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تحديث المقاطع الجيولوجية للخزان الجوفي لمحافظات (الشمال, غزة, الوسطى) لقطاع غزة

Updating Geological Cross-Sections of Gaza Aquifer (North, Gaza and Middle Governorates)

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إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

تحديث المقاطع الجيولوجية للخزان الجوفي لمحافظات (الشمال ,غزة ,الوسطى) لقطاع غزة

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نتيجة الحكم على أطروحة ماجستير

بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحث/ **حازم محمد روحي حلمي الطيب** لنيل درجة الماجستير في كلية *الهندسة* قسم الهندسة المدنية- هندسة مصادر المياه وموضوعها:

تحديث المقاطع الجيولوجية للخزان الجوفي لمحافظات الشمال و غزة و الوسطى في قطاع غزة

Updating Geological Cross Sections of Gaza Aquifer (North, Gaza and Middle Governorates)

وبعد المناقشة التي تمت اليوم الأحد 20 ذو الحجة 1436هـ، الموافق2015/10/04م الساعة الثانية عشرة ، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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واللجنة إذ تمنحه هذه الدرجة فإنها توصيه بتقوى الله ولزوم طاعته وأن يسخر علمه في خدمة دينه ووطنه.

والله ولي التوفيق ،،،

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This Thesis is dedicated to

My Great Father...,

My Kind-hearted and Sweet

Mother...,

To My Beloved Wife...,

To my Cute Daughter...,

To all of my brothers and

Sisters...

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ABSTRACT

The study was carried out in the three Governorates of Gaza Strip coastal aquifer which are represented by North Gaza, Gaza, and Middle Area in order to look into the geological properties of this area. The study aimed at updating geological cross sections in the study area to identify the subsurface lithological structure.

This study was conducted of Gaza Strip because there is a lack of geological information of Gaza Strip. There are no complete geological reports for Gaza Strip but some studies carried out for specific purposes by some researchers, engineering consulting offices, ministries or government authorities such as the Palestinian Water Authority (PWA). Most of these researches are special reports and not published.

This study was conducted using soil descriptions of the surface and subsurface layers, 300 boreholes or wells that have been collected from PWA.

Thirteen geological cross sections has been drawn in different locations. The sections presents soil, and rock types along these locations. Some of these proposed sections correlated wells with previous sections.

The study gives recommendation for creating internet data bank that contains geological and geotechnical characteristics to get them on demand and collect more data to be as for building 3D model and adding new data to get more accuracy in description, Selecting new geotechnical characteristics to conduct similar studies and standardize the geological terminology during drilling wells and description.

The results show that the small change between old and new sections in the study area at top soil texture, the soil type on the sea side beach areas is sandy pure soil and on the northern to middle areas, begin to change gradually as we head east to turn into a silt and clay.

In additions geological characteristics of the soil, water levels can be integrated to gain more information about water resources with more areas.

ملخص الدراسة

اجريت هذه الدراسة في ثلاث محافظات في قطاع غزة والتي تشمل الشمال وغزة والوسطى, للنظر في الخصائص الجيولوجية للمنطقة. هدفت الدراسة الى رسم وتحديث المقاطع الجيولوجية في منطقة الشمال وغزة والمنطقة الوسطة لقطاع غزة لتحديد الهيكل الصخري للمنطقة اضافة الى مقارنتها في المقاطع القديمة المتوفرة لدى سلطة المياه الفلسطينية.

اجريت هذه الدراسة للمنطقة ذلك لان المنطقة تعاني من نقص المعلومات الجيولوجية. حيث لا توجد تقارير جيولوجية كاملة لمنطقة الدراسة, لكن عناك بعض الدراسات التي اجريت لاغراض محددة من قبل بعض الباحثين, والمكاتب الهندسية, والوزارات او الجهات الحكومية مثل سلطة المياه الفلسطينية. الا ان معظم هذه الابحاث تعتبر تقارير خاصة لم يتم نشرها.

اجريت هذه الدراسة في قطاع غزة, واعتمدت على على الوصف الخاص للتربة حسب سلطة المياه الفلسطينية الخاص للطبقة السطحية والطبقات التحت السطحية. تم استخدام 300 حفرة او بئر تم جمعها من سلطة المياه الفلسطينية (PWA) لاتمام هذه الدراسة.

تم رسم 13 قطاع عرضي صخري في منطقة الدراسة حسب توفر البيانات والابار واظهرت القطاعات الجديدة توافق بينها وبين قطاعات رسمت سابقا.

اظهرت النتائج ان هناك اختلافت طفيفة بين القطاعات القديمة والحديثة للمنطقة السطحية من نوع التربة على مناطق الشاطئ حيث تتضح انها تربة رملية نقية, اما المناطق الشرقية فيتضح وجود طبقة من الطين على السطح خاصة في المنطقة الشمالية للقطاع اضافة الى بعض الطبقات من السلت.

اوصت الدراسة انشاء بنك للمعلومات عبر شبكة الانترنت يحتوي على الخصائص الجيولجية والجيوتقنية وجمع المزيد من البيانات لتكوين نموذج ثلاثي الابعاد لقطاع غزة باستخدام البرامج المتوفرة, واوصت باضافة بيانات جديدة للحصول على مزيد من الدقة في الوصف واختيار خصائص جيوتقنية جديدة لاجراء الدراسات عليها, توحيد المصطلحات الجيولوجية خلال حفر الابار والوصف.

بالاضافة الى الخصائص الجيولوجية للتربة , ومستويات المياه يمكن ان يكون تصور دقيق للحصول على مزيد من المعلومات حول الموارد المائية مع المزيد من المساحات.

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LIST OF ABBREVIATIONS

CAMP	Coastal Aquifer Management Program
CMWU	Coastal Municipalities Water Utility
WHO	World Health Organization
MOA	Ministry of Agriculture
MOH	Ministry of Health
MOPIC	Ministry of Planning and International Cooperation
PWA	Palestinian Water Authority
MSL	Mean Sea Level
NNE	North North East
SSW	South South West
GCA	Gaza Coastal Aquifer

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CHAPTER ONE

INTRODUCTION

Groundwater is a critical source of fresh drinking water for almost half of the world's population and it also supplies irrigated agriculture. It is now the most significant source in quantity-deteriorated regions, as Gaza Strip because of scarce presence of surface water, it's important for sustaining streams, lakes, wetlands, and ecosystems in many countries, supplying nearly half of all drinking water in the world and around 43% of all water effectively consumed in irrigation (Holger et. al., 2012).

Groundwater is one of the most precious natural resources in the Gaza Strip as it is the only source of drinking water for the majority of the population. It is utilized extensively to satisfy agricultural, domestic and industrial water demands. Groundwater crisis in Gaza includes two major folds: shortage and contamination. The extraction of groundwater currently exceeds the aquifer recharge rate. As a result, the groundwater level (GWL) is falling continuously and accompanied with it the contamination with many pollutants mainly nitrate and seawater intrusion (Weinthal and Vengosh, 2005; Qahman and Larabi, 2004).

Gaza Strip water sector management is essential for sustain of life particularly in rural areas in arid and semi-arid regions. The knowledge of the occurrence, replenishment and recovery of groundwater assumes special significance. Water problem is expected to grow and the deficit in terms of quantity will reach to about 100 Mm^3/y by year 2020, while the water quality will be deteriorated dramatically according to Palestinian Water Authority (PWA) (Al-Jamal & Al-Yaqubi, 2001).

While groundwater is a major source of Gaza's water, relatively little researches has been undertaken to determine the sensitivity of groundwater systems to affect in critical parameters, such as geological layers. Differences between geological layers expected to affect the hydrological cycle, altering surface -water levels and groundwater recharge to aquifers with various other associated impacts on natural ecosystems and human activities. Furthermore, an understanding of the geological layers disposal is essential to make sensible predictions of the possible use of groundwater resources.

The main objective of this research is to update the geological layers in middle, Gaza, Northern part of Gaza Strip and compare the new sections with old available sections.

1.1 Problem Statement

The problem of this research is the lack of the geotechnical and geological information to the Gaza Strip. There are some geology/ geotechnical reports for Gaza Strip but some sporadic studies carried out for specific purposes by some researchers, engineering consulting offices, ministries or government authorities such as the Palestinian Water Authority. Most of these researches are special reports and is not published, but little of this information has been published.

The internal reports and some of the published data for the study area characterized by a degree of uncertainty, needs of purification and re-classification and verified the presence of a repeat in many of them as some of them need to be an accurate geological description as many of this reports were described as a description of non-geologist.

1.2 Objective of the Study

The objectives of this study to update geological cross sections in the North, Gaza and Middle governorates of the Gaza Strip to identify of subsurface lithological structure and its possible role in groundwater deterioration and compare the new sections with old section.

1.3 Methodology

The stages of the study can be summarized as follows:

1. Gathering data for water level and subsurface geologic structure.
2. Analysing the lithological data by using WinLog and WinFence softwares;
3. Elaborating the data presentation and dissemination of results in appropriate various forms of data output (e.g. Graphs, Cross-sections, etc.);
4. Comparing the differences between new sections and old sections.

Data integration will be carried to be an effective preliminary tool for planning, policy and operational levels of decision making concerning groundwater protection and management.

1.4 Thesis Outline

This study consists of six chapters described as follow:

- **CHAPTER ONE (INTRODUCTION):**

Is a general introduction follows by problem identification, study objectives, methodology and tools used in order to achieve the objectives and finally a plan for thesis outline.

- **CHAPTER TWO (LITERATURE REVIEW):**

Chapter two covers a general literature review on the meaning and importance of software, tools, soil, soil classification, and geology & lithology. It also review of the available published and unpublished data related to the study objectives.

- **CHAPTER THREE (DESCRIPTION OF THE STUDY AREA):**

Describes the intended area and Gaza Strip where the study area is located, with respect to its geography, geology, hydrology and hydrogeology, and land use. Depending on the available studies on the groundwater quality status of the area in order to continue the progress of related works in this thesis.

- **CHAPTER FOUR (APPROACH, METHODOLOGY AND TOOLS):**

It discusses the data collection, processing and analysis and representation of it in different forms of graphs and sections etc. using different software including GIS, WinLog version 4, WinFence and Excel.

- **CHAPTER FIVE (RESULTS AND DISCUSSION):**

Present the collected data in chapter four after their processing through the software with a discussion for these results.

- **CHAPTER SIX (CONCLUSIONS AND RECOMMENDATIONS):**

The results and information gained from chapter five were utilized to conclude some conclusions regarding the study objectives. Specific recommendation will be extracted from this study for the interested engineering companies, ministries, etc.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Geologic cross sections provided two-dimensional slice of Earth's subsurface and is used to help understand geologic conditions that occur in specific areas of the cross section. Creating and evaluating cross-section is a very important aspect of the geoscience profession.

To construct a geologic cross section, you need a map showing the location of the boreholes from which the geologic data were obtained, and the borehole logs that contain the information concerning the underlying sediments and bedrock. The map will provide a horizontal scale, or distance between the boreholes and a projection of elevation. The space between the boreholes is interpreted from the map scale. (http://serc.carleton.edu/).

2.2 Gaza Coastal Aquifer

The aquifer in the Gaza Strip is part of the coastal aquifer, which extends from mountain Carmel in the north to the Sinai desert in the south with a variable width and depth as seen in figure (2.1). The total area of the coastal aquifer is about 2000 km2 with 400 km2 beneath the Gaza Strip. The aquifer media are composed mainly of alluvial sandstone with gravel from the Tertiary era covered with Quaternary sand dunes. These dunes extend along the shoreline up to few kilometers inland. The depth of the aquifer varies from about 170 m at the shoreline to a few meters at the eastern boundary. This makes it vulnerable for pollutants mainly from untreated wastewater in the area. There is a very thick impermeable clay layer underneath the aquifer, the Saqiya formation. This 400 to 1000 m layer forms the bed of the aquifer (ELamassi, 2012).

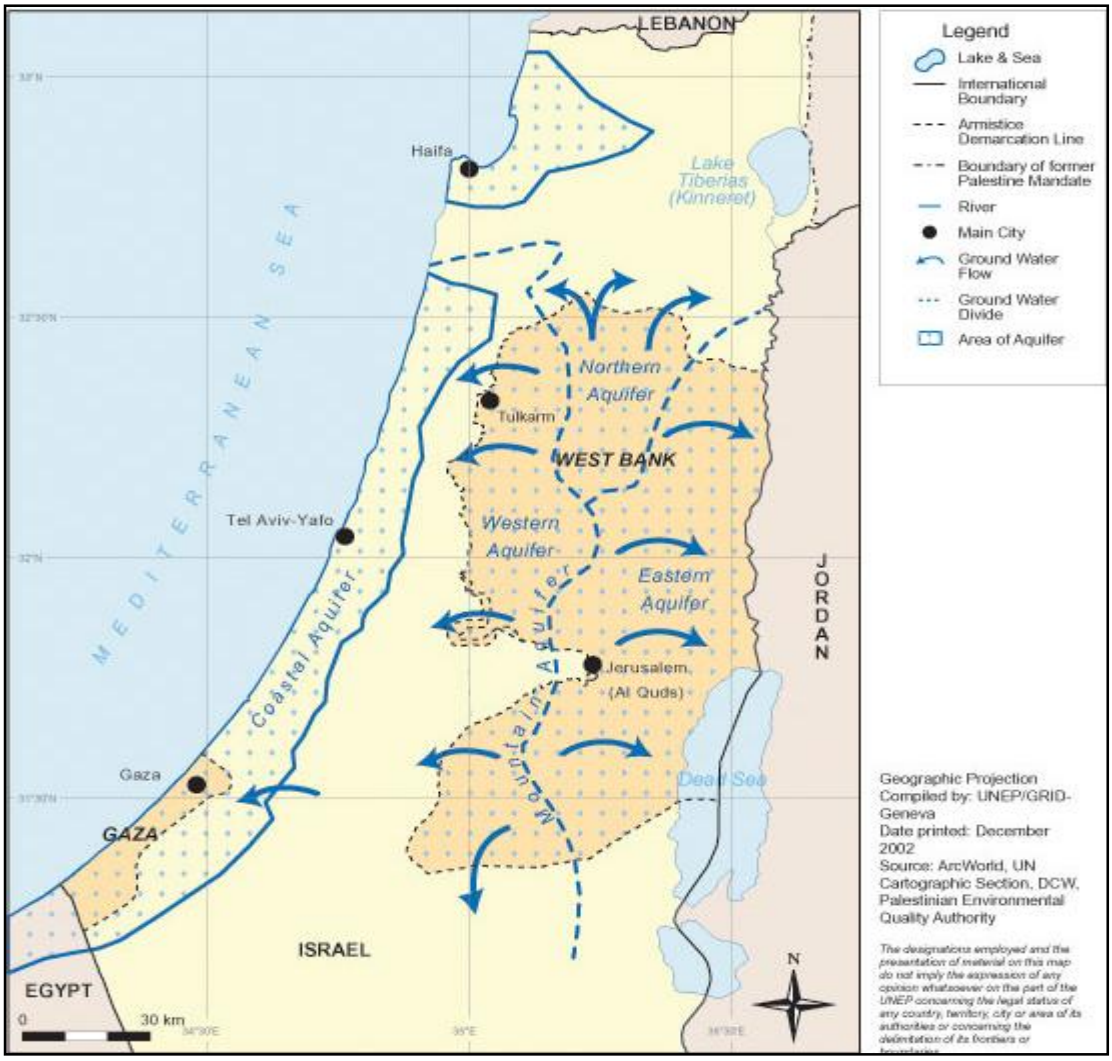


Figure (2.1) Coastal Aquifer. (www.grid.unep.ch)

2.3 Soil

Soil is the mixture of minerals, organic matter, gases, liquids, and the countless organisms that together support life on earth. Soil is a natural body known as the pedo-sphere and which performs four important functions: it is a medium for plant growth; it is a means of water storage, supply and purification; it is a modifier of the atmosphere of Earth; it is a habitat for organisms; all of which, in turn, modify the soil.

Soil is considered to be the skin of the earth and interfaces with its lithosphere, hydrosphere, atmosphere, and biosphere. Soil consists of a solid phase (minerals and organic matter) as well as a porous phase that holds gases and water. Accordingly, soils are often treated as a three-state system. Soil is the end product of

the influence of the climate, relief (elevation, orientation, and slope of terrain), organisms, and parent materials (original minerals) interacting over time. Soil continually undergoes development by way of numerous physical, chemical and biological processes, which include weathering with associated erosion (http://en.wikipedia.org/wiki/Soil).

2.3.1 Soil Classification

Soil classification can be defined by the process of grouping all soil of the like characteristics in separated groups. Accordingly, performance of soil of each group or in the same group can be predicted to a certain limit. Different systems of classifications were proposed to fit the intended purpose, geological, agricultural or structural foundation engineering or structural high way engineering as described herein after Soil classification shall be used in this thesis to include or find a relationship between the different types of soil all over the Gaza Strip. In such a way when the classification or the description is known, the corresponding soil could be defined by a range of many values (http://en.wikipedia.org/wiki/Soil_classification).

The soils classification of any geographic location into categories representing the results of prescribed laboratory tests to determine the particle-size characteristics, the liquid limit, and the plasticity index.

There are three main classes of particle size which is responsible of the soil properties, as defined in the USDA system. These include:

- Sand: includes particles with effective diameters between 2mm and 50µm, which has porosity 36–56%.
- Silt: includes particles with effective diameters between 50µm and 2µm, which has porosity 39–56%.
- Clay: includes particles with effective diameters less than 2µm, which has porosity 35–70%.

Coarse fragments are also recognized. These include particles having effective diameters greater than 2mm.

The soil in the Gaza Strip is composed mainly of three types, sand, clay and silt. The sandy soil is found along the coastline extending from south to outside the northern border of the

Strip, at the form of sand dunes. Clay soil is found in the north eastern part of the Gaza Strip whereas silty soil is found around Wadis.

2.4 Geology, Lithology and Stratigraphy

Geology: the science that deals with the dynamics and physical history of the earth, the rocks of which it is composed, and the physical, chemical, and biological changes that the earth has undergone or is undergoing (http://www.aesgeo.com/geologic-assessments/c1mdd).

Lithology: the lithology of a rock unit is a description of its physical characteristics visible at outcrop, in hand or core samples or with low magnification microscopy, such as color, texture, grain size, or composition. It may be either a detailed description of these characteristics or be a summary of the gross physical character of a rock. It is the basis of subdividing rock sequences into individual litho-stratigraphic units for the purposes of mapping and correlation between areas (https://en.wikipedia.org/wiki/Lithology).

Stratigraphy: is a branch of geology which studies rock layers (strata) and layering (stratification). It is primarily used in the study of sedimentary and layered volcanic rocks. Stratigraphy includes two related subfields: lithologic stratigraphy or litho-stratigraphy, and biologic stratigraphy or biostratigraphy (https://en.wikipedia.org/wiki/Stratigraphy).

2.5 Previous research and studies

There is a number of researches in the world which dealt with this subject. A lot of these researches has been carefully studied and some of the difficulties have been identified.

These are some research which are the following:

- Hydro geological Evaluation of the Aquifer in the Southern Part of the Gaza Strip (Al-Dasht. J 2012). This study was carried out at the Southern part of the coastal aquifer in the Gaza Strip (KhanYounis and Rafah Governorates) considering its geological and hydrogeological characteristics, water quality and water balance. This study was developed a geological cross section to southern Gaza catchment using the win log and win fence software and update the existing cross section using available data.

This study used 2D programs and this studying was only for the south region for Gaza Strip. This research use the available data for borehole and input the data to win log model then drawing the section by hand to produce the section and print it to study and review and compare the result with the geological Israeli atlas and make the comments and conclusion. To do this, data of 100 lithological wells have been used to draw eight cross sections along SE–NW with path line 2km width parallel to Egyptian border as shown in figure (2.2). the lithological subsurface data are logged as boreholes through WinLog software, these logs have been used for creating the cross sections by WinFence software.

