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title: **An integrated approach of hydrogeological, geophysical and seawat modeling studies for delianating the salinity sources in central Godavari delta, A.P., India**

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Oil production from 5 wells in Ravva oil field on Bay of Bengal coast in Godavari Delta has been continuing since 1991. For maintaining constant pumping rate of oil from production wells, brackish water has to be injected into the oil wells continuously. The oil company has drilled 8 tube wells inside Ravva onshore Terminal on the Bay of Bengal coast for withdrawing groundwater $\sim 600 \text{ m}^3/\text{hr}$. The 5 bore wells in continuous operation since 1991. The large quantity of groundwater pumping has caused a cone of depression around Ravva onshore terminal. Ravva onshore terminal groundwater study covers about 250 sq km. Groundwater monitoring as well as water quality analyses have been carried out for Pre-monsoon and post-monsoon 2006 & 2007 and pre monsoon of 2008 and groundwater quality database has been generated to analyze conditions if any favorable for sea water intrusion. Delineation of aquifer geometry and high salinity areas up to 50 m depth has been carried out using Multi-electrode resistivity imaging tomography surveys. Available lithologs of pumping wells inside the Ravva onshore terminal indicate that the top layers are mainly consisted of fine sand with marine clay in the alluvium. The wells have been constructed tapping the aquifer at depths $< -70 \text{ m}$ up to -140 m (a.s.l.) to tap the highly brackish water with salt concentration $> 25\,000 \text{ mg/l}$.

Detailed hydrochemical analysis from 47 samples collected around Ravva Onshore Terminal, Central Godavari Delta, has been carried out to assess the groundwater quality for determining the seawater encroachment. The ratios of ionic concentrations with regard to Na/Cl , SO_4/Cl , Mg/Ca , $\text{Na}/(\text{Na}+\text{Cl})$, $\text{Cl}/\text{sum of anions}$, and Cl/Br ratios have been computed from groundwater quality database to identify the regions, where salinewater intrusion could be possible in the area. All the analyses have indicated that the salinewater intrusion is due to upconing of insitu salinity of groundwater in the marine clays rather than lateral movement of saline water from Bay of Bengal. The upconing phenomenon is limited to the area around the Ravva onshore terminal only. Predominant groundwater types identified in the area are Na-Cl type around Ravva onshore terminal and Na-Cl- HCO_3 type adjacent to it and Sodium, Calcium and Magnesium Type in the rest of the area. The groundwater quality data plotted on Piper and Wilcox diagrams indicate that Sodium and Salinity hazards are very high in the area. Groundwater level monitoring has been carried out for establishing the groundwater flow direction in the study area describes predominate groundwater flow direction towards the Bay of Bengal. SEAWAT model computed salt concentrations have not indicated any possibility of sea water intrusion from Bay of Bengal. Actually the groundwater pumping from Ravva Onshore Terminal is helping reducing in situ salinity of groundwater derived from marine clays in the area.



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