Pakistan Council of Research in Water Resources
Ministry of Water Resources
Government of Pakistan

Electric Resistivity Survey

Pakistan Council of Research in Water Resources (PCRWR)
Karachi

Background:

The site is located at Latitude **24.5817990**° and Longitude **67.5035770**° nearby a tidal creek in the district Thatta. The Electrical resistivity survey was conducted on two points at about 5 km away from the site but having similar geographic and geological characteristics as shown in Fig 1. The geographic coordinates for each point are shown in Table 1.

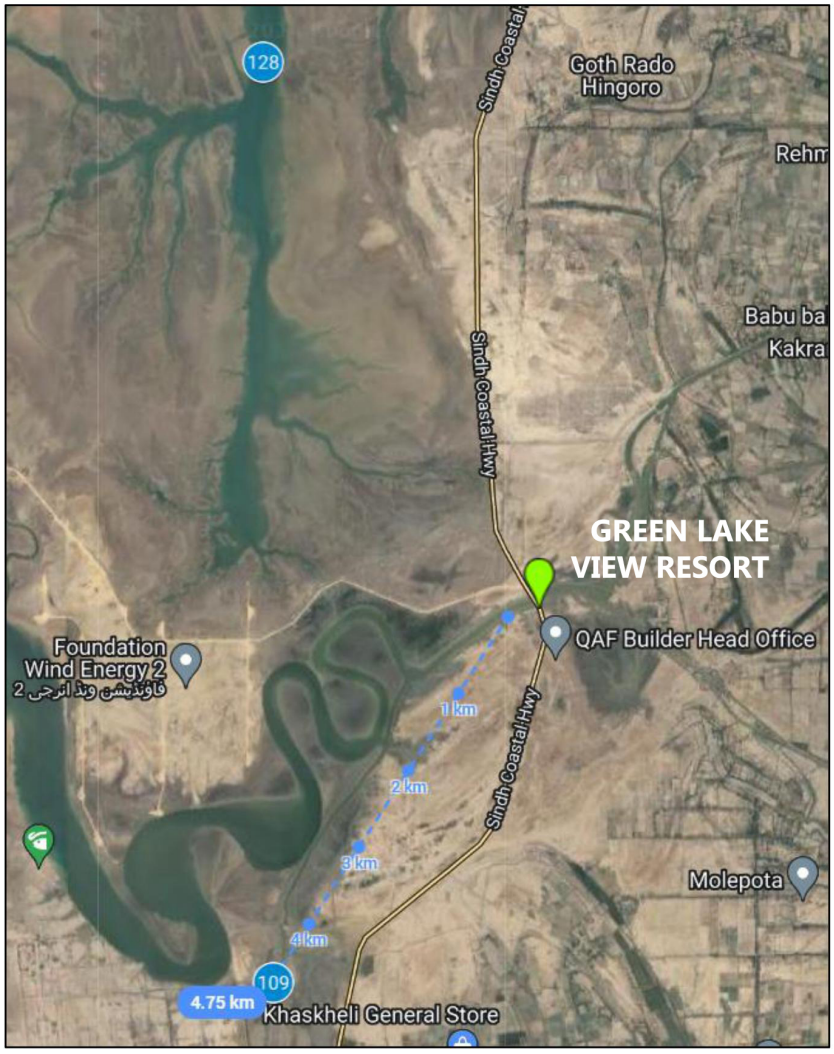


Fig 1 : Site location for Electrical resistivity survey probes

Table 1: GPS Locations for each ERS point

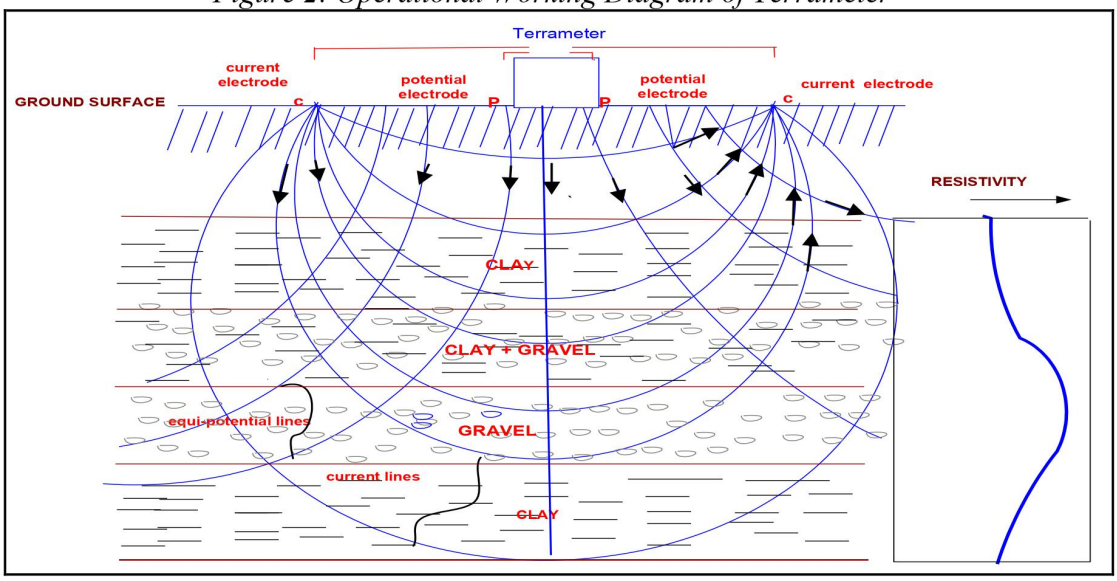
Name	Latitude	Longitude	Description
SWI ERS 109	24.55028	67.47651	Near Coast
SWI ERS 128	24.62818	67.49667	Near Coast

Results and Discussion

Groundwater Potential Assessment

The groundwater investigation through Electrical Resistivity Survey provides the useful information to map the sub-surface geological formations and demarcate the freshwater aquifer. Figure 2 shows the operational working of Terrameter instrument for the acquisition of resistivity data.

Figure 2: Operational Working Diagram of Terrameter



