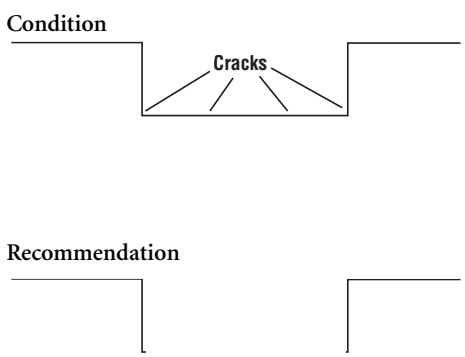


Shallow Groundwater

Condition: The groundwater is very near the surface or the bottom point of the future excavation.

Potential Hazard: Following draining for repairs, hydrostatic pressure on the outside of the shell may cause it to "float" or "pop" out of the ground. Unfortunately, the pool is unlikely to pop out of the ground evenly, resulting in severe cracks and requiring total replacement.

Recommendation: Determine the groundwater level before construction begins, use dewatering wells to lower the ground water during construction and then install hydrostatic relief valves in the shell or a sub-pool drainage system beneath the shell.



Expansive Soil

Condition: The pool excavation is located on moderately to highly expansive soil.

Potential Hazard: The pool walls may experience cracking, damage to coping and tile and uneven lifting and cracking of decks.

Recommendation: Determine the expansiveness of the soil, then design the pool shell and decking for expansive soils. Also provide proper drainage and adequate expansion joints at the pool's perimeter and within the decking.

Considering Decks and Drains

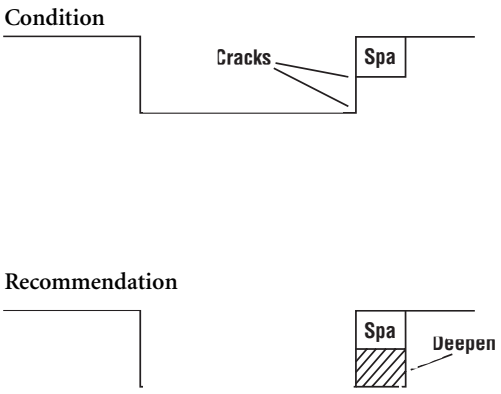
Concerns about soil conditions don't end at the bond beam: The design of pool decking also must take underlying soil conditions into account in order to avoid distress, such as cracking, differential settlement and lifting.

Cracking is a big problem because it opens the area beneath the deck to infiltration of water that, in turn, causes further cracking and additional damage as the soil beneath the deck becomes saturated – which accelerates the problem.

As a consequence, all pool decking must be adequately reinforced and supported on competent material, such as compacted fill or bedrock. If there are concerns, solutions include such measures as cantilevered structural decking or "floating" the deck with expansion joints in anticipation that differential movement will occur.

One of the most critical factors in reducing the risk of future problems with decks is proper control of surface drainage. Install adequate drains within the decking to collect surface drainage, prevent ponding and ensure that all collected drainage is conducted to the street or another suitable location. The drainage must *not* be allowed to flow over any slope in a concentrated form!

– L.P. & W.S.



Spa Distress

Condition: An attached spa is cantilevered off the deep end of the pool.

Potential Hazard: The spa experiences differential movement (a *hinge effect*) and cracks at points of highest stress relative to the pool shell.

Recommendation: Deepen the bottom of the spa structure to the same depth as the adjoining pool shell or install a deepened footing beneath the spa shell.

Soothing Sounds

By Rick Anderson

The sound of water moving through the landscape adds something special to any backyard, offering a powerful aesthetic component to even the simplest of designs. These auditory enhancements evoke powerful images, emotions and associations even from casual or occasional observers, notes landscape designer and watershaper Rick Anderson, who suggests that the 'aural factor' should be considered from the very beginning of the design phase.

All too often, the purchasers of a home (new or old) find a garden space stripped of any natural feel. Large lot or small, they sense no "connection" to the land – only a bleak space devoid of vegetation or any sort of overhead canopy and lacking the finishing touches that draw them out of the confines of the home to enjoy what usually represents the majority of their real estate.

From my perspective, the best way to generate this connection to the land is through the creation of ponds, streams and waterfalls in these backyard settings. Such features bring a more natural look and feel to residential garden spaces and instill a sense of connectedness. And whether customers pick up this sense consciously or subconsciously does not matter: What matters is that they somehow *know* it, that they *feel* it.

Plantings are a big part of this picture, but I lean heavily on watershapes to create connections because of the *sounds* they make. In fact, I believe that sound has as much to do with making the connection as does sight and carries our work to a much higher level – a level that no other single element can.

Simply put, people *respond* to the sounds water makes – a fact that can help you transform a landscape to a garden and a garden to a sanctuary.

KEY QUESTIONS

Many factors contribute to the impressions made by a backyard, including the placement of its watershape, the materials used to build it, the associated landscaping, the lighting – the list goes on and on. All too often, however, designers and their clients focus on appearances and forget about sounds.

As I work on my designs, I always ask myself two questions: "What do my clients see?" and "What do my clients hear?" I can't stress enough that these are two very different things and that each has a clear, dramatic effect. But for all the *visual* beauty embodied in many watershapes, I believe strongly that the effects of sound work almost magically in the way they influence the experience of the observer.

In other words, the combination of visual with aural effects transports us to a special place – a place of reflection, contemplation, meditation and connection – in ways no visual (but soundless) masterpiece can achieve on its own.

The collision of water and water or water

and stone draws people to the source of the sound. It links spaces in and around the home (or office) to the water, even when the participant isn't within eyeshot. Think about your own experiences of entering a home and hearing the sound of falling water through an open kitchen window: You are drawn to the source. Or think about the attractiveness of garden rooms in restaurants – and, on the flip side, about how frustrating it is to be trapped inside a sealed office tower with a view of a graceful fountain you can't hear because the windows won't open!

We're talking about powerful, elemental forces here – things you should think about as you approach any design task.

As you work, consider the rhythm of falling water.

As a watershaper, of course, you have a natural design edge here because you're already bringing in the elements you need for effective work in the aural dimension. If it's not something you do already, all it takes is giving a little thought to acoustics and considering ways you can bring a greater level of subtlety and creativity to the sound patterns with which you're asking your clients to live.

Remember: Your clients will always hear their watershapes more than they will see them. Sometimes they'll even sit or stand by a waterfeature, eyes closed – and minds open to the sounds and images that arise and carry them to other places.

STRATEGIC PLACEMENTS

So how can you achieve optimal aural effects? For me, the best way is to run through a list of water-specific sounds and the images they conjure – from babbling, splashing, meandering and trickling to dripping, splattering, plopping, plunging, gurgling, and gushing.

These words alone should evoke powerful images for you and your clients.

In this project, I created a hidden grotto — and a hidden source of sound. As the water reaches the end of the stream, it flows into a deep tub that will be covered by stones. The large volume of hidden space (which had to be big enough to hold all of the water in the system), releases a deep, rich variety of sounds as the water trickles into it. To make the effect work, I covered the tub with a galvanized metal screen (shown) onto which I later piled stones.

With the tub hidden, the flow keeps the stones wet, but almost all of the sound comes from the hidden source.

More important for you as a professional, they should stir sensations of very specific sound effects and sensations for which you can strive as you compose your watershape, stone by stone, layer upon layer, from one descent to another. These words help you stay focused as you move from the headwaters and down through the cascades to the channels and eventually to the pool or pond.

As you work, consider the rhythm of falling water. By moving stones around to create shorter drops or by dropping water over rock by rock instead of as a straight fall, you change the pitch and sequencing of the sound. For starters, this variation in sequencing of drops creates great acoustic interest. And as it becomes more varied, it also becomes more complex in pitch as well as rhythm. With careful placement of just a few stones, you can create a rich tapestry of sounds even in a tiny watershape that takes up just a few square feet.

