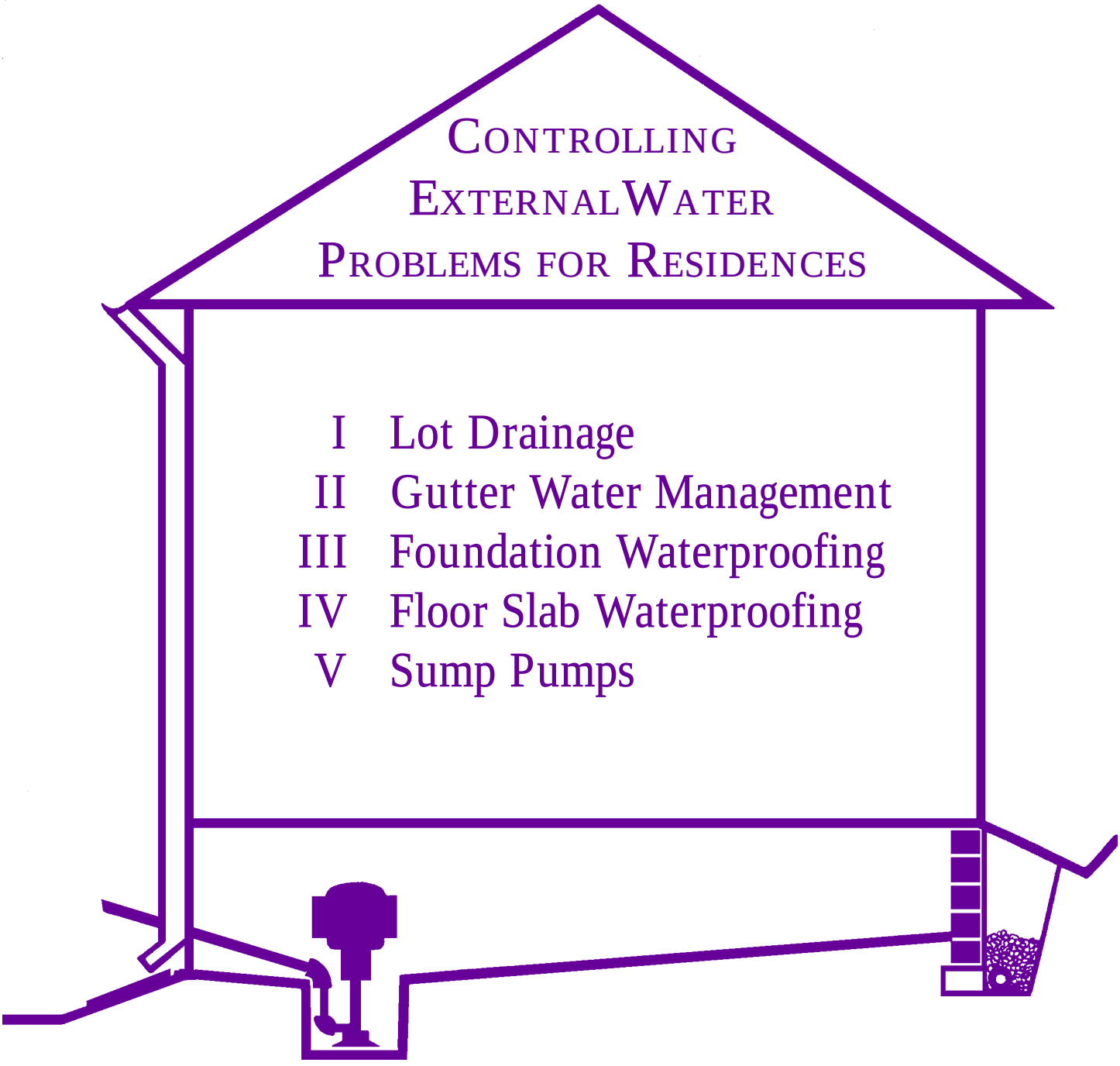
CLEMSON EXTENSION

HL 252 Rev. April 1997

RESIDENTIAL HOUSING

CONTROLLING EXTERNAL WATER PROBLEMS FOR RESIDENCES



I Lot Drainage
II Gutter Water Management
III Foundation Waterproofing
IV Floor Slab Waterproofing
V Sump Pumps

INTRODUCTION

Neglect of moisture and water problems in and around dwellings can produce conditions that support mildew growth within the house and wood destroying fungus attack in the structural members. Management of both surface water and moisture vapor can prevent the conditions required to support mold and fungi growth.

