

Identification of Groundwater Quantum and Quality and Its Demarcation: A Case Study of Muhammad Khan Distributary Command Area

Zubair Ahmed¹, Jazib Bashir Shaikh², Abdul Qadir Memon³, Abdul Rehman Kori⁴, Ismail Siyal⁵ ¹Student,

Department of Civil Engineering, Mehran UET, Jamshoro, Sindh, Pakistan

Abstract: The work performed beneath this gander at is important for an examinations work that will be finished under the task "Feasible clean groundwater the executives for flooded Agriculture in lower Indus bowl (LIB) utilizing PMWIN Model" Funded through HEC under NRPU application. Through Geo-electric resistivity study, the underground opposition of the look at region at explicit chose focuses become decided the utilization of Terrameter SAS 4000 accessible at USPACW, MUET, Jamshoro. To assessment of spring thickness and fine the Software IX1D was utilized. This Study objectives to distinguish the groundwater quantum and lovely beneath the limit of Muhammad Khan distributary order locale that is off-taking from Rohri trench at Almani X-controller. The distributary going through association Tando Fazal chamber of locale Hyderabad, Sindh, Pakistan. The groundwater quantum and fine were chosen through electric resistivity overview (ERS). The results shows that the water excellent in Muhammad Khan distributary order place, up to profundity of 50 m Fresh water changed into found 29% and negligible shimmering about 53%; though the style of groundwater extraordinary is willing from 51 to 75 m profundity discovered shining of seventy eight% and minimal clean of roughly 12% with peripheral alkaline of 6% and alkaline of 4%.The good of drinkable water of the area from 76m descending to the exploration profundity of 100m initiate new. From the examination, it's far informed that agrarian productiveness regarding vegetation of this region can be improved through ability developing of ranchers and right use of farming augmentation division for the conjunctive utilization of surface and groundwater.

Keywords: Electrical resistivity survey, GIS, Ground Water, IX1D software, Terrameter SAS 4000.

I. INTRODUCTION

Groundwater investigation has end up progressively basic now not best in Pakistan anyway likewise universally in light of ever-expanding call for water system water. Pakistan has a dry to semi-bone-dry climate and is basically relying upon water system through an appropriately snared water system network that is explicitly restricted to the Indus Basin. As an outcome of inadequate water substances, the US of America has best 22 (mha) of inundated land out of 31 (mha) of cultivable land to be had. Notwithstanding, bringing more prominent region beneath development relies upon accessibility of water, while water accessibility isn't in every case softly administered over the long run. Also, occasional variation, dry spells and floods can make serious conditions. Trench water materials are perceptibly unjust, variable and problematic. Further, natural issues which incorporate water logging, saltiness and sodality are experienced inside the gigantic tracks of the water system contraption. For this situation, abuse of groundwater sources is the best elective that ranchers have embraced for developing their water materials and getting more command over water system water. This demonstrates the significance and commitment of groundwater to satisfy water necessities for horticulture in Pakistan.

[1] Have completed resistivity study to decide groundwater five star inside the shallow spring. Zones with exorbitant yield capacity have been analyzed based certainly at the resistivity rate through 596 VES study.

[2] Have played out the VES empower charge topographical course of action, through undertaking 32 VER soundings at 6 chose locales, They have noticed pre and post rain storm water stage in the geographical zone of the Himalayan lower area spot of india El-Qadi and Engineering, has considered the geothermal gracefully using geo electrical resistivity inversion as a relevant examination at Hammam Mousa, Sinai, Egypt. He has united 1d Vertical Electrical Survey sounding data and carry out 2D inverse on the educational list for his investigation.[3]

Mukherjee, Debbarma have contemplated planning and groundwater limit drafting the utilization of geo electric strategy in some chose wallet of Baromura slope of Tripura, India [4]. Hodlur and dhakate have made an endeavor to relate the VES and electrical borehole log realities for groundwater investigation in a sedimentary spot [5].

Sathish, Enloag have surveyed the blending zone of seawater and shimmering groundwater zone in south of Chennai, the use of over the top goal electric resistivity tomography method [6].

Majumdar and Das used to check the spring homes of Sagar Iceland area in India, wherein they were confirmed that the outcomes related clearly with borehole records from the locale [7].