A caution: Work carefully with the scale

Setting up a number of small falls of different heights and volumes can create awesome aural effects — including a number of pitches that you can "tune" by working with placement of the stones at the bottom of cascades. As I set up these installations, I look for stones that already have "channels" in them — then use them to advantage.

of sound made by the "sheet falls" that fit so beautifully into a variety of designs. These curtains of water are patterned after the world's great waterfalls (think Niagara); with their weirs or nozzles perfectly placed above a flat water surface, a sheet of water falls over and down into a lower basin. This makes for great visuals and a very distinct type of noise. As I see it, however, the sound here is not really a rhythm but, rather, a constant noise, especially in large applications.

To my way of thinking about water and sound, these large sheet falls are well suited to the public arena, but less effective in backyards. In a public plaza, the observer pauses at the site for a limited time and the opportunity for intimate reaction is constrained by the open setting. These spaces work for a quick break, brief relaxation or a winding-down period, but exposure tends to be limited and the monotone of the falls works perfectly in creating drama, in drowning out traffic noise and in achieving other large-scale, blunt effects.

If the same type of fall is placed in a residential setting, however, the constant sheet of water and fixed sound may dull the senses rather than heighten them – and might even become annoying. The effect isn't so much a sense of connection to the setting as it is a matter of creating "white noise." It may dazzle the eye, but in the long run, it pales in comparison to a watershape designed to reflect nature in greater variety.

I always keep an eye on aesthetics as I work, but I give as much or more consideration to creating multi-layered aural effects for my clients. In this case and many others, I've used double falls rather than single sheet falls to bring acoustical variety to the project.

TUNING IN

That's not to say that sheet falls never work. In fact, many brilliant backyard waterfeatures associated with pools in particular include falls of this type in their designs. My suggestion here is to take up the challenge of my second constant question – that is, "What do my clients hear?" – and think about ways of "fine-tuning" the sounds the sheet of water makes as it hits the pool or pond.

Often, for example, I will add splash stones at the bottom of the falls, extending them out from the edge of the receiving basin to break the falling sheet of water and alter its aural component. This very simple step lends a different rhythm to the falls and enhances the complexity of the sound without disrupting the visual drama of the sheet fall itself.

Another possibility here involves breaking up the sheet into falls of different volumes. Leave one large central flow, for example, and create two or three or four smaller falls on the sides. Let some of the water fall directly into the lower basin alongside water you've allowed to splash, tumble and jump from stone to stone before it reaches the lower basin. This simple interplay creates different pitches of sound and generates great interest. (It can even attract wildlife, which, depending on the setting, may or may not be desirable!)

The key to effective aural design is to make the rhythm indiscernible to the human ear.

I've also experimented with the depth of the water in the receiving basin as a way to tune sounds and create specific effects. Deeper water offers a lower pitch, for instance, especially if there's a large flow of falling water, while shallow water yields a higher pitch. So if the scope of the project permits, I urge you to try experimenting with stone or other hard materials just below the surface to find interesting sounds, pitches and rhythms.

As you work, remember that the key to effective aural design is to make the rhythm indiscernible to the human ear: If you prevent the listener from picking up a pattern or known rhythm that the conscious mind can decipher, the sound will always seem new and refreshing.

Also be aware that there are many, many ways to achieve various pitches, sounds, gurgles and more. You can try placing loose stones in the falls area to send water off into different or variable directions or to collide with other stones or materials. And how about sending the water off in such a way that it collides with other falling water to create irregular rhythms? By dispersing the points where water falls into the basin or by spreading the falls and cascades over a broad

area, you create different effects, filling the surrounding space with a warm, rich variety of sounds.

ECHOING NATURE

These sounds you create in your watershapes are nothing more than what you might find in the natural world as you walk through the woods and happen across a stream or a waterfall. Most times, you'll hear this water before you see it – and what you hear will draw you toward the source every time.

I suggest strongly that you study what you find on these rustic pathways, look at the way the descents work and make note of details and ideas you can apply in your own designs. In this way, you'll be better able to recreate these distinctive rhythms of nature and bring your clients' backyards into closer touch with a very inviting natural world.

That's what it's all about: Our work with watershapes enables us to give clients access to special times, places and memories while creating fresh connections to the natural world. That may be an intangible, subconscious benefit of owning a watershape, but it is one that makes the work particularly rewarding as we capture magic in designing spaces with sight and sound in mind.

Natural Wonders

As I work at tuning naturalistic watershapes, I like to experiment with elements that will move or change in time.

For instance, I'll place sticks, twigs and even logs into my natural streams and waterfalls, aware of the fact that water flowing over or onto a log creates a totally different sound than will that same descent in colliding with rock or more water. Of course, you're introducing something that will decay into the setting, but I don't see it as a source of concern. Rather, I see it as a welcome reflection of the randomness of real waterways.

If you place a good-size log in a watershape, think about adding interest by planting moss or carving out a section of log to plant ferns – it really adds a special feel to the setting. And always remember that we are working with the ephemeral, even in installations that will last for generations!

– R.A.

Pebbles

Swimming pool plaster has changed a great deal in recent years.

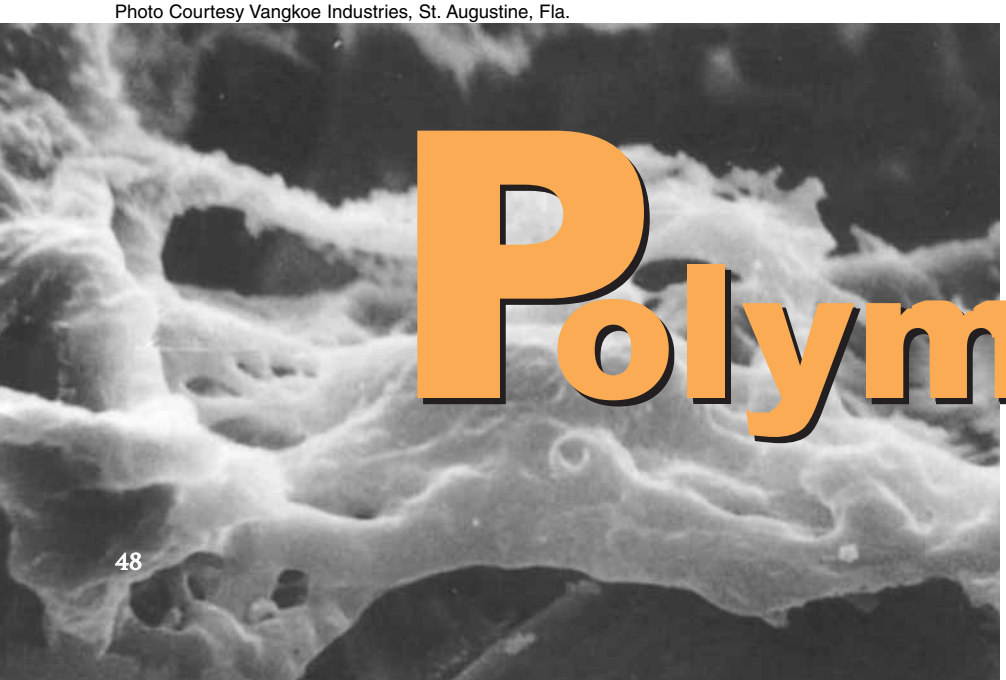
Photo Courtesy Questar/Genesis 3, Escondido, Calif.

Pozzolans

With the advent of pigments in the '60s and the arrival of pebbles in the '80s, first color and then texture were added to surfaces once only white and smooth. Now, reports Greg Garrett, two new admixtures are finding their ways into the mix to add strength and durability and further the evolution of these useful pool finishes.

Photo Courtesy Englehard Corp, Iselin N.J.

Photo Courtesy Vangkoe Industries, St. Augustine, Fla.



& Polymers

By Greg Garrett

One certainly emerges from all the discussions that have taken place about swimming pool plaster over the past several years: The product has had plenty of room for improvement.

Among the complaints has been that traditional white-plaster pool finishes simply haven't kept pace with the rising expectations of owners, who increasingly want their pools, spas and waterfeatures to be entirely forgiving when their lifestyles limit the time they can spend on maintenance and upkeep. In that environment, in fact, traditional white plaster can be at a disadvantage, because its longevity and aesthetic performance depend heavily on the owner's regimen of care – or ability to hire a capable service professional.