These are some of the more common external moisture problem areas and their suggested solutions:

- Lot Drainage
- Gutter Water Management
- Foundation Waterproofing
- Floor Slab Waterproofing
- Sump Pumps

LOT DRAINAGE SYSTEM

Every dwelling should have a grading and landscaping plan that provides control of all surface waters on the lot. Surface drainage must be directed to a storm sewer or other collection point so as to not create a hazard on the lot or on neighboring lots. The lot must be graded so that water drains away from the houe and foundation walls on all sides. This can be achieved with a grade that falls a minimum of 6 inches within the first 10 feet away from the foundation walls, in all directions.

(Note: If this is prohibited by lot lines, walls, slopes or other physical barriers, drains or swales should be provided to ensure drainage away from the structure.)

It is not unusual for houses about twenty-five years old and older to need a complete renovation of the landscaping and grading of the lot. Additions to the landscape plan, maturity of shrubbery and soil erosion and similar changes tend to change drainage patterns and direction and too often surface water meanders against the foundation wall.

Figure 1 illustrates the most common drainage problem of a sloping lot. The uphill side of the house must have a drainage waterway (valley) to conduct the water around the house. This drainage valley should be at least 10 feet from the house and sloped to conduct the accumulated water away from the dwelling efficiently.

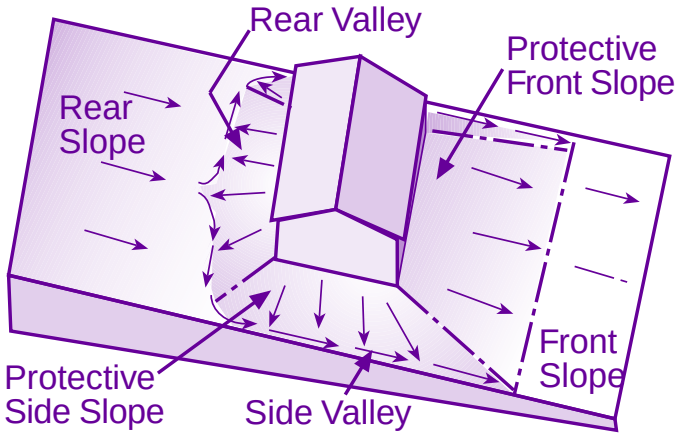


Figure 1. Illustrated surface water management plan of maintaining a 5% slope away from the dwelling for a minimum distance of 10 feet in all directions.

Figure 2 illustrates the effects of elevation and slope on a house.

2 A

Figure 2A illustrates the ease of obtaining drainage away from the foundation when the house is on the crown of a hill. Unfortunately, most houses are located on lots that have drainage problems illustrated in "B" and "C".

2 B

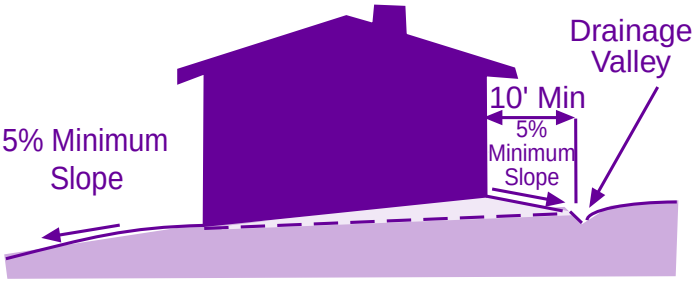


Figure 2B This is a typical drainage problem of a house on a sloping lot. Field studies indicate most speculative houses have some seepage of water collecting under the house due to water accumulating on the uphill side and seeping through a foundation wall that is not water-proofed in any manner; nor is a footing drain installed. When the soil is saturated, the hydrostatic pressure tends to release a significant amount of water into the crawl space through the masonry foundation wall.

