



California Southern Region

Safety Bulletin

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Issue Date: December 1, 2007

Topic: Flood Safety and Sandbag Use

Discussion:

Potential Flooding Conditions:

With the recent fire activity in Southern California resulting in the loss of valuable watershed and the rainy season approaching, it is important to now address and evaluate our operational readiness for flood fighting and sandbagging incidents.

Flash Floods:

Flash Floods are the number one weather-related cause of deaths in the United States today. Several factors contribute to flash flooding. The two key elements are rainfall intensity and duration. Intensity is the rate of rainfall, and duration is how long the rain lasts. Topography, soil conditions, and ground cover also play an important role.

Flash floods may occur within a just a few minutes or may result after hours of excessive rainfall. Other causes for flooding may include a dam or levee failure or a sudden release of water held by an ice jam. Flash floods can roll boulders, tear out trees, destroy buildings and bridges, and scour out new channels. Rapidly rising water can reach heights of 30 feet or more. Furthermore, due to the recent loss of watershed in our Southern California Mountains flash floods also possess the potential to trigger catastrophic mud slides.

Most flash flooding is caused by slow-moving thunderstorms, thunderstorms repeatedly moving over the same area, or heavy rains from hurricanes and tropical storms. If forecasts indicate that rains are approaching Fire Officers should establish pre-event plans by monitoring both local weather and traffic conditions and conduct flood related safety tail-gate sessions with their crews to discuss operational procedures and policies.

It is important to realize that occasionally in the higher elevations floating debris or ice can accumulate at natural or man-made obstructions and restrict the flow of water. Water held back by ice or debris dams can cause flooding upstream. Subsequent flash flooding will then occur downstream as that obstruction suddenly releases. Flash flooding often occurs within 6 hours of the rain event and many flash floods occur at night...be prepared to take quick action. Remember, flooding is no longer considered to be a term event and has the potential to last a week or more.

Personal and Vehicle Safety:

Water weighs 62.4 lbs. per cubic foot and typically flows downstream at 6 to 12 miles an hour. When a vehicle stalls in the water, the water's momentum is transferred to that vehicle.

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Personal and Vehicle Safety (continued):

For each foot the water rises, 500 lbs. of lateral force is applied to the vehicle. But the biggest factor is buoyancy. For each foot the water rises up the side of a vehicle, that vehicle displaces 1,500 lbs. of water. In effect, the involved vehicle now weighs 1,500 lbs. less for each foot the water rises. Even 6 inches of fast-moving flood water can knock you off your feet, and a depth of 2-4 feet may float a fire engine or other apparatus. **NEVER** try to walk, swim, or work in swift-water unless you are certified, equipped and assigned to operate in such conditions.

When approaching flash flood waters you may need to stop; find an alternate safe route or notify your Command Center that the route is impassable and that they will need to dispatch a Unit from a different location. Regardless, always evaluate your "Risk vs. Gain" and base all decisions on keeping both you and your crew safe.

Finally from a health standpoint, remember that both standing and flowing water may contain various types of chemical and bio-hazard materials and after exposure decontamination and appropriate exposure documentation should occur.

Sandbag Operations:

The use of sandbags is a simple, but effective way to prevent or reduce flood water damage. Properly filled and placed sandbags can act as a barrier to divert moving water around, instead of through, buildings. Sandbag construction does not guarantee a water-tight seal, but is satisfactory for use in most situations. Sandbags are also used successfully to prevent overtopping of streams with levees, and for training current flows to specific areas.

Untied sandbags are recommended for most situations. Tied sandbags should be used only for special situations when pre-filling and stockpiling may be required, or for specific purposes such as filling holes, holding objects in position, or to form barriers backed by supportive planks. Tied sandbags are generally easier to handle and stockpile. However, sandbag filling operations can generally be best accomplished at or near the placement site, and tying of the bags would be a waste of valuable time and effort. If the bags are to be pre-filled at a distant location, due consideration must be given to transportation vehicles and placement site access.

