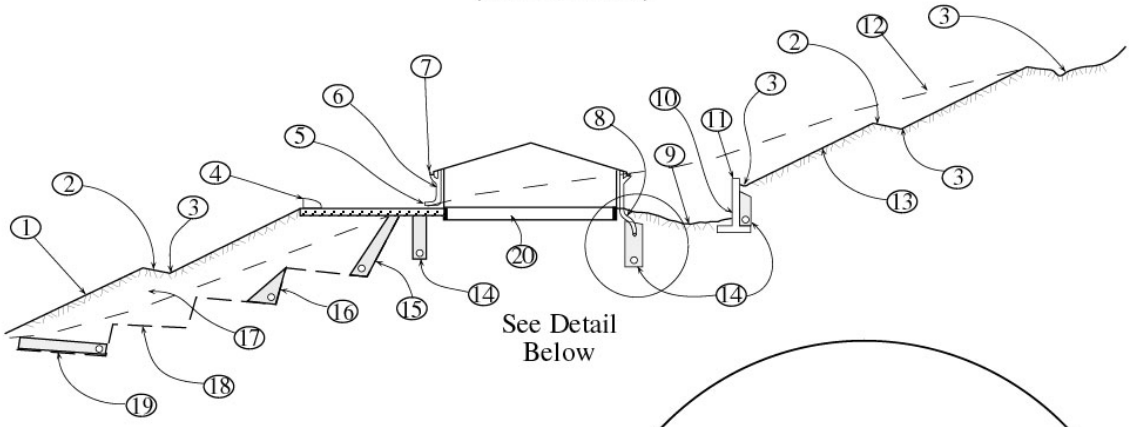
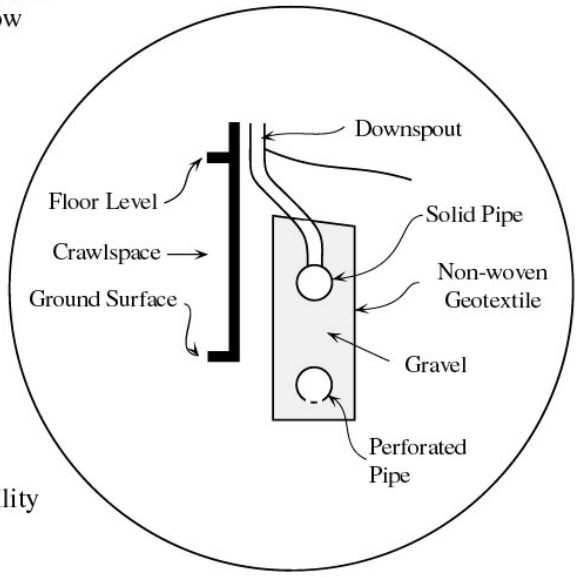
TYPICAL SLOPE SECTION
(Not to Scale)





DETAIL
(Not to Scale)

CONDITIONS:

1. Fill Slope
2. Drainage Terrace
3. Lined Ditch
4. Curb to Prevent Slope Erosion
5. Drain Pipe Provided with Positive Outlet on Paved Surface
6. Downspout
7. Roof Gutter
8. Drain Pipe Connected to Solid Pipe and Discharged to an Approved Drainage Facility
9. Drainage Swale
10. Weep Holes Through Retaining Wall
11. Retaining Wall
12. Original Ground Surface
13. Cut Slope
14. Subdrain
15. Curtain Drain
16. Wedge Drain
17. Fill Compacted to Engineering Specifications and Benched into Competent Material
18. Bench
19. Blanket Drain
20. Crawlspace

Note: Acknowledgment is hereby made to the San Diego Chapter of the California Council of Civil Engineers and Land Surveyors

See attached text.

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TYPICAL SLOPE DETAIL

GUIDE TO THE MAINTENANCE OF HILLSIDE HOME SITES

During the wet winter season, homeowners, particularly those living in houses placed on fill (man-placed earth) or in the vicinity of excavated (cut) slopes, become concerned about the condition of their building site. In general, modern design and construction practice minimizes the probability of serious landsliding (slope failure). The grading codes of the local jurisdictions (cities and counties) in California concerning filled land, excavation, terracing, and slope construction are among the most stringent in the country and, if followed, are adequate to meet almost any natural occurrence. Therefore, the concern of the homeowner should be directed toward maintaining slopes, drainage provisions, and facilities so that they will perform as designed.

The following discussion, general recommendations, and simple precautions are presented to help the homeowner maintain their hillside building site.

The general public often regards the natural terrain as stable — "terra firma." This is, of course, an erroneous concept. Nature is always at work altering the landscape. Hills and mountains are worn down by mass wasting (erosion, sliding, creeping, etc.) and the valleys and lowlands collect these products. Thus the natural process is toward leveling the terrain. Periodically (over tens of millions of years), major land movements rebuild mountains and hills, and these processes begin again. In some areas these processes are very slow, and in others they are more rapid.

Development of hillsides for residential use is carried out, as far as possible, to enhance the natural stability of the site and to minimize the potential for instability resulting from the grading necessary to provide home sites, streets, yards, and other improvements. This has been done by the developer and designers on the basis of geologic and soil mechanics investigations. In order to be successful, the slope, drainage provisions, and facilities must be maintained by the homeowner.

Homeowners are accustomed to maintaining their homes. They expect to paint their houses periodically, replace wiring, clean out clogged plumbing, and repair roofs. Maintenance of the home site, particularly on hillsides, should be considered on the same basis, or even on a more serious basis because neglect can result in serious consequences. In most cases, lot and site maintenance can be taken care of along with landscaping, and can be carried out more economically than repair after neglect.

