A STUDY ON SALINITY INTRUSION PHENOMENA AND ITS IMPACT ON THE ENVIRONMENT

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The tampering of the hydro-geological systems, and the resulting by product of these actions unless properly managed, could be harmful to the resource as well as to the environment as a whole. Salinity intrusion and the eventual degradation of both the land and water is one such case. Any minor changes in the hydro-geological environment could pose a sufficient threat to these potable water sources due to salinity intrusion and thereby to major cities. The recent Asian Tsunami and the consequent changes to seabed profile all gives rise to numerous changes to the hydro-geological environment of coastal aquifers. Future control of saline intrusion necessitates knowledge of the hydraulic conditions within the aquifer.

This study conceptualizes the salinity intrusion process (Fig. 1) and, presents a model (Fig. 2) that would facilitate the identification of influential parameters in Salinity intrusion and, simulate the aquifer behaviour with respect to salinity intrusion in a laboratory setting.

The salinity intrusion process and the interaction of the system parameters are initially conceptualized. Thereafter, this process is simulated by a double tank model, which could then be used to investigate the process as a system in a laboratory. It is said that the governing parameters of salinity intrusion could be established by investigating the resulting behaviour of the liquid in the tanks as the interference process takes place.

The results of short-term variation of the Waiwhetu aquifer New Zealand is presented in this study. The long term variation and its analysis has been presented by De Costa et.al., 2003. It was concluded that the magnitude and threat to the Waiwhetu aquifer is low but quantifiable and if present trends prevail the aquifer at certain locations would pass the threshold category limit for fresh water by the year 2025. The short-term analysis of this aquifer indicated that there is a marginal drop approximately during the hours 10 to 15. Fig. 3 presents a sample variation of conductivity for 17/1/02. This variation might indicate tidal effects on the aquifer. However, it could also be random variation about the mean or accuracy of measuring instruments bringing in such deviations.

The case of the Bundaberg analysis revealed that it is not only possible to prevent the degradation of aquifers by good management practices; it is also possible to facilitate the recovery of the water quality within the aquifer even to the point of yielding potable water.

Many Japanese case studies of salinity intrusion have been reviewed and summarized.

First being the case of the Ogawara lake and the positive impact the breeding of clams in the high salinity areas, taking advantage of this phenomenon. The case of Gonokawa revealed that surface and aquifer water systems are correlated and so care is required, as any intervention in either the surface or the aquifer water systems could impact on both aspects of the hydro-geological system. The Kitakyushu case shows how the location of surface development work such as irrigation and drainage systems within the surface system, can play a major role in salinity intrusion of coastal aquifers. It has been shown here that the sensitivity of salinity intrusion to direct recharge is high in lowlands and low in high lands. The North Okinawa Island aquifer study illustrates how the degree of exploitation of aquifers is not necessarily as important as achieving sustainability of the hydro-geological system by naturally maintaining hydraulic gradients and sometimes by actively creating impervious subsurface barriers.

Examples from Sri Lanka illustrate how apparently unrelated interventions such as the application of irrigation water may also give rise to higher levels of soil salinity, which eventually finds its way to the ground water system.

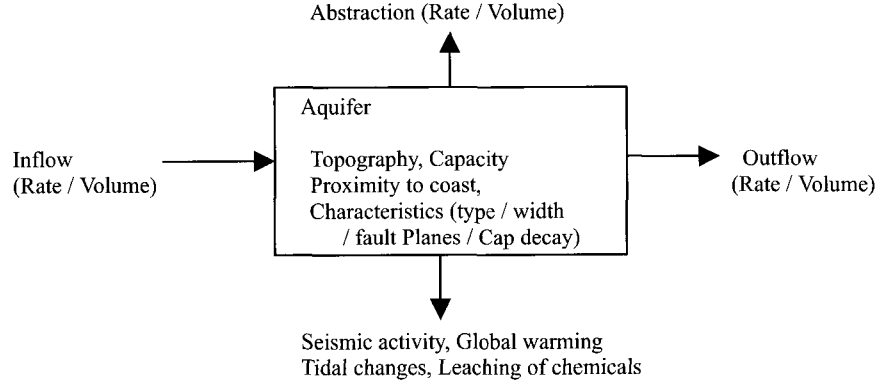

Fig. 1 Salinity intrusion process and variables

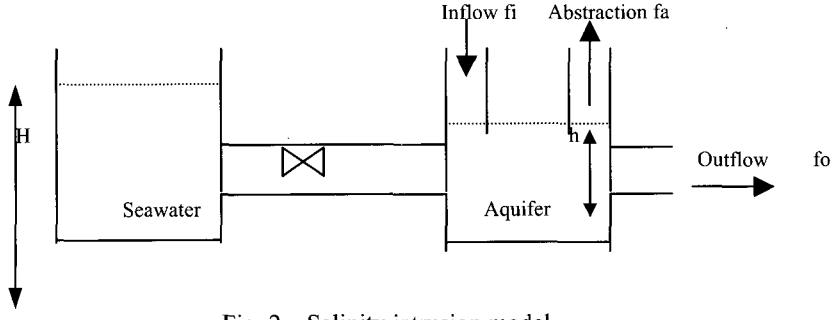

Fig. 2 Salinity intrusion model

Salinity intrusion at point xyz, time t is given by, Sxyz, t = F(fn, fac, fev)
Where, fn, = fi, - fo, - fa, fac = f(t, v, d, s) fev = f(G, S, T, L) H = f{G, T} h = f{t, v, d, s} V= valve factor = f{S,L}

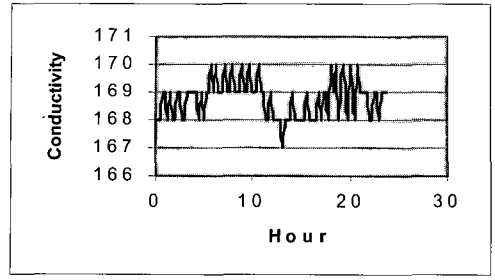

Fig. 3 Variation of Conductivity 17/1/02

REFERENCES

De Costa. S., Porter. M., and Jones. A., 2003 : Comparative analysis of salinity intrusion-Case of the Waiwhetu aquifer New Zealand and the Bundaberg aquifer Australia, Proceedings of the 30th Congress of the IAHR, Theme B, pp.565-572.