Sirhaan, Hamidi have worned this approach to manage map electric resistivity scattering for Al Avovb Basin in Palestine. Have being the life of a determined delicate game plan went with the guide of a higher clayey layer and a vivacious association with existing wells arranged inside the request [8].

King, Santos have considered the underlying components, stratigraphic contraptions, groundwater probability, and force to the cellar rocks utilizing remembered geophysical understanding of resistivity and gravity for Japanese a piece of Ismailia Canal, Greater Cairo, Egypt [9].

Khan and Science have done resistivity outline in Peshawar for assessing underwater utilizing SAS 4000 abem terrameter at different districts close to University grounds and Hayatabad town. They have look over their encounters utilizing IX-1D programming and found that the discount in ground table from average degree of 23 meter to a level changing from 41 – 92 meters underneath floor. They have asked to plot the stores inside the weak district pass open burrowed well for created enable [10].

Khaki el at have guided Electrical resistivity to cheek the effect of a close to lake The geo electric resistivity surveys includes 14 regions The outlines foreseen the domains with extraordinary permeability presenting pathways for lake squander. The groundwater and soil tests have been also found for 2010 to 2013 confirmed that of great and cruel water zones of their look at territory [11].

Osele, Onwuemesi have deciphered vertical electric sounding five geo-electric ed spring attributes including contagiousness and water powered conductivity [12]. Gadgets with force to the spring layers differing from 21 to 78m. They have furthermore gauge

Rasool, Farooqi have driven the assessment to pick of groundwater inadequacy cutoff of vadose material utilizing geo-electric technique. Complete of 8VES have been taken near Khizarabad town ranch, area Sargodha, Pakistan The results portrayed the district into three layers, dry alluvium, soaked alluvium with over the top resistivity (10 - 20 ohm - meter) and incidental resistivity (>10 ohm- meter). This view expected that there's not confined spring accessibility with agrarian toxins [13].

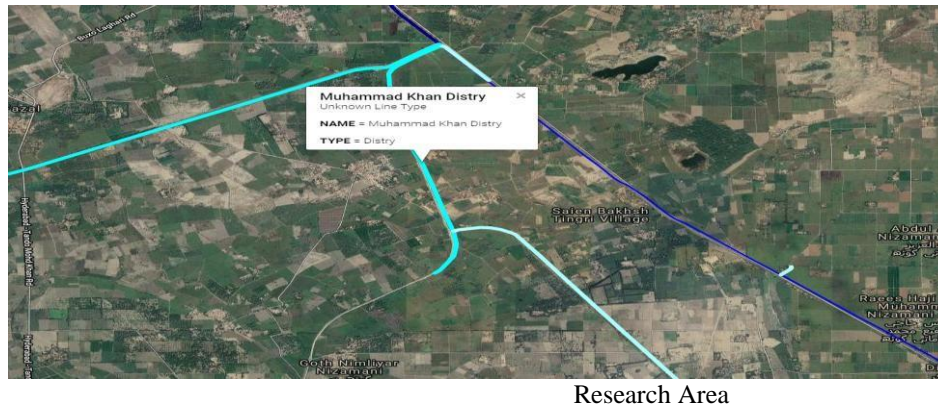
II. HYDROLOGICAL SETTINGS

It is flanked with the guide of Hyderabad, Pakistan and Region of Tando Allahyar toward the north, toward the south & east Badin zone and toward the west Thatta region. The Indus streams in north west. It is put among 68° 14' 13" - 68° 43' 1" east longitude and 24° 45' 41" to 25° 17' 8" north reach. The demeanor of Tando Muhammad Khan District is fragile. Notwithstanding, the mid year months from April to June - are unbelievably hot eventually of the day. The find unimportant and most unmistakable temp; for the scope of this time are 25° - 45°C only. December - January are the coldest months with most and insignificant temperatures of 30° and 10°C freely. The temperature drops out of nowhere around evening time. The air is tempered by utilizing the west - south air breeze, which blows for a long time from March - October, making the persistent atmosphere reasonable. The gather time begins in Sept and proceeds for around 2 months.

The most recorded wetness at Tando Muhammad Khan is 55 rate. Precipitation is really irregular with an ordinary of around a hundred thirty mm. The tempest overpowers from July - September.