Indeed, plaster is a big issue, with many unresolved questions. But there's no doubt that making plaster more durable and capable of encompassing a broader range of aesthetic options is something that would please just about everyone, from the industry's top architects and designers straight through to contractors, plasterers, service technicians and consumers.

The good news is that cement technologies we're now borrowing from other industries are being used to improve cementitious finishes' resistance to chemical deterioration, reduce their reliance on steady maintenance and make them more adaptable to changing needs. For convenience, I call these products the Three P's: pebbles, pozzolans and polymers – a triad of additions that will, I believe, alter traditional pool plaster forever and for better.

THE PATH TO CHANGE

To understand swimming pool plaster and have any hope of improving it, the first thing you need to do is understand *cement* and the role it plays in the product's performance.

For starters, it helps to recognize that this branch of materials science has been around a long, long time. Cementitious materials were used in construction by the ancient Egyptians, Greeks and Romans. Plaster used as a surface coating dates back just as far and enjoys rich traditions of use throughout world history, from the linings of wells and aqueducts of Biblical times to the ceiling of the Sistine Chapel in modern times.

For the past 175 years or so, mortar, concrete and other building materials have been made with *Portland cement*, the primary ingredient in many of today's most commonly used forms of cement and concrete. For its part, the modern swimming pool industry has used white Portland cement and an aggregate (marble, limestone or silica sand, for example) as the preferred interior finish in concrete swimming pools for most of this century.

What part does the cement play? According to F.M. Lea, one of the most eminent of all cement chemists, this material is best defined as "adhesive substances capable of uniting fragments or masses of solid matter to a compact whole." It's a wonderfully clear description that holds true for all sorts of structural and decorative forms, from pools and spas to fountains and waterfeatures.

To be sure, Portland cement and the basic components of white plaster have changed little over time. Part of the problem, therefore, is that they are surrounded by *other* components of swimming pool installations that have undergone major transformations. So plaster stayed white and white only while accompanying structural materials, equipment, decking, lighting and other systems all changed, often dramatically, as did approaches to chemical maintenance. And it's important to note that when change *did* come and pigments finally arrived to bring much-needed variety to traditional white plaster in the 1960s, it did nothing to alter the physical nature of the product.

It's easy in hindsight to knock plaster as not having kept up with the times, but the fact remains that it was the one element of the overall package that didn't seem to need "fixing." In fact, the stability and reliability of white plaster over so long a time offers enduring testimony to its merits as a product, no matter how much it might benefit from improvement.

In other words, my intention here isn't to knock traditional plaster; rather, my interest is in examining its developmental history and pointing out key improvements that may make plaster a key player in swimming pools, spas and waterfeatures for generations to come.

It's easy in hindsight to knock plaster as not having kept up with the times, but the fact remains that it was the one element of the overall package that didn't seem to need "fixing."

Proud As A Pebble

As I just mentioned, the use of pigments revolutionized the appearance of plaster in pools, but it did nothing to alter the basic nature of the product itself. That development came first in the 1980s, when *pebble-modified* finishes arrived on the scene. (I use the term "pebble-modified" to refer to a broad category of exposed-aggregate cementitious finishes that use rounded, smooth river pebbles or synthesized glass or even plastic beads as the aggregate in place of sand or marble.)

Thought to have originated in Australia as an interior pool finish (a point that's proved difficult to confirm), pebble surfaces were introduced to the U.S. market in significant numbers in the mid-1980s for pool interiors as well as in decking materials.

Pebbles caught on slowly, but eventually grew to redefine markets in many regions, particularly among more affluent consumers. In 1987, for example, pebble finishes accounted for less than 3% of the market in Phoenix. Ten years later, they were approaching the 50% mark – a fantastic growth curve that can be attributed to several key factors, including the natural appearance of pebble finishes, the variety of available "looks," a desirable texture and, most important, the product's durability.

Despite the dramatic shift in appearance pebbles provide, the difference is mostly one of method: During the application of pebble finishes, the surface cream is misted or washed off as a slurry that is subsequently pumped to an on-site holding area or tank and later hauled away. With the surface cream removed and the pebble aggregates standing just proud of the cement binder, the result is a surface on which it's extremely difficult to detect any etching or physical deterioration as the pool ages.

This "hide factor," as I like to call it, also helps conceal a variety of stains. In addition, the variegated pattern of the multi-colored pebbles visually breaks up the pattern and appearance of many types of mineral deposits. As a result, the mottling or shade variations so common in white and especially colored plaster interiors become less of an issue through pebble surfaces.

In the event that severe mineral deposits should occur with a pebble finish (perhaps the most significant potential problem affecting pebble surfaces), a light acid bath generally does the trick without changing either the texture or appearance of the surface. (But do note that the binder holding the matrix together is cementitious and that, over time, severely aggressive water may loosen some pebbles in some areas.)

The desire for this new look makes it clear that pebbles are here to stay.

On the contractor side, it's also a fact that pebbles require an investment in new tools and systems, including specialized slurry pumps, misting pumps and wands, and slurry-containment equipment and disposal measures. In addition, most pebble surfaces are mixed at a one-to-one ratio, or one 94-pound bag of white cement to one 100-pound bag of pebble (plus associated pigments that give these products their unique colors). All of this has a direct influence on cost per square foot – and on the customer's comfort zone in terms of expense.

As time has passed, other materials have joined pebbles in the realm of exposed-aggregate finishes. Many of these use white cements along with aggregates and synthetic aggregates of various sizes and colors. As with pebbles, the installation process involves removing the cream (or *laitance*) by one of several methods including light acid washes, in-air acid processes or combinations of acid washing and polishing with specialized equipment.

Many of these finishes incorporate pigments giving the consumer choices other than traditional white. When used in conjunction with the synthetic aggregates, the applicator truly can offer an exciting range of below-water combinations.

I specify "below-water" here because the other exposed-aggregate finishes do not stand up as well as pebbles do in dry, sunlit conditions. Where pebbles can "emerge" from the water on rolled-beam or beach-entry designs, the smaller exposed-aggregate surfaces tend to crack and/or de-laminate from the shotcrete when exposed.

Of course, exposing pebbles at the water line makes them subject to mineral deposition that can lead to a need for frequent acid washes and, in severe cases, blasting with glass beads. All in all, however, the desire for this new look makes it clear that pebbles (and exposed-aggregate finishes of all other types, for that matter) are here to stay. More exciting still is the possibility that these finishes, along with traditional white and colored plaster, are now benefiting from two classes of admixtures that *dramatically* enhance their durability.

Pozzolan Power

The interesting thing is that the first of these admixtures – that is, pozzolanic material or *pozzolans* – is among the most ancient of all cement additives.

These materials usually fall into one of three major groups. The first group consists of raw or natural pozzolans, which are usually (but not always) of volcanic origin. *Santorin earth* and *Shinasu* are, for example, found in the volcanic soils of respectively, Greece and Italy or Japan. For their part, the Romans used natural pozzolans and lime as construction materials in producing many of the world's most enduring aquatic structures.

(Another example of a natural pozzolan material that should be familiar to you is diatomaceous earth, which is made up of fossilized microbes known as diatoms.)

The second group of pozzolans is composed of natural products that have been heated at high temperatures (or *calcined*) to form highly reactive materials. Examples here are burnt clays, metakaolin and husk ash. The third group includes industrial waste products such as fly ash and ground, granulated blast-furnace slag. The use of fly ash to prevent efflorescence is familiar among those who apply shotcrete for pool shells and install decking around pools.

These pozzolanic materials are classified by materials expert V.S. Ramachandran as "siliceous or siliceous and aluminous material which in itself possesses little or no cementitious value but will, in finely divided form and in the presence of moisture, chemically react with calcium hydroxide at ordinary temperatures to form compounds possessing cementitious properties."

As such, pozzolans have an ability to perform a sort of alchemy in pool plaster by taking the weakest component of pool plaster – that is, *calcium hydroxide*, which is produced by the reaction of Portland cement and water – and changing it into a stronger compound.