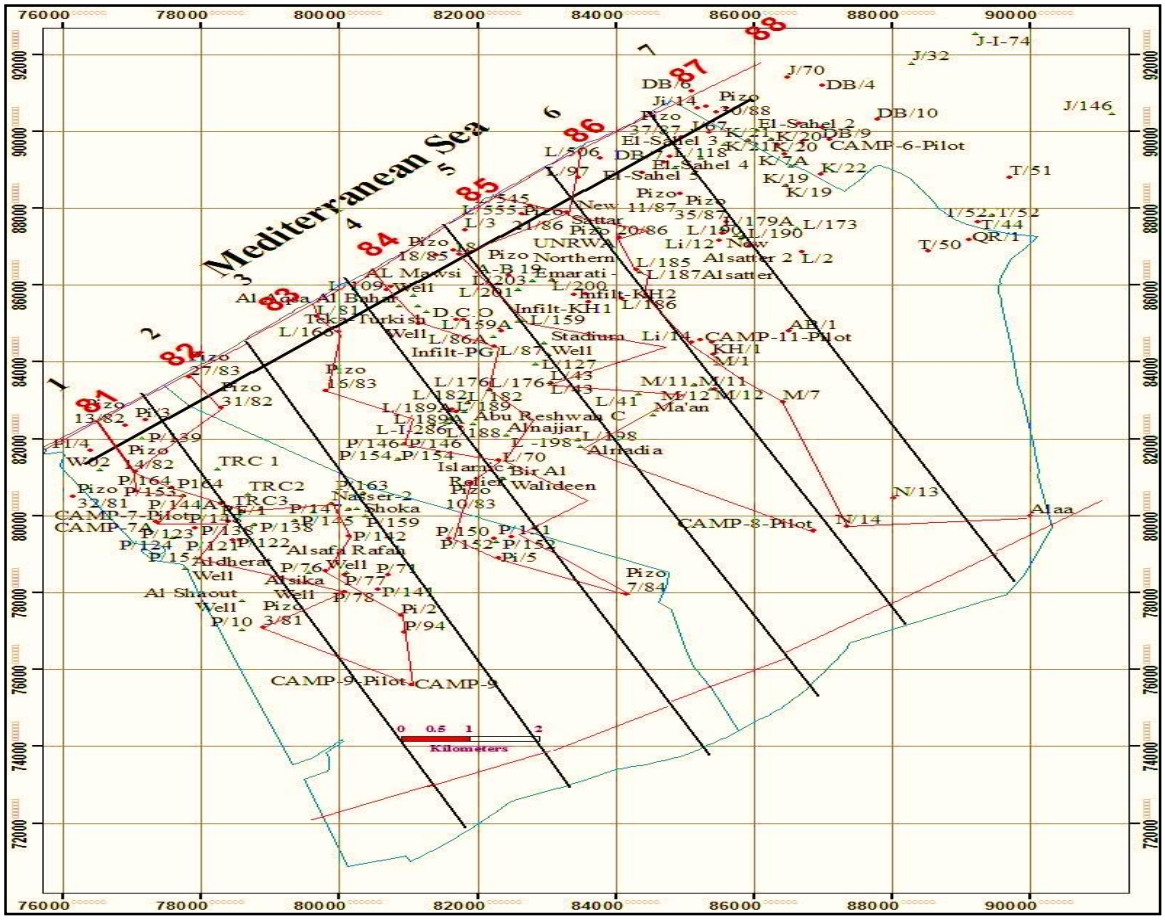


Figure (2.2): Cross sections path line in the study area (AL Dasht, 2012)

- Coastal aquifer atlas (Greitzer and Dan, 1967) this study display the cross sections were drawn since the Israeli Occupation and there are more than twenty cross section for Gaza strip aquifer there distributed from Rafah to Beit Hanon there is one section every more than Two kilometer. There are three sections in Northern Gaza, ten sections in Gaza city,

three sections in the middle area and six sections in the southern area for Gaza city as shown in Figure (2.3).

Figure (2.3) Atlas for Costal aquifer (Greitzer and Dan, 1967)

- Using geographic information systems in soil classification and analysis in Gaza city (El Jamassi A., 2013). This study used Geographic Information Systems (GIS) to analysis and classification soil in Gaza city. This research aims to investigate the development of a (GIS) to better collect, manage, analyze and visualize soils data which obtained from boreholes test results collected from 92 boreholes covering about 70% of Gaza City. This

study develop the GIS application to create geological cross section for Gaza by analysis data.

- Evaluation of ground water quality in north governorates of Gaza strip (1994-2004) (Abu-ALNaeem M 2007), study shows the analysis of 9 hydrological years data record (1994/1995 – 2003/2004) for the north governorates of Gaza strip.

This study was determined the spatial distribution of chlorides representing salinization and nitrates representing pollution in the aquifer at three stages (1994/1995, 1999/2000 and 2003/2004) and the main factors affecting them add to, defining the status of ground water quality and its suitability for domestic use.

Chloride ,aps with chlorographs and nitrate maps have been drawn and correlated with drawn rainfall maps, rate of abstraction maps, water level maps, 3-D topography map and aquifer lithology cross sections to determine their effects on groundwater quality through the study period. In this study the cross section was drown using WinLog and WinFence program to create the geological cross section for northern governorates of Gaza to determine geological effects on groundwater quality.

- Subsurface geological-geotechnical modeling of Gaza Strip (AL Aklouk M. 2015) study was conducted of Gaza Strip, and depend on some physical properties of the surface (soil texture, water content, density, liquid limit, bearing capacity) to depth 7.5m, and subsurface layers, geological studying of characteristics geological of the layers. 749 boreholes or wells have been collected from Palestinian water authority (PWA) and materials and soil laboratory (MSL) of the Islamic University in Gaza, 547 from PWA and 202 from MSL.

The geological and geotechnical sections at different areas in Gaza strip Have in forms of 1D and 2D, this study was determine the geotechnical properties for different rocks for the study area (nature water content, liquid limit, dry density, soil bearing capacity, soil classification, rock texture..), Determine the characteristics (geological / engineering) for the different rocks at different depths, Update geological cross sections in Gaza Strip to identify of subsurface lithological structure.

The results for this study show that the small change happened to the Gaza strip at 0.5m top soil texture, the soil type on the sea side beach areas is sandy pure soil and especially the

northern and southern areas, begin to change gradually as we head east to turn into a silt and clay in the south and clay containing calcium in the north area as Beit Hanoun.

- Subsurface geological-geotechnical modeling to sustain underground civil planning F. de Rienzo, P. Oreste, S. Pelizza. The aim of the paper was to document the use of 3D subsurface geological-geotechnical modeling to optimize the planning and development of subsurface structures in city areas. The proposed procedure was applied to the analysis of the subsoil of the City of Turin (Northern Italy). The results of more than 300 boreholes were analyzed to develop a model of the geological setting up to a depth of 60 m from the surface planning (http://www.sciencedirect.com/science/article/pii/S001379520700227X).

2.6 Tools and softwares

WinLog and WinFence can be used to create graphically detailed full color, cross-sections and fence diagrams quickly and easily. The program can be used to interpret and map soil, rock layers, contamination, fossils, minerals and hydrocarbons.

2.6.1 WinLog

WinLoG can be used to quickly create, edit and print a wide variety of borehole and well logs. The graphical windows interface displays the log as it is changed and shows exactly how the log will look when it is printed. Boring logs and templates can be edited by pointing and clicking, making the program fast and easy to learn. WinLoG uses a Microsoft Access data management system to store borehole and project data. This data management system provides you with the ability to effectively manage your project data and interface the data with other applications. A master database is used to keep track of all the projects and directories (http://.scisoftware.com/).

2.6.2 WinFence

WinFence can be used to graphically create detailed, full-color, cross sections and fence diagrams quickly and easily. The program can be used to interpret and map soil and rock layers, contamination, fossils, minerals and hydrocarbons. A wide variety of strata can be used to create cross sections using WinFence. Types of strata that can be used include layers, faults, lenses, intrusions, and alteration zones. Very detailed and complicated stratigraphy can be represented and easily drawn. Layers can contain multiple segments to represent unconformities and erosion in highly faulted zones (http://.scisoftware.com/).

In this study WinLog 4 and WinFence software were used to input data for borehole and update the existing cross section to North, Gaza city and Middle area for Gaza strip.

CHAPTER THREE

DESCRIPTION OF THE STUDY AREA

3.1 Introduction

The Gaza Strip is located on the south eastern coast of the Mediterranean Sea, between longitudes 34° 2" and 34° 25" East, and latitudes 31° 16" and 31° 45" North. Width of the strip ranges between 5Km in the middle to 8Km in the North and 12Km in the South where study area is located. Its length is approximately 40km along the coastline and its area is about 365km^2, (PCBC, 2005). The study area includes Northern, Gaza and Middle governorates of Gaza Strip which represented in figure (3.1).

Figure (3.1): Location map of Gaza Strip (Abu Samra, 2014).

3.2 Topography

Gaza Strip is characterized by narrow elongated ridges and depressions extend parallel to the shoreline (NNE-SSW) (PWA, 2010). As well as topography characterized of land surface elevations in Gaza Strip from mean sea level (zero) at shoreline to about 1l0 m above MSL in some places in the side of Gaza strip area. Figure (3.2) shows a topographic map for Gaza Strip topography, (UNDP. 2010).

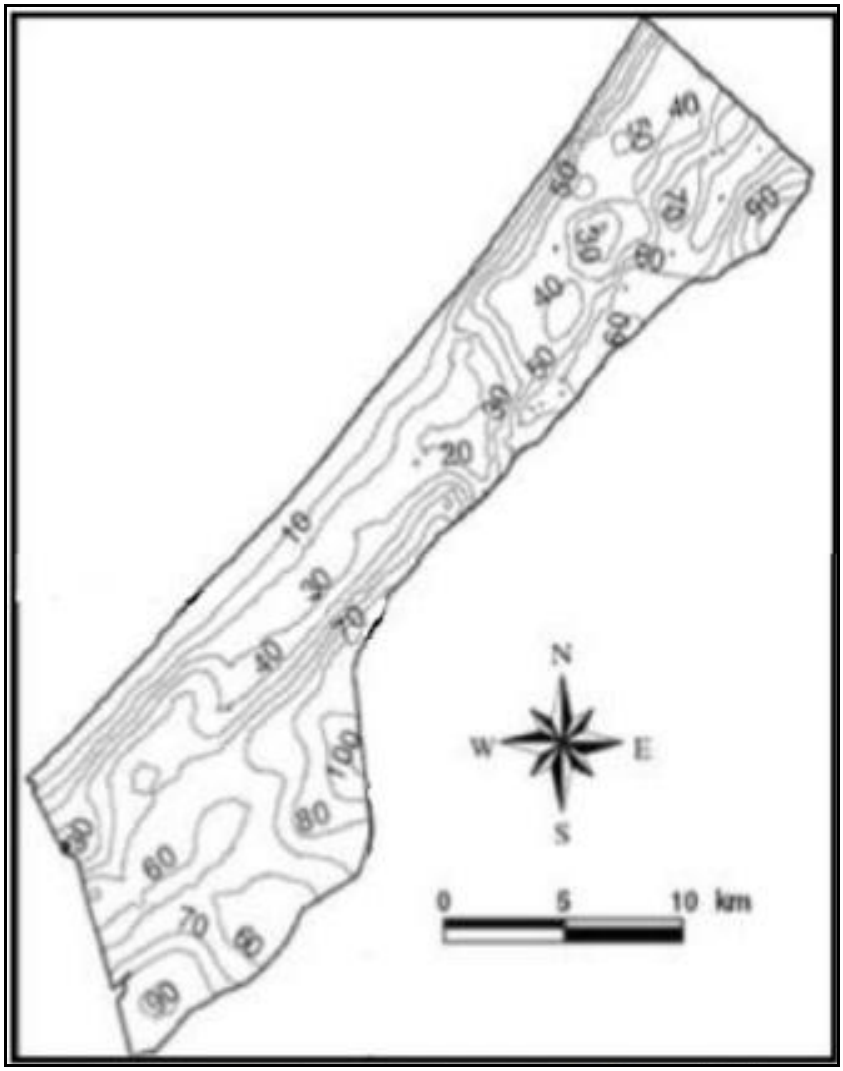


Figure (3.2) Topographic map for Gaza city (Shaheen, 2007)

Gaza Strip surface as a whole is covered by the Pliocene-Quaternary sediments varying from the Pliocene sand dunes and alternating Pleistocene loess and gravels outcropping in Wadi Gaza (Picard; 1943). The Pleistocene coastal area has alternating stratified calcareous sandstones (locally termed as Kurkar) and red sandy paleosoils (locally termed as Hamra = Arabic word for red). While the Holocene sediments, are represented by the coastal sand dunes and alluvial deposits. The Kurkar is intercalated by the Hamra formed the coastal ridges. These ridges are designated to represent typical longitudinal concave forms parallel to the coastline by dominant wind direction perpendicular to the coast (Anan & Zaineldeen, 2008).

The ridges have been dissected by Wadi Gaza, the largest surface water feature in Gaza Strip. It rarely flows due to the diversion and storage projects upstream in occupied areas in the occupied territories (PWA, 2010). Picard (1943) noted to the Quaternary Kurkar is mainly distributed in the western half of the coastal plain and formed at the surface 3-4 subdued ridges arranged more or less parallel to the coast. This can be grouped into two main complexes of continental Kurkar.

(Avnimelech, 1952) distinguished four Kurkar complexes, while Neev and others (1987) recorded three onshore and four offshore Kurkar ridges along the Palestinian coastal plain. MOPIC (1994) mapped five scattered ridges on land Gaza Strip. (Anan & Zaineldeen , 2008) are introduced two ridges with possibility for the third one, and detected their type locality in the Gaza Strip. They named the first one as 'Sheikh Ejlin Ridge' that extends up to the current coastline in the West, and the other as 'Al Montar Ridge' in the East of Gaza Strip. The third ridge most probably located Eastward outside of the Gaza Strip or just around the armistice line. In addition, sand dunes are dominant along the shoreline with elevations about 15 to 50m above MSL and their width is small in the South, increasing northward. These dunes originate partly from Nile River sediments (Almahallawi, 2005; Abu El- Naeem, 2007).

3.3 Land Use

Land use of the Gaza Strip is based on a regional plan developed by the MOPIC for the West Bank and Gaza Strip. Gaza Strip suffers from high population density, and thus there is land scarcity for all kinds of uses (urban, industrial, and agriculture). Most of the study area is categorized as agricultural and urban, but it includes small sites industry, where cultivated area constitute about 49.1 Km of total area in KhanYounis and about 36.6Km2 of total area of Rafah (MOA. 2010; Almahallawi, 2005).

The agricultural land is considered dominant and economic sector in the Eastern part of Gaza Strip. Urban and some agriculture expansion are concentrated in the Western coastal zones of Gaza Strip. There is crowdedness and related housing problems, especially in the refugee camps areas figure (3.3) and Table 3.1 gives the area of each land use type of total area 365Km^2.

Table 3.1: Land use classes of Gaza Strip (Saleh. 2007; Shomar, 2010)

Land	Area Km^2	Percent (%)
Airport	7.5	2
Built-up	54	14.8
Cultivated	226	62
Harbor	0.35	0.10
Roads	9.8	2.67
Open areas	67.35	18.45
Total area	365	100

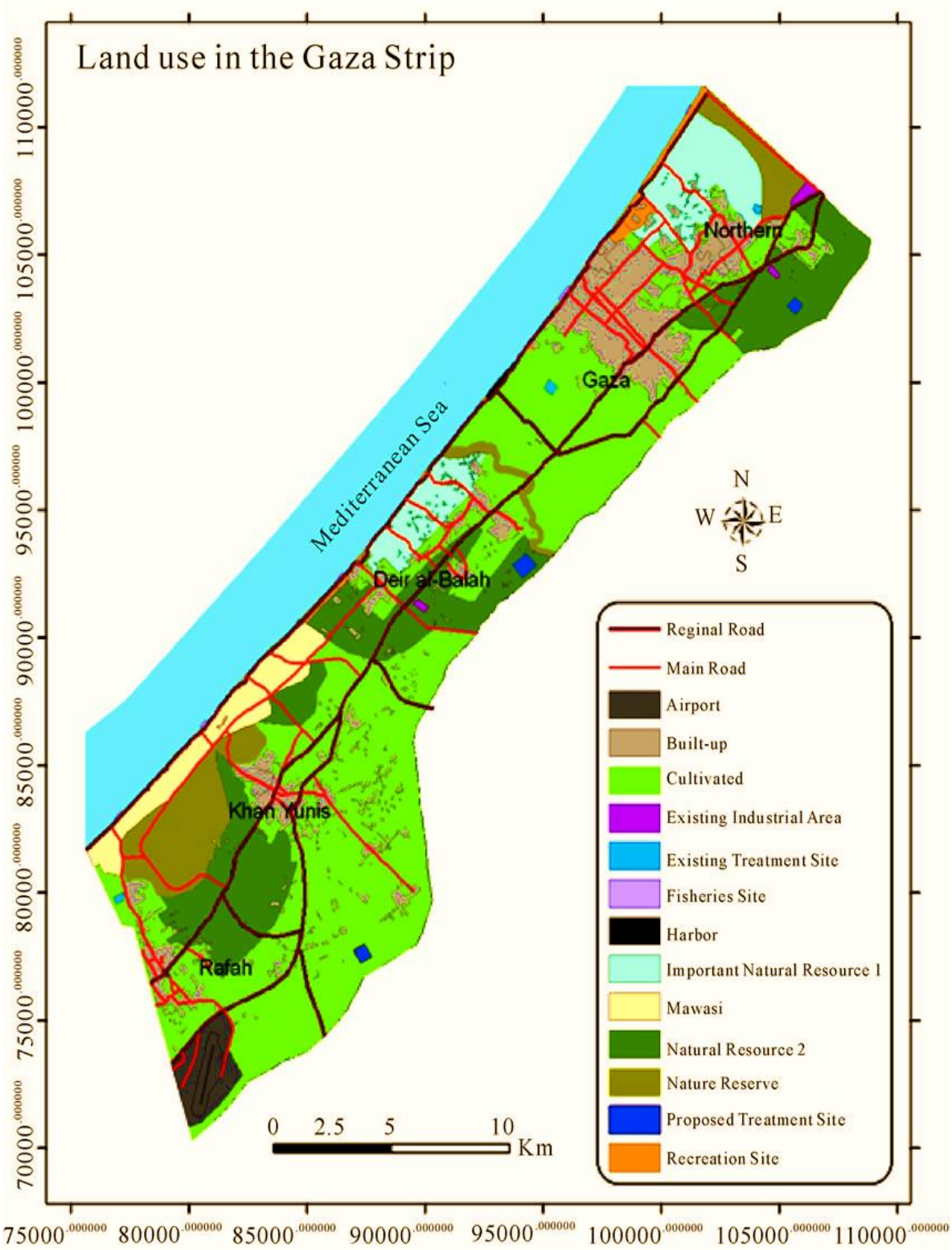


Figure (3.3): Land use classifications in Gaza Strip (Shomar, 2010)

3.4 Soil

The Gaza Strip has several major soil types figure (3.4). It is composed mainly of three types: sand, clay and loess. Along the shoreline there is a zone of sand dunes with varying in thickness from 2m to 50m due to the hilly shape of the dunes, and extends up from 4 to 5km in land in some area. The sandy soil at along the coastline extends from south to outside the northern border of the Gaza Strip at the form of sand dunes. The dunes have relatively high permeability. Moving eastward, the soil type change and becomes less sandy with more silt, clay, and loess. Clay soil is found in the North Eastern part of the study area (PWA, 2000; Shaheen, 2007; Abu El-Naeem. 2007: Jaradat, 2010).

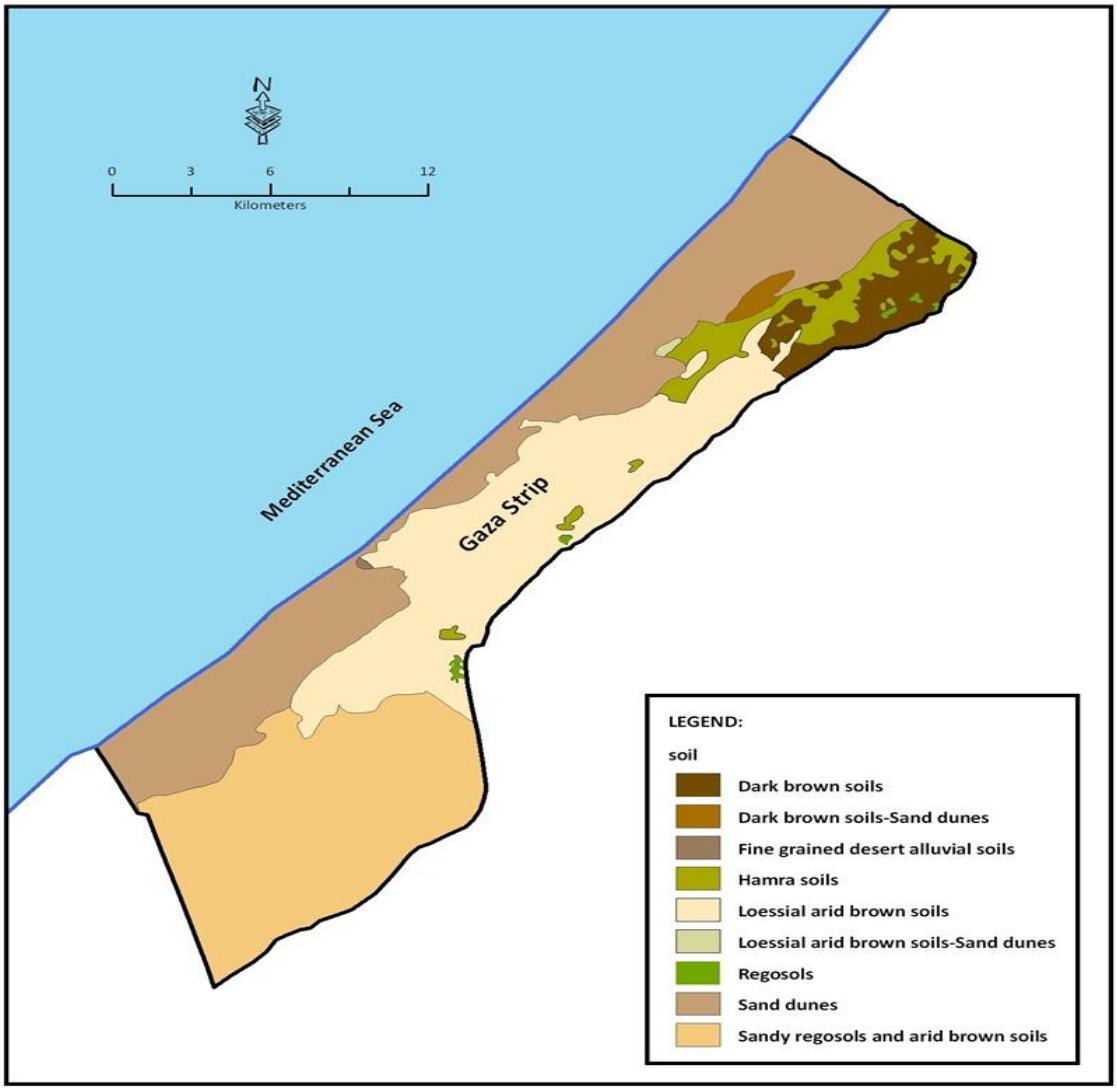


Figure (3.4): Soil map of Gaza Strip (http://www.phg.org/)

3.5 Geology

Palestine is located within the Arabian Shield (Crystalline plutonic rock and Met sediments) where most of the Palestine covered by Mesozoic to Cenozoic carbonates rocks. Gaza Strip covered by Tertiary-Quaternary sandstone rocks. During the Cambrian age continental environment circumstances were prevailed in the Arabian Plate caused large quantities of mechanical sedimentary rocks to be formed known as Nubian Sandstone (Picard, 1943; Black, 1937; Said, 1962).

