Residential Pollution Prevention	RHP-12 Tips for Wet Basements and Crawlspaces

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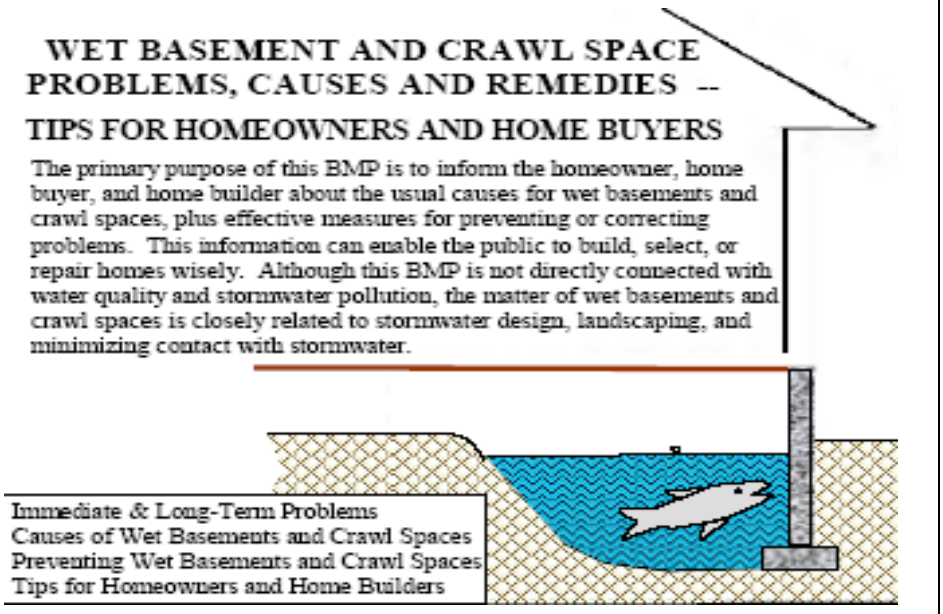

Immediate and Long Term Problems

Standing water or seepage inside residential crawl spaces and basements can cause frustrating problems for the homeowner. These problems can be both immediate and long-term. For example, standing water and mud inside crawl spaces make it very difficult and messy to gain access under the house for inspecting, maintaining, and servicing electrical circuits, drains and water lines, heating and air conditioning, and other utilities. Wet basements and crawl spaces are sources of high humidity, which can produce surface condensation, mildew and fungi, musty odors, and an unhealthy environment. Such moisture can cause deterioration of floor joists, beams, subflooring, insulation, and electrical-mechanical systems. Prolonged water around the footer and foundation wall can soften the soil and weaken its bearing capacity, increasing the possibility of wall settlement and cracking. Serious seepage under the foundation footer may erode soil away and cause sinkhole collapse. Excessive moisture can eventually penetrate the subflooring and buckle the flooring or cause warping, making doors and cabinets difficult to close or open. Since crawl space or basement dampness always moves toward the drier upstairs areas, higher humidity will result in costlier heating and air conditioning bills. In the case of crawl spaces, if the underflooring insulation collects moisture, or sags from excessive wetness, the heating and air conditioning costs are driven even higher.

Finally, wet basements and crawl spaces reduce the value of the house – at least by the amount that would be required to repair the damage and to eliminate the cause of the problem. Homeowners in these situations should immediately seek professional assistance in assessing the source and extent of the problem and in finding a remedy.

Cause of Wet Basements and Crawl Spaces

Most wet basements or crawl spaces are caused by surface water that is not adequately drained away from the foundation wall. Sources of this water may include the following:

