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GEOHYDROLOGICAL STUDY FOR THE "DORADO LOMAS ROYAL DEVELOPMENT" HOTEL PROJECT, MUNICIPALITY OF SOLIDARIDAD, STATE OF QUINTANA ROO

In recent years, attention has been paid to the design and implementation of strategies to increase the availability of water resources. Actions include: reuse, desalination of brackish or salt water, artificial recharge and, recently, the construction of underground dams (impervious screens).

Due to the aforementioned and due to the protection of the mangrove and saline intrusion problems presented by the hotel project "Development Dorado Lomas", Municipality of Solidaridad, State of Quintana Roo, its directors requested our company to carry out a geohydrological study with the purpose of determine the causes that generate saline intrusion and that affect the natural balance of the land, causing changes in the environment of flora and fauna.

To obtain a good result, the geohydrological investigation will be carried out by geoelectric prospecting, using the Vertical Electric Sounding method. This study will be complemented with the following site investigations: geological environment, subsoil stratigraphy (identified as geoelectric units), sampling of water bodies (measurements of Total Dissolved Solids, PH and electrical conductivity), surface hydrological conditions and geohydrological units. of the aquifer at the project site.

The study is divided into five chapters:

• Physical setting. It consists of the description of the geographical conditions from a regional level that the study area has.

• Geology. It broadly defines the outcropping geological units of the study area and a regional outline. The final result has the objective of delimiting the interface zones of fresh, brackish and salt water.

• Geohydrology. In this part, the geohydrological province to which the study area belongs, type of aquifer, hydrological characteristics and groundwater flow are defined.

• Geophysics. In this part, the theoretical foundation and the working method used to determine the geohydrological characteristics of the subsoil are exposed, as well as the results obtained, which are shown in the geoelectric sections, where thicknesses, resistivities and lithology of the different layers of the subsoil are observed. Subsoil

• Conclusions and recommendations. In this part, the results obtained in this study are addressed, as well as the recommendations to be made to meet the objectives of the project.

The study includes the results of the field and office work related to geology, geohydrology and geophysics, obtaining the conclusions and recommendations that are described in this study.

The isoline maps of total dissolved solids and electrical conductivity are:

