

Saltwater Encroachment Encyclopedia Article

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Contents

Saltwater Encroachment Encyclopedia Article.....	1
Contents.....	2
Saltwater Encroachment.....	3

Saltwater Encroachment

Saltwater encroachment or intrusion is the movement of saltwater into subsurface aquifers previously occupied by **freshwater**. Frequently, this occurs as freshwater from coastal aquifers is displaced as a result of the shoreward movement of seawater. Encroachment also occurs as the upconing of saltwater beneath pumping wells in areas where **groundwater** aquifers are underlain by more saline layers. In fact, the latter of these forms is quite common because two-thirds of the freshwater aquifers used for **water** supply in the United States are underlain by highly saline aquifers.

Because salt water contains dissolved **minerals**, its density is greater than that of freshwater. The lower density of fresh groundwater allows it to override or float on saltwater. As **precipitation** falls onto and infiltrates the land surface, freshwater accumulates in the ground above the saltwater in the shape of a lens. As more water is added through precipitation, the height of the **water table** above sea level is increased and the thickness of the freshwater lens also increases. Under certain conditions, the depth below sea level of the freshwater lens can extend to approximately 40 times the height of the water table above sea level. Along the lower curved boundary of the lens, some mixing of fresh and saltwater occurs due to movement of the interface by **tides** and other natural phenomena.

Saltwater encroachment occurs as a result of the withdrawal of fresh groundwater in the vicinity of saltwater. As freshwater is withdrawn from the ground, the pressure imposed on the saltwater by the overlying freshwater is reduced. This allows the saltwater/freshwater interface to migrate toward the point of withdrawals. The interface moves to a point where the pressure balance is restored. Lateral migration of the interface is most common in coastal locations whereas encroachment in areas overlying saline aquifers typically takes the form of an upward-pointing cone of saltwater directly beneath the pumping well.

Several methods have been examined for the control of saltwater encroachment. These techniques have included reduction of groundwater withdrawals, repositioning of withdrawal locations, utilization of recharge basins or injection wells to artificially maintain freshwater pressure, interception of intruding saltwater through a line of pumping wells parallel to the coastline, and emplacement of a subsurface groundwater barrier between the coastline and pumping wells. Reduction of groundwater withdrawals and relocation of pumping wells are the techniques found to be most effective and economically feasible in the control of saltwater encroachment.

See Also

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