Muhammad Khan distributary order territory has been taken as study region. The distributary is off-taking from Rohri trench at Almani X-controller at RD 1038. It is going through Tando Fazal Union committee of region Hyderabad, Sindh, Pakistan. The town of Tando Fazal is 30.9 kilometers southeast of Hyderabad with coordinates 25° 15' N 68° 32' E. Tando Fazal is governed by Sindh Government under Mir Ahmed Ali Talpur, Taluka Chairman and Syed Ali Akber Shah, the Taluka Vice-Chairman. Tando Fazal is connected with Hyderabad city via N-120 Hyderabad -Tando Mohd Khan Road.

III. RESEARCH METHODOLOGY AND DATA COLLECTION



Research Area

The resistivity survey was performed at common organizations for productive and significant arranging of groundwater. Resistivity diagram has been performed at 2 x 2 km² structures for normal survey up to the significance of a 150m using SAS 4000 Abem Terrameter. In such way, specific gathering of workers of (DRIP), Tando jam, running underneath the control of Pakistan Council of Research in Water Resources (PCRWR) has been referenced to empower doing the audit. The Device an ABEM Terrameter become equipped through the Department USPCAWS MUET Jamshoro. Under this look at, for the most part 14 ERS audit have been finished in the Taluka Tando fazal.

A. Electrical resistivity survey :

The reason for the (VES) layout was to mistreat ground-water inside the investigated zone. Going before coordinating and the killing ground-water from the zone, it's miles basic to have characteristic clinical information concerning the hydro topographical conditions like: course of action of the shimmering saline-water interface; thickness and equivalent volume shining-water design; litho sharp nature of spring inside the zone of amusement activity and examination of the ground-water sensational profiles.

Vertical Electrical Survey (VES) thusly assists with settling on worth amazing and thought decisions Such as choice of the normal objections for the maltreatment of ground-water, insistence of prey depleting criticalness to avoid pointless probing penetrating and ID of the nature and thickness of the springs in the locales of premium.

B. Data collection of electrical resistivity survey:

The motivation behind the VES diagram was to mistreat ground-water inside the investigated zone. Going before coordinating and the wiping out ground-water from the zone, it's miles crucial to have characteristic clinical information concerning the hydro topographical surroundings like: plan of the shining saline-water interlinking; thickness and equivalent volume shimmering water format; litho sharp nature of spring inside the territory of entertainment activity and examination of the ground-water wonderful profiles. VES thusly assists with settling on worth astounding and thought decisions Such as choice of the normal objections for the maltreatment of groundwater, insistence of target depleting centrality to evade vain exploratory penetrating and ID of the nature and thickness of the springs in the districts of premium.

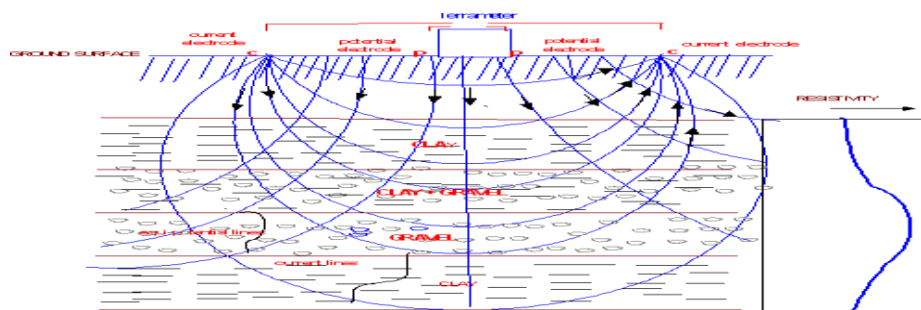


Fig: Setting of the Current electrodes and Potential

The floor is stimulated through the external A and B cathodes underneath extreme Direct Current Voltage and consistent present day is made to move through the floor. The consistent chose advanced I (in mille amperes) passing by means of the 2 contemporary anodes and achieve gin capacity qualification V (in mille/miniature volts) between the two potential cathodes is handled with the guide of the device and the R is shown for the relating contemplating. The distance among the two limit cathodes is more modest than the hole between both limit terminal or its bordering forefront anode. Estimations are taken and noted sooner than repositioning the cathodes. The midpoint of the cathodes is fixed on the sounding locale, simultaneously as the time of the setup is bit by bit raised subsequently that permits you to quantify the resistivity at given force degree. At every area, in one sounding evident resistivity esteems are gotten at restrictive novel profundities.