The most commonly used bags are untreated burlap sacks available at feed or hardware stores. Empty bags can be stockpiled for emergency use, and will be serviceable for several years, if properly stored. Filled bags of earth material will deteriorate quickly.

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Sandbag Operations (continued):

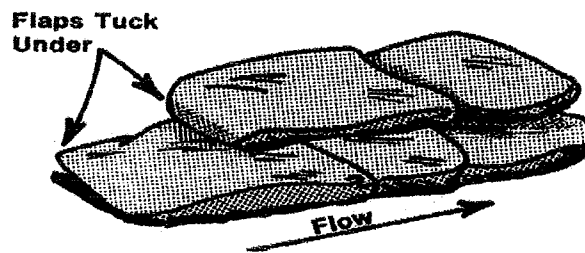
How to Fill a Sandbag:

The person holding the sack should be standing with knees slightly flexed and head and face as far away from the shovel as possible. The person using the shovel should carefully release the rounded shovel full of soil into the throat of the bag. Haste in this operation can result in undue spillage and added work. Bags should be filled between one-third (1/3) to one-half (1/2) of their capacity. This keeps the bag from getting too heavy, and permits the bags to be stacked with a good seal.

For large scale operations, filling sandbags can be expedited by using bag-holding racks, metal funnels, and power loading equipment. However, this special equipment required is not always available during an emergency.

Sandbag Placement:

Remove any debris from the area where the bags are to be placed.



Fold the open end of the unfilled portion of the bag to form a triangle. If tied bags are used, flatten or flare the tied end. Place the partially filled bags lengthwise and parallel to the direction of flow, with the open end facing against the water flow. Tuck the flaps under, keeping the unfilled portion under the weight of the sack.

Place succeeding bags on top, offsetting by one-half (1/2) filled length of the previous bag, and stamp into place to eliminate voids, and form a tight seal. Stagger the joint connections when multiple layers are necessary. For unsupported layers over three (3) courses high, use the pyramid placement method.

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Sandbag Operations (continued):

Commercial plastic sandbags, made from polypropylene, are also available from most bag suppliers. These will store for a long time with minimum care, but are not biodegradable. Thus, they have to be disposed of, or will remain around for a long time. Do not use garbage bags, as they are too slick to stack. Do not use feed sacks, as they are too large to handle. Use bags about 14-18" wide, and 30-36" deep.

A heavy bodied or sandy soil is most desirable for filling sandbags, but any usable material at or near the site has definite advantages. Coarse sand could leak out through the weave in the bag. To prevent this, double bag the material. Gravelly or rocky soils are generally poor choices because of their permeability.

Sandbag barriers can easily be constructed by two people, as most individuals have the physical capability to carry or drag a sandbag weighing approximately 30 pounds.

How to Fill a Sandbag:



Filling sandbags is a two-person operation.

Both people should be wearing gloves and eye protection. One member of the team should place the empty bag between or slightly in front of widespread feet with arms extended. The throat of the bag is folded to form a collar, and held with the hands in a position that will enable the other team member to empty a rounded shovel full of material into the open end.

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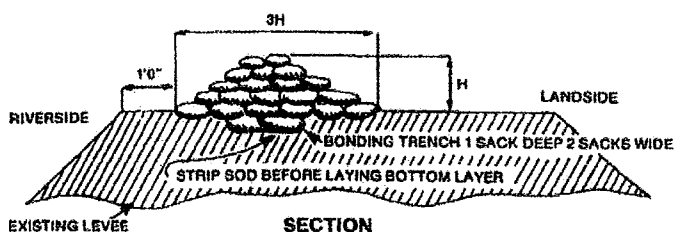
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Sandbag Operations (continued):

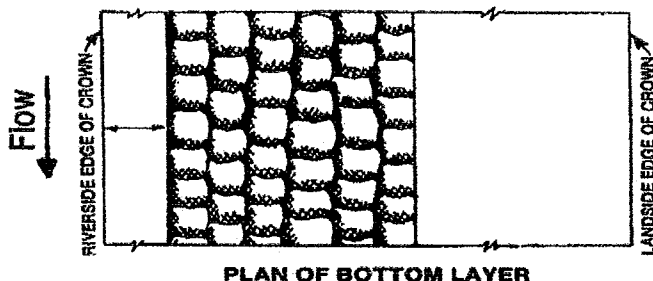
Pyramid Placement Method:

The pyramid placement is used to increase the height of sandbag protection.