In Palestine, two sedimentary environments were appeared and characterized by two sediments. The first was continental sediments formed mainly sandstones, and the other was marine sediments formed mainly carbonate rocks (limestone's). West Bank is covered by carbonates rocks, while Gaza Strip is covered by sandstone (sand sediments), which it is Quaternary sediments (Picard, 1943). At the beginning of Paleocene, Gaza Strip was affected by earth movements caused regression of the Mediterranean Sea and formation of swamps. At the beginning of Quaternary, sand sediments started to form which considered as a good groundwater aquifer while the swaps were dried and then filled with continental sediments (MOPIC, 1994). The geology of the Gaza Strip consists of a series of geological formations sloping gradually westwards as shown in figure (3.5).

Gaza Strip lithological consists of the Pleistocene age Kurkar group (Gvirtzman, 1984) and recent (Holocene age) sand dunes. The Kurkar group consists of marine and Aeolian calcareous sandstone (Kurkar), reddish silty sandstone (Hamra), silt, clay, unconsolidated sand and conglomerates. Regionally, the Kurkar group is distributed in a belt parallel to the coastline, from Haifa to the Sinai (Saleh, 2007). Geology of the Gaza Strip was obtained from oil and gas exploitation logs up to depth of about 2000m drilled by Israelis and from wells had been drilled during the CAMP Project.

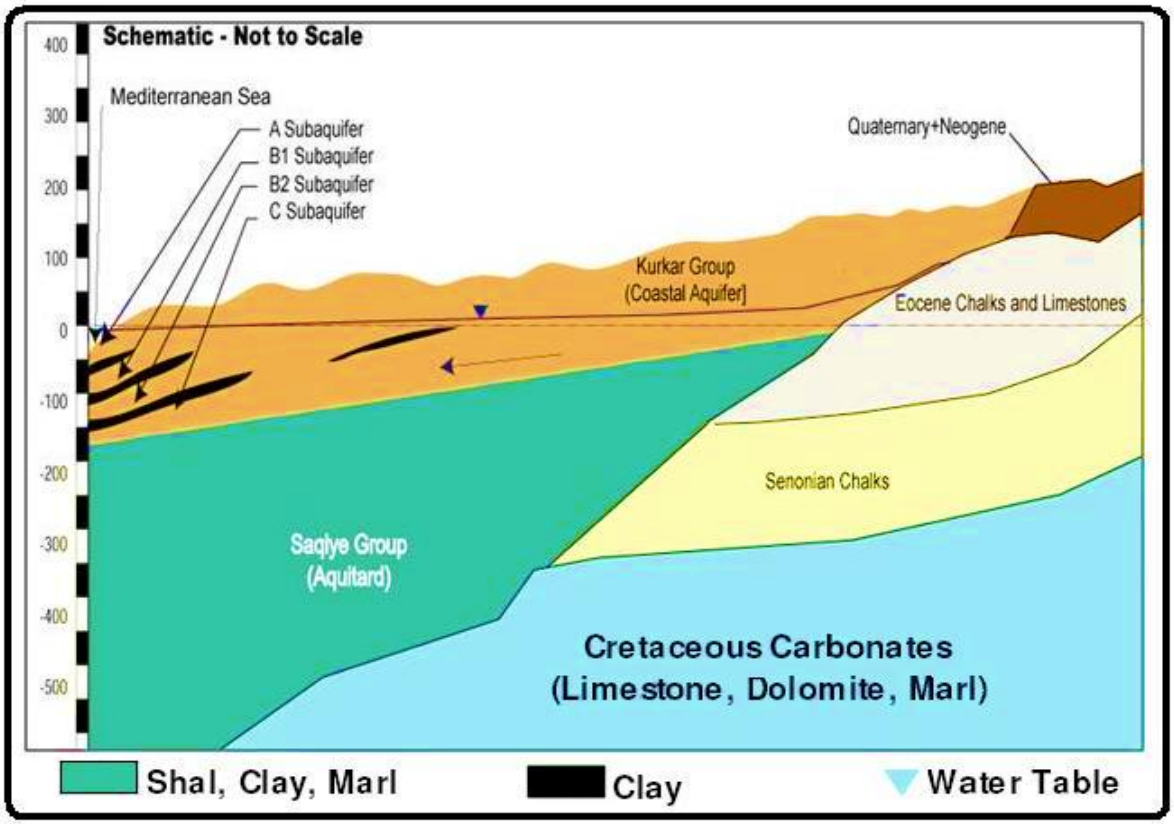


Figure (3.5): Typical hydrogeological cross section of Gaza Strip (PWA, 2003)

3.6 Hydrology

Precipitation falling on land is either returned directly to the atmosphere by evaporation, flows along the land surface to become surface water or percolate into the ground. Water that infiltrates into the ground is either drawn into plants and returned to the atmosphere by transpiration or continues infiltrating and becoming groundwater.

3.6.1 Surface Water

The surface water system in Gaza Strip is represented by Wadi Gaza. It's located at the northward of the study area. It runs in the central part of the Gaza Strip and discharge into the Mediterranean Sea. Wadi Gaza length is about 9km with catchment area about 60Km^2 within Gaza Strip, and it extends into the armistice border for about 95km where it collects the water from a big catchment area 3600km^2 from the Hebron mountains and the Northern Negev with an estimated average annual flow of 20-30Mm^3/yr. This main stream was diverted by the Israelis to an adjacent area, where it's been stopped and collected at basins

located 6km East of Gaza. There are two others small and insignificant Wadis in the Gaza Strip: the first is Wadi Bait Hanoun which flows into occupied area to the North of the Gaza Strip, and the other one is Wadi El Salqah located South of Wadi Gaza which is almost always dry. Wadis are ephemeral streams, characterized by short duration floods that occur after heavy rainfall while most of the times are completely dry. Freshwater flows into them in the winter season. Israel has retained and changed the course of Wadis and they became dry since the early seventies. This means that fresh surface water resources are negligible (Jradat, 2010).

3.6.2 Aquifer

The coastal aquifer of the Gaza Strip is part of a regional groundwater system that stretches from the coastal areas of the Sinai in the South to Haifa in the North as shown in figure (3.6). The active area of the coastal aquifer is 1,162.5km^2 (PWA, 2000) and its width is about 10-15km. Within the Gaza Strip, the total thickness of the Kurkar Group fluctuate of about 100m at the shore in the South (study area), 200m near Gaza city, and ranges from 60-70m at the Eastern north border decrease gradually to only a few meters in the South (East of Rafah) (PWA, 2010; Ashour et al, 2009; Almahallawi, 2005; MOPIC, 1994). The boundary extends beyond the Gaza Strip political boundaries towards the north (PWA, 2000).

The regional groundwater flow from Southeast to Northwest is mainly Westward towards the Mediterranean Sea. Thus, the groundwater flows from occupied area toward the Gaza Strip (Weinthal. E et al, 2005), towards the East where the coastal aquifer pinch out the surface no flow boundary towards the South in Egypt where data not exist and assumed no flow boundary, and finally towards the West where Mediterranean Sea is located (PWA, 2010). Recharge occurs along the flow paths through the unsaturated zone in areas of sand dunes but it is restricted by the thick layers of loess soils, particularly in the Eastern areas of the aquifer (Weinthal. E et al, 2005). Hence, most of the recharge is from dune areas of the Western coast of the coastal aquifer (Almahallawi, 2005).

Figure (3.6): Coastal aquifer basin in Palestine (PWA, 2007)

3.7 Hydrostratigraphy

In the study area, the coastal plain aquifer contains many diverse hydraulic and hydrologic units and thus, several water-producing zones. The layered stratigraphy of the Kurkar Group within the Gaza Strip subdivides the coastal aquifer into 4 separate sub-aquifers near the coast. Further east, the marine clays pinch out and the coastal aquifer can be regarded as one hydrogeological unit. The upper sub-aquifer "A" is unconfined, whereas sub-aquifers "B1, B2, and C" become increasingly confined towards the sea (Abu-Alnaeem, 2007).

3.7.1 Kurkar Group:

1 Sub-aquifer A

Sub-aquifer (A) occurs in the uppermost and westernmost part of sequence extend from the shoreline to the east up to 2 Km. It is mainly composed of variously cemented concretionary calcareous sandstone mixed and interlayered with loose sand, of both continental and littoral origin. This aquifer is bounded from the top by the water table and at the bottom partly bounded by the first aquitard of silty clay. In the study area, it is 25 m thick in the east to about 60 m in the west. This aquifer unit overlies continental-estuarine clay or loam extending eastwards and upwards, reaches in thickness to 15 m. The clay rich base layer of sub-aquifer A is between Sub-aquifer A and underlying sub-aquifer B does not always exist or can be clearly identified. Sub-aquifer A may contain thin interlayers of clay, sandy clay and silty clay, which act as aquitard (Abu Alnaeem, 2007).

2 Sub-aquifer B1

Sub-aquifer B1 is mainly from Kurkar and micro-conglomerate deposited in a more littoral environment, the cementation of which is harder than in the overlaying sub-aquifer A and having a lower proportion of loose sand. The base of this sub-aquifer is formed by marine to lagonal-estuarine clays. Further eastwards, these base layers turn into continental clays and loams and extend 6 – 7 km east of the shoreline. (Abu-Alnaeem, 2007).

3 Sub-aquifer B2

The calcareous sandstones of this unit are predominantly products of a high-energy littoral depositional environment, such as conglomerates and beach rock overlying a marine clay horizon and sub-aquifer B2 is 20-40 m thick (Zilberbrand et al, 2001).

4 Sub-aquifer C

Between the shoreline and 3-4 km inland, the lithology of this sub-aquifer is of a marine type, with no indications of shallower faces. It is characterized by interlayering of clay, silt and silty sand, 10-20 m thick. Generally, the occurrence of calcareous sandstones increases eastwards on account of silty-clayey beds. The hydraulic conductivities of this unit are significantly lower than in the overlying sub-aquifers. Sub-aquifer C overlies impervious

layers related to top of the saqiye Group. Their occurrence is usually marked by thin streaks of chalky and marly sandstone, yellowish chalky marl, and clays. The top of the saqiye occurs at elevations of 150 – 160 below MSL, close to the shoreline (Abu-Alnaeem, 2007).

5 Saqiye Group

The Pleistocene Coastal Plain aquifer system (the Kurkar Group) overlies a very thick complex of shales and marls related to the plio-pleisticene Saqiye Group that wedges out gradually eastwards. In the study area its maximum depth reaches 190 m near the coastline, wedging out in the eastern parts of the coastal plain. The top of Saqiye Group dips 1-2 % westwards (Abu-Alnaeem, 2007).

3.8 Groundwater Monitoring System

The general definition of monitoring is: follow up the temporal change of system variables in order to provide information about the evolution of these variables to support goals for the policy of decision making. Therefore, monitoring is only one tool for collecting information for water system management (Mogheir, 2003). In the Gaza Strip, the groundwater monitoring networks are divided based on:

(1) groundwater level,
(2) groundwater quality, and
(3) Municipal wells.

The groundwater level network measures the groundwater level on a monthly base using approximately 130 Piezometers and agricultural wells. The groundwater quality network measures three variables: EC, Cl and NO3 these measurements are made twice a year using approximately 400 agricultural wells. The third type of monitoring network consists of all municipal wells which measure: EC, TDS, Cl, NO3, Calcium, Magnesium, Sodium, Potassium, Alkalinity and Hardness. For this purpose, approximately 200 municipal wells are used. The measurements are made in spring and the in autumn. (Mogheir et al, 2008).

3.8.1 Groundwater Level Monitoring

Groundwater elevation is an important parameter for monitoring the groundwater system. If groundwater level declines with time, an imbalance between recharge and discharge would occur. Also, a groundwater level below MSL is an indication of saltwater intrusion (Qahman, 2004). Groundwater level is monitored quarterly by PWA's monitoring team from 87 monitoring wells distributed spatially and covering the whole Gaza Strip Area. After completing measurements, the recorded data is tabulated, presented in contour map and graphs and evaluated for the purpose of identifying the main water level decline and the reason behind that as reference for managing the abstraction rate in terms of quantity and time intervals. As a result of continuing intensive groundwater abstraction, two cones of depression have occurred in the northern and southern areas of the Gaza Strip, with water level of 6m and 19m below sea level respectively figure (3.7). The water level declines in most of the monitoring wells have continued with the same magnitude and attitude of the year 2012 as well as the previous years.

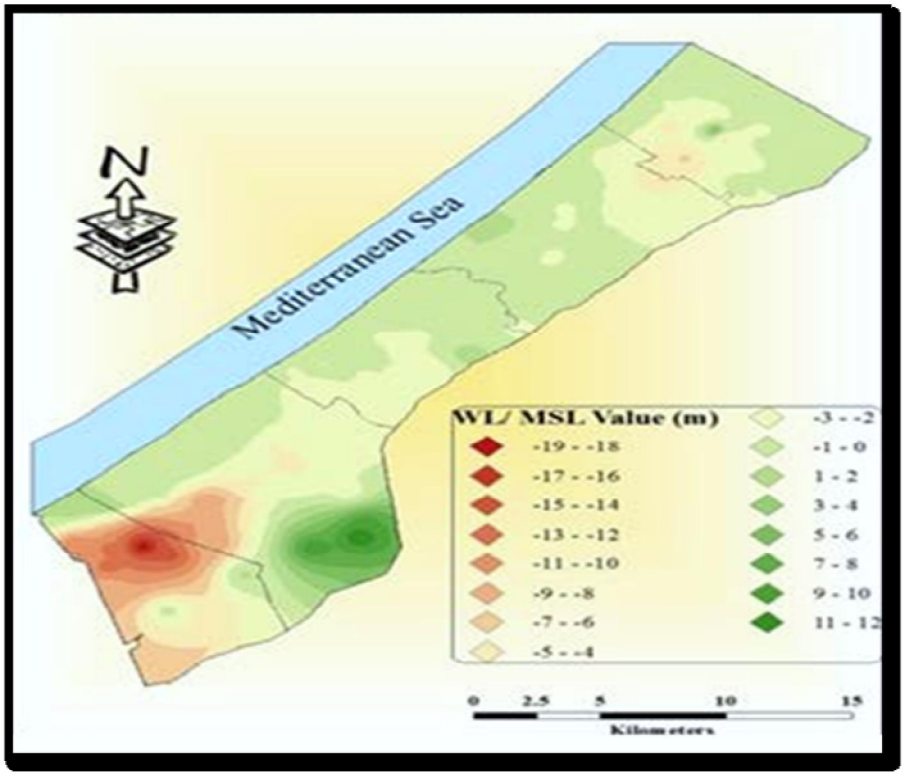


Figure (3.7): Water Level in Gaza Strip (PWA, 2014)

Generally, the magnitude as well as the attitude of groundwater level decline changes from area to another based on; location of the monitoring wells, hydrogeological characteristics of the water bearing formation, production rates in the vicinity of the monitoring wells and the production duration. The significant water level decline has been recorded in the two cones of depression areas that located in the north and south of Gaza Strip figure (3.8 & 3.9) as a result of high density of domestic wells that are pumping continuously with high pumping rates. The influence of the cone of depressions affects all the monitoring wells surrounding, with different degree of influence. The water level decline in Rafah area is significantly high reflecting the low aquifer potential as well as its low renewable water amounts compared to the pumped quantity.

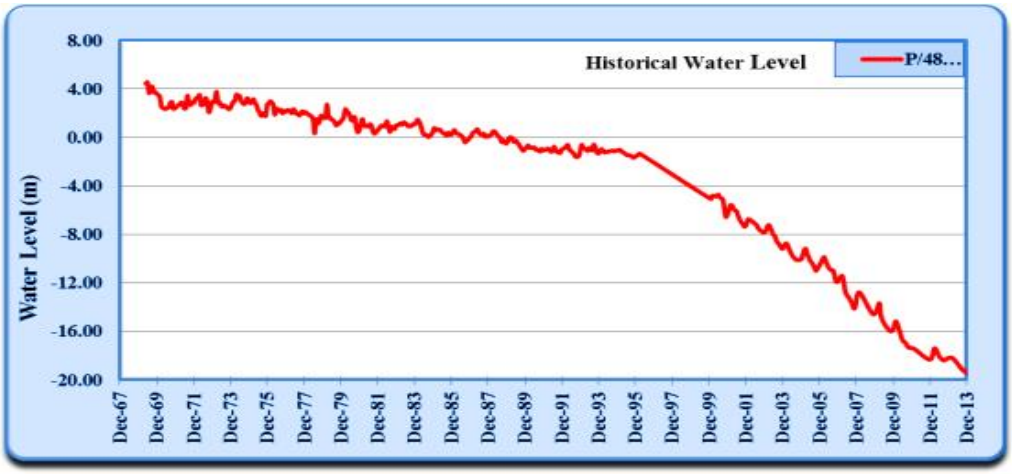


Figure (3.8): Water Level Decline in the Southern Area (PWA, 2015)

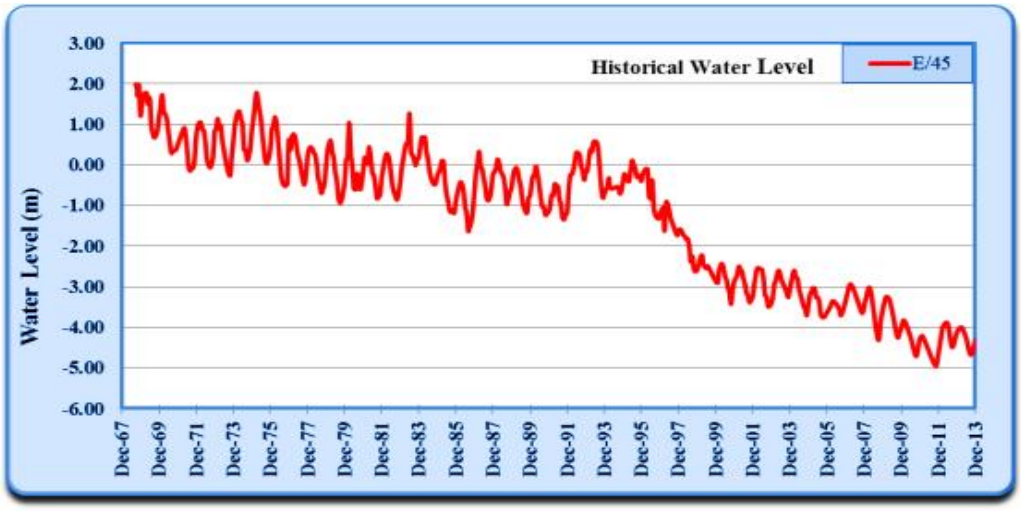


Figure (3.9): Water Level Decline in the Northern Area (PWA, 2015)

3.9 Groundwater Quality:

Depending on the results of the groundwater chemical analyses carried out twice a year by both Ministry of Health Lab (MOH) and Coastal Municipal Water Utility (CMWU) for about 200 domestic water wells in Gaza Strip, PWA has evaluated these results through preparing contour maps as well as graphs for the main ions such as Chloride as salinity indicator and Nitrate as pollution reference.

As reflected in the chloride contour map figure (3.10), the fresh groundwater of chloride concentration of less than 250 mg/l exists in limited part of the aquifer located in the north of Gaza and west of Khan Younis (Mawasy).

The major parts of the aquifer have a Cl concentration of 500 -1500 mg/l, while along the coastal line exceeds 2000 mg/l of Cl concentration because of seawater intrusion influence. The map shows also that the Cl concentration in the southeastern part of the Gaza Strip is more than 1500 mg/l reflecting the Upward leakage of the high saline water from the underneath water horizons.

That limited fresh groundwater part shrinkages with time compared to previous years and it is expected to demolish during the next few years in case of continuing depending on the coastal aquifer as the only water resource for fulfilling the water needs of Gaza Strip. On the other hand, the seawater will continue invading the land and covering more inland areas (PWA, 2015).

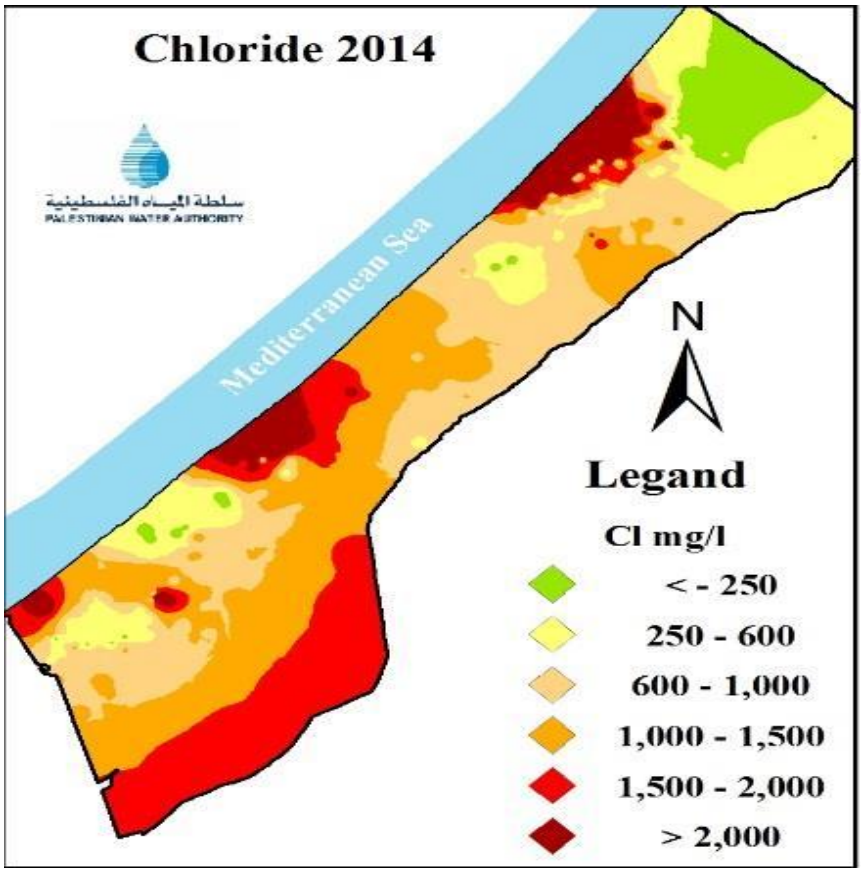


Figure (3.10): Chloride Contour Map, (PWA, 2015)

Nitrate (NO_3) is generally a reference and / or an indicator for the water pollution because of wastewater and/or organic fertilizers leakage through the unsaturated zone. Its concentration is controlled by the availability of wastewater/pollutants, thickness of the unsaturated zone, and its hydrogeological characteristics in terms of hydraulic conductivity. As indicated in the NO_3 contour map for the year 2014 figure (3.11), it is clear that the NO_3 concentration in the pumped domestic water is ranging between 50 mg/l and > 300 mg/l.