This calcium hydroxide is of critical importance: Highly soluble, it constitutes about 25% of all the cementitious compounds formed as cement reacts. Pozzolans neatly convert the calcium hydroxide into one of two of the strongest, least-soluble calcium compounds – that is, calcium silicate or calcium aluminosilicate hydrate.

This lead-into-gold transformation is especially interesting in light of the fact that spot etching, general etching and other plaster phenomena are often associated with the selective dissolution of calcium hydroxide. In other words, when you chemically convert highly soluble calcium hydroxide into far less soluble compounds, you increase the plaster's ability to resist deterioration in the presence of aggressive water.

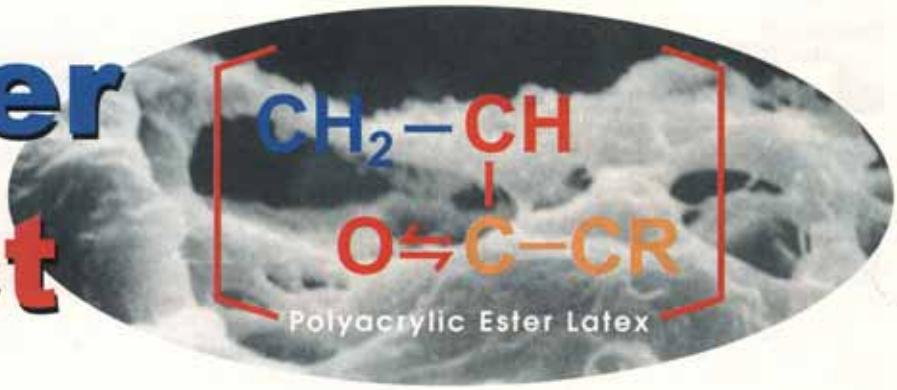
I began adding pozzolans (mainly calcined clays) to my mixes in the early 1990s and immediately noticed real improvement in the plaster's resistance to etching – not to mention improved workability.

Most pozzolanic materials are extremely fine – often smaller than the cement grains themselves, which are usually only 7 to 10 microns across. Because of their size, pozzolans offer a physical edge in addition to their chemical one: These tiny particles function as fillers in the minute "interstitial" areas between cement particles, thus reducing the porosity of the cement as well as its permeability.

The main downside with pozzolans also has to do with particle size: Despite small size, they have large surface areas, which increases water demand. This results in a need to monitor the relative percentage of pozzolans in use and, possibly, the need to use specialty admixtures such as water-reducing agents.

Helpfully, there are now several pozzolan-modified cement products on the market as well as several blended cements that already include aggregates and other additives. Pozzolans also are available in raw form, but using them requires familiarity with (and control of) the dynamics of the overall mix and getting relative proportions just right.

Polymer Perfect



The final component in my "P Triad" has not enjoyed centuries of use, as have the other materials discussed here – but they nonetheless have been around a good while.

Indeed, polymers have been used in the cement industry for more than 75 years now, with the first polymer-modified cements gaining their patents as early as 1920. These early products mixed latex (rubber) with cement to create specially modified mortars and concrete.

Today, most polymer-modified cementitious products are a bit more complex: They feature liquid latexes, powdered emulsions, water-soluble polymers, liquid resins and monomers that are either preblended or mixed with cements and aggregates at the jobsite. (In the case of dry-blended materials, the various chemical components are added to water in the mixer.)

We all hear the word *polymer* used in conjunction with all sorts of products these days, but few of us probably know what it means in the context of cement chemistry. According to N. P. Mailvaganam, a polymer is "a compound formed by the reaction of simple molecules having functional groups that permits their combination to proceed to higher molecular weights under suitable conditions."

That's not entirely helpful, but what he's saying is that polymers are essentially big, synthetic molecules that have been designed for specific purposes. A student at a seminar I was teaching once commented that he saw polymers as "special glues" (and pozzolans as "special dirt," which I also liked). His intention was humorous, but his approach comes close to that of many

chemists who refer to polymers as *chemical* glues that form a co-matrix with the *mineral* glues of cement and pozzolans.

In other words, almost all polymer-modified plaster mixes are characterized by a co-matrix consisting of, on the one hand, a matrix of coalesced polymeric material and, on the other, a matrix of cement particles that have, through gel hydration, interpenetrated into one another and developed a monolithic structure. The second major feature of polymer-modified plaster mixes is the formation of a surface film composed of closely packed polymer particles.

These unique characteristics allow polymer-modified plaster mixes to enjoy greater water tightness, greater resistance to chemical deterioration by aggressive waters and greater workability. Additional benefits include increased adhesion to shotcrete substrates – often critical in renovation projects.

The most popular polymer materials on the market today are acrylic latexes and powdered emulsions and silicon-based materials. These products

Coming To Terms

The lingo used in the plastering community continues to grow. Here's a quick glossary of key terms:

- *Admixtures:* These are traditionally added to mortar or cement mixes to alter application or performance properties. Typical classes of materials include set accelerators, set retarders, water-reducing agents, pozzolonic materials and polymer additives.
- *Aggregate:* In traditional plaster, this is usually a white marble or limestone (a metamorphically altered calcium carbonate). In newer products, larger aggregates comprised of river pebbles or synthetically produced colored sands are often used.
- *Concrete:* This is a mixture of cement, water and designed portions of sand, gravel, crushed rock or other aggregates. Typically, the aggregate will comprise 70% of the total mix volume.
- *Emulsion:* A material made up of colloidal resins or oil particles dispersed in a water system.
- *Latex:* An emulsion of a natural or synthetic polymer in a water phase.
- *Monomers:* A material composed of single molecules – the basic building blocks used in making polymers.
- *Polymer:* A compound formed by the reaction of simple molecules having functional groups that permit their combination to proceed to higher molecular weights under suitable conditions.
- *Portland cement:* A finely inter-ground mixture of calcium silicates, calcium aluminates, calcium oxides and other end products that result from processing selected raw materials (primarily limestone and clay) through a rotary kiln. The kiln product, known as clinker, is ground with predetermined amounts of gypsum (4-5%) to produce the final cement product. Portland cement is a hydraulic material: When mixed with water, it reacts and hardens after setting, even under water.
- *Resin:* A material (usually a solid or a viscous liquid), natural or synthetic, used as part or all of a film-forming phase with paints, varnishes, lacquers and other materials.

– G.G

can be added on site with traditional plaster components, white cement and calcite aggregates in liquid or dry form. Several suppliers also pre-blend them or package them separately as additives for on-site use.

As with any new product or additive, you need to know what you're getting into with polymers. I strongly suggest checking with suppliers about your intended application. Some polymer additives, for example, have excellent adhesive characteristics that make them useful in bonding new plaster to old shotcrete; unfortunately, these products also yellow or discolor when exposed to ultraviolet light or sunlight. Other products may form a film on the surface and then break down or re-emulsify in the aqueous environment of a watershape.

You should also check to see if the material is repairable or serviceable in the event that a minor repair is required. For example, will sanding a metal stain off the surface harm the surface film? You also need to watch mix proportions carefully: As with pozzolans, polymer additives should be used in careful balance with the weight of cement or the total mix weight. Too little or too much may have extremely detrimental effects on the final appearance, workability or resistance to chemical deterioration.

The last caution: Temperature sensitivity can be an issue with polymer-modified mixes. Most concrete masons and plasterers are aware that ordinary cement does not hydrate at low temperatures; they also need to know that most polymers will not coalesce at temperatures below 45 degrees Fahrenheit and may actually inhibit the cement from hydrating or actually "kill" the materials.

When in doubt, test the temperature of the substrate before applying these materials with one of several devices available on the market. My favorite is a gun-like device that you aim from about 12 inches above the substrate. All you do is pull the trigger to determine surface temperature in degrees Fahrenheit or Celsius.

PLASTER POSSIBILITIES

Within limitations described here, these additives and mixes provide excellent options for the builder, subcontractor and consumer. In fact, many can be sold with extended warranties that protect buyers from many of the common complaints about traditional plaster, from delaminations to spot etching – fresh reasons why these special products are attracting attention and displacing traditional plaster finishes.