- Roof water, if no guttering is present or if the guttering leaks and overflows due to leaves and obstructions. Concentrated roof water, when falling from a height of one or two stories, can cause erosion along the foundation wall and exacerbate the problem of stormwater infiltration.
- Roof water, if the downspouts are clogged or do not have sufficient means to drain water away from the foundation wall. Frequently, a downspout ends at the corner of the house without a splash pad (splash block) or shoe (sometimes called an elbow), leaving roof water to concentrate at that point and seep into the soil next to the foundation wall. A typical 2000 square foot roof can produce almost 1250 gallons of water during just 1 inch of rainfall. If rainfall is steady and prolonged, roof water is even more likely to soak into the ground next to the foundation wall.
- Excessive watering of flower beds and shrubbery around the foundation wall. Once the upper soil layer or mulch bed is filled with water, the excess water either runs off or seeps into the ground next to the wall. Prolonged watering can contribute large amounts of water to crawl spaces or basements.
- Rainwater runoff from the adjacent lawn, walks, or driveway areas if the landscaping slopes water to drain toward the house instead of away. If surface runoff is directed toward foundation wall, water will pond and then soak into the soil, thus becoming a potential source of basement or crawl space water. Downspout splash pads are not very effective if the lawn drains back to the foundation wall.

Water or dampness problems in basements or crawl spaces are sometimes caused by other factors:

- Subsurface or groundwater may be intercepted or dammed up by a basement or foundation wall. Houses which are built on a hillside are particularly vulnerable. Foundation walls act like dams to intercept and trap this subsurface water, causing pressure to build up on the outside of the wall, which forces water through joints and cracks in basement walls or as seepage under the footer.
- Nearby springs may have been filled in or covered up by others. Unless the springs were properly drained away from the lot or subdivision, such water will eventually seep into the surrounding fill, become a pool of groundwater, and eventually force itself laterally and upwardly into basements and crawl spaces.
- Nearby creeks may overflow during storm runoff and either directly flood basement or crawl space areas, or contribute to the groundwater, which may become sufficiently high to cause seepage into the basement or crawl space area. Homeowners may not experience the effects of groundwater seepage or overflowing creeks for months or years after purchasing a house because of drought or infrequent out-of-bank flooding. However, when such conditions do occur, they may come suddenly without warning and cause serious problems after the warranty period has expired.

Cause of Wet Basements and Crawl Spaces (cont'd)

- Improperly installed, clogged, collapsed, or leaky drains may not allow water to escape. Perimeter, footer, or foundation drains are installed around the exterior of a house below basement floor level to intercept groundwater build-up and seepage under the house. If drains are improperly installed or become clogged with silt or roots, they will not operate as intended. Sometimes an otherwise good perimeter drain gets covered up or crushed during the final backfilling or landscaping stages of construction, and the intercepted water will backup into a foundation wall and eventually to seep into the basement or crawl space.

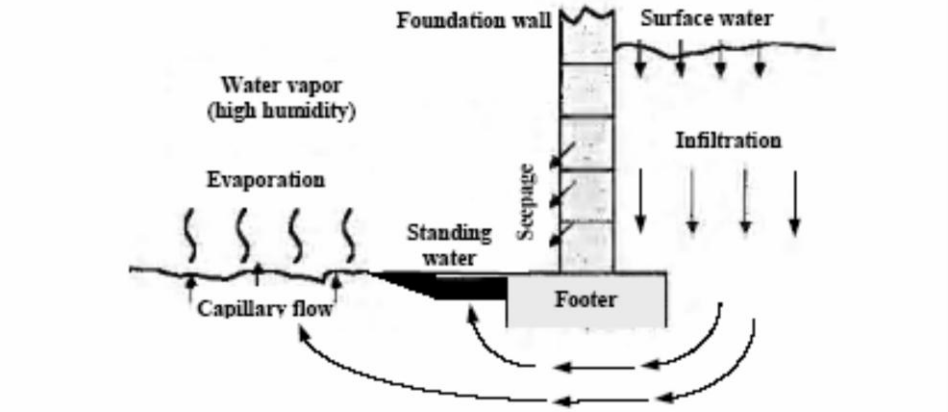

Figure 1. Typical paths of water and moisture entering into a crawl space area.

- Soil continuously draws water up from subsurface groundwater sources in a crawl space by capillary attraction. The finer the soil (e.g. clays), the more aggressive the capillary pumping action. As the water rises to the surface, it evaporates into the crawl space. This ground moisture is a significant source of dampness and humidity under a house, even without standing water. The presence of capillary water is often indicated by a whitish residue, left on the ground surface of the crawl spaces, resulting from evaporation of water containing minerals and salts. Lack of a moisture barrier, such as a plastic sheet, will allow capillary action and evaporation to contribute unlimited moisture to crawl space areas. Figure 1 illustrates how surface water and moisture can enter a crawl space area.
- Closed, inadequate, ineffective, or no crawl space venting around foundation walls will force the buildup of humidity in the space beneath a house. Given the combination of high humidity and low temperature, condensation can form on heating/AC ducts, joists, underflooring, and insulation. This environment, together with likely darkness, encourages mildew and other fungi to form.

