RECLAMATION

U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region

Truckee Canal Zoned Earthfill Embankment

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The Truckee-Carson Irrigation District began construction on January 16, 2008, to permanently repair the breach in the Truckee Canal using a "Zoned Earthfill Embankment" type design. This type of design is similar to that used in major earthen dam structures. This approach is being used because of the urban area that lies downslope of the canal and the importance of protecting public health and safety. What makes this type of design special is that it provides multiple layers of protection to prevent failure. “Zoned" means it uses several different types of soils, each with its own purpose, to protect against failure.

IMPERVIOUS MATERIAL	The primary soil is a material that is “impervious,” meaning it is very difficult for water to pass through it. This is sometimes called Zone 1 material. This is the first line of protection: a soil material that essentially does not pass water. These soils are silts and clays that are composed of very small, fine particle sizes.
SAND	The second important soil is a clean sand material. The sand is the second line of defense against failure. The sand acts like a filter, similar to a swimming pool filter. When water passes through a swimming pool filter, the filter traps sediment and other debris; the water can flow through the filter, but the sediment and debris cannot. If water were to begin moving through the impermeable soil first line of defense (because of a rotting tree root or rodent hole for example) the water could begin moving the small clay/silt particles. But the sand, similar to the swimming pool filter, would trap the smaller particles. The water could pass through the sand, but the sand would trap the clay/silt particles before they could move very far, and this would prevent the embankment from failing.
FILL MATERIAL	Other fill material - random earth material that is free from debris - is then added. Because the sand is essentially placed in a vertical, or near vertical, column, the random fill backs up the sand to hold it in place. The fill material also provides mass and strength to the embankment.
COBBLES	And, finally, the slopes of the embankment are protected against erosion with a stone cobble layer. This cobble layer on the slope provides a third line of defense by preventing surface erosion from the face of the embankment. The cobbles also provide some level of deterrent against rodents digging into the soil materials.