Where the high NO_3 concentration mainly occurred in the different residential areas of Gaza Strip reflecting the percolation of the wastewater to the underneath aquifer through the networks or cesspits and septic tanks. Khan Younis has the highest concentration since most of the residential area is not served by sewerage system and many areas are still served by cesspits facilities. On the other hand, the low NO_3 concentration occurred in the area that is not occupied by residents (southeast part of Rafah) or characterized by low transitivity of thick unsaturated characterized (Al Nusairat area) (PWA,2015).

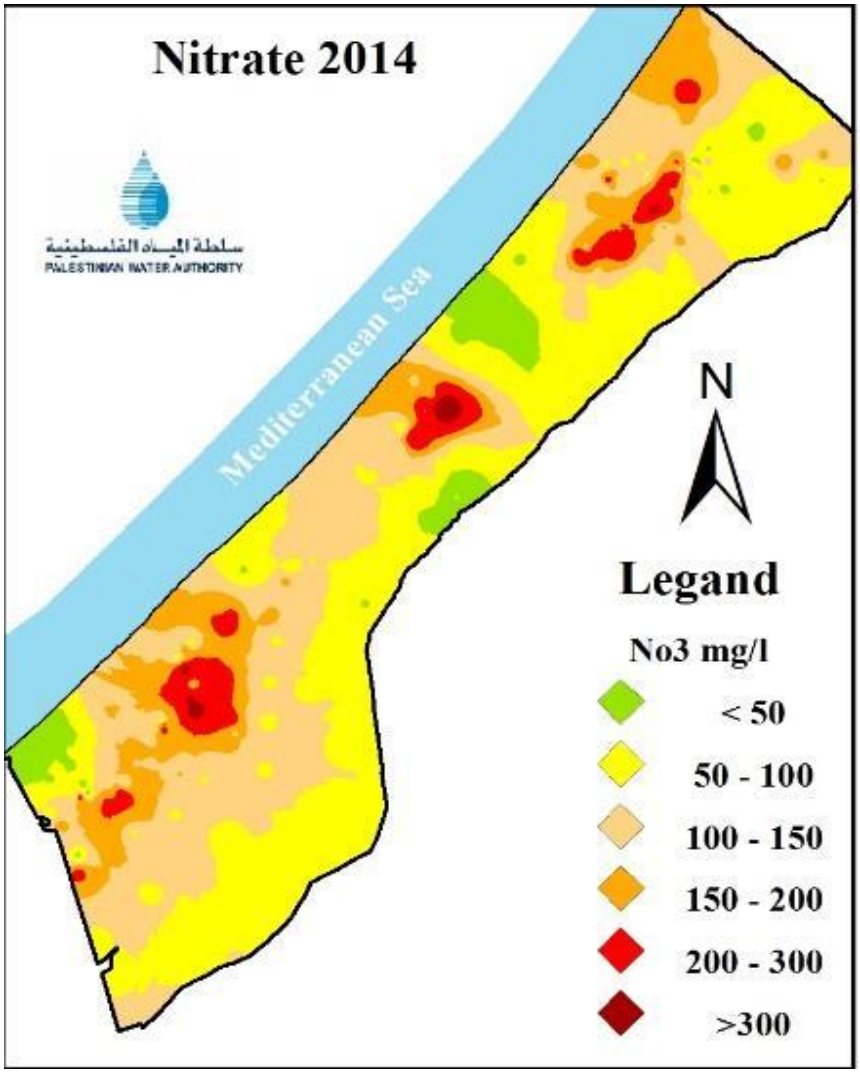


Figure (3.11). Nitrate Contour Map (PWA, 2015)

Generally, Chloride concentration in the municipal wells in 2013/2014 ranges from 250 to more than 5000 mg/l. 47.8% of them have chloride concentration less than 600 mg/l (PWA allowable limit) while the remaining (52.2%) exceeds the PWA chloride level figure (3.12).

Nitrate concentration in the municipal wells ranges from 50 to more than 200 mg/l. 16.3% of them had Nitrate concentration less than 70 mg/l (PWA allowable limit) while the remaining (83.7%) exceeds the WHO nitrate level as shown in figure (3.13).

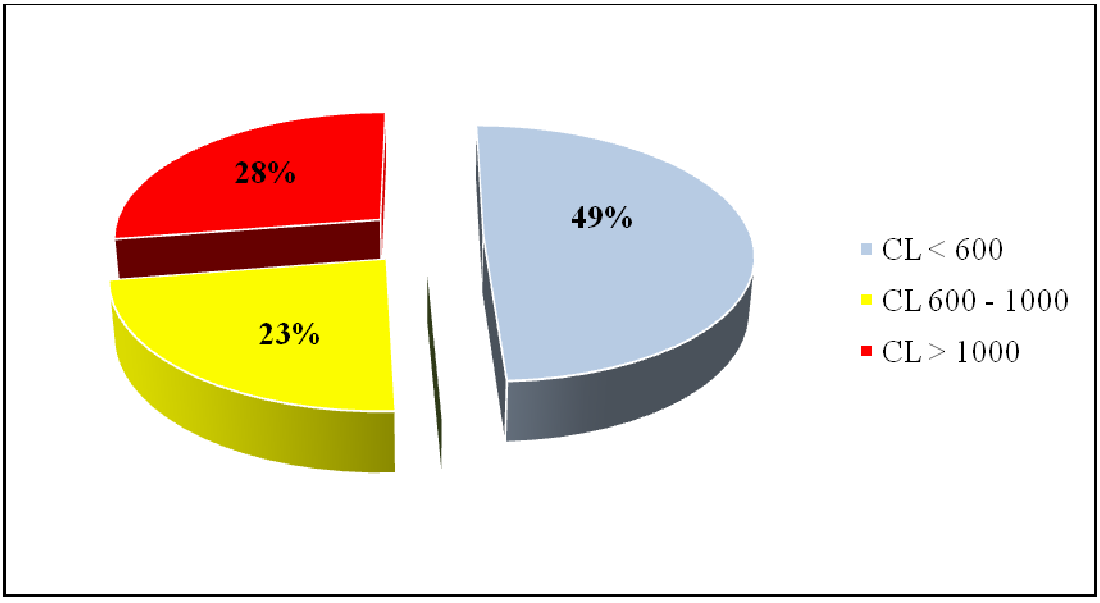


Figure (3.12): CL Concentration (PWA, 2015)

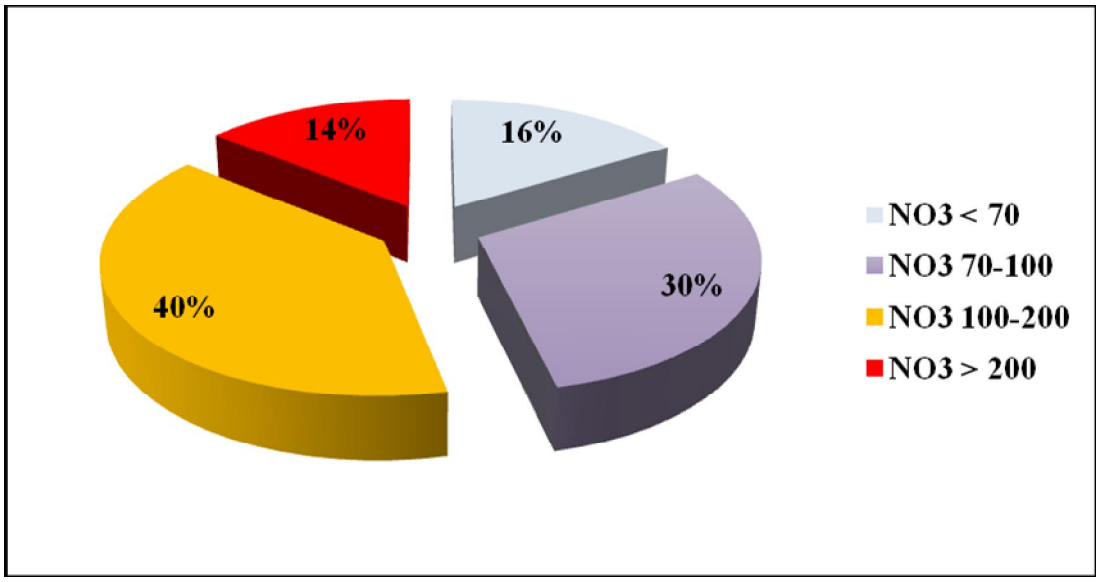


Figure (3.13): Nitrate Concentration (PWA, 2015)

CHAPTER FOUR

APPROACH, METHODOLOGY AND TOOLS

In the current study, parameters have been used to achieve clear and complete information about geological cross section of the aquifer situation in the study area. The study area includes Northern, Gaza and Middle governorates. The process of data collection was relied in different sources including reports, articles and personal communication.

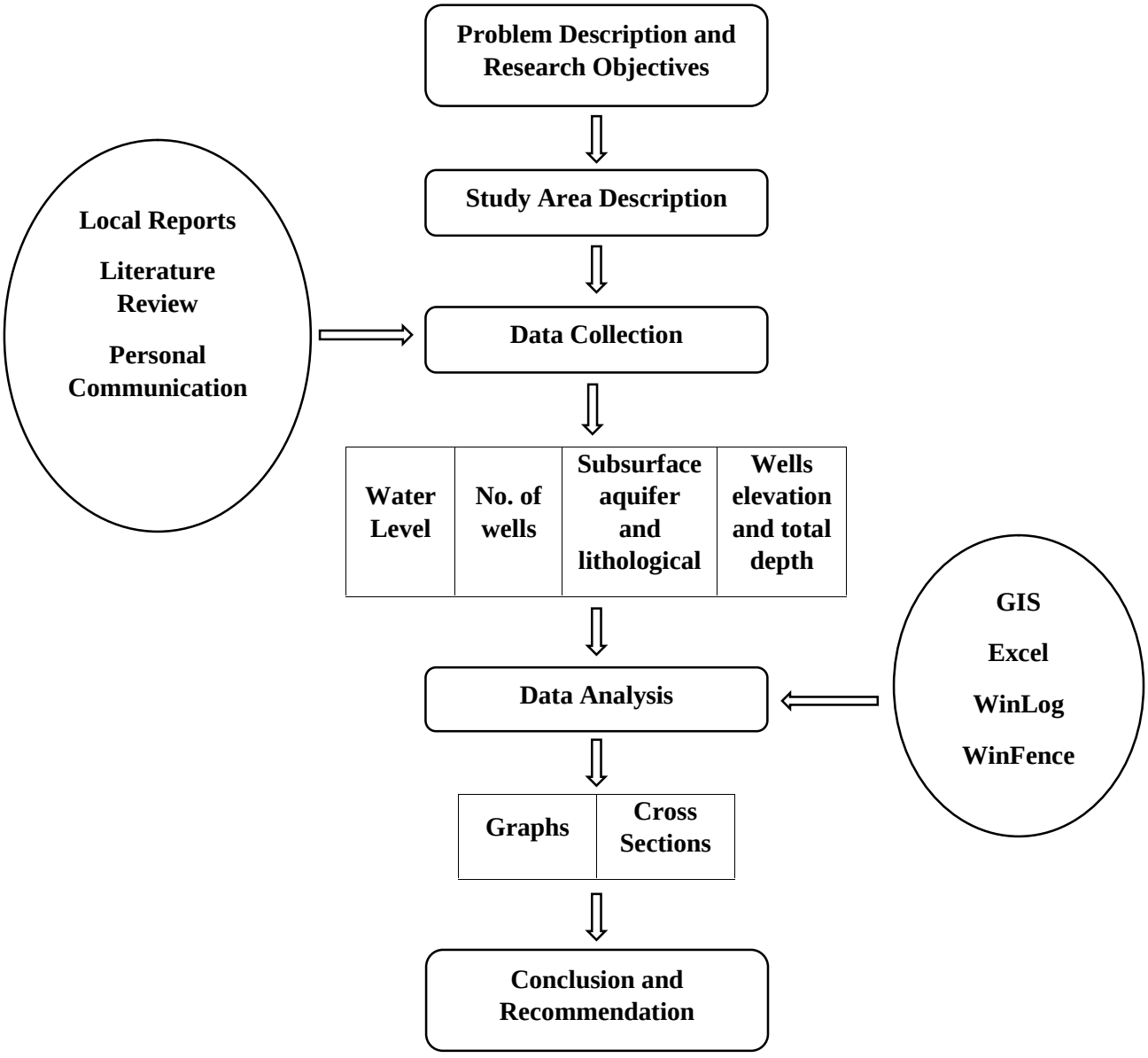


Figure (4.1): Study approach and methodology

4.1 Methodology

This study seeks to update the geological sections in the North, Gaza and Middle Governorates of Gaza strip using historical geological atlas and data generated by monitoring system by the PWA. Many wells have been drilled which are including soil type, water level and water quality. These wells will take into consideration in the current study. The study approach and methodology are presented in Figure (4.1).

4.2 Data Collection

Data needed for this study have been collected from Palestinian Water Authority (PWA) and Materials & Soil Labs (MSL). The collected data are including:

1. Borehole Logs are collected from MSL.
2. Wells are collected from the PWA for the hydrological purposes shown in appendix (I).
3. Soil classification and its properties from PWA.
4. Lithological data; information's about the subsurface geologic structure are obtained through drilling boreholes processes for various purposes, In this study, more than 300 water wells had been selected to draw geological cross section in this area.

Correlation between these wells was presented as cross sections by using WinLog and WinFence software. The direction of these sections is SE–NW. Thirteen cross-sections will be achieved to produce new and modified cross hydrogeological section for the study area.

4.2.1 Data Storage and Processing

The raw collected data may have some errors such as repetition of the information. Most the existing errors in data from year to another associated with human errors (Data entering) during written or transcription of data from laboratory notebooks or during a computer keyboard, and labeling or numbering these data, in addition, individuals responsible for data entry in many institutions or ministries. Therefore, these input errors can be reduced through careful and integrated design for raw data recording forms and a computer entry template. Moreover the data should be updated.

4.3 Tools for Data Analysis

The data must be available to be used by different softwares for the interpretation of the different features of computer systems. Data analysis and cross sections can be done by using numerous softwares as follow:

1) Access & Excel for storing data;
2) ArcGIS (Version 10.1) for manage and editing borehole data, that done by use spatial method,
3) WinLog (Version 4) and
4) WinFence were used to create detailed colored cross-section.

4.3.1 WinLog 4

WinLog can be used to create graphically detailed full color, cross-sections and fence diagrams quickly and easily. The program can be used to interpret and map soil, rock layers, contamination, fossils, minerals and hydrocarbons. WinLog program has numerous features to make creating and editing of borehole logs easier and faster. Most of the existing features have been enhanced in Version 4 of the program, and many features have been added such as: 1) Project reports can be generated for all data in a project, for example: layer tops, thickness, lithological description and water table. 2) Used data can be imported and /or exported: boreholes data can be entered and displayed manually or imported from excel. Several methods for calculating true depth are supported.

WinLog can be used to quickly create, edit and print geotechnical water wells log. This program displays the log and shows exactly how the log will look when it is printed. These borehole and well logs can be printed in black and white or color. The geographical information system feature added in WinLog version 4 displays a location map for the project showing the boreholes and cross-sections. There are no limits to the number and types of borehole logs that can be created with WinLog. Logs can contain general borehole data such as (Location, Project Number, Wells Coordinates, Lithological Descriptions, Symbols, Sample Data, Water Level Measurements and additionally Text Comments).

4.3.2 WinFence

WinFence shares the same database in WinLog and can be used to access and plot the borehole data entered in WinLog. Several types of borehole data can be plotted on the cross sections including lithological symbols, sample symbols, core logs, well diagrams, graphs, and geophysical logs. Cross-sections are created by specifying path line on a location map. The location map shows all wells entered in WinLog and any additional wells specified in WinFence. Path lines can be straight or bent. The location map including the path line can also be shown on the cross sections.

CHAPTER FIVE

RESULTS AND DISCUSSION

The results of geological cross section, and subsurface lithological (stratigraphy) structure will be discussed in this chapter and including compare between the oldest hydrological Israeli atlas section since 1967 with the new section that result from WinLog and WinFice program.

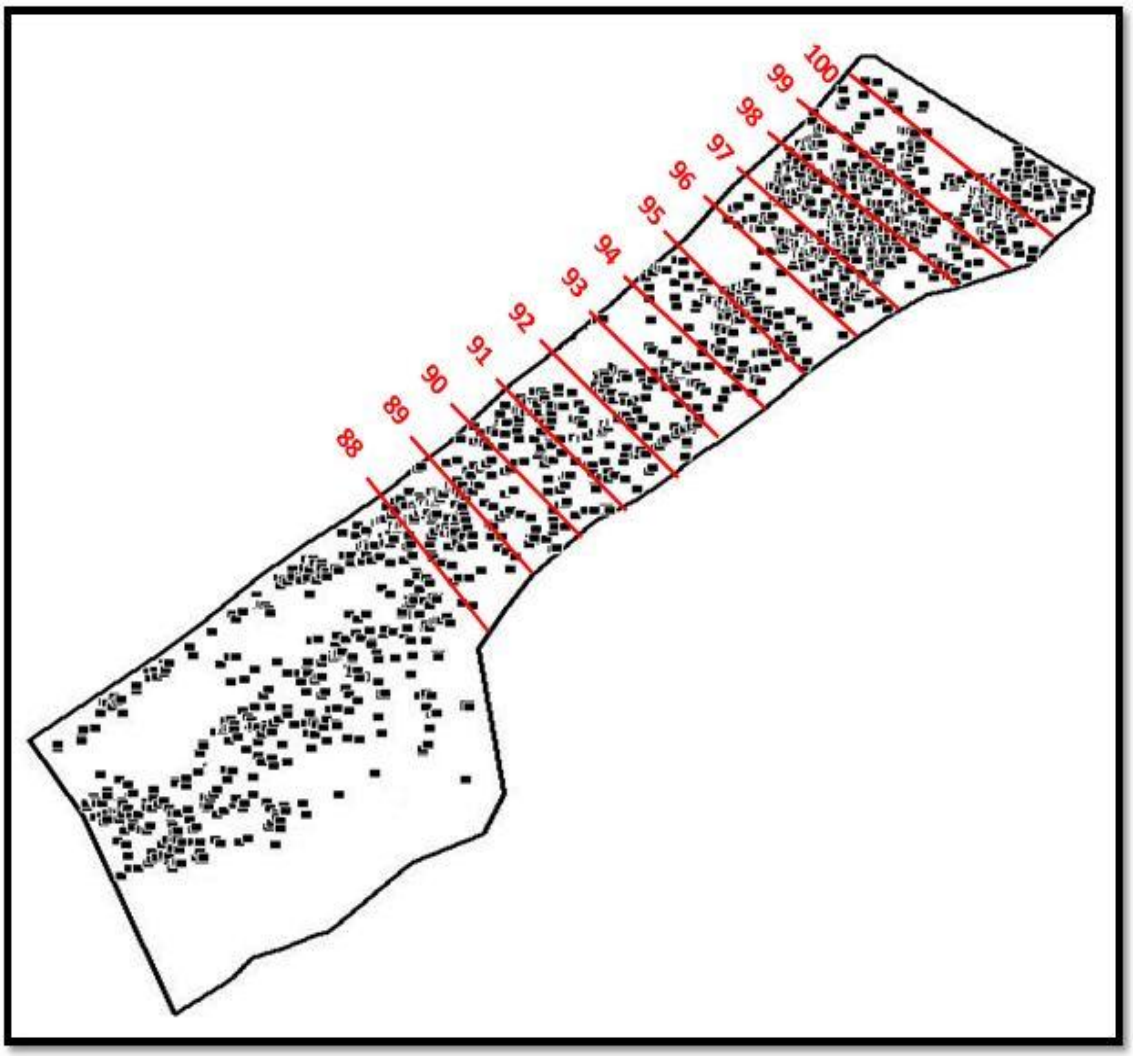


Figure (5.1): Cross sections path line in the study area

5.1 Lithological Cross sections

The main objectives for this study is to develop a lithological cross section for the aquifer in the study area. Then, compared the developed cross section with one that created by Greitzer and Dan, 1967. To do this, data of 300 lithological wells have been used to draw thirteen cross sections along SE–NW with path line parallel to Egyptian border as shown in Figure (5.1).

The lithological subsurface data are logged as boreholes through WinLog software, sample of these wells logs are illustrated in figure (5.2). Other wells logs are shown in the annex I. These logs have been used for creating the cross sections by WinFence software.