Cause of Wet Basements and Crawl Spaces (cont'd)

- Damp or wet basements and crawl spaces may be caused by ruptured water or sanitary lines either just outside the wall or under the house. If a crawl space is unusually wet and muddy, inside leaks may be difficult to find and repair. Outside pipe leaks may be even more difficult to find, since water may appear several feet away from the actual leak. Old field drains under a house may also be a source of unwanted water.

Preventing Wet Basements and Crawl Spaces

Many construction complaints about new homes arise from inadequate site drainage and water problems. Proper drainage of surface water is a primary element in preventing wet basements, damp crawl spaces, eroded banks, muddy yards, and possible failure of a foundation system. The City of Bowling Green requires that new construction or alteration of houses must conform to the requirements of the Southern Building Code Congress International, Inc. (SBCCI). Generally, surface water drainage should be directed from all sides of the house and off the lot in a manner that will:

- Minimize possibility of dampness in basements and crawl spaces.
- Prevent standing or ponding water on the site.
- Prevent soil erosion.
- Not adversely affect the supporting foundation soil behavior.

Walks, driveways, retaining walls and other landscape improvements should be constructed so as not to interfere with drainage. Walks should not be used as drainage channels. Site grading plans should specify minimum slopes from the house (usually 2 to 5%), depending on location, type of soils, frost depth, and soil moisture, to ensure water drainage for some specified distance (usually 6 to 25 feet) away from supporting foundations. In cases where minimum slopes or distances cannot be attained, paved gutters or other drainage structures acceptable to the Building Inspector may need to be installed. Maximum slopes are specified to prevent erosion or unstable banks around the house and yard.

Roof water should be directed to a downspout and away from the foundation wall toward a suitable ditch, swale, or drainage pipe to prevent ponding or backflow as shown in Figure 2. All drainage structures should be properly connected to adequate outlets that are protected, where necessary, by recorded permanent easement. House plans and landscaping should be developed to prevent "dead" drainage areas around the foundation wall -- areas where rainfall has no place to flow away except by ponding and soaking into the soil near the foundation wall. Areas bounded by the front entrance / sidewalk/garage / driveway are especially vulnerable to trapped pockets of surface water.

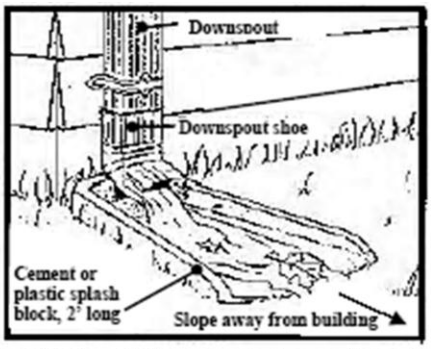

Figure 2. Correct installation of downspout shoe and splash block at foundation wall.
(Note that the ground surface slopes away from house.)

Another vital step in preventing water in basements and crawl spaces is to intercept outside subsurface or groundwater with a perimeter drain at the footer base level around all sides of the house where the exterior ground surface is higher than the inside floor or crawl space level. While foundation drains are clearly necessary for houses with basements or potentially habitable living space below exterior ground surface, they may also be used in crawl spaces where water, soil, and/or earth floor elevation conditions warrant. The drains should discharge by gravity to a positive outfall such as an approved drainage ditch, swale or storm system. In some cases, sump pits and pumping with automatic float actuation may be required.

Specifications for waterproofing and damp-proofing foundation walls are found in SBCCI. Building codes specify the materials, maximum vapor transmission rate, venting, etc., appropriate for construction. Excessive moisture vapor can be prevented from entering a crawl space area with the use of an effective and correctly installed vapor barrier (typically polyethylene sheeting) over the ground surface. Torn pieces, poor or non-overlapping joints, missing sections, or improperly sealed corners and edges at the walls, fireplaces, and interior piers must be avoided to produce an effective vapor barrier.

