A Primer on Water Management

Strategies for dealing with water both around and on a home

BY STEVEN BACZEK

Water is probably the biggest enemy of the structures we build. It's relentless, and given the chance, it will ruin our hard work. So for residential construction, water management isn't an option or a preference—it's a requirement. And to develop proper techniques for keeping water at bay and under control, we need to understand it and respect it.

THE 'GRAVITY' OF GRAVITY

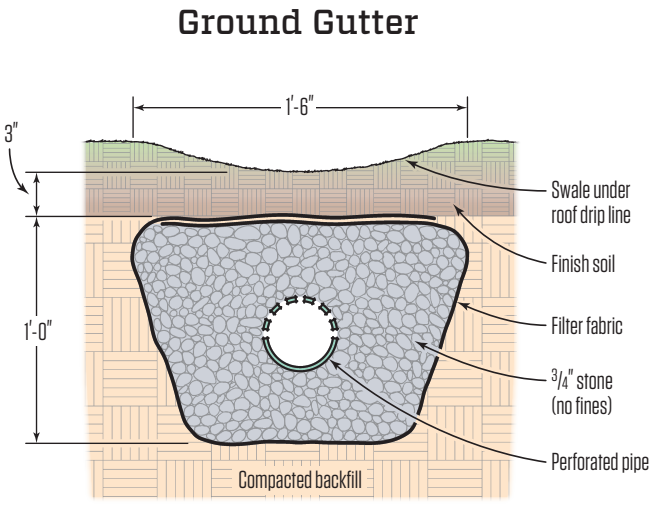
Water behaves predictably: It almost always follows the laws of gravity and flows downhill. If water-management strategies use gravity to an advantage, they have a much greater chance of success. If we try to circumvent the laws of gravity, the house will fail. Admittedly, under certain conditions, water can flow upward and sideways. But most of the time, water will take the path of least resistance, so if we give it an easy path to flow downward, it will.

Providing that downward path solves only half of the problem, however. We still need to manage the water in and around the assembly and move it safely *away* from the structure. In other words, we need to give water a path to flow downward successfully, and then guide it away from the building—and keep it away. These simple rules are essential for successful water management.

GETTING WATER AWAY FROM THE HOUSE

For the most part, the water that needs to be managed in a home's construction comes in the form of either rain or snow, so water-management strategies can be broken down into two categories: managing water that falls around the house and managing

Photos by Steven Baczek



A ground gutter (above) channels water from the perimeter of a house before it can collect and compromise the foundation. A depression or swale sits below the drip line of the roof. Water seeps through filter fabric and crushed stone before entering a pipe that carries it away safely.

Pipes from the ground gutters, the downspouts, and the basement drain all join together and drain to daylight below the grade of the house, at a safe distance from it **(1)**. The garage sits on its own foundation, and the elevated mudroom entry between it and the house provides a clear path underneath for running piping from the back of the house to the front, where water can drain away safely **(2)**.

water that falls on the house. It's also important to recognize that in some instances, water that first falls on the house then becomes water that falls around the house.

A recent project gave me the chance to employ a number of different water-management strategies. The first step in dealing with water around the house is proper siting. The builder, the owner, and I sited this house on high ground in a corner of the lot, so draining water away from the structure could be easily achieved. The soil on the site was a mix of sand and gravel that was good for drainage.

Part of my strategy for routing water away from the structure was installing what I call a "ground gutter" on the uphill side of the house (see Ground Gutter, above). The pipe in this assembly connected with a network of pipes from the downspouts and from the basement perimeter drain and eventually drained to daylight at a safe distance away from the house **(1)**.

I designed the house with four distinct parts: the garage, the mudroom and entry, the main house, and the screened porch and deck. Placement of the garage and the mudroom created an inside corner on the high side of the house with the potential for collecting groundwater against the foundation. To deal with that situation, I put the garage on a separate foundation and designed the mudroom as a bridge between the house and the garage **(2)**. Elevating the mudroom gave the ground gutter a clear path from the rear of the house to the front, allowing groundwater to drain away from that inside corner. The bridge design also provided a convenient place to run downspout drains to the common pipe that connected to the daylight drain.

Along the rear of the house, the grade sloped away from the house, forcing groundwater to run parallel to the back wall. To manage the roof runoff, the ground gutter continued, situated directly

Illustration: Tim Healey

Black building paper, with 4-inch overlaps between courses, covers the side wall. To complete the drainage plane beneath the open plank siding, vertical strapping then attaches over the paper **(3)**, and the siding nails to the strapping **(4)**. The siding—1x6 boards painted on all four sides—is installed with a 3/16-inch gap between the boards and all adjacent material **(5)**. The gaps provide ventilation for the back of the siding. Note that the wide overhangs on the roof protect much of the siding and the windows from water.

below the roof drip line. This simple but effective strategy captures water where it hits the ground and uses gravity to move the water safely away from the house.

Although the crew put in a drain system to service all the downspout locations, the client wasn't sure whether he wanted gutters and downspouts. But even without gutters, I am confident that the ground gutters can handle all the groundwater and runoff.

KEEPING THE WALLS DRY

The next step in water management is dealing with the water that falls on the building. Of the four barriers (water, air, vapor, and thermal) that I consider essential in a building assembly, the water barrier is number one on the list. Without a rock-solid water barrier, the other three barriers don't matter, because the structure is destined for failure.

Exterior walls are the most difficult places on a house assembly for establishing a water barrier, and a good place to start is not letting them get wet in the first place. To that end, all of the major roof planes had 30-inch overhangs—wide enough to keep much of the runoff away from the walls when there isn't much wind.