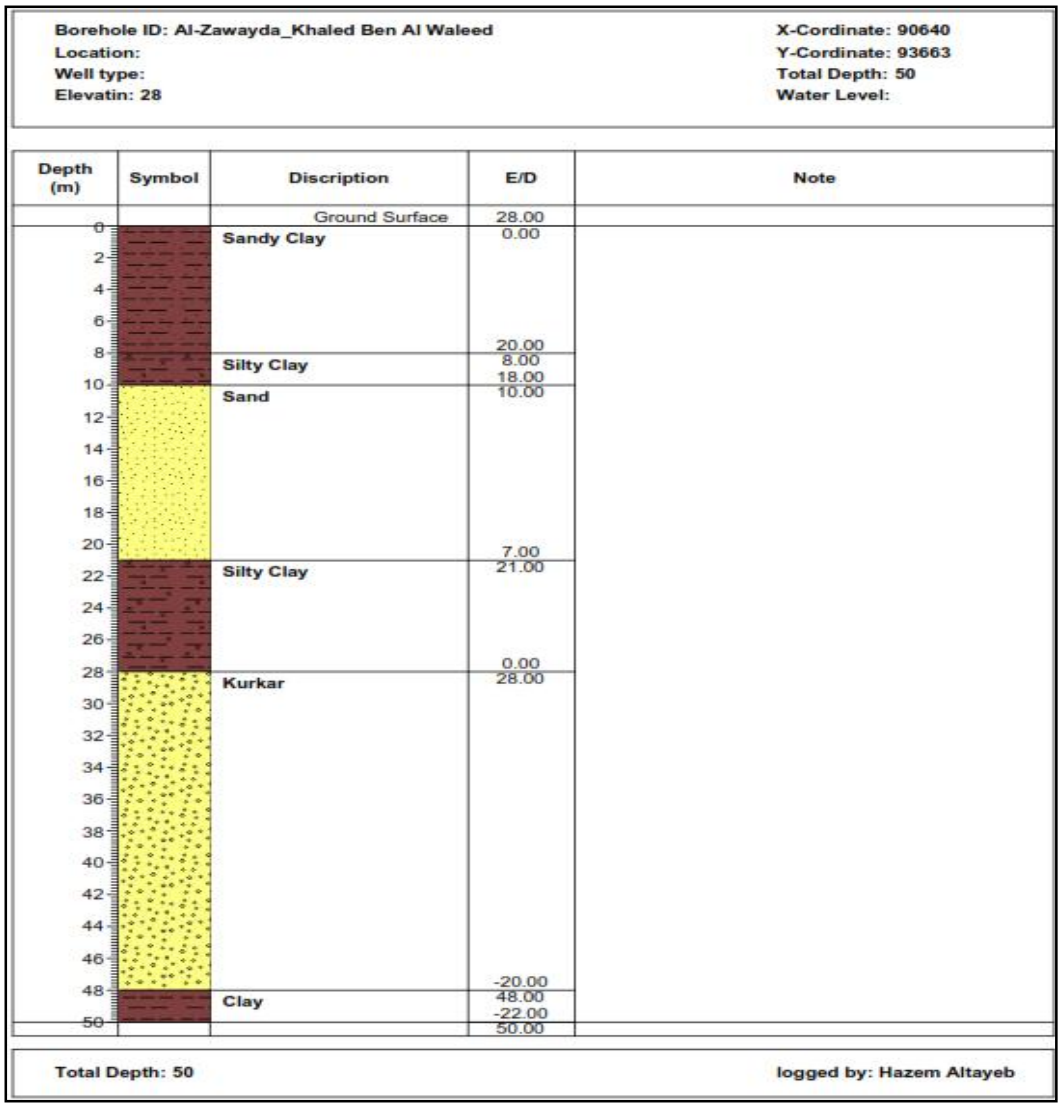


Figure (5.2.a) Lithological well logs used for creating cross section (Khalid bin Alwaleed)

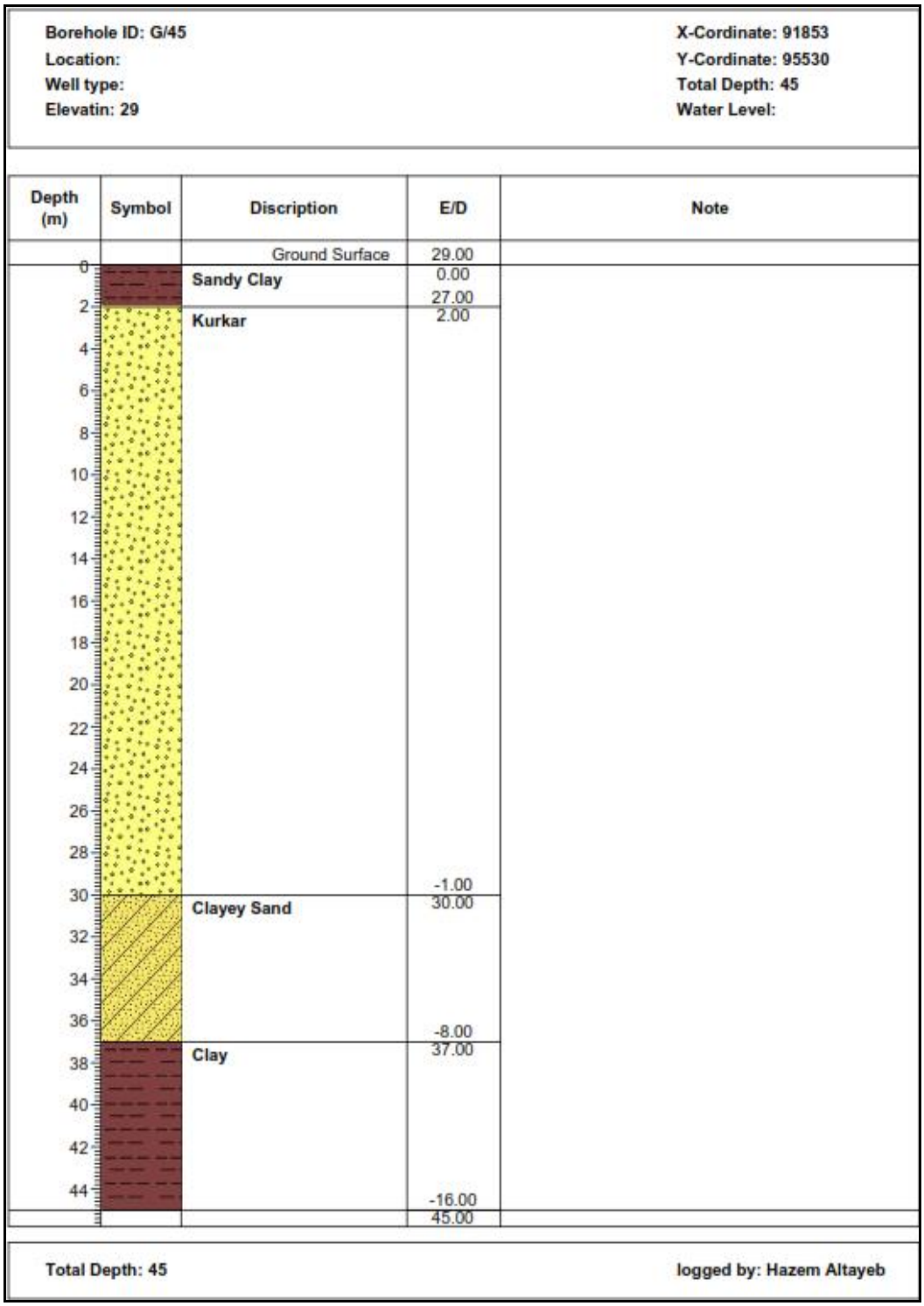


Figure (5.2.b): Lithological well logs used for creating cross section (G/45)

From lithological wells data, cross sections have been created in the study area. The cross sections of Northern Gaza area are shown through figure (5.3), figure (5.5), while figures (5.5) to (5.12) represents the cross sections for Gaza area, and figures (5.13), (5.15) represents the cross sections for middle area.

Cross sections show the distribution of impervious to semi impervious layers and lenses alternating with predominantly permeable sand and calcareous sandstones. Near the coast, coastal clay lenses extends about 1-4 km in land and divides aquifer sequence into three or four sub-aquifers (referred to as sub-aquifers A, B1, B2 and C) depending upon the location. These cross sections will helps for identifying the impact of the lithological structure in the deterioration of the groundwater quantity and quality in the study area.

There is many problem we find in the section, some of these problem is defined as:

- Some of wells not have a data because there drill without monitoring.
- Some of wells closed and not have data for many depth because it was drilling without document the well log
- Some of these wells located out of study area and also not find data about these wells in PWA.

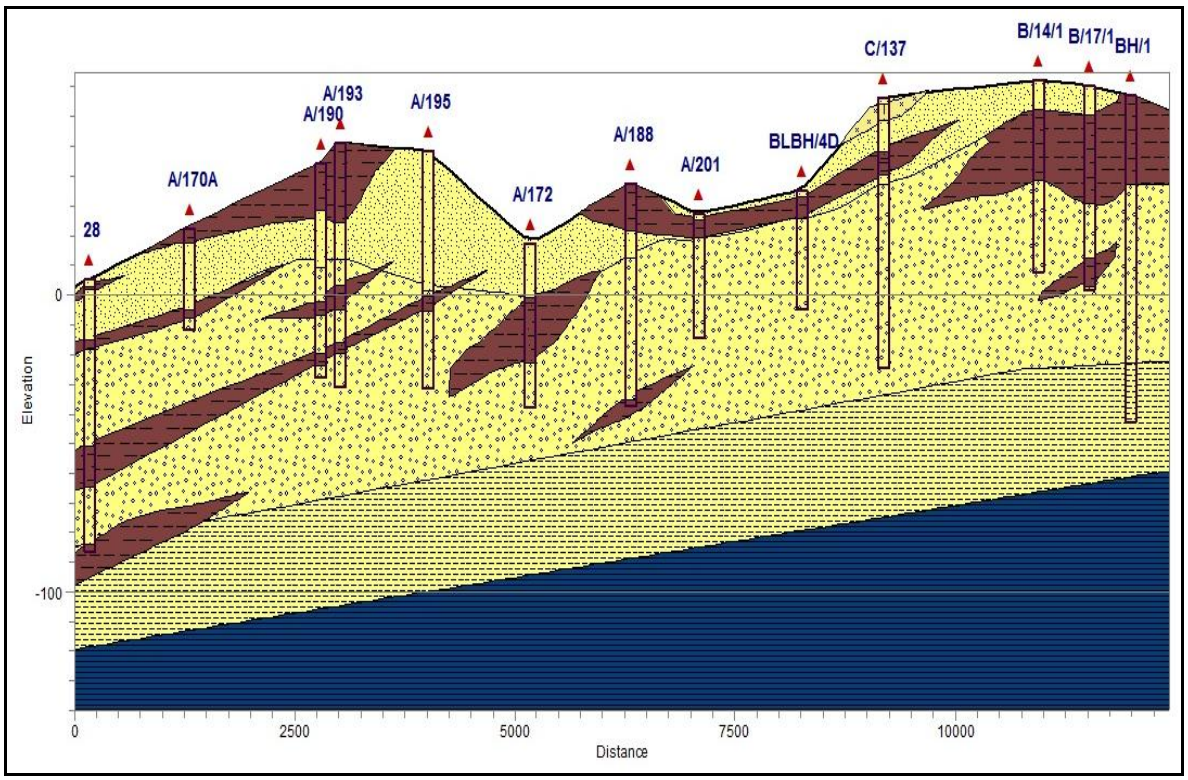
5.1.1 Cross sections No. 1

Cross section No.1 figure (5.3) represents the Northern part of Bait Hanoun that close to the Northern border. Thirteen lithological wells log have been used to draw this cross section. These wells arranged from West to East as a follows: 28, A/170A, A/190, A/193, A/195, A/172, A/188, A/201, BLBH/4D, C/137, B/14/1, B/17/1 and BH/1.

The section shows the many layers for different thickness for clay extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many coastal clay lenses extend eastward from 1Km to about 5Km in the aquifer structure and divided it into four sub-aquifers (A, B1, B2 and C).

- There are many problem that find when this section created, these problems represented in:
    1. There are two boreholes have missing data or error data so that's required to research and editing these data or change some of these borehole.
    2. The clayey layers that above aquifer C extended about 2 km because there is no boreholes reached this layer depth so this lenses can't extended.
    3. The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Silt		Saqiah	**Section** No. 1	
						Drown By: H. Altayeb	2015

Figure. (5.3) Cross section No.1 at Beait Hanoun area

5.1.2 Cross sections No. 2

Cross section No.2 figure (5.4) It is the same as one that done by Greitzer and Dan, 1967. Cross section No.2 parallel to the section No.1 and located in Beat Lahia area. Eight lithological well logs have been used to draw this section. These wells from West to East are: A/189, 26 A-B, A/196, A/60, CAMP-1 Pilot, C/137, BH/2 and CAMP-10-Pilot.

The section shows the major difference represented by the thick clay lens extending to the mid of cross section.

- There are many of the coastal clay lenses extend towards to East from 0.5Km to about 1.5Km in the aquifer structure and divided it into four sub-aquifers (A,B1 and C).
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- Coastal aquifer in the West is divided by clay lenses, and including a thick clay lens within lithological structure that extends 1.5Km to the east reaching to center.
- From the figures there is many differences between the old section and the new section and it's represented in:
    1. Sand layer in the new section appears thicker than the old section.
    2. The clayey layers that above aquifer C in the new section that's being less than layer in the old section and in new section that can also extended it for 1.5 km only.
    3. The new section appear a layer of clay in the east that have length about 3 km that's not find in the old section.

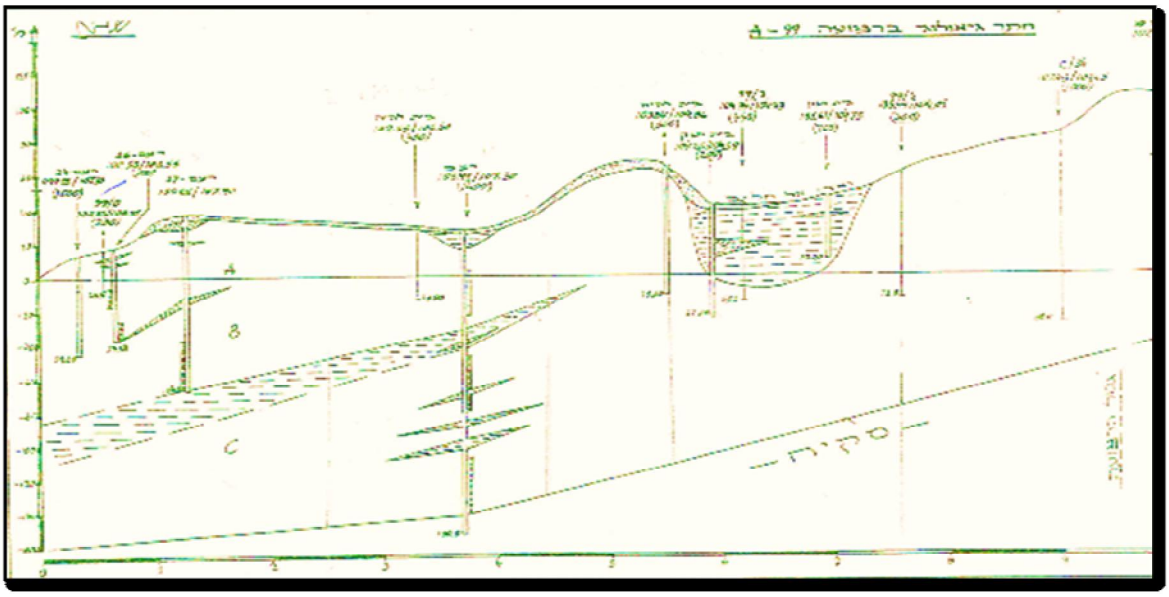
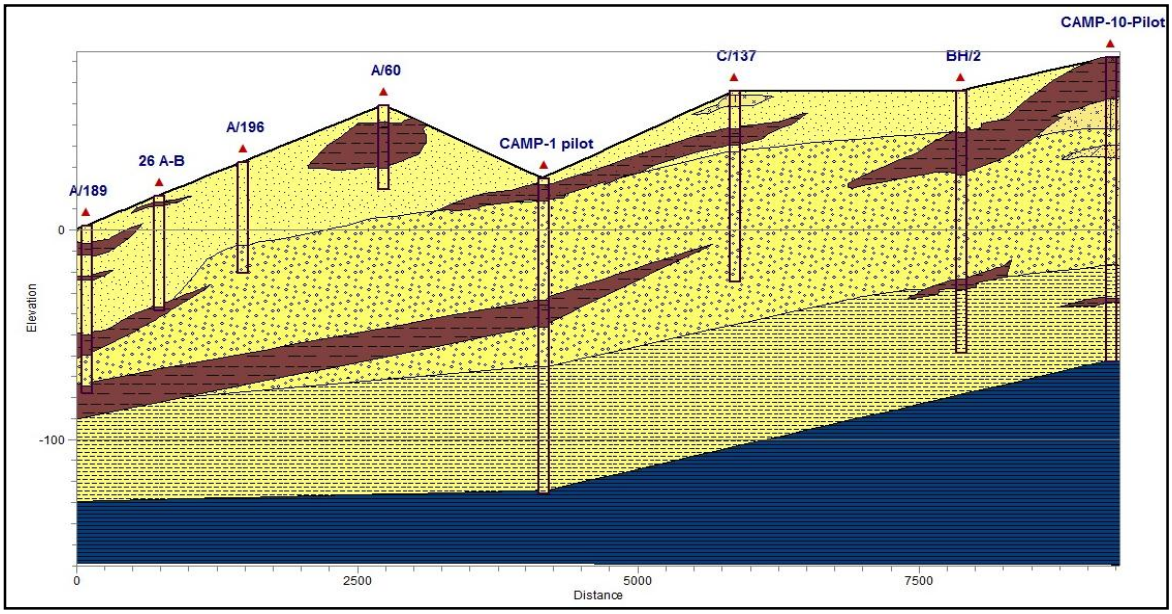


Figure (5.4.a) Cross section No. 99 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Silt		Saqiah	**Section** No. 2	
						Drown By: H. Altayeb	2015

Figure (5.4.b): Updating for cross section No.99 in Study area

5.1.3 Cross sections No. 3

Cross section No.3 figure (5.5) is located between Gaza and Jabalia. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.98. Ten lithological well logs have been used to draw this cross section. These wells include AT.98.1, 24, 25 A-B, D/75 Pilot, D/60/1, E/156, Q/72, Q/70, Q/69A and BH/4.

The section shows the primary difference represented by the thick clay lens extending to the mid of cross section. This section shows the lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend eastward from 1Km to about 5Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- Saturated aquifer thickness is characterized as less thick in the Eastern part.
- Coastal aquifer in the West is divided by clay lenses, and including a thick clay lens within lithological structure that extends 5Km to the east reaching to center.
- The new section also display that more than 4 sub-aquifer may be found in the coastal area.
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- The new section appear that the aquifer B2 contain three layers of clay in the coastal area and there length more than 1 km.
- The clayey layer that above aquifer B2 has more length than the layer in the old section it has a length more than 5 km extended through borehole (AT-98-1,24,25A-B, AT-98-2, D/75 pilot, D/60/1, E/156).
- In the east of new section there are more than one clayey layers but in the old just one layer can be defined.