2 C

Figure 2C This illustrates a house on a "flat" lot. During construction, the house site usually has the topsoil removed and the finish grade ***outside*** *the house may typically be one or two feet* ***above*** *the soil level of the crawl space. "Flat" lots also tend to have high water tables, especially during long rainy periods. Developers and builders would do the homeowner a lasting service if the soil in the crawl space were to be brought to a* ***level equal to or slightly higher than the outside finished grade.*** *This, in turn, would require the foundation to be higher by a foot or so, but would permit effective footing drains with an outfall near the house.*

GUTTER WATER MANAGEMENT

Management of roof and gutter water is essential to prevent excessive moisture in homes. The method illustrated in Figure 3 below is NOT ACCEPTABLE. The RECOMMENDED method is illusrated in Figure 4.

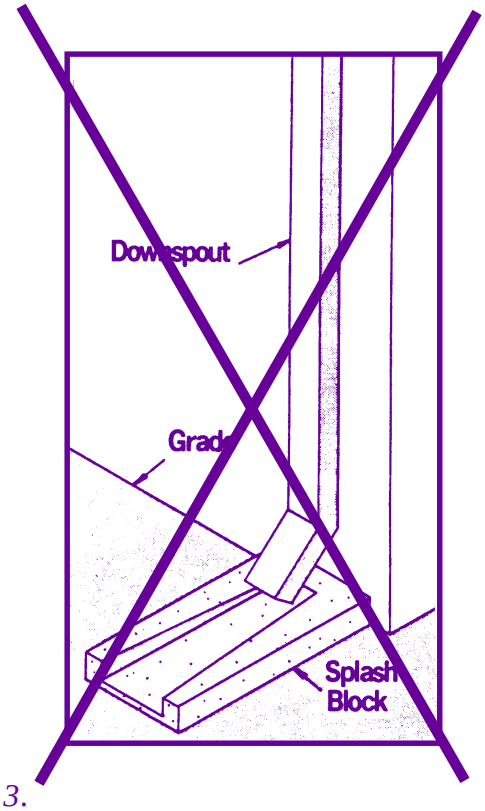


Figure 3.

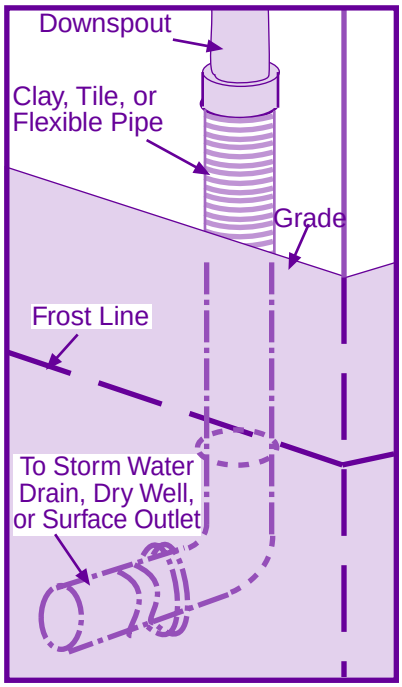


Figure 4.

NOT ACCEPTABLE

Though the use of a splash block to receive water from a downspout is commonly used, it is not acceptable. It does not meet minimum code requirements. Water released close to the foundation moves through the soil and foundation walls, often creating dampness and standing water in crawlspaces, basements, and under slab floors.