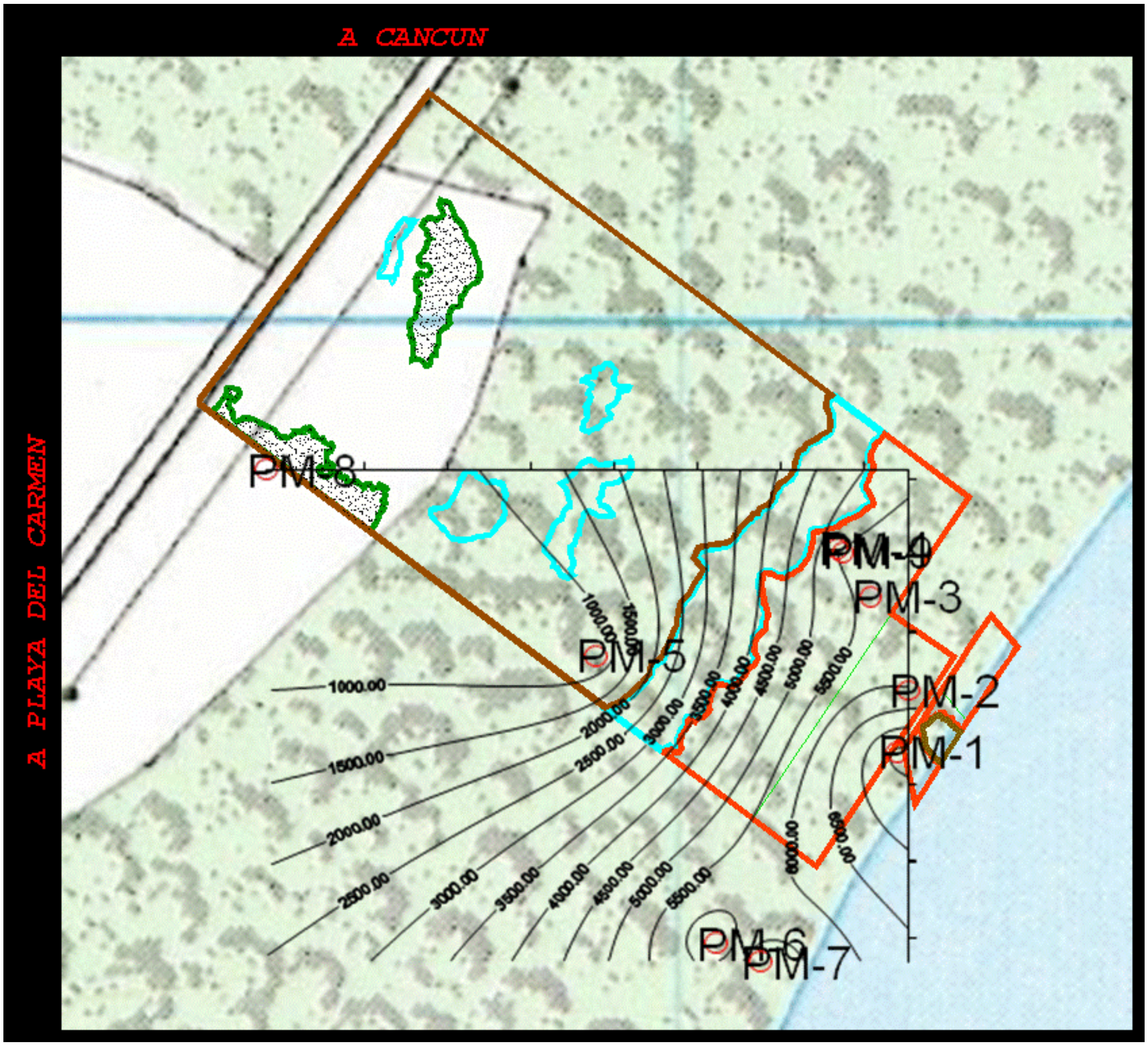

Figure No. 3.2 shows that in the mangrove salinity values are greater than 4,000 ppm, reaching 7,000 ppm close to the coast, these values are extremely high and can cause the death of the mangrove due to the amount of sodium, which is very high.

In the medium forest, the STD values range from 2,000 ppm in the eastern part, up to 4,000 in the area next to the mangrove.

Lastly, in the low deciduous forest, practically the water is fresh and the problems are reduced in terms of the affectation by salinity.

The following figure shows the electrical conductivities recorded in the field with the conductivity meter.