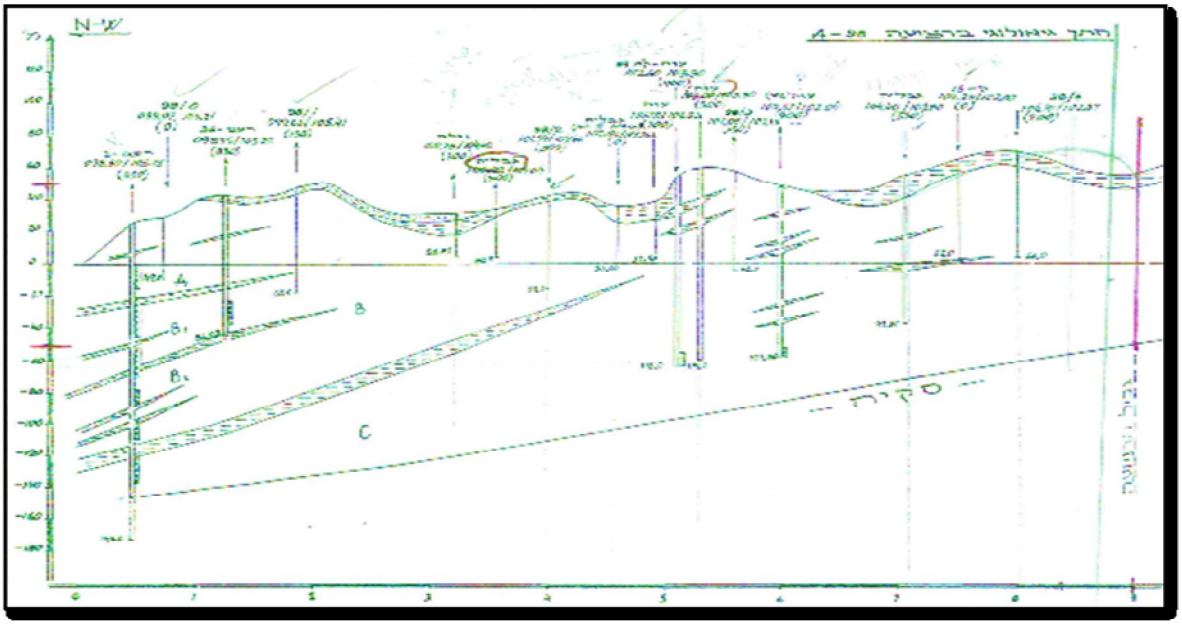
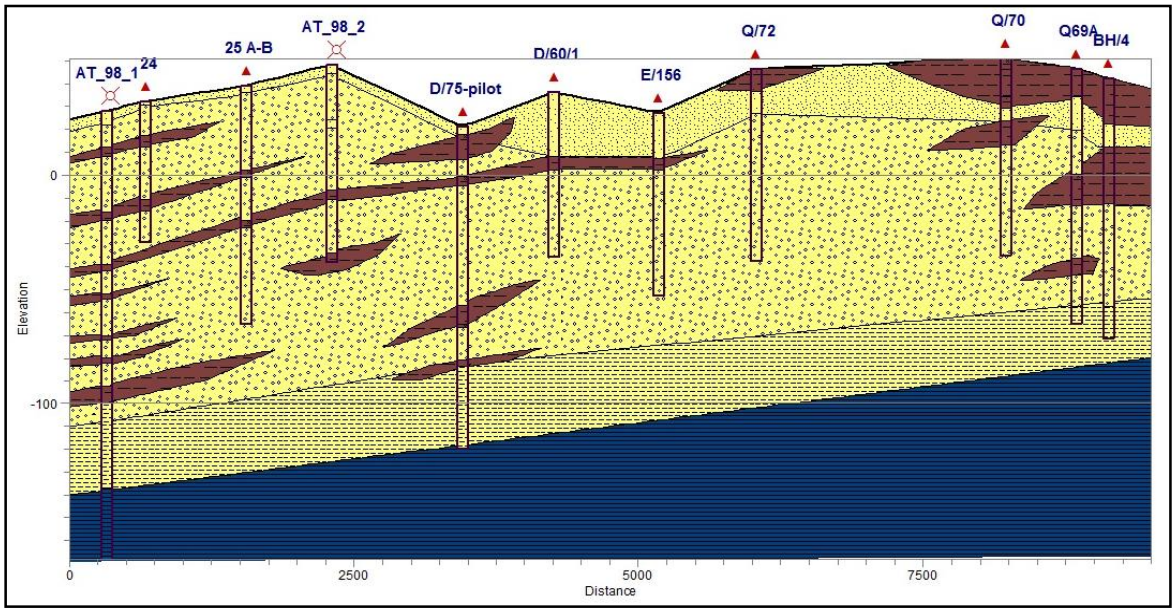


Figure (5.5.a): Cross section No. 98 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Silt		Saqiah	**Section** No. 3	
						Drown By: H. Altayeb	2015

Figure (5.5.b): Updating for cross section No.98 in Study area

5.7.4 Cross sections No. 4

Figure (5.6) shows cross section No.4 that is located northern part of Gaza city. This section is similar to the old cross section No.97 that done by Greitzer and Dan, 1967. Thirteen lithological well logs have been used to draw this cross section. These wells include AT_97_1, 2 A-B-C-D-E-F, 36 A-B, Alshaikh Radwan Well, E/161, AT-97-4, AT-97-5, Boring BH-2, CB-04, Q/16A and C/140.

From the figures it can be inferred that some differences between the new and old sections. These differences could be summarized as follows:

- There are many of the coastal clay lenses extend eastwards about 2.5Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C) and every one of these aquifer have a clayey layer that parallel to the main clay layer.
- The dip angle for the clayey lens that above aquifer C is sharp in the old section but in the new one it is smoother and less dipping.
- From west to the middle of the new section shows a sandy layer, not a clay one as old section presented.
- Also in the east of new section there is a clayey lens in the end of depth of borehole Q/16A that's not find in the old section and these lens is possible to be more thickness.
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- Clayey lens that's above the aquifer B1 is longer than the same lens in the old section.
- There are some of layers of clay dispersed close to the surface with various thickness.

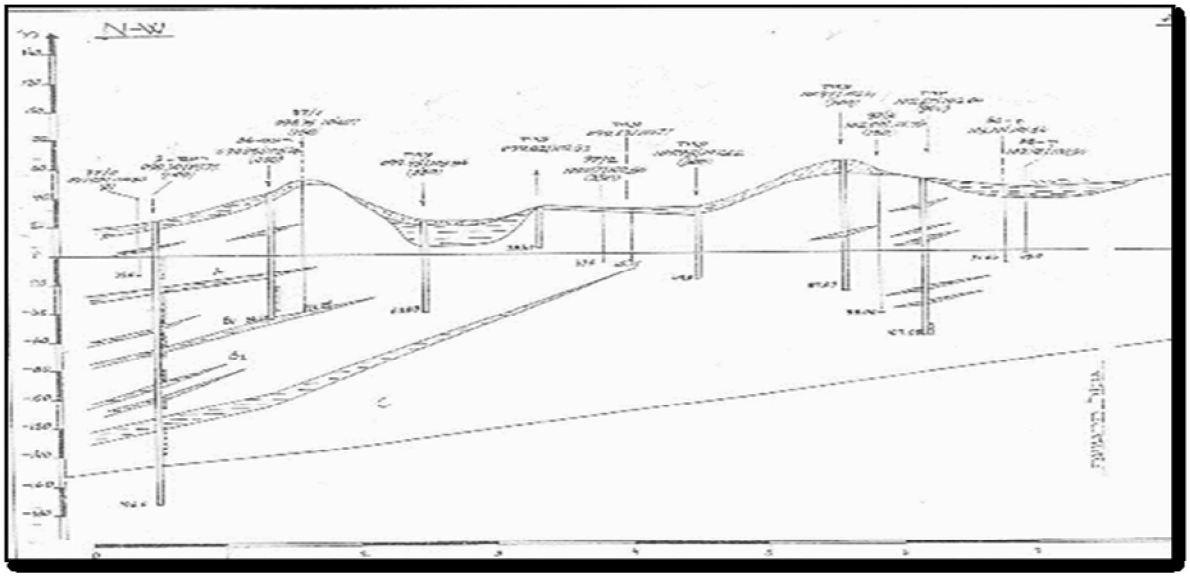
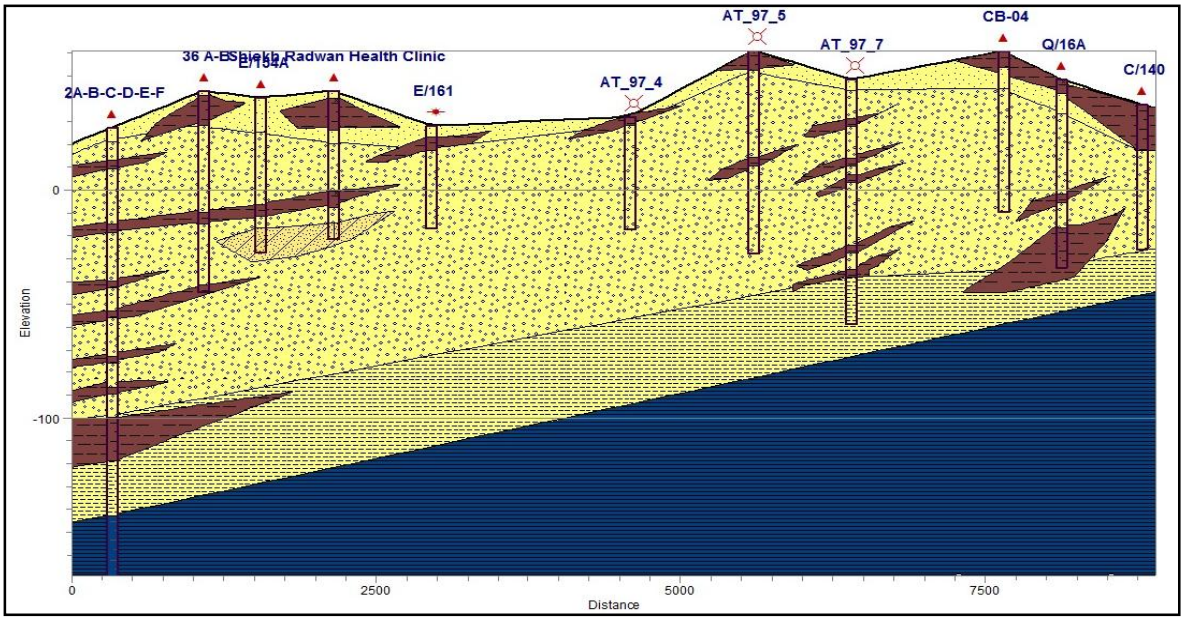


Figure (5.6.a): Cross section No. 97 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Clayey Sand		Saqiah	**Section** No. 4	
						Drown By: H. Altayeb	2015

Figure (5.6.b): Updating for cross section No.97 in Study area

5.1.5 Cross sections No. 5

Cross section No.5 figure (5.7) is located northern part of Gaza city. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.96. Twenty lithological well logs have been used to draw this cross section. These wells include AT-96-1, AT-96-2, R/313, AT-96-3, R/308, R/233, R/219, Tunis ALkhadra, R/278, AT-96-4, R/272C and AT-96-5.

From the figures it can be inferred that some differences between the new and old sections. These differences could be summarized as follows:

- There are some of the coastal clay lenses extend towards to East from 1Km to about 2Km in the aquifer structure and divided it into four sub-aquifers.
- The clayey lens that above B2 in the new section is smaller than in length the same lens in that find in the old section this is because there is more new boreholes used in pathline and there are not have clayey layer to extend the clayey lens through it.
- The third clayey lens near the coast it being smooth angle not as an old section that have sharp angle.
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- Coastal aquifer in the West is divided by clay lenses, and including a very thick clay lens within lithological structure that extends 5Km to the east reaching to center.
- There are many clayey lens appear in the east of new section with different length and thickness that its nit defined in the old section.
- The new section display that clay layer extend from the middle to the east in different thickness.

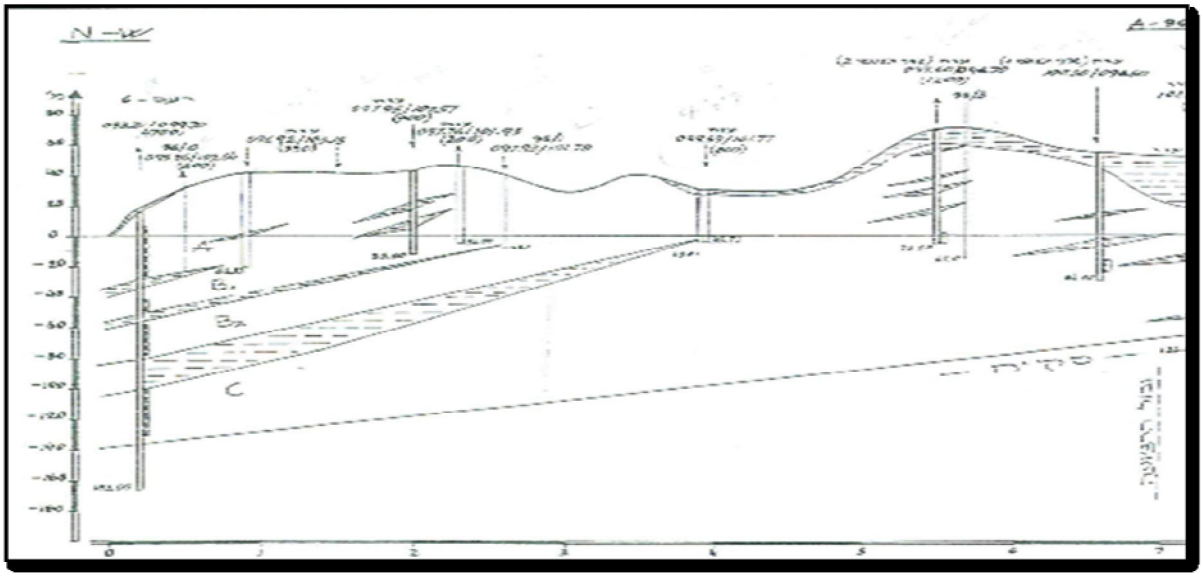
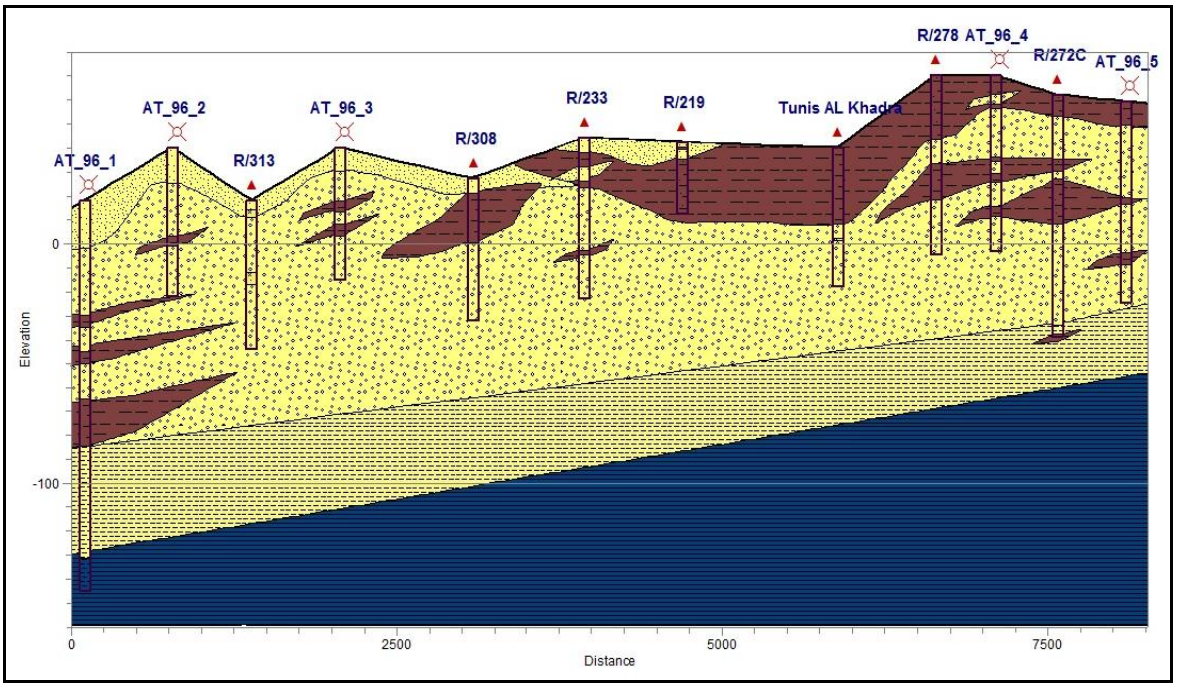


Figure (5.7.a): Cross section No. 96 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Saqiah			**Section** No. 5	
						Drown By: H. Altayeb	2015

Figure (5.7.b): Updating for cross section No.96 in Study area

5.1.6 Cross sections No. 6

Cross section No.6 figure (5.8) is located in middle Gaza city. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.95. Twenty lithological well logs have been used to draw this cross section. These wells include AT-95-1, RG2, R/277, R/293, R/218, R/305, R/219, AT-95-3, AT-95-4, R/272A, R/272B and AT-95-5.

Cross section No.6 shows presence of three separate thick clay lenses in middle and the East of cross section, where these lenses are shown in the old cross section since 1986 due to no adequate available information in these area.

From the figure can be find many differences between the old and the new section which are illuminated as:

- The clay layer that extends in the old section from the shore to the middle was replaced with a sand layer in the new one.
- There is clayey sand on the surface extends from the middle to the east in the old section, whereas in the new one, it was replaced with a clay layer is getting thicker from the east towards the middle.
- There are many clay layers in the new section in the east, which are larger and longer.
- Clay layer near the surface near the shore and extends about 2 km, with 5 m thick.
- Saturated aquifer thickness is characterized as very low in the Eastern part is about 60m or less, increase gradually to the Western part reaching to 130m.
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}

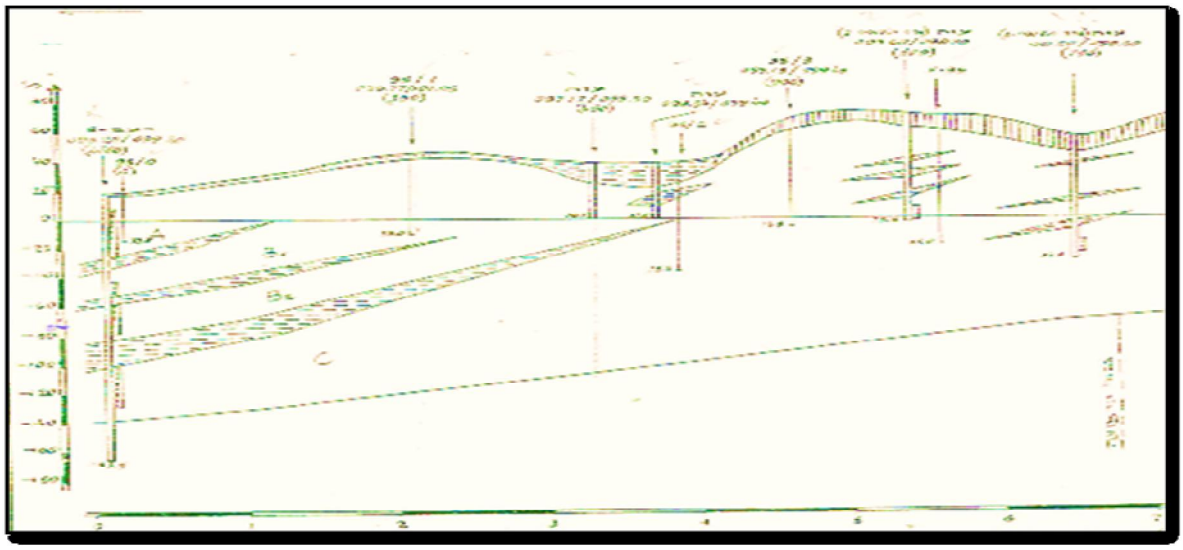
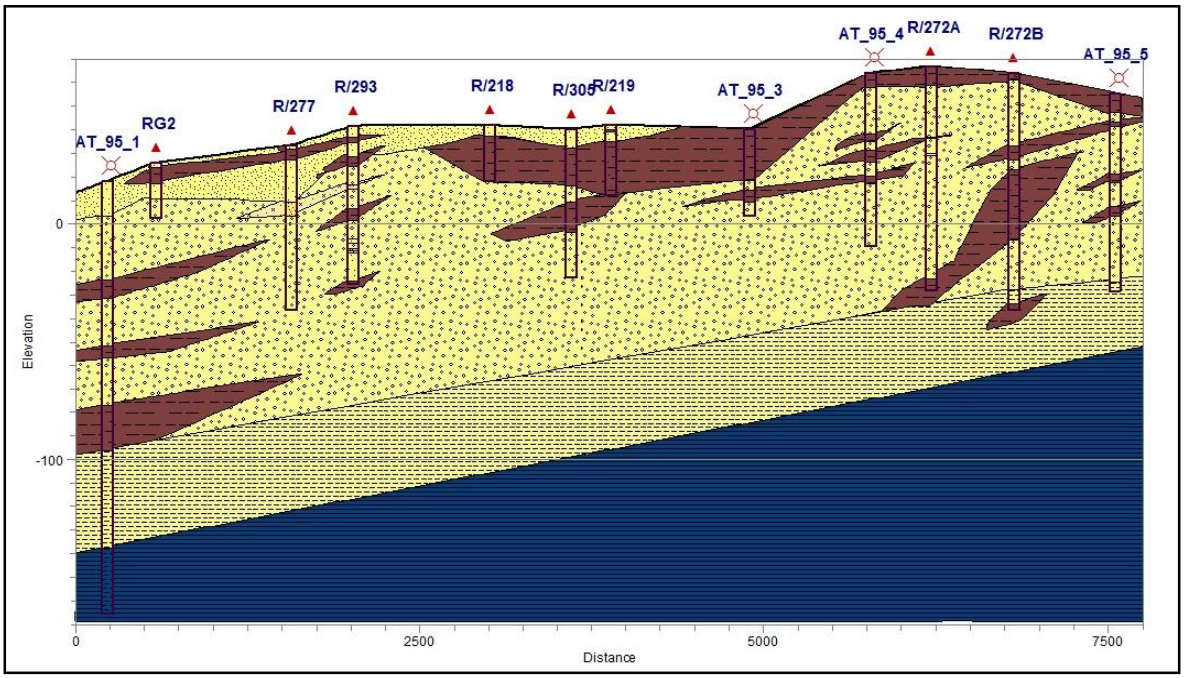


Figure (5.8.a): Cross section No. 95 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Silt		Saqiah	**Section** No. 6	
						Drown By: H. Altayeb	2015

Figure (5.8.b): Updating for cross section No.95 in Study area

5.1.7 Cross sections No. 7

Cross section No.7 figure (5.9) is located Southern part of Gaza. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.94. Twenty lithological well logs have been used to draw this cross section. These wells include 6, 9, Netsarim, F/191, F/199, 9B, Fi/8, Fi/2, F/205, Fi/7, F/204 and BJ/3.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 5Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C). But the new section display that more than four sub-aquifer that fined near the coast area.
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- The new section display that clay layer extend from the middle to the east in different thickness.
- There are many differences between the old section and the new one:
    1) The three clay layers near the shore which are extended to the middle appear longer than in the old section.
    2) There is an extra clay layer that appears about 140 m deep near the shore where it is in the Saqiah.
    3) The clay layer in the old section near the surface which extends from the west to the middle hasn't appeared in the new section where there is sand layer.
    4) The loam sand layer in the old section from the east to the middle hasn’t appeared in the new one which was replaced with a clay layer in the east, and a sand layer in the middle.