RECOMMENDED METHOD

Downspout water may be released into a clay tile or flexible pipe and conducted underground to a suitable release outlet. PVC plastic pipe may be used to conduct the water for some distance under ground to a release point. Both rigid and flexible pipe are satisfactory under ground and require a minimum of maintenance.

Most gutters on a house need frequent inspection and leaf or pine straw accumulations removed. Gutter guards are partially effective in preventing clogging by leaves. Larger downspouts, with a minimum of sharp turns from the gutter to the release near the ground line, have fewer stoppage problems.

The code (a minimum requirement) calls for discharge of all roof drainage at least 5 feet from foundation walls or to an approved drainage system. A better recommendation is for all roof water to be discharged at least 10 feet away from foundation walls, in a downhill slope away from the house in all directions.

FOUNDATION WATERPROOFING

Site selection, landscaping the lot, and waterproofing the foundation can prevent objectionable water problems around and under a residence. Figure 5 illustrates a standard construction procedure to effectively waterproof a masonry wall. Two thin coats of portland cement plaster are applied directly to the masonry surface. The cement plaster seals the voids in the mortar joints and establishes a dense impermeable layer. The foundation wall below grade is mopped with two coats of a bituminous foundation coating material. Most manufactured foundation coating material contains an ingredient to aid in establishing a bond between the masonry wall and the coating material. In any event, the manufacturer's instructions on the label should be followed. Some materials require a primer before the material is applied to the wall. The label will specify what is needed.

Note: Before waterproofing, consult CABO and local codes to assure meeting current requirements.

A perforated footing drain is installed at a level with the bottom of the drain at the bottom of the footing as indicated, with perforations pointing down to allow water to enter drainpipe. Drain shall discharge by gravity or mechanical means into an approved drainage system. The footing drain is encased in gravel (a minimum of 2 inches underneath the drain, extending horizontally at least 12 inches out from footing), with additional gravel to at least 12 inches above the top of the footing.

Note: The CABO code (1995, sections 406.2 through 406.3.5) gives detail for individual situations. Before beginning work, always check current CABO and local codes for minimum requirements.

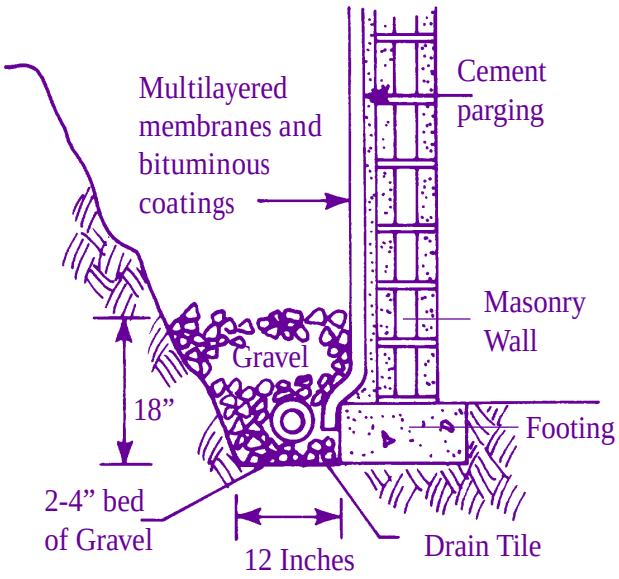


Figure 5. Waterproofing Foundation Wall

FLOOR SLAB WATERPROOFING

Concrete floor slabs on the ground must have a 6 mil thick polyethylene vapor retarder to prevent ground moisture movement through the concrete slab. Penetration of moisture can affect floor adhesives and support the growth of mold and mustiness in carpets. Figure 6 illustrates a standard construction procedure to install both gravel (4 inches) and polyethylene plastic (minmum 6 mil thick) vapor retarder under the concrete. Polyethylene seams should overlap 6 inches.

The function of the gravel is to break capillary water movement toward the concrete. The polyethylene impedes vapor movement above the gravel. When concrete is being poured, avoid puncturing polyethylene when walking / spreading concrete, or when lifting reinforcing wire with rake. Moisture can move upward through punctures.