To be sure, these developments are only the latest steps in an evolutionary chain that started with the first plastered pools and will continue until the industry attains the ultimate "fill it and forget it" finish. My sense is that the P Triad represents a great step forward in this developmental process – the clearest pathway now available when it comes to giving customers the trouble-free finishes they crave while allowing builders and subcontractors to work with materials, systems and applications they know well.

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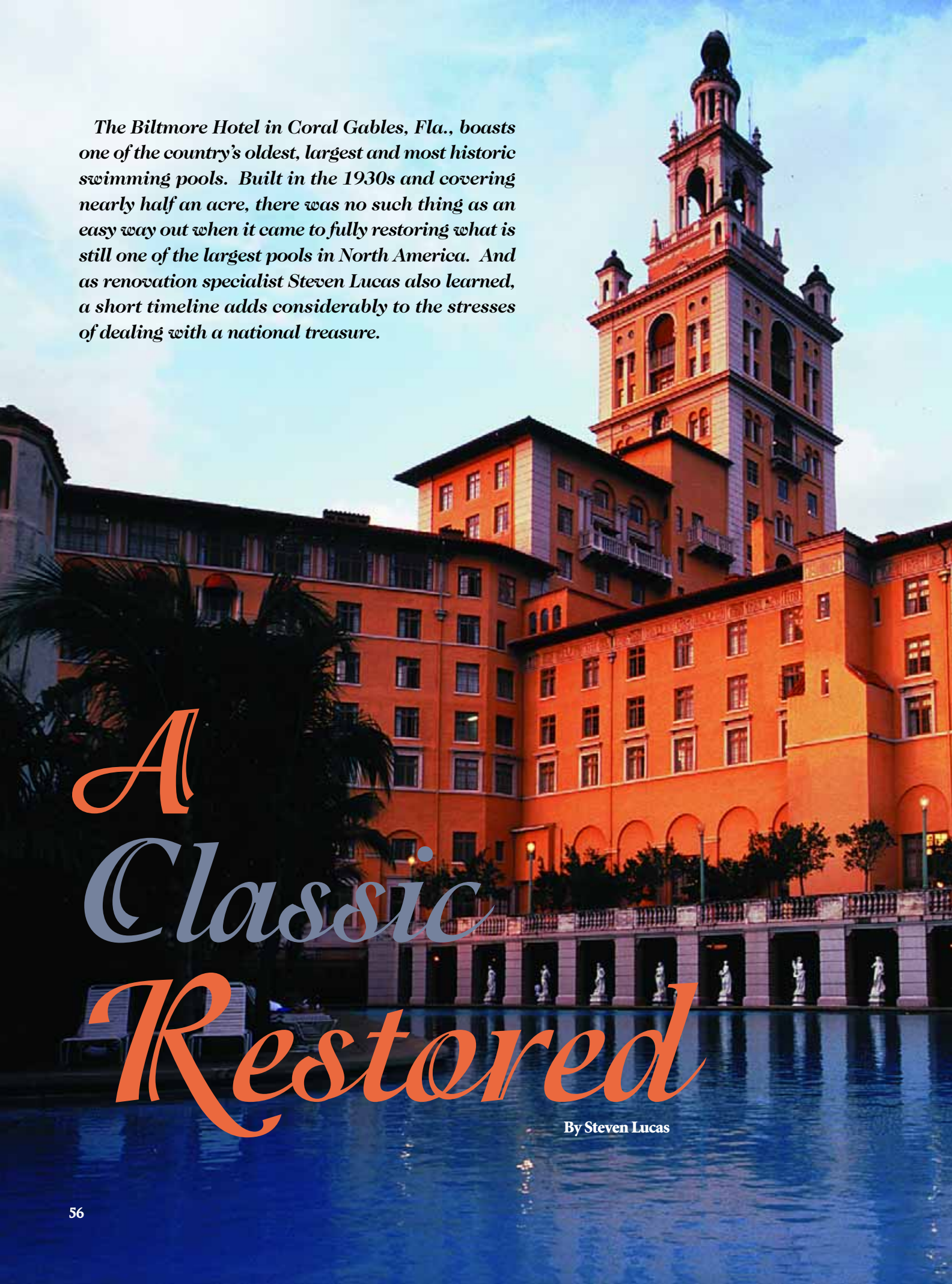

The Biltmore Hotel in Coral Gables, Fla., boasts one of the country's oldest, largest and most historic swimming pools. Built in the 1930s and covering nearly half an acre, there was no such thing as an easy way out when it came to fully restoring what is still one of the largest pools in North America. And as renovation specialist Steven Lucas also learned, a short timeline adds considerably to the stresses of dealing with a national treasure.

A Classic Restored

By Steven Lucas

Photo courtesy Biltmore Hotel, Coral Gables, Fla.

Steeped in history and a fixture of South Florida's cultural heritage, the Biltmore Hotel and its pool have now both been restored to their former glory.

With just a few weeks to go before our work was to begin, I took my wife Denise to visit the historic pool at the Biltmore Hotel in Coral Gables. I wanted to take a long look at what was (and may always be) the largest replastering job I'd ever landed.

As I stood at the edge of what can truly be described as a *huge* pool, I actually thought for the first time in my career that I'd bitten off more than I could chew: The surface of the massive U-shaped pool was in terrible shape and dragged down the hotel's otherwise beautiful decor and landscaping.

Yes, it was the kind of prestige job I'd always wanted, but it only took a few minutes for the enormity of what I had undertaken to sink in. Before long, I turned to Denise and said, "I think I've made a big, big mistake."

But there was no turning back, so from that point until the job was complete, I thought about nothing other than the project, planning for every conceivable detail, looking at the operation in all its facets and considering all it would take to get the results the customer was demanding.

I even started a notebook and kept it with me constantly, writing down questions as they came to mind. And I didn't let *anything* go until I was sure I knew the answer. It was quite an adventure, and the best thing is that we all lived to tell the tale.

IN DEEP

I first heard about the project from my friend, John Centera, owner of Starlite Pools in Sunrise, Fla. He had been asked to bid on the pool's restoration, which included some tile work and minor repairs, but the bulk of the work would be preparing for and installing a new surface. He wanted a local plasterer with the ability to handle large projects. That's our specialty, so we got the call.

Centera cautioned us that the project timeline was set in stone and that we had only the few weeks between Thanksgiving and Christmas to get the whole job done – and that once we committed ourselves, there

Continued on page 60

Getting a huge job done on a short timeline required mobilization of more than 65 laborers and finishers drawn from a half-dozen plastering firms. The logistics involved in keeping so large a group working as a team was indeed a tremendous challenge.

Of Interest

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 at page 58.

New boom pump offers versatility

Circle 100 on Reader Service Card

REED MFG. introduces its *XXT32 Dragonfly*, a truck-mounted, 36-m. boom pump. *Dragonfly*'s front and rear outrigger legs are attached at a single pivot point, allowing the rear leg to overlap the front as needed. The front outrigger leg is then able to slide out very close to the cab of the truck for greater versatility, thus avoiding jobsite obstacles and allowing set-up in extremely tight situations. The 350-hp Mack truck, 44,000 ft./lb. Steibel PTO-driven concrete pump includes Reed's S-valve as well as its Power-Flo dual Rexroth A4V125 closed-loop, over-center hydraulic system to achieve a maximum pumping output of 200 cu. yd. per hour with concrete pressures of 1,300 psi. A fully proportional control system allows for smooth pumping and keeps boom bounce to a minimum even when pumping at maximum output. The *Dragonfly* also incorporates Black Box pump cycle control for smooth, fast pump cycling. This technology eliminates the heat-generation problem of hydraulic cycling and failures of old-style relays. **Reed Mfg.**, Chino, CA.