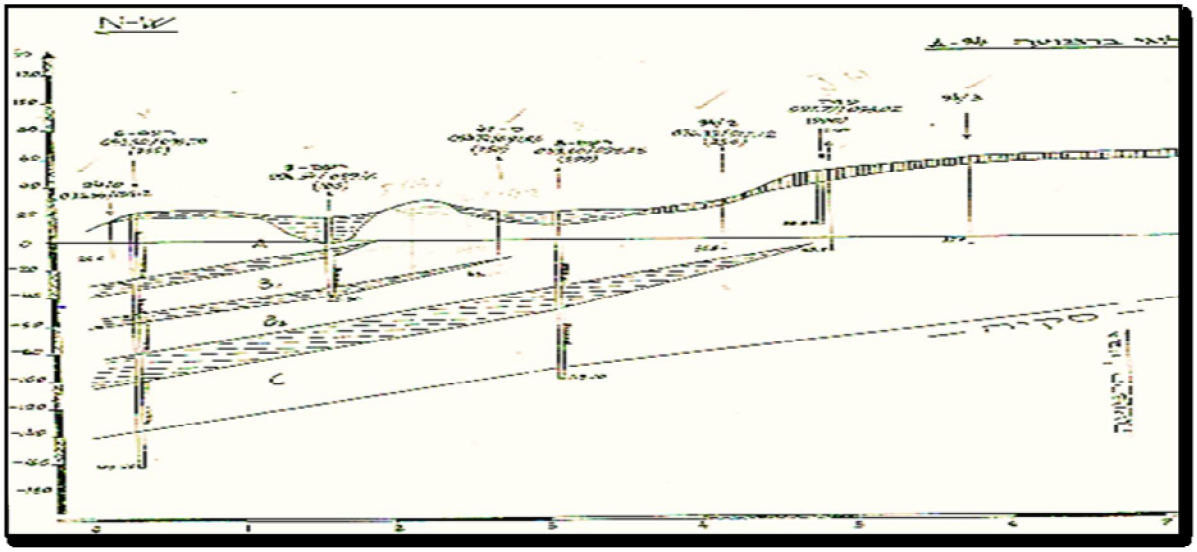
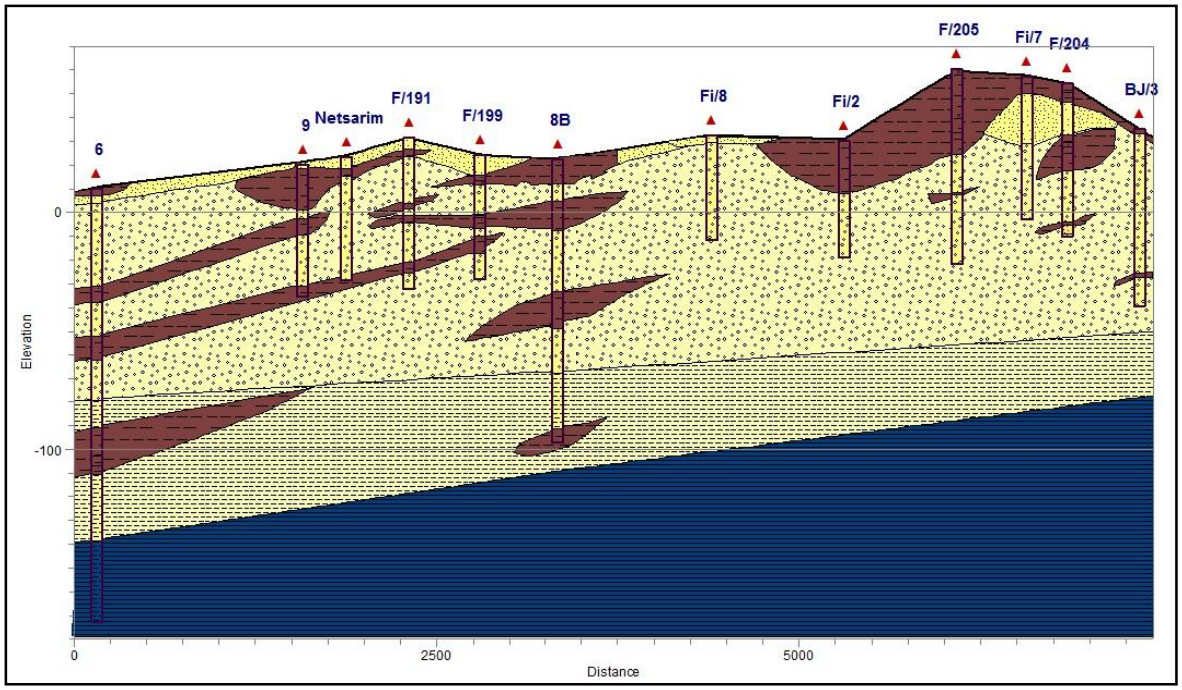


Fig5.9.a Cross section No. 94 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Saqiah			**Section** No. 7	
						Drown By: H. Altayeb	2015

Figure (5.9.b): Updating for cross section No.94 in Study area

5.1.8 Cross sections No. 8

Cross section No.8 figure (5.10) is located in ALzahra and. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.93. Eleven lithological well logs have been used to draw this cross section. These wells include AT-93-1, ALzahra city well, Q/24, F/203, G/51, AT-93-2, F/68B, BJ/1, BJ/4, Fi/3 and Ji/11.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 2.5Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- The new section display that many clay layer find in the middle and the east of Gaza area in different thickness. But in the old section there just one layer of clayey sand ore loam sand that find in the east of these section area not clay as that display in new section.
- There is a big similarity between the old section and the new one for the sand layers, but there are some differences:
    1- The loam sand layer on the surface in the eastern area in the old section is replaced with a sand layer and another clay layer in the near area of the middle.
    2- The old section appears a clay layer from the shore to the middle on the surface whereas in the new section there is a sand layer replaced in the clay.
    3- There are many clay layers spread near the surface with different length and thickness.

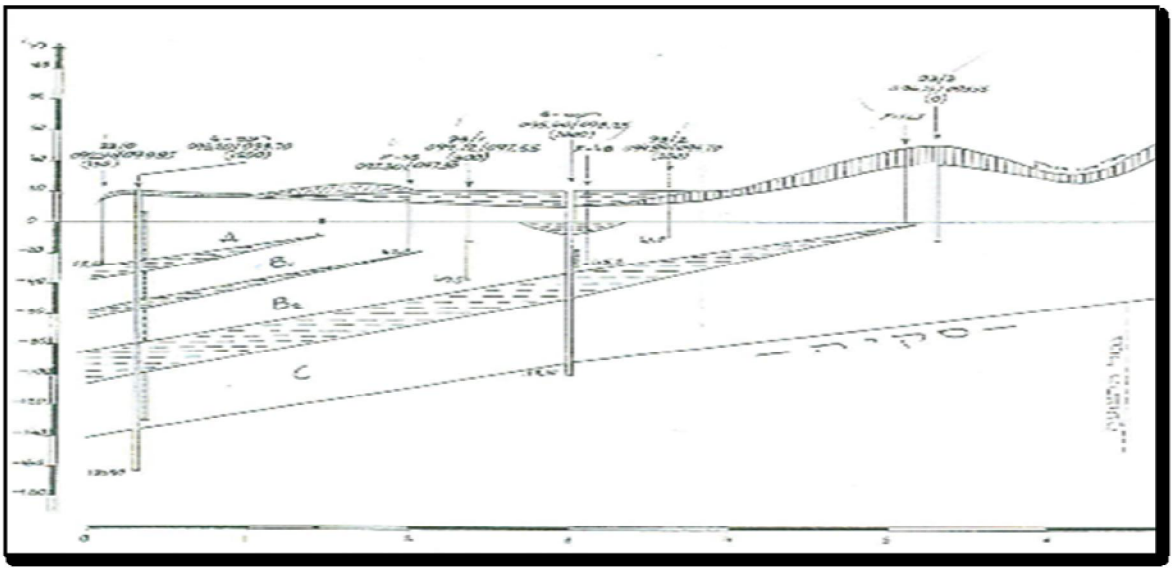
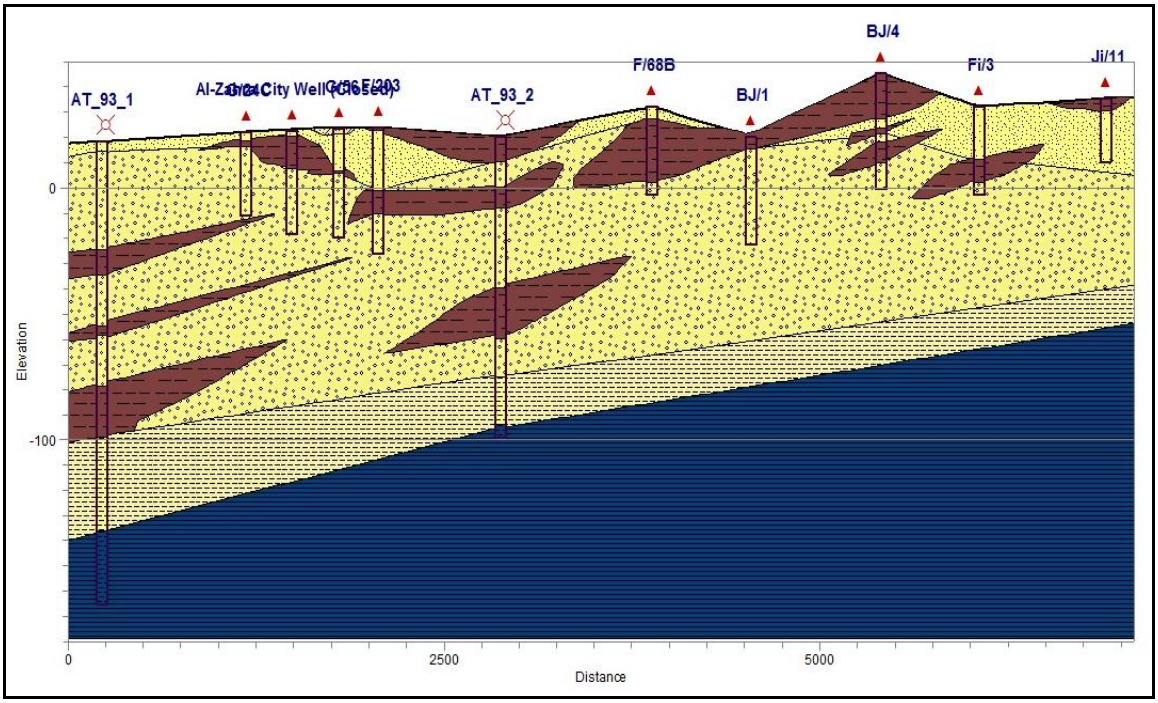


Figure (5.10.a) Cross section No. 93 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Saqiah			**Section** No. 8	
						Drown By: H. Altayeb	2015

Figure (5.10.b): Updating for cross section No.93 in Study area

5.1.9 Cross sections No. 9

Cross section No.9 figure (5.11) is located southern part of Gaza and. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.92. Thirteen lithological well logs have been used to draw this cross section. These wells include AT-92-1, G/22, G/49, AT-92-2, G/45, 3 A-B, S/61, AT-92-4, S/29, AT-92-4, S/29, S/72, Maqbola, CAMP-14 Pilot and S/82.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 7Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}.
- During checking the section, you will find the following:

1- The clay layer on the C section extends from west to east 1 km, apparently this layer is longer than it is in the old section
2- There is clay sand on the surface near the shore which is the same in the old one.
3- There is another sand layer in the east which is thicker than the same layer in the old section.
4- There is a clay layer in the middle on the surface looks longer than it is in the old one.
5- There are clay layers with different deeps in the middle and the east, with different thickness.

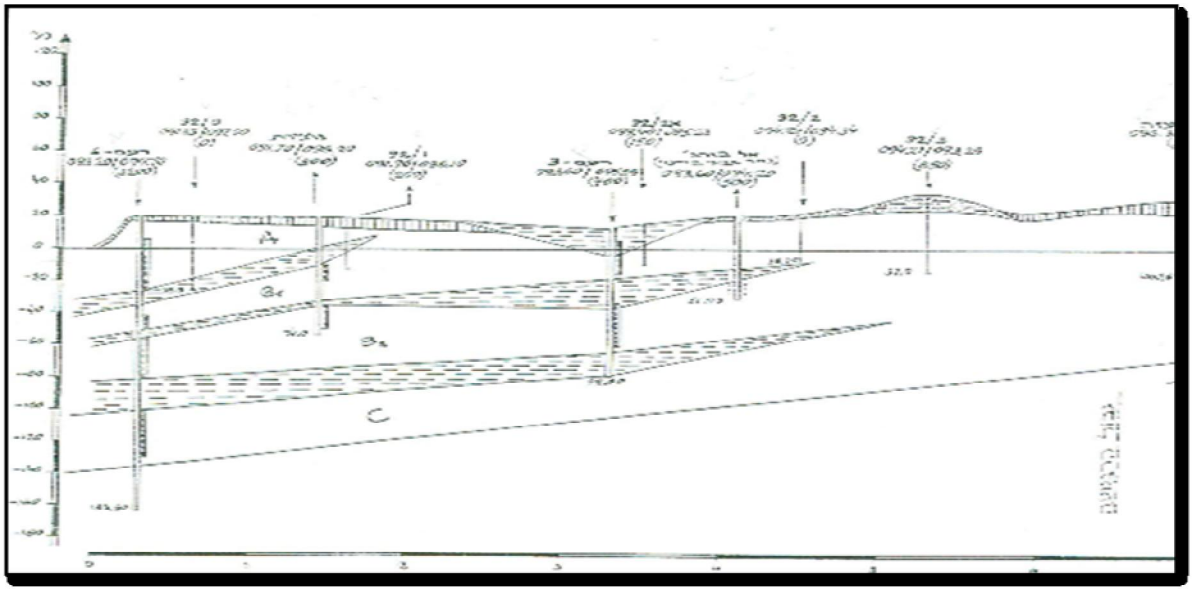
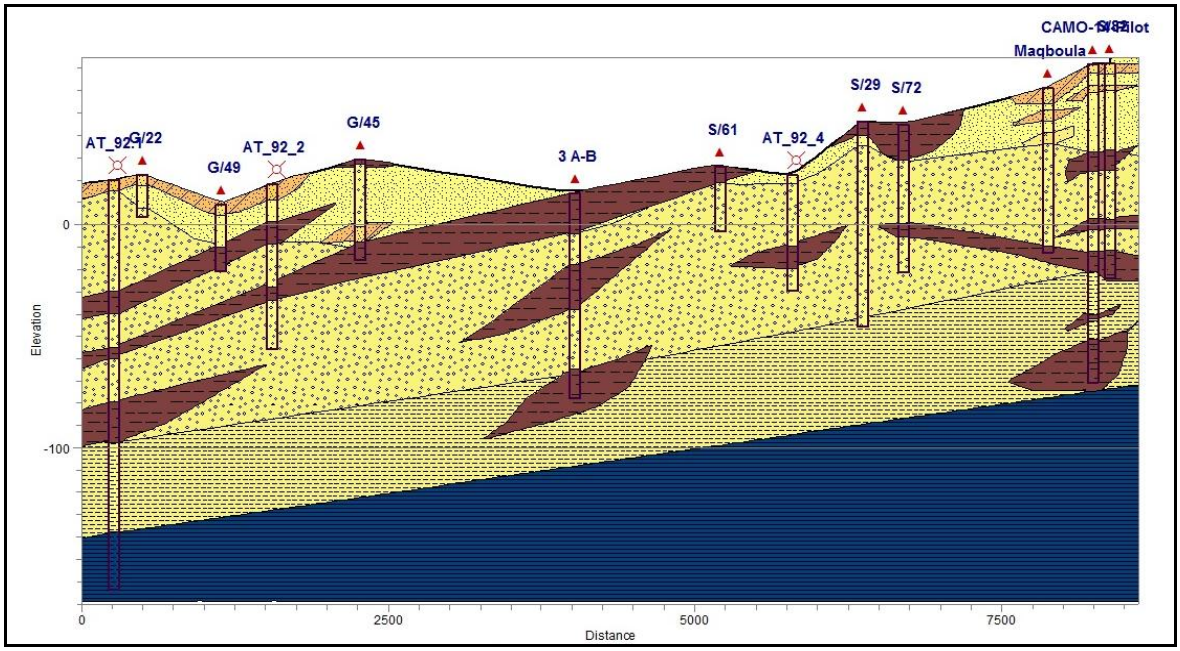


Figure (5.11.a): Cross section No. 92 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Clayey Sand		Saqiah	**Section** No. 9	
						Drown By: H. Altayeb	2015

Figure (5.11.b): Updating for cross section No.92 in Study area

5.1.10 Cross sections No. 10

Cross section No.10 figure (5.12) is located southern part of Gaza. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.91. Fourteen lithological well logs have been used to draw this cross section. These wells include G/503, AT-91-1, G/2, G/1, AT-91-2, H/97, CAMP-5-Pilot, AT-91-3, AT-91-4, AT-91-5, S/65A, S/80, S/71 and S/42A.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 7Km in the aquifer structure and divided it into three (nut four as old section) sub-aquifers (A,B, and C).
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- There are many differences between the old section and new one which shows in the following pictures:
    1- In the new section there are two clay layers from the west to the middle which divide the aquifer well into 3 sections instead of 4 which is shown in the old section, where it shows 3 clay layers.
    2- There is a clay layer in the middle of the section with 100 meters deep, 20 meters thick, and 2 km long.
    3- The old section appears a clayey sand layer from the east to the west while in the new section it's replaced with different divided clay and sand layers, and there is a clay sand layer with 2 km from the east.
    4- There is a clay sand layer in the east of the new section with 20 meters deep, to the middle about 2 km.
    5- There are many clay layers spread from the east to the west of the section with different length, depth and thickness

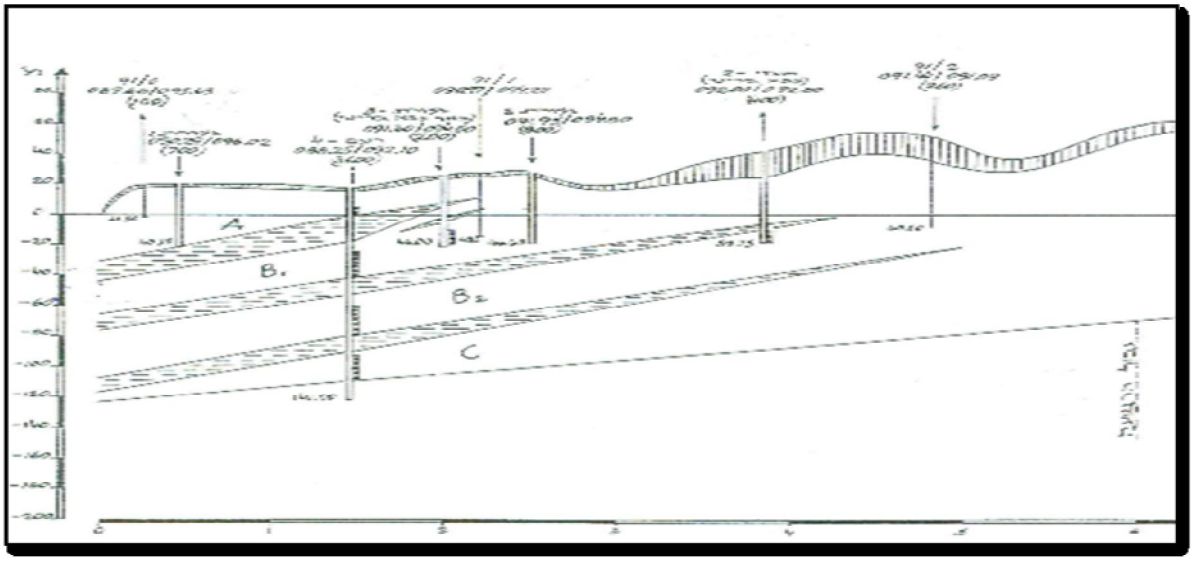
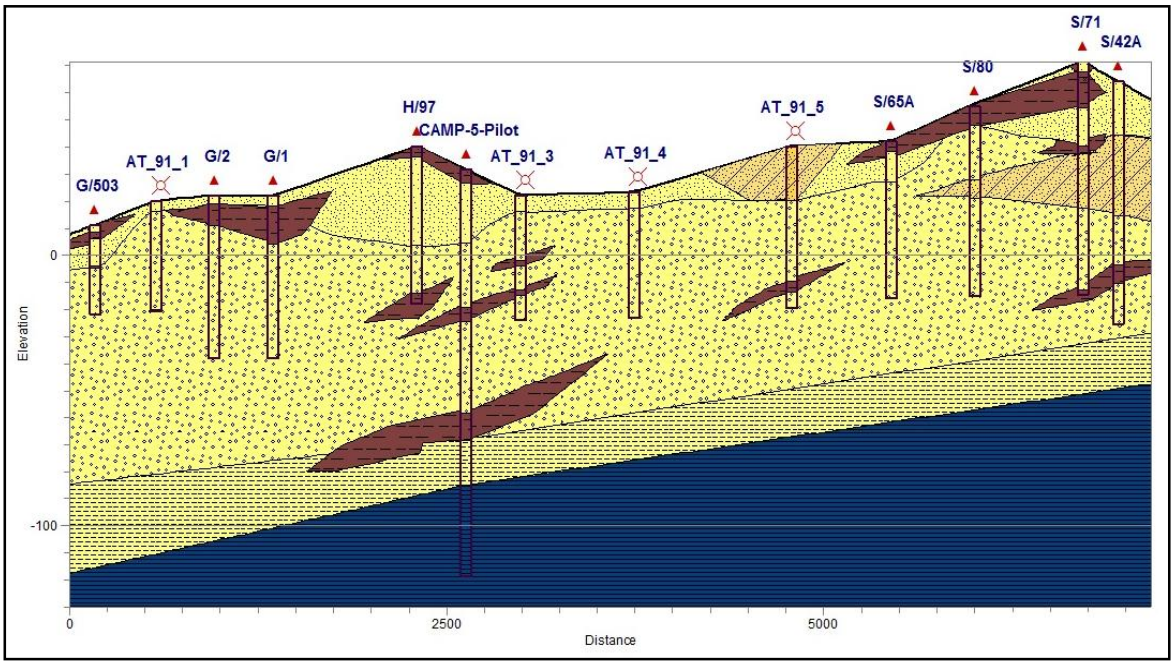


Figure (5.12.a): Cross section No. 91 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Clayey Sand		Saqiah	**Section** No. 10	
						Drown By: H. Altayeb	2015

Figure (5.12.b): Updating for cross section No.91 in Study area

5.1.11 Cross sections No. 11

Cross section No.11 figure (5.13) is located southern part of Gaza. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.90. Ten lithological well logs have been used to draw this cross section. These wells include H/88, AT-90-1, AT-90-2, Alzwaydah Khaled bin Alwaleed, S/65A, AT-90-3, S/49, AL musader, S/69 and T/46.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 7Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- During checking the section, you will find the following:
    1- There is sand layer on the surface near the shore which is the same in the old one.
    2- There is another sand layer in the east which is thicker than the same layer in the old section.
    3- There is a clay layer in the middle on the surface looks longer than it is in the old one.
    4- There are clay layers with different deeps in the middle and the east, with different thickness.
    5- The old section appears a loam sand layer from the east to the middle while in the new section it's replaced with different divided clay and sand layers, and there is a clay sand layer with 2 km from the east.