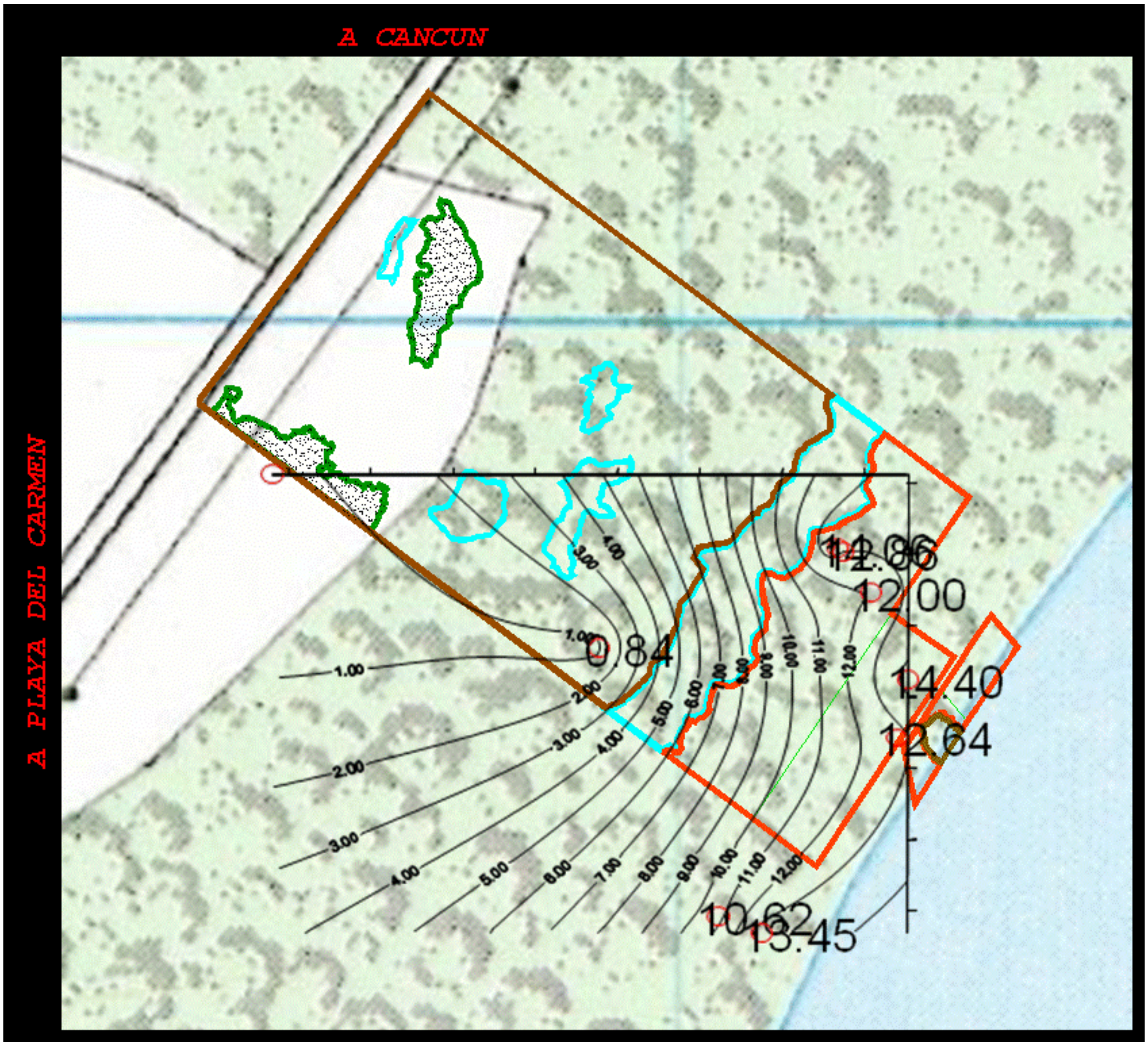

Figure No. 3.3 Map of electrical conductivity isolines

Figure No 3.3 shows the distribution of electrical conductivity in ms/cm. Above the mangrove swamp, the water is very brackish, with values above 8,000 ms/cm, up to 1,300 ms/cm in the part closest to the coast.

In the part of the medium forest, the conductivities range between 4,000 and 7,000 ms/cm and in the deciduous forest the values belong to fresh water with values less than 2000 ms/cm.

Figure No. 3.6 below shows that there is a large deposit of brackish water in SEV-1 and SEV-3. This may be the product of Hurricane Wilma, which made a mechanical deposit of seawater-sediments in this area, an area where the affected (dead) mangrove is precisely located.