The insights was gathered by receiving set systems wherein contemporary become welcomed on through current terminal and the capacity become estimated at ability anode and hence obstruction esteems were acquired. The data become gathered at different pre-chosen destinations. The gadget got orchestrated at a spread of 600 m on every part of the apparatus.

C. *Electrical Resistivity Survey Data Evaluation Using IX-1D Software:*

The turns of the resistivity topic are obtained by plotting the simple respects of resistivity on a log-log diagram paper contrary to depths. All the subject data is selected for PC in the wake of smoothing the plotted bends. With the aid of pc and clear comprehension programming, the knowledge of sounding changed to performed. The space resistivity-sounding experiences are deciphered by PC-maintained programming techniques, IX1D, Interpex, U.S.A. By an iterative loop, the layer plans are resolved. As far as possible, the deviation of the associated turn from the deliberate bend is verified during each further movement. The variance is shown by the RMSE (root imply square fumbles), which is shown after each complement. The range that results within the humblest staggers is plotted with the passive consent of counts, exhibiting the deciphered resistivity and differentiating thickness of the sheet. In essence, perception of sounding resistivity is tirelessly applied to the proportionality norm, i.e. With a few barely wandering model turns, any resistivity sound may be encouraged, tending to a fascinating sub-surface resistivity plot depending on the locale's groundwater lead. Along these lines, the mediator of the pieces of data stood up to with masses of choices for a specific subject bend to make his statement of the most accurate sub-floor conditions model.

D. *Resistivity Measurement*

Ohm-m measured resistivity (a is a mass property of a texture and demonstrates how properly the material represses the float of today. The resistance of the Schlumberger anode is determined as the conspicuous resistivity and R is the resistance.

$A=G$; wherein; the geometric component (G) is given by way of the subsequent relation $(MN/2) \quad (3.2)$

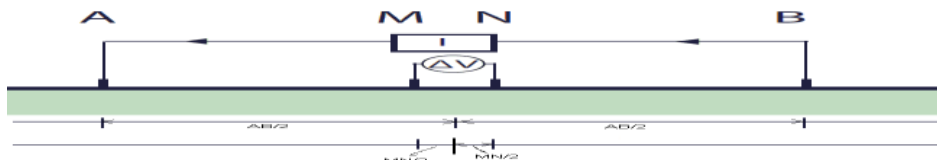


Fig: Outline of a Schlumberger array

E. *Electrical Resistivity Survey Data Interpretation*

While introduced to the method of interpretation, the intentional resistivities yielded electrical layers sub-surface. Such decoded electrical layers need a relationship with the sub-geological floor's conditions. This disparity in decoded layers into litho reasoning devices is basically focused entirely on the geographical records obtained from study openings, tube wells, and various estimates of going before organized district evaluations. The translated sub-surface hydro land conditions are orchestrated into world class resistivity zones. The relationship set up among electric resistivity and subsurface land condition and water content for an investigated area given in Table under.

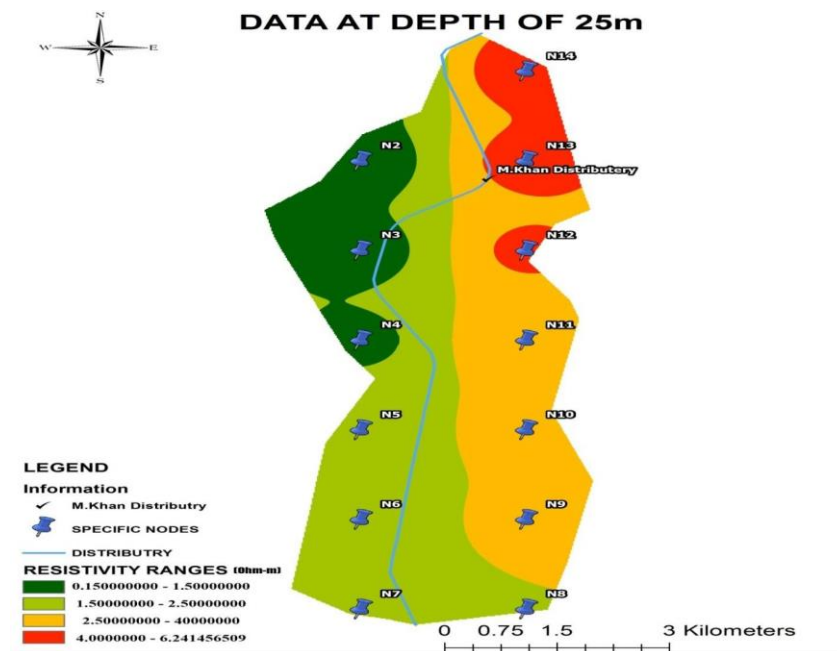
Table: The correlation between Resistivity with Geological Formation and Water Content Quality