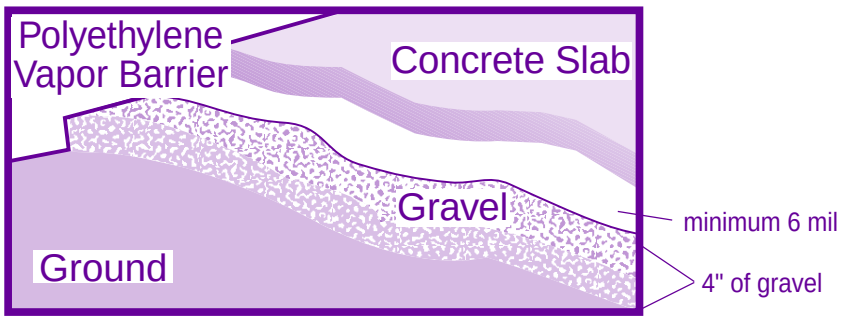


Figure 6. Moisture Control through Concrete Floor Slab on Ground

SUMP PUMPS

Should seepage and leakage problems persist in a basement or crawl space area, and if they prove to be impossible or economically unfeasible to correct, a sump pump is often a suitable solution to remove an accumulation of water.

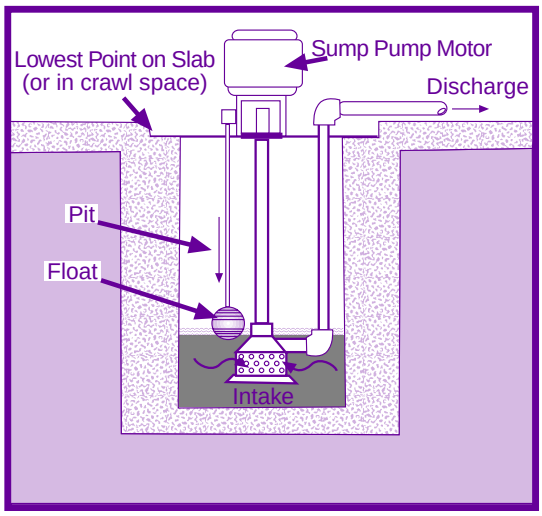


Figure 7. Sump Pump

These pumps are electric powered; they have automatic controls and are permanently installed in a prepared sump or the lowest place where water accumulates. Figure 7 illustrates the pump, the pit to collect the water and float switch to automatically operate the pump as the water level changes. The discharge line may be connected to a sewer, if available. These units are often used where water problems develop after the initial building construction.

In a crawl space under a house, a sump pump is located in the lowest point. A hole, is excavated to accommodate a piece of 12x12 flue liner is placed in the center on the gravel; the gravel fills the hole on the outside of the flue liner. The sump pump is placed in the flue liner and fixed in position with guy wire from the pump to the joist. After 12-20 years of service, the pump may need some repair such as bearing replacement.

Note: Follow current code minimum requirements when installing a sump pump. The CABO code gives details (1995, section 405.2.3 “Drainage System”).

SUMMARY

Control of external water around and under a house is essential. Mildew, wood destroying fungi and wet insulation will result when surface water floods or saturates the ground around and under a house. Techniques that will eliminate external water problems are:

1. a functioning lot drainage system
2. properly installed and maintained gutters, downspouts and drains to conduct the water away from the house
3. a waterproofed foundation wall with properly installed footing drains
4. a waterproofed floor slab
5. a sump pump for use in extreme cases

Basements and crawl spaces can be dry. The techniques presented are easy to accomplish during construction. They will, of course, be more expensive in an existing residence. The long term damage that will result in uncorrected problems will be more expensive.

This material was originally assembled by Frank H. Hedden and Richard A. Spray to assist with the general educational programs in the area of housing conducted by the Cooperative Extension Service of Clemson University. Revised by Linda L. Redmann, Ph.D., Extension Housing Specialist.

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