CONTAINMENT: When designing a vanishing-edge catch basin, knowing how much water to contain makes all the difference

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Vanishing-edge pool experts Skip Phillips and Lew Akins get pretty passionate when talking about their specialty--especially about what can go wrong.

Both men serve as expert witnesses in lawsuits and both have seen more than a few vanishing-edge atrocities, resulting from mis-sized catch basins or holding tanks.

"I had one [instance] where the customer had a $112 average water bill for 10 years, and it went to $650 after they built their negative-edge pool," says Akins, president of Ocean Quest by Lew Akins in Salado, Texas. "Every time they went swimming, they lost about 150 gallons of water. In the summer, if they'd have three swimming events in a day, that was 450 gallons.

"The pool contractor told them that's the way [negative edges work]."

Fortunately for the original builder, this was a fairly easygoing customer, wealthy enough to afford such a mistake. Some customers, however, don't take such mishaps in stride. "We've seen cases where the remedy for fixing them has been to remove and replace," Akins says.

Such miscalculations can prove even more catastrophic. If enough water spills onto the surrounding soil, it can erode the soil, detracting from its stability. If the water falls down slope into a neighbor's yard and erodes their soil, it may even compromise their home.

Less-disastrous results from mis-sized basins, such as high noise levels and pumps mined by cavitation, also can put a serious damper on the pool-owning experience.

In many ways, the basin is the hub of the vanishing edge. Its job isn't merely to store the water that falls into it, but to contain enough water to replenish the pool and plumbing under any given circumstance. That's why a catch basin's size is the most crucial part of its design.

Sizing the catch basin works on principles that aren't always obvious, so taking the proper steps--and avoiding any kind of guesswork--is crucial.

Here are the steps experts say must be followed to properly size a vanishing-edge catch basin:

Get into the volume mind-set

First, and most importantly, remember that volume dictates the tank's dimensions, not the other way around.

There must be enough water to flood the weir, replace water lost from swimmers, keep the pump primed and hold any water that will drain from waterfeatures placed above the main pool. You may also want to contain the spa's volume and any captured rainfall. Attached vanishing-edge basins also must be sized to capture splash-out and water lost in winds.

As for the dimensions necessary to accomplish this, Akins says, "It's a moving target. Everything you do impacts the design." So using the same dimensions every time--say, vanishing-edge length by 2 feet wide by 3-1/2 feet deep--won't work.

Secondly, when calculating the basin's capacity, builders can't include its whole volume. The bottom point of your calculation should start at the minimum operating level. This is the depth of water you need to prevent the drain from sucking air, which can result in cavitation. The top point of your calculation should begin at the overflow line, placed at the top of the tank. This is the highest level that water will go before it gets carried away.

You can also try this equation for calculating the tank's surge capacity:

Overflow line height - minimum operating level = surge space.

Thus, a 4-foot-deep tank with a 1-foot operating level and an overflow pipe placed 6 inches below the rim (at the bottom of the pipe) would contain 2.5 feet of surge capacity.

Establish your minimum operating level

To establish your minimum operating level, figure out how high up the water will vortex in each of the drains in the basin or tank. This depends on the velocity through which water leaves the drains.

Phillips and Akins achieve a 1-foot operating level because they minimize that velocity. The lower the velocity, the lower the minimum operating level.

To get a low minimum operating level, you must use large plumbing and smaller pumps, says Phillips, Genesis 3 co-founder and president of Questar Pools in Escondido, Calif. For example, he plumbs his systems to move 1 foot or less per second through each drain.

Akins sometimes keeps his minimum operating levels at 6 inches. To do that, he keeps the total velocity among all the catch-basin drains at less than 2 feet per second.

"If you use the typical pool-guy mentality, where you've got 2-inch plumbing on a 2-horsepower pump, that pump will vortex that water through 3 feet of water, Phillips says. "Having the right volume with the wrong pump and line size, you could still very easily have a failure."

Akins and Phillips, both instructors on building vanishing-edge pools, still constantly find themselves frustrated with pump and plumbing practices. The wrong choices prove especially disastrous on this type of pool. "In my seminar, I always say, If you guys out there still think of 2-inch pipe as the big stuff, you're in big trouble here,'" Akins says.

Compute displacement

Every swimmer who enters the pool will displace water over the edge. Every swimmer who dives into the pool will displace even more. And every swimmer who cannonballs will displace the most.

The catch basin has to contain that displaced water. This not only prevents water loss, but also maintains the vanishing-edge illusion and keeps the system running, says David Schneider, president of Natures Creations in Santa Fe, N.M.

If you don't account for this volume, he says, "You'll never have enough water to refill the pool when everybody gets done swimming. Your pump will cavitate because it's sucking air and will run dry. If you really miss it, your tank's empty and your pool doesn't negative overflow because it doesn't have enough water to do it with."

Larger pools present a greater danger of this happening, Akins says, "because more people will fit it in and if the catch pool is too small, it will overflow because there's not enough room."