Name of Resistivity Zone	Resistivity (Ohm-m)	Correlation with Geological Formation and Water Content Quality
Low	Less than 10	This zone shows the presence of beautiful materials with uncommon sand, such as earth/shale, and therefore has saline or less saline water bearing ability.
Medium	10 to 30	The appearance of middle of the road sand with some gravel indicates this territory. The presence of sand and mud/shale trade bedding can also be inferred. Groundwater can be created by the construction if the work area is under water.
High	30 to 100	This zone is deciphered as coarser material intensity, i.e., sand with correct fine groundwater.
Very High	Greater than 100	The high resistivity can also assess the presence of the unsaturated zone under the water table above the water work area and bed rock.

IV. RESULTS AND DISCUSSIONS

Water magnificent guides in expressions of have been developed for separating the locale Hyderabad at 04 remarkable profundities viz., 25, 50, 75, a hundred. In such manner resistivity zones were inferred having resistivities of the hydro land layers to the comparing EC estimations of groundwater substantially less than 1.5 dS/m, between 1.5-2.5 dS/m 2.5-4 dS/m and additional then 4 dS/m were identified with comprise new, minimal shimmering, minor saline and phenomenally saline individually. These guides are characterized and referenced as follows.

4.1. Ground-water quality demarcation at the depth of 25 meter.



The groundwater EC of district Hyderabad at the intensity of 25m has been indicates in discern 4.14 the regions in phrases of fresh, marginal sparkling, marginal saline, saline had been estimated with GIS 10.3 (see Table 4.1 and Figure 4.15).

Table 4.1 represents the most percentage of sparkling groundwater of 15% at this depth; there are only a few patches of saline groundwater aquifers on this district; which had been found as the regions a ways from river.

Fig.4.1: Ground-water Quality at the Depth of 25meter

Table 4.1: Ground-water Quality in percentage at the Depth of 25meter

S. No.	Groundwater Quality		Area	
	Electrical Conductivity (dS/m)	Description	(km ²)	(%)
1	> 1.5	Fresh	4.725	15
2	1.50 to 2.5	Marginal-fresh	12.60	40
3	2.50 to 4	Marginal-saline	3.307	34.5
4	4.00 to 6.24	Saline	3.307	10.5
Total			31.5	100

4.2. Electrical Conductivity of Ground water at the depth of 50 meter.

The electric resistivity carried out ground water great of district Hyderabad on the depth of 50 m has been supplied in parent 4.54. Table 4.2 represents the maximum percent of fresh groundwater of 29% at this depth, the first-class of groundwater of union council Tando Fazal is predominantly marginal fresh. It become also discovered that floor water nice of a few wallet. (Fig.4.2): Groundwater Quality on the Depth of 50m)