System purifies as it cleans

Circle 101 on Reader Service Card

KREEPY KRAULY USA's *Pollywog* is a new mineral-based water purification system that easily attaches to an automatic pool cleaner hose. The system's special minerals eliminate bacteria, prevent algae growth and help stabilize pH for six months at a time, and a replacement canister attaches in just seconds. *Pollywog* reduces the need for adding chemicals while maintaining superior water quality as your pool cleaner cleans the pool. The unit installs on the pool cleaner's hose in seconds without tools. **Kreepy Krauly USA Inc.**, Sunrise, FL.

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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Chlorine Generator Now Directs Water Flow

Circle 102 on Reader Service Card

GOLDLINE CONTROLS introduces its *Turbo Cell*, now available with all Aqua Rite electrolytic chlorine generators. Its unique offset design creates a turbulent "scrubbing" water flow that directs water flow and offers an advanced answer to preventing mineral deposits. The *Turbo Cell* is covered by a five-year limited warranty. **Goldline Controls**, East Greenwich, RI.

Ozone-System Sizing Software

Circle 103 on Reader Service Card

DEL INDUSTRIES' new *Pro*$_3$ *Size* is a software package that allows designers, architects, contractors, distributors and representatives who specify ozone for commercial pools to properly size ozone- purification systems. Developed by DEL industries, *Pro*$_3$ *Size* is designed to simplify the ozone-sizing process, prompting users for essential information relating to the facility, then calculating the required amounts of ozone. The software is available on CD-rom or floppy disk. **DEL Industries**, San Luis Obispo, CA.

Glass Tiles Detailed in Four-Color Catalog

Circle 104 on Reader Service Card

BISAZZA NORTH AMERICA's "Panorama Mosaico" is a 44-page four-color catalog of its full range of glass-mosaic tiles seen in finished works. Coverage includes a full

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could be no turning back.

We knew it would take a company like ours, with the staff, the equipment and, most important, the project management needed to get the job done in an orderly way, but I told Centera I needed to think it over. I visited the site, did a careful inspection and, before submitting a bid, mentally walked through as much of the project as I could, trying to visualize how each phase would come together.

Ultimately, I sent Centera a bid he incorporated into his master bid. According to the plan, Starlite was to do all the prep work and the tile repair; we would tackle the installation of the Hydrazzo, a type of polished exposed-aggregate finish supplied by Aquavations, which happens to be based in Coral Gables and would play an active role in the project.

From the outset, it was clear we'd all have to work hand in glove to make it all work – but there was so much more to the job than setting up divisions of labor. In fact, the project was so huge that I needed to double the size of my own crew to about 65 finishers and laborers, which meant coordinating with competing plastering companies in the immediate area. Before I finished, I'd enlisted top people from six other firms; they saw cooperation as a good opportunity to make a nice dollar for a day's work and become involved with the most prestigious job any of us had run into in a long time.

Denise worked closely with these contractors to make sure that everyone had cleared their calendar for the big day – December 7. We organized the workforce into two groups – finishers and laborers – and established a chain of command for each. We also developed a tight schedule for the placement of equipment and supplies as well as for the arrival and dispersal of labor over the various portions of the pool.

LAYER UPON LAYER

In the weeks leading up to December 7, Starlite surveyed the pool, sending in a diver to determine the nature and extent of the damage to the plaster. Starlite's inspection and subsequent analysis of some plaster samples collected by the diver revealed that the pool had been resurfaced at least six times through the years, leaving behind what looked like sedimentary layers of material that were up to three inches thick in some spots.

Our initial plan was to take the plaster down by two or three layers to reach a solid, uniform substrate and then install the new finish at a uniform depth of about half an inch.

The work began in earnest November 26, just after Thanksgiving, when Starlite's crew set in pumps to drain the pool. Hotel staff had estimated this process would take only half a day, but in actuality it took more than a day and a half. At this point, we discovered that nobody knew how much water the pool held; suffice it to say we were dealing with more than any of us had ever dreamed of.

Once the pool had emptied, Starlite's crew began chipping out the surface – and we immediately ran into trouble. Centera informed me that the existing material was inconsistent and that some areas were easily removable and others so hard that even jackhammers proved ineffective and no more than a half-inch or so could be removed.

There would be no problem building up from this remarkably hard material, but the variable thicknesses of the substrate meant that we would be forced to increase the depth of the new surface in the areas where it was necessary to take out more old plaster, forcing us to lay new material more than two inches thick in some spots.

At first, this depth differential looked like a show-stopper. For one thing, it meant we would be using far more material than initially anticipated. Of even greater worry, however, was the concern that, when applied so thickly, the Hydrazzo finish would develop shrinkage cracks or cure unevenly. (Typically, these finishes run no more than an inch deep.) Fortunately, the staff at Aquavations was able to make some key adjustments in the product's formulation that enabled us to apply it in greater depth and still achieve the smooth, uniform finish required.

This crisis averted, we ordered up 120,000 pounds of the pre-mix material in a standard Scandinavian Rose color chosen to match the terra cotta plaster on the hotel – and then we waited for Starlite to hand the job over to us.

As that day approached, Starlite's prep crew worked seven days a week in a fevered attempt to lower the high spots and decrease the depth differentials. Amazingly, they were able to remove material that was as hard as any old plaster any of us had ever seen. By the time they finished, the differential in material depth was less than two inches – not ideal, but workable.

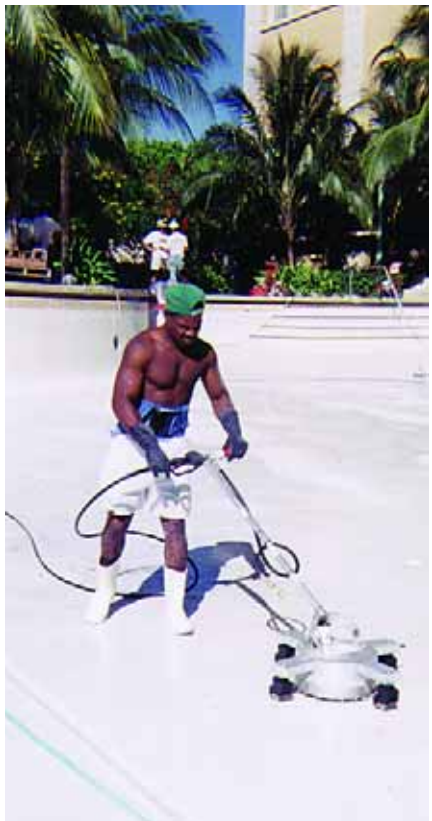

Photo courtesy Aquavations, Coral Gables, Fla.

Fortunately, we were able to make relatively short work of finishing the floors through use of a (successful) prototype floor polisher offered to the project by Aquavations.

As a final preparatory step, Starlite's crew applied an elastomeric bond coat to give us a uniform adhering surface. This was intended to eliminate any absorption problems we'd be likely to encounter over the vast surface area of the pool and provided us with an effective mechanical "key" for adhesion of the new surface.

BESEECHING THE SKIES

As we prepared for the big day, more and more phases of the project began to come together. We arranged to have the material delivered to the site and secured all the equipment we needed to run four

Filling the 600,000 vessel (above) takes time — and it was a tense time for us, because we didn't want the new finish exposed to too much and the Florida sun as the process inched along.

mixing stations that were to be located in the pool itself. (Setting the mixers down in the pool was necessary because there really weren't any other places on the property to place the mixers.)

We spent a good bit of time simply reviewing and working through our game plan – dividing the pool into five zones defined by tile breaks that run through the pool's interior and thinking through the process from the point furthest from our access area through to the final spots in one of the pool's two shallow ends.

Once on site, we started in one shallow end, moved through the deep end and then up into the pool's other shallow end. Although it's unusual in a renovation to end up in the shallow end, it made the most sense given the layout of this particular pool.

We planned to do the largest of the sections toward the middle of the day, at a time when we knew we'd have the most people on hand to help. As our time on center stage approached, we had everything in place and had left nothing to chance – except, unfortunately, the weather.

On December 7, I left for the site at about 2:30 am so that I could take my time, ease into the work and prepare myself mentally for the day ahead. When I arrived at about 3 am, it was pouring rain, and the forecast called for showers during the early part of the day.