Most slope and hillside lot problems are associated with water. Uncontrolled water from a broken pipe, cesspool, or wet weather causes most damage. Wet weather is the largest cause of slope problems, particularly in California where rain is intermittent, but may be torrential. Therefore, drainage and erosion control are the most important aspects of home site stability; these provisions must not be altered without competent professional advice. Further, maintenance must be carried out to assure their continued operation.

As geotechnical engineers concerned with the problems of building sites in hillside developments, we offer the following list of recommended "Do's and Don'ts" as a guide to homeowners.

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1. DO check roof drains, gutters and down spouts to be sure they are clear. Depending on your location, if you do not have roof gutters and down spouts, you may wish to install them because roofs, with their wide, flat area can shed tremendous quantities of water. Without gutters or other adequate drainage, water falling from the eaves collects against foundation and basement walls, which can be undesirable.

2. DO clear surface and terrace drainage ditches, and check them frequently during the rainy season. Use a shovel, if necessary. Ask your neighbors to do likewise.

3. DO be sure that all drainage ditches have outlet drains that are open. This should be tested during dry weather and can usually be done with a hose. If blockage is evident, you may have to clear the drain mechanically.

4. DO check all drains at top of slopes to be sure they are clear and that water will not overflow the slope itself, causing erosion.

5. DO keep subsurface drain openings (weep-holes) clear of debris and other material which could block them in a storm.

6. DO check for loose fill above and below your property if you live on a slope or terrace.

7. DO monitor hoses and sprinklers. During the rainy season, little, if any, irrigation is required. Over-saturation of the ground is unnecessary, increases watering costs, and can cause subsurface drainage.

8. DO watch for water backup of drains inside the house and toilets during the rainy season, as this may indicate drain or sewer blockage.

9. DO exercise ordinary precaution. Your house and building site were constructed to meet certain standards which should protect against any natural occurrence if you do your part in maintaining them.

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1. DON'T block terrace drains and brow ditches on slopes or at the tops of cut or fill slopes. These are designed to carry away runoff to a place where it can be safely distributed. Generally, a little shovel work will remove any accumulation of dirt and other debris which may clog the drain. If several homes are located on the same terrace, it is a good idea to check with your neighbors. Water backed up on their property may eventually reach you. Water backed up in surface drains will tend to overflow and seep into the terraces, creating less stable slopes. Maintain the ground surface upslope of lined ditches to ensure that surface water is collected in the ditch and is not permitted to be trapped behind or under the lining.

2. DON'T permit water to collect or pond on your home site. Water gathering here will tend to either seep into the ground (loosening fill or natural ground), or will overflow into the slope and begin erosion. Once erosion is started, it is difficult to control and severe damage may result rather quickly.

3. DON'T connect roof drains, gutters, or down spouts to subsurface drains. Rather, arrange them so that water either flows off your property in a specially designed pipe or flows out into a paved driveway or street. The water then may be dissipated over a wide surface or, preferably, may be carried away in a paved gutter or storm drain. Subdrains are constructed to take care of ordinary subsurface water and cannot handle the overload from roofs during a heavy rain.

4. DON'T permit water to spill over slopes, even where this may seem to be a good way to prevent ponding. This tends to cause erosion and, in the case of fill slopes, can eat away carefully designed and constructed sites.

5. DON'T drop loose soil or debris over slopes. Loose soil soaks up water more readily than compacted fill. It is not compacted to the same strength as the slope itself and will tend to slide when laden with water; this may even affect the soil beneath the loose soil. The sliding may clog terrace drains below or may cause additional damage in weakening the slope. If you live below a slope, try to be sure that loose fill is not dumped above your property.

6. DON'T discharge water into subsurface blanket drains close to slopes. Trench drains are sometimes used to get rid of excess water when other means of disposing of water are not readily available. Overloading these drains saturates the ground and, if located close to slopes, may cause slope failure in their vicinity.

7. DON'T discharge surface water into septic tanks or leaching fields. Not only are septic tanks constructed for a different purpose, but they will tend, because of their construction, to naturally accumulate additional water from the ground during a heavy rain. Overloading them artificially during the rainy season is bad for the same reason as subsurface subdrains, and is doubly dangerous since their overflow can pose a serious health hazard. In many areas, the use of septic tanks should be discontinued as soon as sewers are made available.

8. DON'T over-irrigate slopes. Naturally, ground cover of ice plant and other vegetation will require some moisture during the hot summer months, but during the wet season, irrigation can cause ice plant and other heavy ground cover to pull loose. This not only destroys the cover, but also starts serious erosion. In some areas, ice plant and other heavy cover can cause surface sloughing when saturated due to the increase in weight and weakening of the near-surface soil. Planted slopes should be planned where possible to acquire sufficient moisture when it rains.

9. DON'T let water gather against foundations, retaining walls, and basement walls. These walls are built to withstand the ordinary moisture in the ground and are, where necessary, accompanied by subdrains to carry off the excess. If water is permitted to pond against them, it may seep through the wall, causing dampness and leakage inside the basement. Further, it may cause the foundation to swell up, or the water pressure could cause structural damage to walls.

10. DON'T try to compact soil behind walls or in trenches by flooding with water. Not only is flooding the least efficient way of compacting fine-grained soil, but it could damage the wall foundation or saturate the subsoil.

11. DON'T leave a hose and sprinkler running on or near a slope, particularly during the rainy season. This will enhance ground saturation which may cause damage.

12. DON'T block ditches which have been graded around your house or the lot pad. These shallow ditches have been put there for the purpose of quickly removing water toward the driveway, street or other positive outlet. By all means, do not let water become ponded above slopes by blocked ditches.

A typical slope section showing various grading and drainage requirements, as well as terms used for hillside developments, is attached.