

9. UPRIVER SALTWATER PENETRATION

9.1 INTRODUCTION

An estuary by definition is a semi-enclosed water body in which sea water and fresh water from river mix under tidal action. Sea water is thus diluted measurably (Cameron and Pritchard, 1963), and, in some cases, penetrates in the form of a saline wedge upriver. In other cases the waters are vertically well mixed, and salt water penetration occurs without the presence of a distinct wedge. Water bodies which do not receive fresh water tend to be highly saline, with salt concentration equal to that in the sea. In some cases, e.g. in parts of Florida Bay, in southern Florida, excessive evaporation during the hot and dry season renders the waters super-saline, with salinity exceeding that in the sea (Atlantic Ocean).

The three main parameters which control the degree of salt penetration are the river runoff velocity, water depth and tidal range in the sea. Increasing the tidal range or the depth, or decreasing the runoff will increase penetration. In urbanized areas, withdrawal of fresh water and dredging of deeper channels for vessel navigation are important issues; hence the effect of reduced runoff as well as the effect of increased depth on salinity intrusion have been investigated by scientists and engineers. The effects of reduced runoff has, for example, been recently investigated in the Myakka and other rivers near Florida's Gulf of Mexico coast.¹ A serious problem of this nature occurred in the Delaware River Basin in the 1960's due to drought. During the worst period, the salt front advanced 53 km up the river and forced some industries near Philadelphia to seek water from a municipal system that imported water from the Susquehanna River Basin (Hull and Titus, 1986).

The influence of increased depth is analogous to what would occur (and has occurred) in the event of a sea level rise. The propagation of tide up the estuary is affected in this case. On the other hand, enhanced fresh water withdrawal only partially simulates the sea level rise effect, since reduced runoff does not influence tides as significantly as does an increased water depth.

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