This caused some serious concern, because nothing in the plan accommodated weather delays. Working with so many different companies meant we had no choice but to make things happen on time. As I watched all that rain falling through the wee hours of the morning, I was certain that doom and destruction awaited all my careful planning.

By the time the sun came up, however, the sky had cleared. Some water had collected in the deep ends, but because we were starting in a shallow area, we had time to pump the rainwater out before we'd get to those areas.

From that point forward, the job of mixing, plastering and moving on went pretty smoothly. Make no mistake, however: It was a stressful day, compounded by the fact that the hotel was fully operational and we were in charge of 65 workers who were supposed to be kept as separate from the hotel's upper-crust clientele as possible. Just making sure that everyone showed up and was working according to plan required a major effort!

OF MIXERS AND SQUEEGEES

All in all, I'd have to say things went very smoothly as we moved through the pool.

A major concern had been achieving a consistent and proper mix for the aggregate material. I was reassured by the fact that Bruce Torrance was overseeing the mixing process: He's the guy who created the Hydrazzo finish, and he worked long and hard to make certain we had material that was thick enough to build properly – but thin enough to level and trowel. The scale of all this is a bit mind-boggling: By the time we finished, it's estimated that we used 15,000 gallons of water in mixing the 120,000 pounds of material.

Given the problems Starlite had in removing the old material in some places, one of our biggest challenges was making certain that the finish on the expansive pool floor was level. We dumped material in place using wheelbarrows, then small battalions of laborers with broad squeegees hopped in to pull the material across the floor. Crews of finishers with trowels then followed, smoothing the surface. Two foremen were always on hand: They knew where the high spots were and conducted frequent checks of material depth to keep the Hydrazzo at least 3/8-inches thick.

At the end of this long day, we'd spent a bit more than 12 hours inside the pool and had used just about all of the material. The choreographed movement of labor, material and equipment had come off virtually without a hitch, and I breathed a huge sigh of relief as I thanked the sky.

The next day, we returned to begin the process of polishing the finish. The final look and texture of the Hydrazzo finish is achieved by exposing the large marble aggregate using a light acid wash and then polishing the coarse pieces of marble aggregate to the desired smoothness. One of the keys to success with this finish is to remove just the right amount of cement after the material has been applied.

With a crew of six, we showed up with 300 gallons of muriatic acid – but ended up using slightly more than 100 gallons for the entire pool in a weak 3-to-1

water-to-acid mix that removed only the very top layer of cream.

(In preparation for the job, I had done some informal experiments on an 8,000-square-foot pool at another location and did what I could to align acid mixes and resulting polishing times. I found that if you get too aggressive with the acid wash, you expose larger portions of the coarse marble aggregate and can dramatically increase the labor required to polish the surface smooth. By the same token, if you don't expose enough, you're polishing cement rather than the aggregate.)

The acid washing went completely according to plan, and we were able to begin polishing at about 4 pm the same day.

LASTING IMPRESSIONS

To polish the Hydrazzo, we used hydraulic tools called "Hydrotorques," also manufactured by Aquavations. Helpfully, one of these was a prototype of a floor polisher — a real back-saver given the size of the pool's floor. Their diamond abrasives cut through and polished the marble aggregate down to the desired final finish.

On this job, we needed to keep an eye on both the smoothness and non-slip characteristics of the finish, as mandated by the local department of health. Our use of 70-grit abrasive wheels enabled us to polish the surface fairly quickly while leaving behind the necessary texture – a factor checked several times by a health inspector who was on hand throughout the polishing phase.

With the surface finished, we began filling right away using a special manifold built by Starlite for attachment to a two-inch water main. Starlite handled the start-up along with my staff and Aquavations' Randy Dukes; all fill water was run through a bank of carbon-activated filter tanks, given the tendency of South Florida water to contain a variety of undesirable mineral constituents. Best of all, the filtering and ongoing treatment meant the pool was ready for swimmers as soon as it reached capacity.

We spent a lot of time worrying that the finish would develop shrinkage cracks as a result of rapid curing; fortunately, the December weather stayed cool most of the time, and to date we've found no signs of any cracking.

I've heard it said often that luck is the residue of good planning. Given the fact that nothing truly went wrong on this project, I'd have to say that we were indeed lucky.

I consider myself fortunate in another respect as well: It's always a pleasure to work on a project that, when you leave it, you have the sense that you've done something well, something that made you stretch your own abilities. Through the years, countless people have enjoyed this pool. I'm proud to know that for many, many years to come, our work will be a part of the experience people have when they take a dip in a swimming pool that has become a part of South Florida's cultural heritage.

At last, I'm certain that taking on this job was no mistake!

A Dip into History

The swimming pool at the Biltmore Hotel in Coral Gables, Fla., is among the most historic in the United States.

Built in 1926 as part of the resort's original construction, the swimming pool's immense size – 22,000 square feet holding a whopping 600,000 gallons of water – made it the largest inground concrete swimming pool in the country. As beautiful as it is large, the pool is surrounded by cabanas, Moorish arcades and classical statuary. In the 1930s, swimming legends Esther Williams and Johnny Weissmuller starred in productions staged in and around the pool.

The hotel overflows with history as well. During the Jazz Age, the hotel typified the South Florida lifestyle and was host to the social elite of the day, including the Duke and Duchess of Windsor, Ginger Rogers, Judy Garland, Bing Crosby, Al Capone and many others.

With the onset of World War II, the hotel was transformed into a hospital by the War Department – and remained a Veterans Administration hospital until 1968, when its doors were closed. In 1973, the City of Coral Gables took ownership of the site but did nothing with it for more than 10 years. In 1983, however, the city oversaw the old hotel's complete renovation, a project that consumed four years and an estimated $55 million.

The Biltmore reopened to the public December 31, 1987, and has assumed its rightful place as a world-class hotel and first-class resort. To this day, officials back the hotel pool's claim to be the largest such vessel in the continental United States.

– S.L.

We look back on this project with tremendous satisfaction and the sense that we all contributed to the preservation of a great landmark for generations to come.

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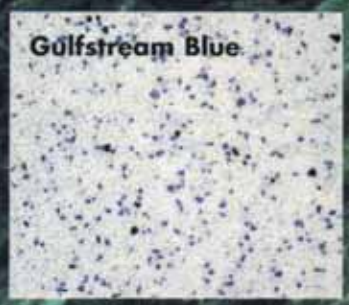

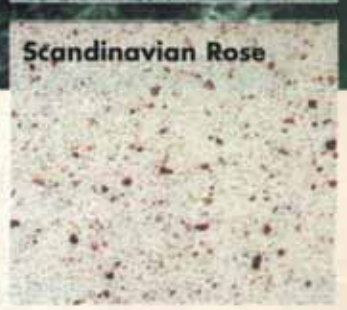

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Continued from page 59

range of tiles suitable for use in pool and spa projects as well as mosaic packages. Also included in the catalog is a detailed color chart. **Bisazza North America**, Miami, FL.

SPECIAL VALVE OFFERED WITH WATERFALL SYSTEM

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TELEDYNE LAARS is now offering a *NeverLube* three-way valve with every Sheer Descent waterfall feature. Designed to produce a range of water effects and easily adjustable to fit any mood or environment, Sheer Descent is available in curved and extended-lip models to achieve a variety of design concepts. The patented *NeverLube* valve never needs lubrication and is totally maintenance free. It never cracks, melts, loses pressure, or slips – even under a working pressure of 70 psi. Its rounded bottom prevents the diverter from being glued into place. It's also guaranteed for life. **Teledyne Laars/Jandy Products**, Novato, CA.

SIMPLE BACTERIA TEST NOW AVAILABLE FOR ON-SITE USE

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AQUA VAC's *De-Tekt* is a simple, inexpensive bacteria test that can be performed on-site. The simple test is safe and dependable, and it keeps pool owners and users out of harm's way. **Aqua Vac**, West Palm Beach, FL.