Place the sandbags to form a pyramid by alternating header courses (bags placed crosswise) and stretcher courses (bags placed lengthwise).



Stamp each bag in place, overlap sacks, maintain staggered joint placement, and tuck in any loose ends.



Ringed Boils:

A boil is a condition where water is flowing through or under an earth structure (such as a levee) that is retaining water. Free flowing water wants to move to lower elevations. If a levee is stopping floodwaters, the water may be able to find weak points to enter. This action is called "piping". If the water finds a large enough path, the flow will become visible, and is a serious threat to the integrity of the levee. Most boils occur in sand, silt, or some combination.

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Sandbag Operations (continued):

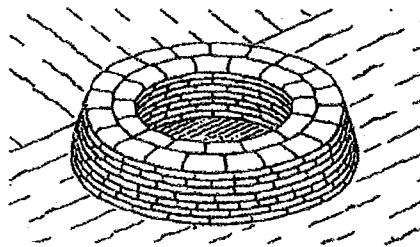
Ringed Boils (continued):

A boil is found on the landward side of the levee, or in the ground past the levee toe (the exact distance varies with local conditions). Possible boil sites can be identified by free standing or flowing water (other than culverts, pumps, etc). A boil can be found only by close inspection and a prime indicator is water bubbling (or "boiling"), much like a natural spring. Another is obvious water movement in what appears to be standing water.

Carefully examine the water for movement. Boils will have an obvious exit (such as a rodent hole), but the water may be cloudy from silt or the hole being very small. If there is any movement in the water, carefully approach the site, disturbing the water as little as possible. Let the water settle, and look at the suspected site. If you see the hole, examine it carefully. If the water flow is clear, there are no problems as yet. If there is no distinct hole, the water flow is not a threat. Monitor the site regularly for changes, and take no other actions.

A dirty water flow indicates that the soil is being eroded by the water, and that could mean failure of the levee. A boil ring is the best solution. The idea is to reduce the water flow until the water is flowing clear, but not to stop the water flow. This acts as a relief valve for the water pressure; the water continues to flow, but is not eroding the material. If the water flow is stopped, the pressure will remain, and another boil will form.

Ring the boil with sandbags, with the first bags back 1-2 feet from the boil. More, if the soil is unstable. Build the first layer in a circle, 2-4 bags across, and then build up, bringing each layer in. If possible, keep the interior face straight. Build the ring wall with the means for water to flow out, leaving a gap in the wall, or using pipes. Adjust the flows until the water slows, and becomes clear. Monitor the ring wall constantly. Raise or lower the height of the wall as necessary, maintaining a slow, clear flow.



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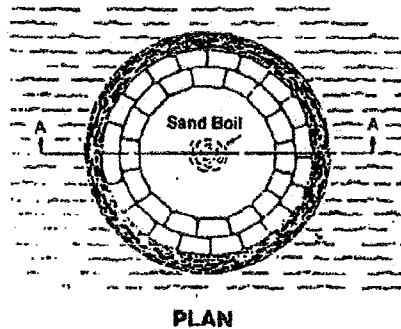
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Sandbag Operations (continued):

Ringed Boils (continued):

The height should be only enough to create enough head to slow flow so that no more material is displaced, and the water runs clear.

- Do not sack a boil which does not put out material.
- The entire base should be cleared of debris and scarified.
- Tie into the levee if the boil is near a toe.
- All joints must be staggered.
- Be sure to clear the sand discharge.
- Never attempt to completely stop the flow through a boil.



CDF Policy Review

*All CDF Personnel Should Review CDF Policy 7000, Fire Operations Handbook
Section 7039, Flood and Water Rescue Operations*

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