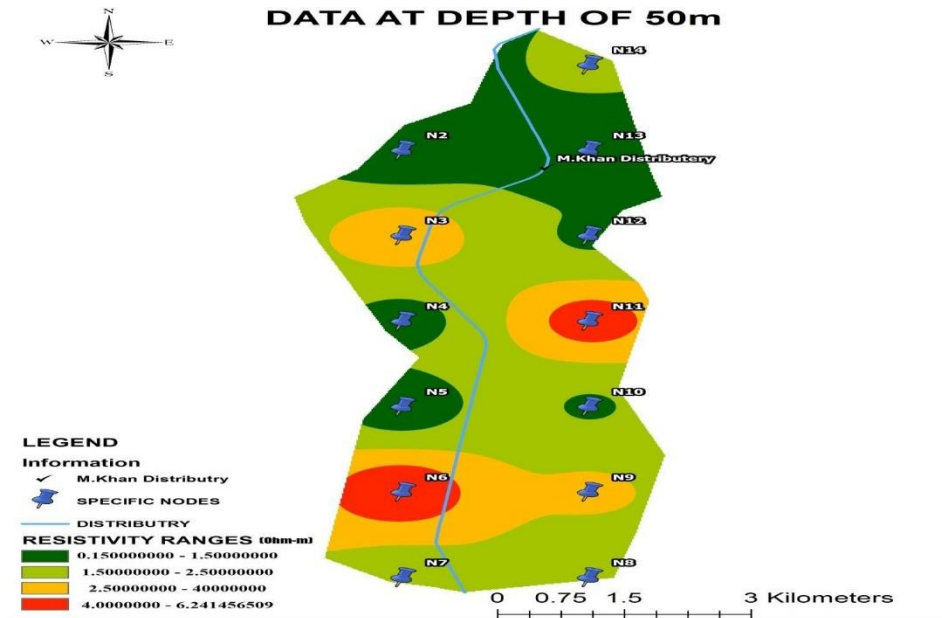


Fig.4.2: Groundwater Quality at the Depth of 50m

Table 4.2: Groundwater Quality in percentage at the Depth of 50m

S. No.	Groundwater Quality	Description	Area (km ²)	(%)
1	Electrical Conductivity (dS/m) 0.150005847 - 1.5	Fresh	9.135	29
2	1.50000001 - 2.5	Marginal-fresh	16.695	53
3	2.50000001 – 4	Marginal-saline	3.465	11
4	4.00000001 - 5.227684975	-Saline	2.205	7
Total			31.5	100

4.3. Electrical Conductivity of Ground water at the depth of 75 meter.

The floor water fine of district Hyderabad at the depth of 75m has been presented in figure 4.17 and see table 4.3 represents the most percent of clean floor water of 78% the areas in terms of fresh,12% marginal clean,6% marginal saline,4% saline It turned into found that the first-class of floor water of union council Tando Fazal mainly sparkling.

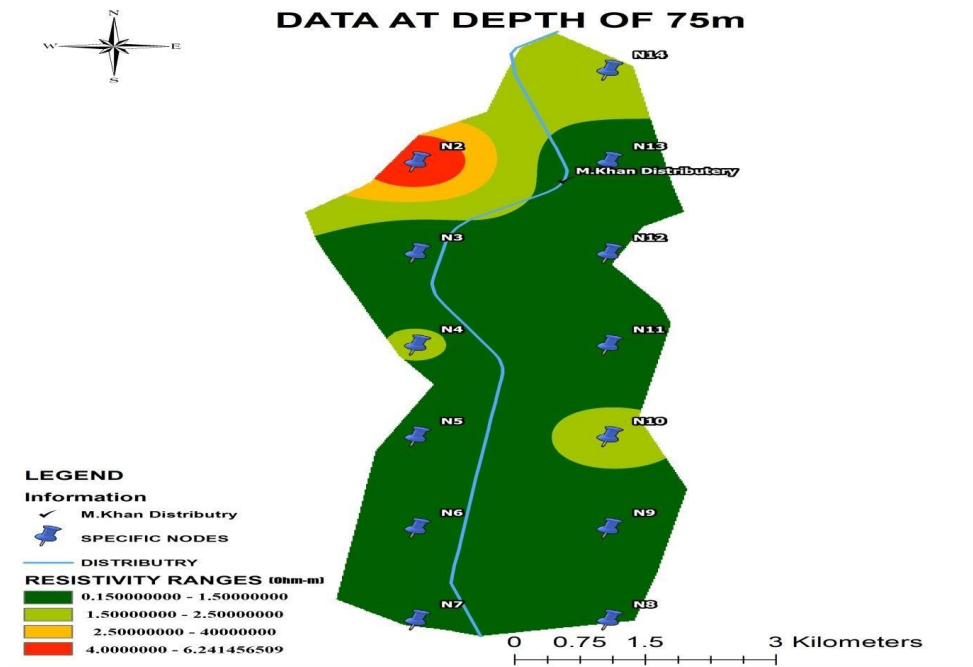


Fig.4.3: Ground-water Quality at the Depth of 75 meter

Table 4.3: Ground-water Quality in percentage at the Depth of 75 meter

S. No.	Groundwater Quality	Description	Area (km ²)	(%)
1	1.1043876 - 1.5	Fresh	24.57	78
2	1.50000001 - 2.5	Marginal-fresh	3.78	12
3	2.50000001 - 4	Marginal-saline	1.89	6
4	4.00000001	- Saline	1.26	4
Total	6.3250947		31.5	100

4.4. Electrical Conductivity of Ground water at the depth of 100 m.

The satisfactory of ground water in phrases of EC of District Hyderabad at the intensity of 100 m. Has been supplied in Figure 4.18 and table 4.4 represents the most percent of sparkling groundwater of 80% It became determined that the satisfactory of ground water of union council of Tando Fazal largely fresh water.