NEW PUMP FOR MAKING ARTIFICIAL ROCK

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QUIKSPRAY has developed its new *Carrousel Heavy Duty Pump* (model #15010TBM-3-GAM) for the spray application of heavy-bodied cement coatings, with or without fibers, for the production of artificial rocks and water scapes. The pump uses peristaltic principles; no moving parts come in contact with the material, which makes for a low-maintenance system. This variable-speed model is powered by a high-torque pneumatic motor requiring a 125 cfm compressor, but electrically and hydraulically driven models are also available. The system also can run dry indefinitely without sustaining damage. **Quikspray, Inc.**, Port Clinton, OH.

Continued from page 66

piece of rubbed glass, they found that they *attracted* one another! Therefore, they reasoned, the electric charge on the amber must be *different* from the charge on the glass.

All Charged Up

Through the years, it has been shown that every object that can hold a charge of static electricity will fall into one of these two categories: It will either be attracted by the amber and repelled by the glass, or it will be attracted by the glass and repelled by the amber.

Try it yourself: The accompanying sketches show how to set up a little experiment using a pair of plastic rulers (for the resinous elements) and a pair of glass rods (for the vitreous elements). The rulers should be easy to come by – or any thin strip of plastic will do. And you can substitute a pair of wine glasses for the glass rods – empty and dry, please.

Charge **them all up by rubbing** vigorously with a soft cloth or by stroking them through a friendly person's clean, dry hair. Or, best of all, give each item a few strokes with the family cat, providing, of course, that the family cat is willing and has previously shown an interest in fundamental science.

These things were all known by the 1740s, but not truly understood or well documented. That began to change when Benjamin Franklin took an interest and sponsored a series of electrical experiments. It wasn't long before he leaped in with both feet and purchased the experimenter's devices and apparatuses so that he could delve deeper into the subject. The results of Franklin's involvement are still with us today.

Two quick thoughts regarding Franklin are in order here: First, although he benefited from less than two years of formal schooling, he retired from the business world at the age of 42 with a modest fortune acquired primarily from his printing and publishing interests. It was *after* his "retirement" that he became active in government, became postmaster general, promoted the first hospital in the colonies, founded the University of Pennsylvania and the American Philosophical Society, developed the concept of Daylight Savings Time, investigated the Gulf Stream, was a principal author of the Declaration of Independence and, at the age of 75, sailed to Europe to negotiate the final peace with Great Britain. That's some retirement!

Second, our minds' eyes have us locked on Franklin as he appears on the $100 bill – a good likeness of him when he was in his seventies. But when we think "electricity," we must see a much younger man, because the kite-flying-in-the-thunderstorm incident took place when Franklin was just 46. By ten or 15 years later, he would have gained enough knowledge about electricity that he would never have tried such a dangerous experiment. All in all, quite a guy.

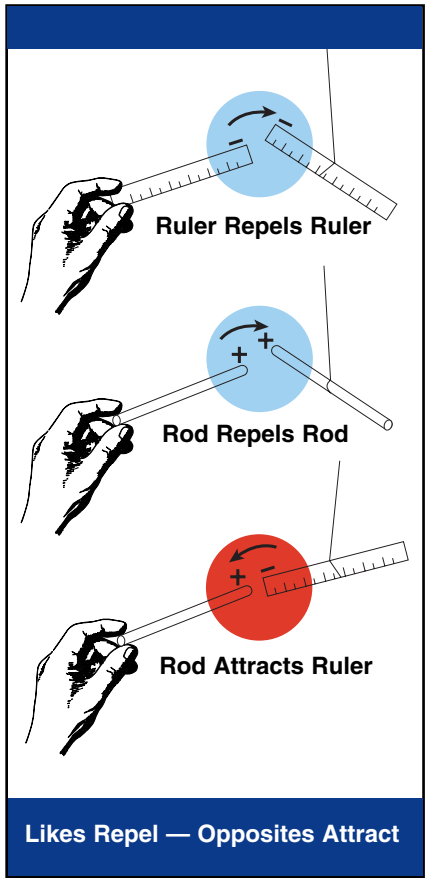
Finding the Flow

Franklin's experiments led him to the conclusion that there was only one kind of electric "fluid" and that the difference from one charged substance to another corresponded to whether the substance had either an excess or a deficiency of that fluid. He said that the rubbed glass rod had an excess of vitreous electricty and was, therefore, a *positively* charged body; conversely, the rubbed amber had a deficiency of vitreous electricity and was, therefore, a *negatively* charged body.

Thus, Franklin proposed that when a positively charged body comes in contact with a negatively charged body, the electric *current* must be *flowing* from the first body (where there is an excess) toward the second body (where there is a deficiency). In other words, everything must equal out – that is, *neutralize.*

In the 100 years following Franklin, other scientists proposed two-fluid theories that have proved to be closer to reality than Franklin's single-fluid idea – although the factors involved are much more complex than visualized by any of them.

Franklin acknowledged that his choice of which term went with what substance was arbitrary, and to some degree we might wish he had reversed his use of positive and negative. In any event, we continue to use Franklin's terminology today. Our present understanding of the structure of atoms, for instance, provides us with *positively* charged protons and *negatively* charged electrons.



We also know that nature does not allow any imbalance to exist for long: Likes attract and opposites repel. When those opposites are negatively charged electrons and positively charged protons with a conductive connecting path, we can expect a current flow – a movement of negatively charged electrons through a conductive path.

Incidentally, Ben Franklin also coined the terms *plus* and *minus*, *charge* and *discharge*, *conductor*, *electric shock*, *stroke* and *electrician* – a term he used to describe a scientist dabbling in electrical experimentation. His inventions include the rocking chair, bifocals, the Franklin stove, the odometer and his most important, the lightning rod, which is in worldwide use today, virtually unchanged from the original model. And I can't find time to go get a haircut . . .

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

Ben Franklin, Electrician

By Jim McNicol

Why does the current flow?

That was the question we left on the table at the end of our last session. We had pretty well nailed down the *ampere* as being the basic unit of measurement of electric current, in that it describes the quantity of flow of electrons from one place to another. We were about to examine the *volt*, the *ohm* and the *watt* when the current-flow question arose to command our attention.

To get a firm handle on this, we are forced to backtrack a bit. Actually, we have to go back a long, long way – about 60 million years, to when a particular species of pine-like trees grew along the Baltic coast. Over the millennia, the resin from those trees became fossilized, producing the beautiful, beer-colored material called *anbar* by the Arabs. The Spanish corrupted that into the name that we use for it today: *amber.*

Many of us will recall an elementary-school field trip to the museum where we stared in fascination at an ancient bug trapped forever in a lump of amber. There is evidence that man has used amber for more than 10,000 years – as a medicine, as jewelry, even as amulets to protect against witchcraft.

But it's the Greek connection with amber that is of the greatest interest to us in our discussion of things electric.

Tales In Amber

The Greeks recorded the fact that when a lump of amber was rubbed vigorously with a piece of fur or soft cloth, it acquired the magical ability to attract small particles of dust, thread and other matter. Although they could not begin to explain this phenomenon, it became a popular topic of discussion – the parlor trick of its day.

The Greeks had their own word for amber – it was "ηλεκτρον." That's approximately *ilektron* in English – our word *electron.* This phenomenon eventually became known as the "electron effect"; today, we refer to it as *static **electricity.*** (A whimsical thought: If English had been popular for scientific dialogue a few hundred years ago, we might be using the words *ambericity* and *amberonics* instead of *electricity* and *electronics.*)

By the early 1700s, the people studying such things were

convinced that there were two distinctly different forms of this electric "fluid": that produced by rubbing amber, hard rubber, sealing wax or other resin-like substances, and that produced by rubbing vitreous (glass-like) substances such as glass or mica. These names stuck for a while, with the scientists of the time referring to *resinous electricity* and *vitreous electricity*.

How did they know they had two distinctly different forms of a phenomenon?

They observed that a rubbed piece of amber will attract the same bits of dust and thread that are attracted by a rubbed glass rod. They didn't learn anything from that, but when they brought a piece of rubbed amber near another piece of rubbed amber, they found that they *repelled* each other. And when they brought a piece of rubbed glass near another piece of rubbed glass, they saw that they repelled each other, too.

But when they brought a piece of rubbed amber near a

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