To figure displacement, Akins uses this equation:

Number of people in the pool x 25 = displacement

To calculate the number of people in the pool, Schneider looks to his clients. "If it's a family with kids, then I figure they're going to have parties of 25 people in there," he says. "If it's just a husband and wife, and they say it's really going to be a low-us-age pool, then I only factor in 10 people."

He arrived at this number by observing pool parties. "You will find that usually the parties are 15 to 20 people, and only about one-half are in the pool at any one time," he says. "Very rarely do you see parties of 50 or more who are swimming."

Of course, ponds or waterfeatures that will not take on bather load will not need to contain this gallonage.

But there's another way to figure displacement that Phillips and other proponents say is nearly foolproof: The 2-inch rule.

To do this, calculate how much water it would take to replace the top 2 inches of water in the pool, using the equation for figuring out how much water is needed to flood the weir (see sidebar on page 70).

The lower the water level, the less will splash out of the pool, he says. Experiments conducted by Phillips have shown that once the water drops 2 inches, it reaches equalization, a point where the system supplies water as quickly as it can splash out. So no matter how many people enter the pool, or how hard, you can expect it to take care of itself after 2 inches have been displaced.

For small pools, where bodies can make a larger volumetric impact, he'll boost that number.

Just to be sure, Schneider uses the 2-inch rule to start, and then adds an additional displacement figure.

Calculate water in transit

The amount of water to recover splashout will almost always trump water in transit--the amount necessary to spill over the edge. So when designing vanishing-edge pools, calculating displacement will take care of everything. But if you're including a vanishing edge on a waterfeature that will not contain swimmers, you will need to calculate the water in transit.

The water in transit depends on the look you want and the tolerance of your weir wall. The more level the weir wall, the less water is needed to cover it and, therefore, the smaller the catch basin. The less flat and level, the more water it takes to overcome the low points.

To figure how much water in transit is needed just to cover the wall, multiply the edge tolerance by two. Where it would take a 1/8-inch sheet to cover a weir built to a 1/16-inch tolerance, you'd need a 1/2-inch sheet to cover an edge built to 1/4-inch tolerance.

The more dramatic the effect, the bigger the catch basin needs to be.

"Is [the client] looking for a sheet of water or just a vanishing-edge appearance from the high side?" Akins says. "That makes a humongous difference in the catch pool size requirement."

In calculating the gallonage required to create this effect, you need to allow enough water to lift the water in the entire pool until it spills the right amount over the weir.

But keep in mind that when water falls, it automatically breaks up and splashes. Attached catch basins or gutters going to remote tanks must be wide enough to catch this splash-out.

This width will depend on how far the water drops, says Phillips. "Generally, it's a one-to-one equation," he says. "If your gutter is 1 foot lower than the vanishing edge, then the opening of the gutter should be probably 1 foot wide. If your surge tank is 2 feet lower than your vanishing edge, then it should be 2 feet wide.

What doesn't affect the size of the basin is the length of the weir, says Akins. To spill the right amount of water over the edge, the whole pool has to lift, regardless of the weir's length.

This fact seems to go against many pool builders' instincts, notes Akins. "The real danger is when big pools have short Weir walls," he says. "They have a shorter weir, so they only make the catch pool as wide as the weir and they don't compensate for it with a significantly extra depth or width."

RELATED ARTICLE: Sheet thickness.

To spill the necessary sheet thickness or recover water lost to displacement, the water level of the entire pool must lift.

For example, if you built to a 3/8-inch tolerance and only need to wet the edge to create the right look, you would have to lift the whole pool's water level 3/4ths of an inch so it overflows.

Calculating the water volume necessary to do that requires a three-step equation. We'll try it on a 1,000-square-foot pool to pour a 3/4-inch sheet over the weir:

1. Convert the pool's surface area into cubic feet: (upper pool surface in square feet) x 7.5 = cubic foot gallonage

The 7.5 represents how many gallons a cubic foot holds. This tells you how many gallons it would take to lift the pool 1 foot. You only need to find out how much water will lift the pool a fraction of an inch.

In our example: 1,000 x 7.5 = 7,500.

2. Find out how many gallons it takes to lift the water 1 inch:

cubic foot gallonage / 12 = cubic inch gallonage

With "12" indicating the number of inches in a foot, now you know the gallons that sit on the top inch of water.

In our hypothetical pool: 7,500 / 12 = 625.

3. Break this down to the sheet thickness you actually need:

cubic inch gallonage x desired sheet height (in decimals) = volume to lift pool

The required volume in the example: 625 x .75 = 468.75.

If you want to recover 2 inches of displaced water, multiply the cubic inch gallonage by 2 in Step 3.

Remember: This only takes care of the water needed to flood the edge. "I've actually seen guys try to do this with 500-gallon catch pools. Needless to say, they're a train wreck," Akins says, because the basin still has to accommodate displacement and gallonage from other factors. --R.R.