The correlation established between electrical resistivity and subsurface geological condition and water content for investigated area is given in Table 2. The Figure 3 shows the correlation of the resistivity with the sub-surface conditions. The resistivity data was processed in an IX1D v3 Software to determine the subsurface resistivity and thickness of different layers of the soil to the investigated depth. The resistivity models and processed data are attached as Annexure-I. The recommendations for each probe based on the observations are provided in the later section.

Table 2: Correlation between electrical resistivity and hydrogeological conditions in investigated area

Name of Zone	Resistivity (Ohm-m)	Correlation with Geological Formation and Water Content Quality
Low Resistivity Zone	0-30	This zone indicates the presence of fine materials like clay/shale, with rare sand/sandstone and therefore hardly has any water bearing potential.

Medium Resistivity Zone	31-100	This zone indicates the presence of gravel and sand with some clay/. It may also indicate the presence of alternate bedding of sandstone and clay/shale or admixture of gravel, sand clay. The formation can yield groundwater if below water table.
High Resistivity Zone	101-250	These zones represent the presence of alternate bedding of shale and hard sandstone. The alternate bedding of shale and sandstone can hardly yield any appreciable amount of the groundwater as sandstone in this area is hard and shale is without any required permeability.
Very High Resistivity Zone	>250	The very high resistivity may represent the presence of dry boulder, gravels/conglomerate and dry sandstone above water table and bedrock if below water table.