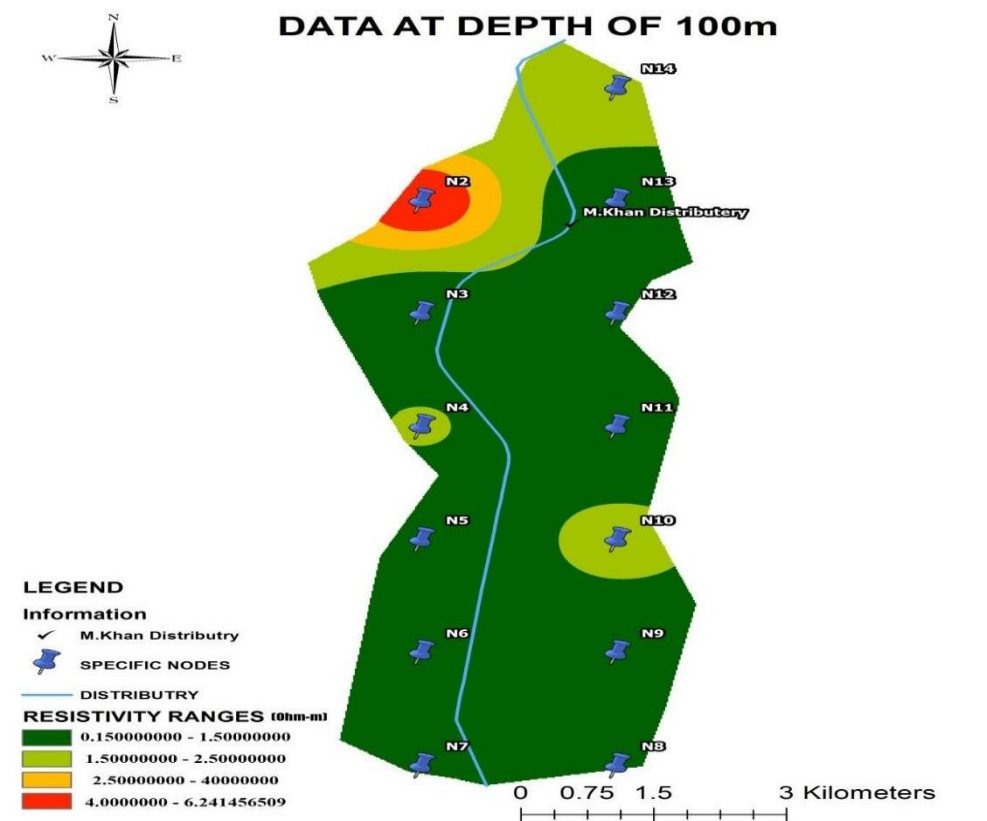


Fig.4.4: Groundwater Quality at the Depth of 100m

Table 4.4: Groundwater Quality in percentage at the Depth of 100m

S. No.	Groundwater Quality		Area	
	Electrical Conductivity (dS/m)	Description	(km ²)	(%)
1	1.142625928 - 1.5	Fresh	25.2	80
2	1.50000001 - 2.5	Marginal-fresh	3.78	12
3	2.50000001 - 4	Marginal-saline	1.575	5
4	4.00000001	-Saline	.945	3
	6.304771293			
Total			31.5	100

V. CONCLUSIONS

The electrical resistivity survey (ERS) has been performed in district Hyderabad the usage of Terrameter SAS 4000 with a view to decide the groundwater first-rate and the ability and the IX1D software to be applied for agriculture purpose. The outcomes display that the general the water great in Tando fazal at command place of Muhammad Khan distributary up to intensity of 25m the Freshwater determined is 15% and marginal clean about 40% ; whereas the trend of groundwater nice at 50 m depth was observed fresh of 29% and marginal clean of approximately 53% with marginal saline of 11% and saline of seven%.The excellent of groundwater at 75m is as clean, marginal sparkling, marginal saline and saline as seventy eight%,12%, 6% and 4% respectively. The research at depth of 100m found out sparkling at eighty%, marginal sparkling at 12%, marginal saline at 5% and saline at 3%.

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