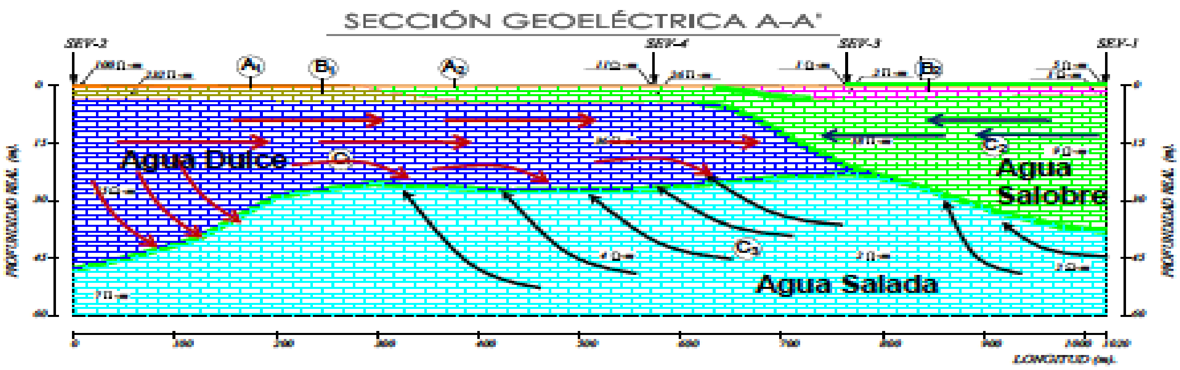

Figura No. 3.5 Modelo geohidrológico conceptual

4 GEOPHYSICAL EXPLORATION OF THE SUBSOIL BY THE METHOD OF

ELECTRICAL RESISTIVITY

4.1 Groundwater prospecting

Prospecting for water requires a basic understanding of the different types of formations that contain groundwater and can be found underground. Within this framework, the focus of its exploration for water supply should be developed.

Groundwater is captured in pores, voids or fissures in geological formations. Pores are the spaces between mineral grains in sedimentary strata, sedimentary rocks, and weathered rocks. The number of pore spaces in a rock formation depends on factors such as grain size and shape, textures, compaction, and the presence of cementing material. Porosity is the ratio between the pore space and the total volume of the rock (figure No. 4.1). High porosity does not always indicate good permeability (potential for holding water).

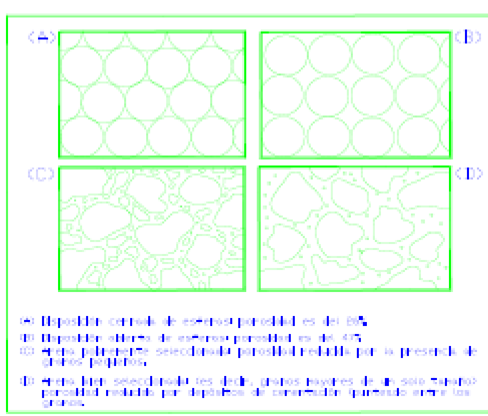

Figura No. 4.1 Porosidad y textura

Although clays and silts have high porosity, the pore size is too small to allow water to flow easily. All openings in rocks such as joints, bedding, cleavage planes, and cracks are called fissures (in hydrogeological terminology). Generally, igneous rocks

they are not porous, unless weathered by the corrosive action of natural elements. Lavas that contain cavities formed by gas bubbles that escaped from them during the eruption may be an exception. Even when a formation is highly porous, the permeability can be very low because the voids are not always interconnected. Fissures can also occur in sedimentary rocks.

Geologically young, unweathered fissures in all formation types tend to close and are likely to contain little or no water. With the action of weathering, cracks will open near the soil surface but remain closed at depth.

Location of Vertical Electrical Probes

For the study area, eight Vertical Electrical Soundings (1 to 8) were carried out, with which two profiles of apparent isoresistivity were formed with their respective geoelectric section, whose distribution is shown in figure No. 4.9.

A continuación se presenta una tabla con las coordenadas UTM con el DATUM WGS84* y elevación de los SEV´s realizados (Tabla No. 4.3).

SEV	ESTE	NORTE	ELEV (m)
01	507,149	2'299,441	7
02	506,310	2'299,691	17
03	507,075	2'299,685	15
04	506,884	2'299,680	9
05	506,599	2'299,424	5
06	506,909	2'299,200	15
07	506,334	2'299,617	19