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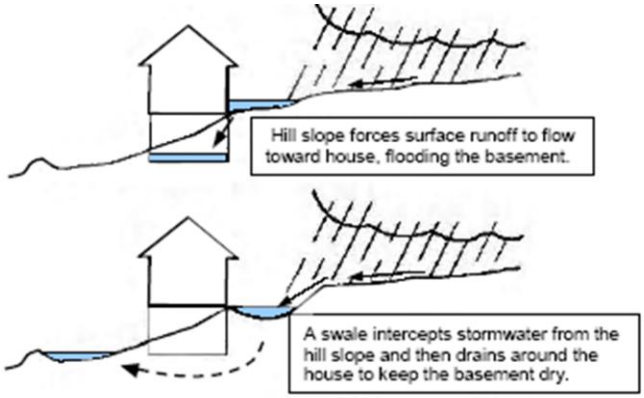

Figure 3. Correction of typical slope drainage problem using swale or ditch.

Crawl space areas should have adequate wall ventilation openings around the foundation walls to provide cross ventilation for preventing the buildup of water vapor inside the crawl space. Building codes specify minimum vent opening areas (usually 1 square foot of net opening for each 150 square feet of crawl space), opening location or arrangement, corrosion-resistant wire mesh screen, and any reduction in ventilation opening area allowance if an approved vapor barrier is used.

Preventing Wet Basements and Crawl Spaces (cont'd)

In older houses where any of the above moisture control methods are missing, measures should be taken to install appropriate drainage facilities, vapor barriers, or ventilation openings. Installing any of these elements after a house has been built will be more costly than while the house is constructed. A combination of remedial measures is often necessary. If the yard area slopes toward the house and surface water collects or ponds near the foundation wall, a V-ditch or swale should be constructed around the house to allow surface drainage from both the foundation wall and the other yard areas to an adequate ditch or storm drain. Such cases often exist where the front street is higher than the first floor of the house, or when the house is built on the side of a hill. Figure 3 illustrates how this problem can be solved.

If a flower bed or garden is next to the foundation wall, it may be a significant source of water for the basement or crawl space. Consider relocating the flower bed or shrubbery, or install heavy plastic sheets with drains beneath the flower bed. Then any water which soaks deeply into the soil is intercepted and carried safely away by gravity at least six to eight feet from the house to a gravel collection drain or swale.

Tips for Homeowners and Homebuilders

"A teaspoon of prevention is worth a gallon of cure" certainly applies to new homebuilders – at least in avoiding water problems in basements or crawl spaces. Buyers of new or older houses should be cautious about drainage. The best time to sign a contract is on a rainy day!"

Work with a professional to help locate the new house on the lot and at an elevation which minimizes the potential for surface or groundwater drainage problems. If a flowing stream or creek is nearby (especially if bordering the lot), check with local planning agency authorities or a hydrologic engineer for potential flooding, whether in a designated 500-year flood hazard zone or in an area where that may be affected by nuisance flooding.

Tips for buying or building a new house

The following tips are suggested to avoid water problems when building or buying a new house:

Work with a reputable homebuilder that can supply reference names and projects for houses that he has built. Visit these sites and check for patterns of any drainage problems. Contact the Better Business Bureau and other organizations to see if there are complaints and outstanding issues.

It may be beneficial to hire an engineer or architect to check slopes, foundation wall waterproofing and dam-proofing, underground drains, general surface and roof water drainage, and general quality of construction. If you suspect a potential problem, ask the local building inspector for advice.

Tips for Homeowners and Homebuilders (cont'd)

Check to make sure that the perimeter foundation drain, basement drain, or crawl space drain has an unobstructed outlet to a ditch or swale leading away from the house. Pay special attention around the outside and the basement or crawl space for: (1) back sloping lawns and landscaping toward foundation walls; (2) back sloping driveways toward garage, stoops, walks or patios which force surface water toward the foundation wall; (3) very flat property; (4) standing water inside of crawl space next to foundation wall; (5) pattern of wet concrete blocks inside basement walls, particularly with whitish salt deposits on inside foundation walls as a result of leaching from moisture seepage and evaporation; (6) downspouts which drain to the foundation wall without any clear path for water to escape; and (7) depressions or settlement near the foundation. If necessary, use a level to check the slope direction.