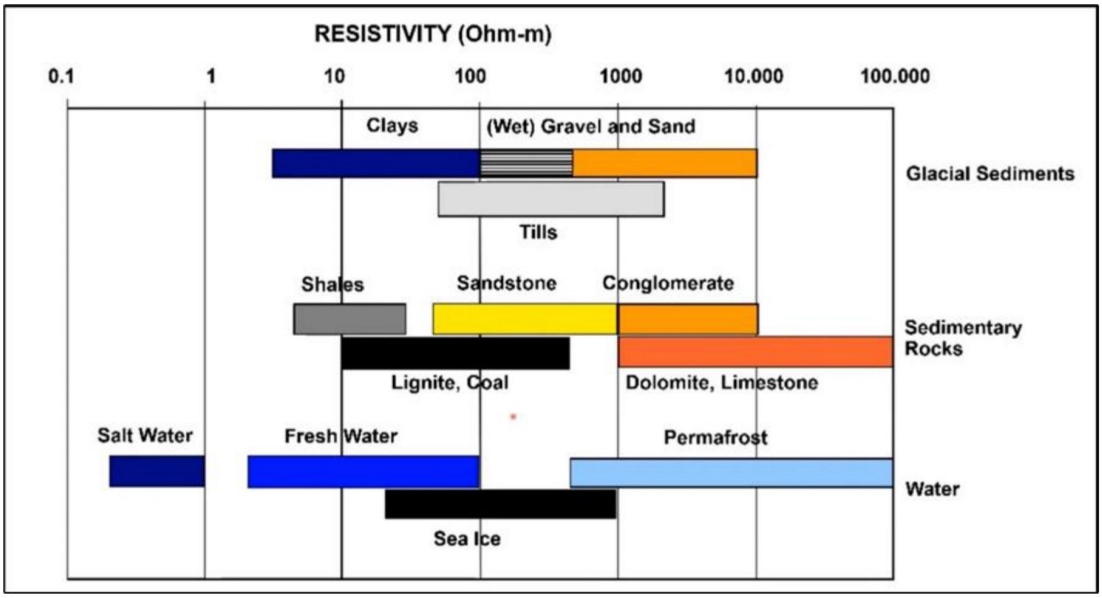
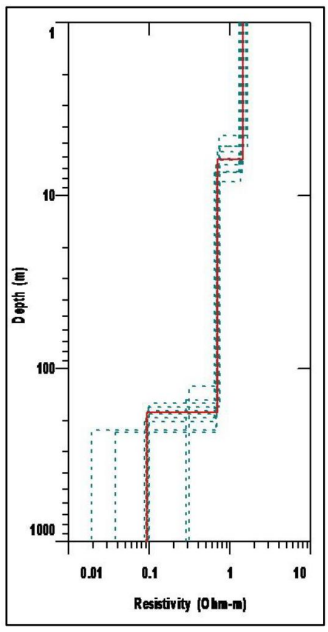


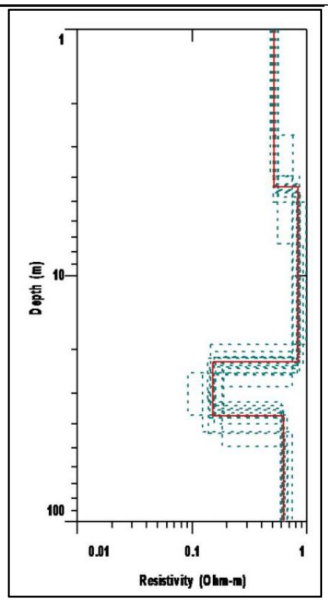
Figure 3 Correlation of Resistivity with the sub surface conditions (after Palacky,1987