DRAINAGE FOR AN OPEN-PLANK WALL

Of course, some water will still make it to the wall. This water must be dealt with by the wall itself, as well as by all the parts and pieces in the wall—such as windows, doors, and electrical fixtures and outlets—and by intersecting planes that meet the wall. For aesthetic reasons, this house had two different exterior wall treatments: The majority of the wall area was covered with a horizontal open-plank (pressure equalized) rainscreen, while areas of shingle siding with a vented rainscreen provided a visual accent.

Strips of building paper that will be integrated with the building-paper drainage plane provide additional protection for the window sills **(6)**. Certain wall areas are shingled in cedar for a visual accent. Rainscreen mesh applied over the building paper provides drainage space behind the shingles **(7)**. The mesh extends to the bottom of the rainscreen to provide a measure of ventilation for the siding, as well **(8)**, and transitions between the two types of siding have to be carefully detailed **(9)**.

The primary weather barrier for all the exterior walls was 1/2-inch Zip System sheathing properly taped at all joints (see photo on page 51). For the open-plank areas, the building crew applied black building paper—overlapped 4 inches on all the horizontal joints to shed water properly—over the sheathing. While the building paper does act as secondary weather barrier, its main purpose is to be the primary drainage plane behind the horizontal siding.

At each window sill, the crew installed additional 10-inch strips of building paper that we integrated into the sill pan. Those strips then lapped over the building paper on the wall to provide a proper weather lap at each window.

To mount the horizontal siding, the crew installed vertical 1x3 strapping, painted black, over the building paper **(3)**. Aesthetically, the building paper and the black furring strips darkened the gaps between the planks that attached directly to the strapping **(4)**. The siding was 1x6 quartersawn wood planks painted on all six sides and installed with a 3/16-inch gap between the boards on the sides as well as the ends **(5)**.

Those boards provide the barrier for most of the water that hits the wall. The 3/4-inch air space created by the strapping allows the building paper to function as a drainage plane for any water that gets through the gaps between the boards. But more importantly, that space provides ventilation behind the siding, giving the siding a stable and near-uniform environment on all sides. That uniform environment minimizes the challenges to the paint and should extend the life of the finish and the siding significantly.

DRAINAGE FOR SHINGLED AREAS

For the wall areas that were shingled, the crew installed the shingles over a vented rainscreen mesh. Here, too, they used strips of

Where roof planes intersect with a side wall, the vertical part of the roof flashing integrates with the drainage plane of the wall. At the bottom of the flashing, a kickout diverts water away from the siding **(10)**. At the deck ledger at the bottom of the wall, flashing channels away any water from the drainage plane **(11)**. Window cap flashing folds in to properly divert water on a micro scale **(12)**. Grooves on the bottom edge of the window sill let water drip off instead of following the contour of the sill **(13)**.

building paper at the window sills **(6)** and integrated the strips with the building paper on the wall. Then they installed the rainscreen mesh on top of the black building paper **(7)**.

The installation allows the rainscreen mesh to drain all the way to the bottom of the wall **(8)**. Much like the 1x3 wood strapping on the open-plank walls, the mesh not only allows for drainage of liquid water, but it also provides ventilation behind the shingles for a near-uniform environment.

As an aesthetic treatment, a few of the shingled areas bumped out from the plane of the wall, creating shingled bays **(9)**. These bump-outs, much like the roof overhangs, also provide a measure of rain protection for the windows below. The bump-outs returned to the main plane of the wall and integrated with the horizontal siding via inside corner boards that were painted on all sides and attached to the wall over the layer of building paper.

INTERSECTING ROOFS AND DECKS

Areas where roof planes intersect rainscreen walls are of particular concern in a water-management strategy. On this project, the mudroom roof and the porch roof, both standing-seam metal, intersected with the wood-plank walls. The crew installed proper flashing with a 2-inch vertical leg taped to the Zip System sheathing along the entire roof-to-wall intersection. The building-paper drainage plane then lapped over the flashing. Where the roof plane terminated at the eaves, a kickout flashing would channel away any water that might run down the flashing **(10)**.

The other intersecting plane that had to be dealt with was at the base of the wall where the rainscreen met the deck frame. Here proper flashing on top of the deck ledger integrated with the drainage plane from the wall above to channel away any water that might drain down and accumulate **(11)**.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Exterior outlets mount into boxes that are flashed into the drainage plane **(14)** and the rainscreen mesh. Shingles then complete the outer weather barrier **(15)**. Temporary strapping the thickness of the siding holds the electric meter out from the strapping and the drainage plane **(16)** until the siding is installed. The meter then attaches directly to the siding, keeping the drainage plane intact behind the meter **(17)**.

MANAGING THE DETAILS

With the major wall-drainage issues addressed, the final challenge was integrating the parts and pieces that attached to the house into the water-management system. In addition to the building-paper strips mentioned earlier that provided protection for the window sills, proper head-cap flashing protected the tops of the windows and doors **(12)**. The sides of the cap flashing were folded in so that the cap itself could properly channel water away from the window at the smallest level of detail. To match the aesthetics of the other windows, even the windows that enjoyed overhead protection received the same cap flashing.

The window sills themselves received a special treatment: A groove was cut along their bottom edges to act as a drip edge. Instead of the water following the contour of the sill and dripping down the wall, the water shed off the sill could drip away safely **(13)**.

Electrical outlets and exterior light fixtures also received a cap-flashing treatment to integrate them into the drainage plane behind the shingled sections **(14, 15)**. Similarly, the building crew flashed in the backing boards installed for fall protection at the screen porch, and for the brackets that held the shade arbor over the basement walk-out doors.

Items such as the electric meter that mounted to the open plank siding received a little different treatment. The crew installed the meter temporarily on strapping that was the same depth as the siding **(16)**. When the siding replaced the temporary straps and the meter was permanently installed, drainage and ventilation could take place behind it **(17)**.

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