RECOMMENDATIONS*:*

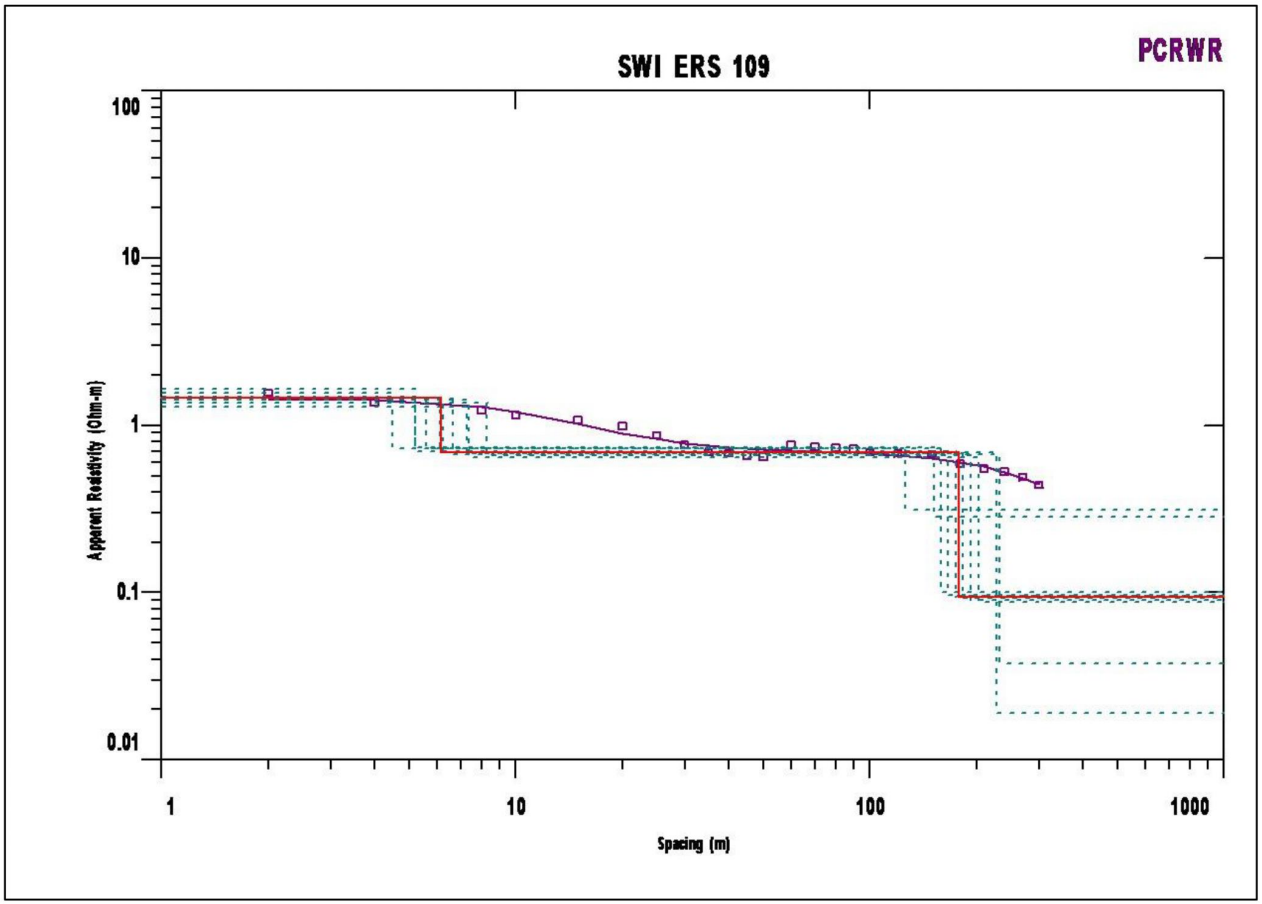
The water quality of the potentially explored underground source is found unsuitable for direct drinking as per water quality standards. Therefore, it is suggested that water treatment facility may be installed prior to the use of underground water for human consumption. The groundwater table lies at about 2ft below the ground level. The recommendations based on ERS data collected are given as under:

<table>
<tr><th>Site</th><th>Probe No.</th><th colspan="5">Recommendation on Basis of Electrical Resistivity Survey (ERS) Data</th></tr>
<tr><td rowspan="2">Thatta</td><td>ERS-109</td><td>Layer</td><td>Depth (m)</td><td>Resistivity (Ω-m)</td><td>Interpretation</td><td>VES Model</td></tr>
<tr><td></td><td>1</td><td>6.18</td><td>1.4512</td><td>Indicates the presence of clay or loam saturated with highly saline water having EC > 4dS/m</td><td rowspan="3"> 
</td></tr>
<tr><td></td><td>2</td><td>166</td><td>0.69</td><td>Indicates the presence of a saturated zone of water with high salinity</td></tr>
<tr><td></td><td>3</td><td>>166</td><td>0.14</td><td>Indicates saturated zone with highly saline water.</td></tr>
<tr><td></td><td>ERS-128</td><td>Layer</td><td>Depth (m)</td><td>Resistivity(Ω-m)</td><td>Interpretation</td><td>VES Model</td></tr>
<tr><td></td><td></td><td>1</td><td>4.35</td><td>0.52</td><td>Indicates the presence of clay or loam saturated with</td><td></td></tr>
</table>

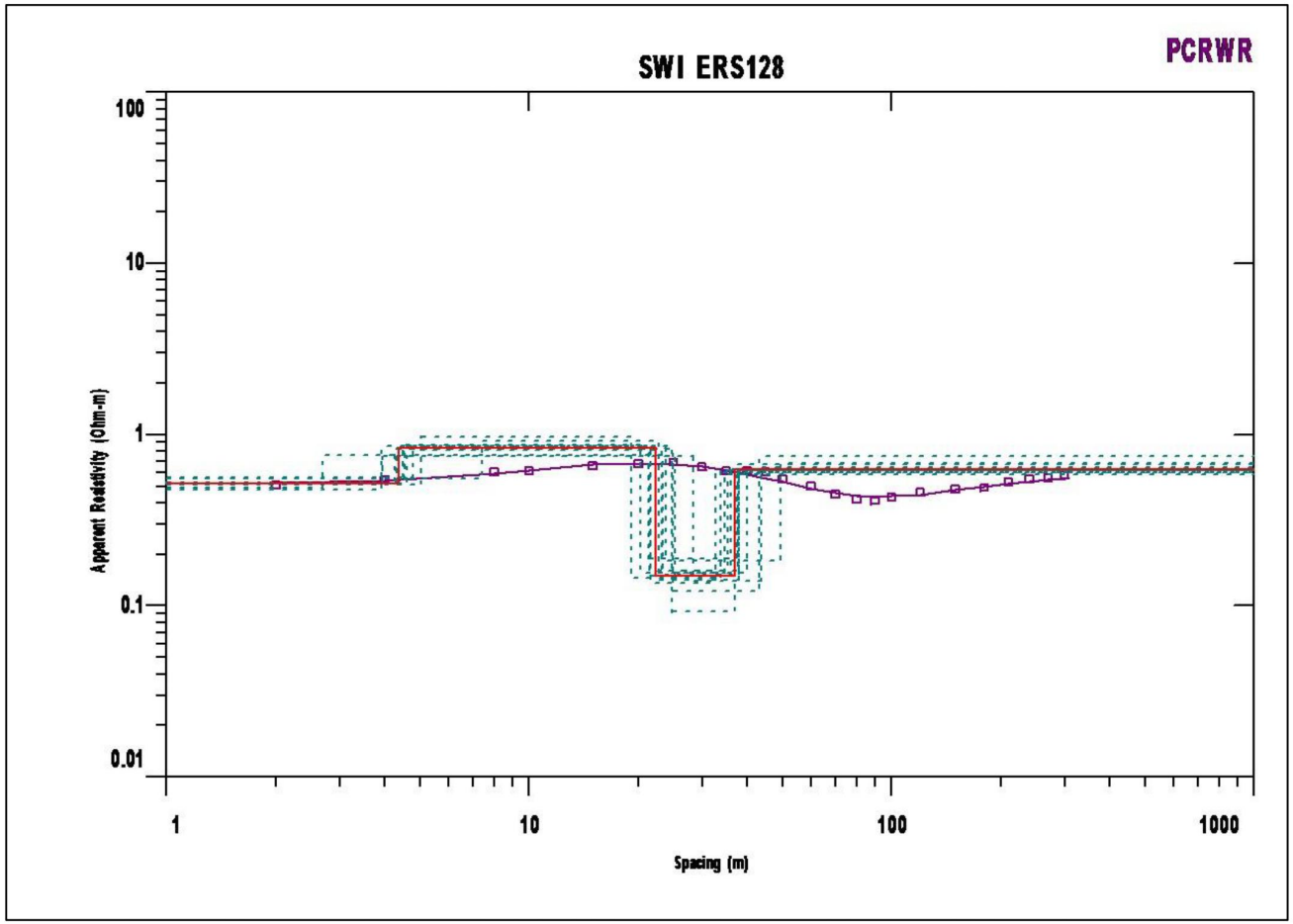
			highly saline water having EC > 4dS/m
2	22.5	0.83	A saturated zone with highly saline water
3	37	0.15	A saturated zone with further increased salinity indicating a highly saline zone
4	>37	0.62	A saturated zone with highly saline water.



Annexure-I



ERS Model showing results of the field survey at probe 1



ERS Model showing results of the field survey at probe 2.