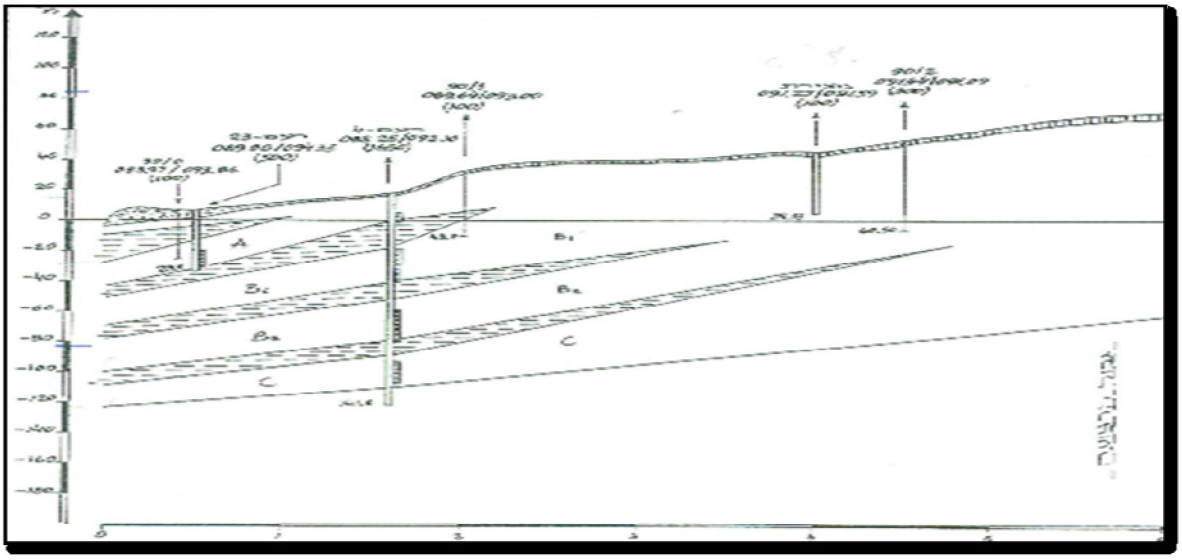
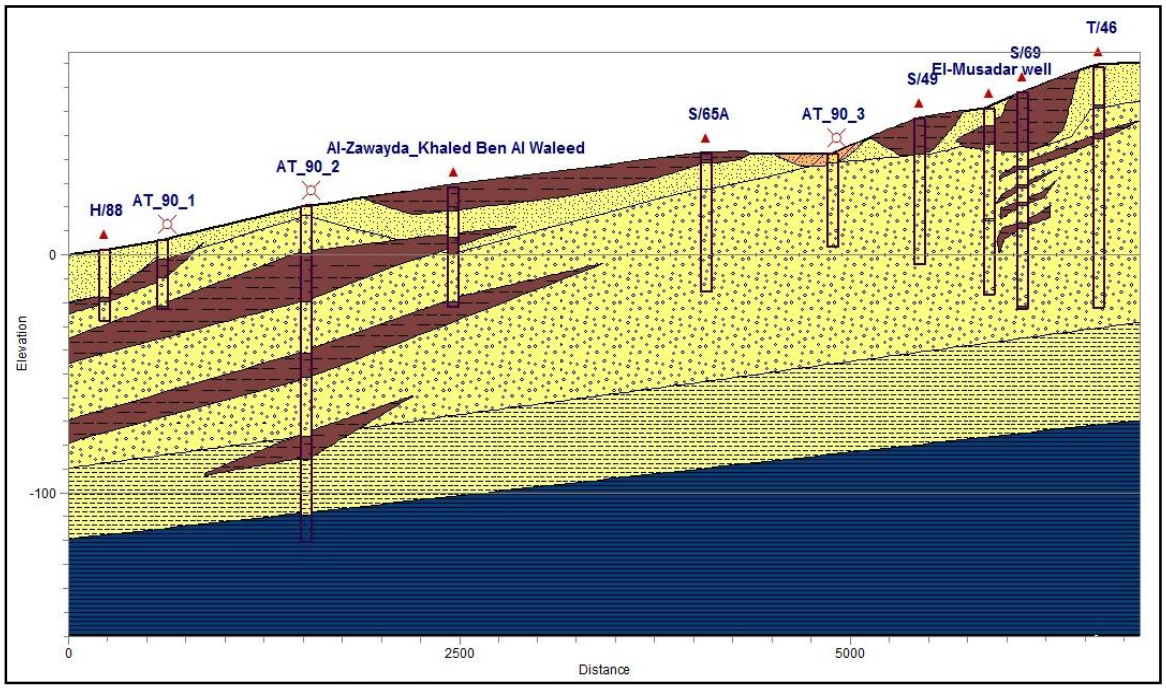


Figure (5.13.a) Cross section No. 90 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Clayey Sand		Saqiah	**Section** No. 11	
						Drown By: H. Altayeb	2015

Figure (5.13.b): Updating for cross section No.90 in Study area

5.1.12 Cross sections No. 12

Cross section No.12 figure (5.14) is located in middle area. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.89. Fourteen lithological well logs have been used to draw this cross section. These wells include H/98, PWA, AT-89-1, AT-89-2, Ji/18, AT-89-3, AT-89-4, J/85, EZ/1, J/13, AT-89-5, T/37, T/43 and T/48.

The section shows the fundamental thick for clay lens extending to the mid of cross section. This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 5Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- The new section display that the layer of clay soil that extend from the east to the near coast area in different thickness.
- There are many differences between the old section and new one which shows in the following pictures:
    1- In the new section there are four clay layers from the west to the middle which divided the aquifer well into 4 sections instead of 3 which is shown in the old section, where it shows 3 clay layers.
    2- There is a clay layer extended from the west to the east with difference thick but it's cutting at the middle for about 1 km length with sand layer and at near the coast.
    3- The old section appears a clayey sand layer from the east to the west while in the new section it's replaced with different divided clay and sand layers, and there is a sand layer with 2 km and 4 km from the east.
    4- There is a silty sand lens in the east of the new section with 80 meters deep, to the middle about 2 km.
    5- There are many clay layers spread from the east to the west of the section with different length, depth and thickness.

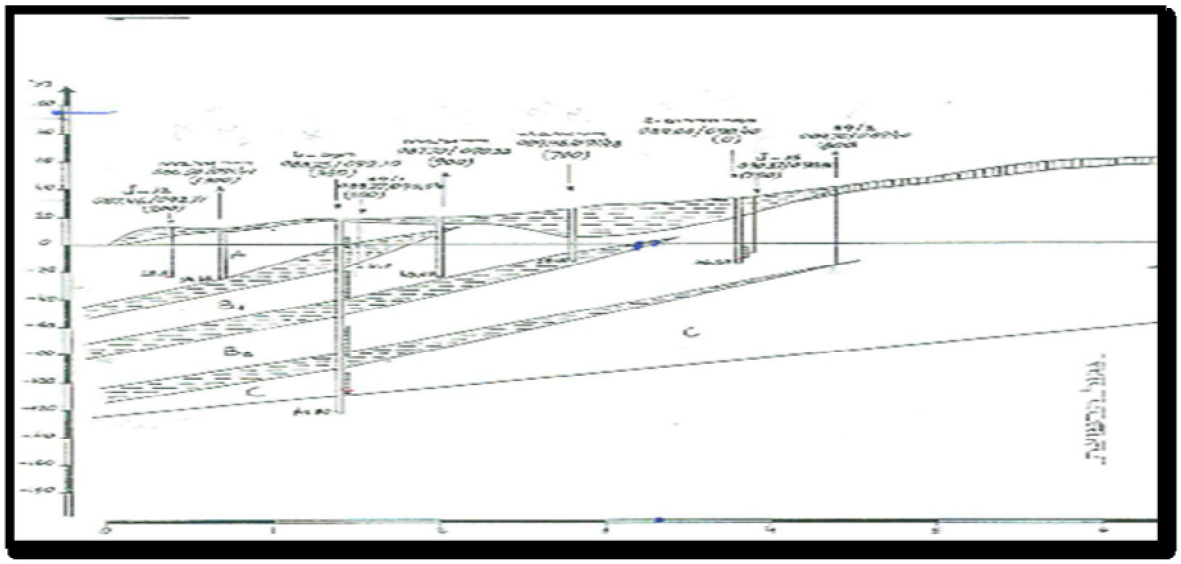
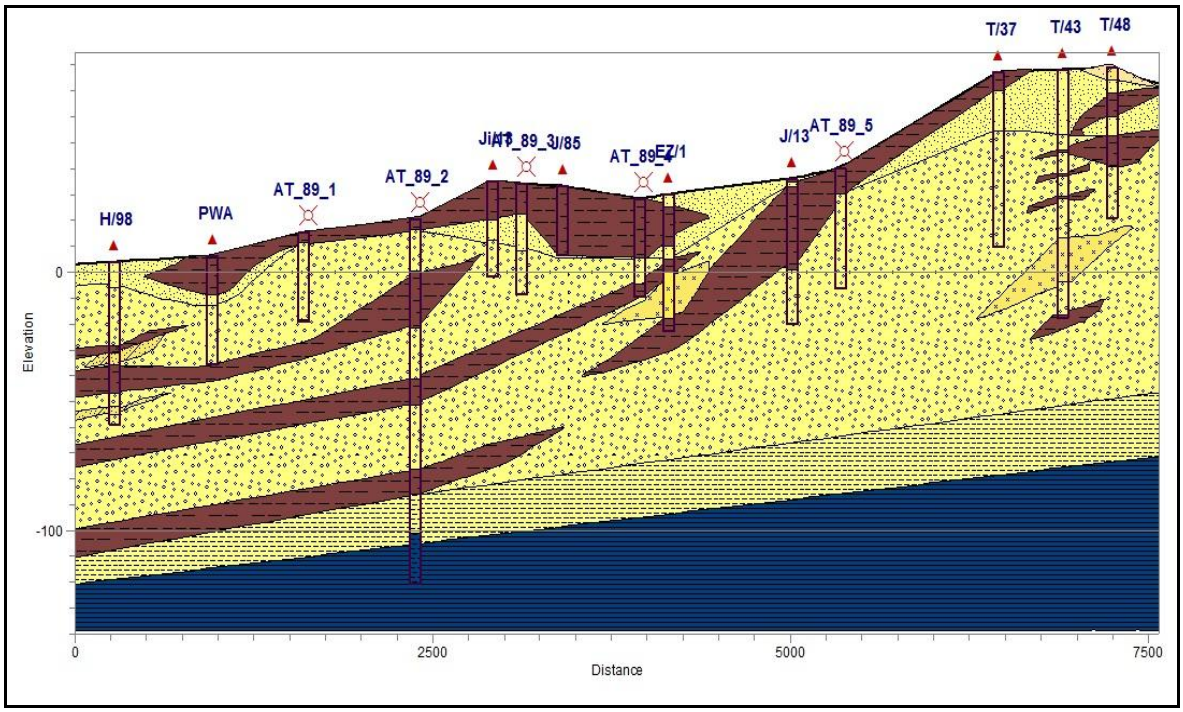


Figure (5.14.a): Cross section No. 89 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Silt		Saqiah	**Section** No. 12	
	Clayey Sand					**Drown By:** H. Altayeb	2015

Figure (5.14.b): Updating for cross section No.89 in Study area

5.1.13 Cross sections No. 13

Cross section No.13 figure (5.15) is located at middle part of Gaza strip. This cross section is almost the same as one that done by Greitzer and Dan, 1967 cross section No.88. Nine lithological well logs have been used to draw this cross section. These wells include DB/6, AT-88-1, AT-88-2, K/21, K/20, AT-88-3, K/7A and T/44. The section shows the fundamental thick for clay lens extending to the mid of cross section.

This section shows role of lithological sub-surface in limiting of the aquifer capacity for receiving quantities of renewable water due to these clay lens. From this section, it can be inferred that:

- There are many of the coastal clay lenses extend towards to East from 1Km to about 7Km in the aquifer structure and divided it into four sub-aquifers (A,B1,B2 and C).
- The figure shows that the thickness of the aquifer is almost the same Eastward, it is about 120 m at west and East , but decreases westward with 12^{o}
- There are many differences between the old and the new section which are illuminated as:
    1- There is clayey sand on the surface extends from the middle to the east in the old section, whereas in the new one, it was replaced with a sand layer is getting thicker from the east towards the East.
    2- There are many clay layers in the new section in the east and middle, which are larger and longer.
    3- Clay layer in the middle and near the surface can find at depth about 3 m and it have a more than 20 m thickness.

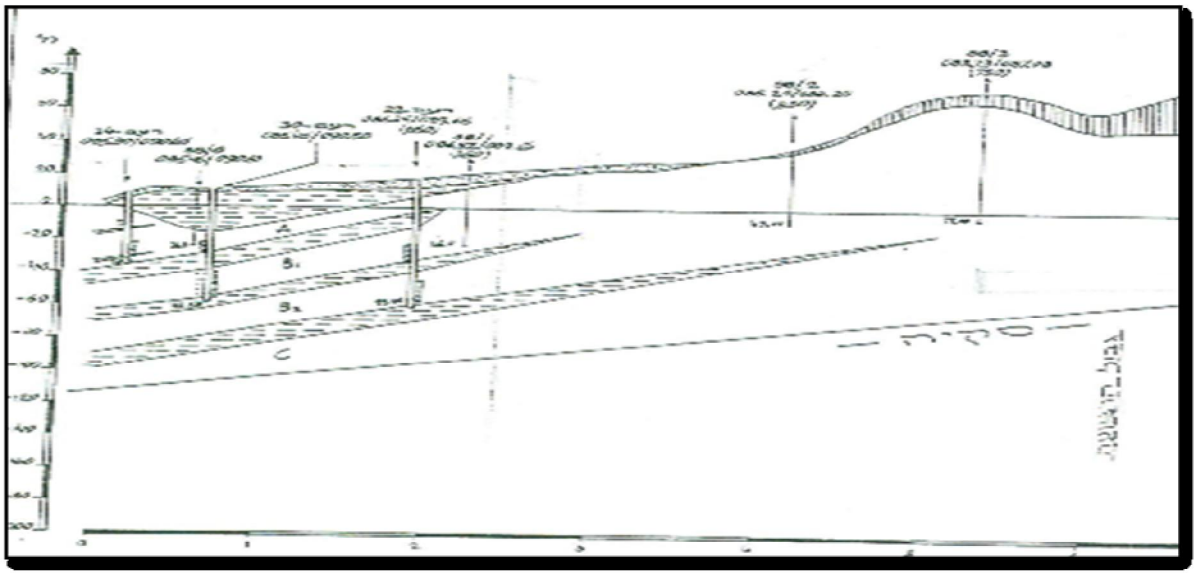
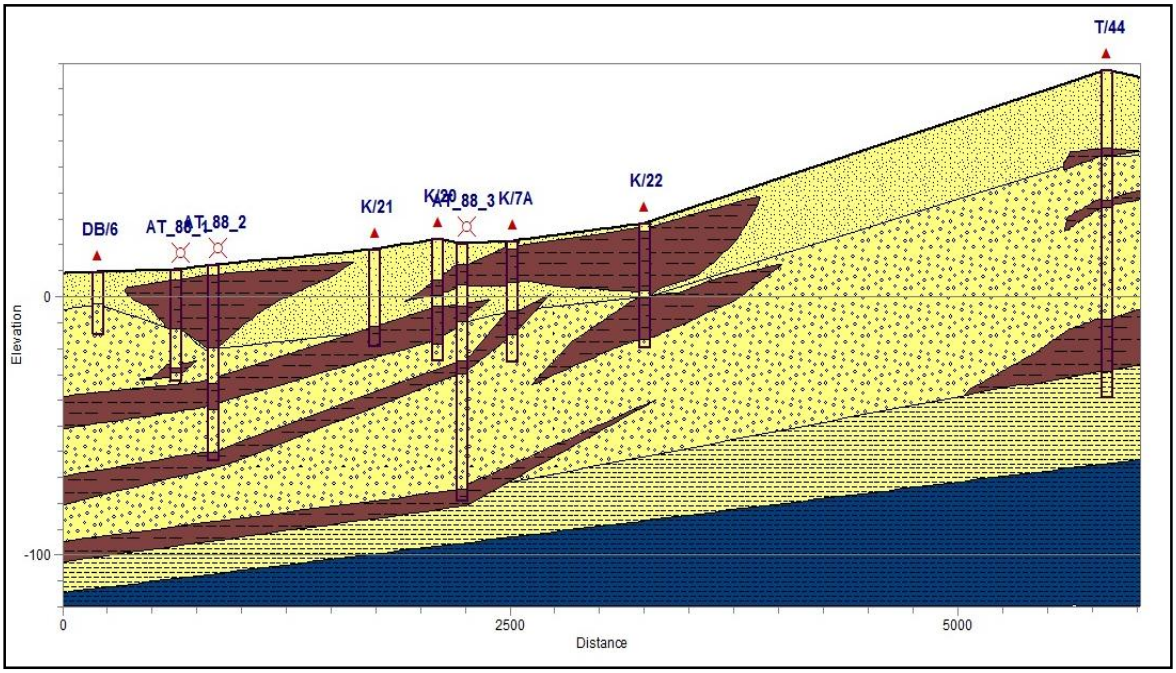


Figure (5.15.a): Cross section No. 88 by Greitzer and Dan, 1967



Legend						Cross-Section Profile	
	Sand		Clay		Kurkar	**Location:** Gaza Strip	
	Sandstone		Saqiah			**Section** No. 13	
						Drown By: H. Altayeb	2015

Figure (5.15.b): Updating for cross section No.88 in Study area

CHAPTER SIX

CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

This research is considered to be one of the main studies which evaluate the geological of Gaza Strip. The research mainly collected the considerable number of top soil samples from (North, Gaza and Middle area) of Gaza Strip Governorates. The researcher collected 300 boreholes and wells from PWA and used WinLog and WinFence analyses were used to present the findings.

The following conclusions that achieved:

- This study is considered as initial Gaza strip geological data bank and maps, which can help geologists, geotechnical engineers, agricultural and environmental for collecting initial data for design projects and soil investigation especially for areas with low borings.
- Sub-surface lithological structures in the study area has been shown their important and main. As well as, in comparison the revised cross sections with old sections that created by Greitzer and Dan, 1986. It can be concluded that's were used to present the findings.
- The sections presents soil, and rock types changes along these directions some of these proposed sections correlated well with previous sections suggested by others, while others show different sections.
- Presence of thick clay lens reduces the infiltrated rainwater to replenish the groundwater and minimizes aquifer capacity of store more quantities of freshwater.
- There are significant variations in terms of available lithological information and shape of the present clay lenses in the old cross section.
- Thickness of saturated zone in the Western part of the aquifer in the study area is about 90m decreasing gradually toward the East and Southeast to 20m or less. There are three or four clay lenses intruded the aquifer land, and divided the main coastal aquifer into three or four sub aquifers.

6.2 Recommendations:

According to obtained results the following main recommendations can be generated:

- Create Data bank over the Internet that contains geological and geotechnical characteristics to get them on demand.
- Collect more data to be as for building 3 dimensions model for Gaza strip.
- Selecting new geotechnical characteristics to conduct the same studies.
- Standardization the geological terminology during drilling wells and description.
- Regards geological characteristics of the soil, water levels (tables) can be integrated to gain more information about water resources with more areas.
- The collected data maps is a very important tool that can be used to:
    - ✓ Determine location of solid waste
    - ✓ Define, building areas
    - ✓ Mark areas for agriculture purposes
    - ✓ Assign areas to be used for wastewater treatment plants.

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APPENDICES

Annex I: Lithological and Wells Log Data

Borehole ID: AT_95_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 95491
Y-Cordinate: 1002633
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
0		Sand	0.00	
14			-3.00	
16		Kurkar	15.00	
42			-24.00	
44		Clay	42.00	
50			-32.00	
52		Kurkar	50.00	

Total Depth: 183.5
logged by: Hazem Altayeb

Borehole ID: AT_95_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 95491
Y-Cordinate: 1002633
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
67				
69			-52.00	
71		Clay	70.00	
75			-57.00	
77		Kurkar	75.00	
95			-77.00	
97		Clay	95.00	
115			-97.00	
117		Sandstone	115.00	
129				

Total Depth: 183.5
logged by: Hazem Altayeb

Borehole ID: AT_95_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 95491
Y-Cordinate: 1002633
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
132				
156			-138.00	
158		Sandstone	156.00	
182			-165.50	
184			183.50	
194				

Total Depth: 183.5
logged by: Hazem Altayeb

Borehole ID: AT_95_2
Location:
Well type:
Elevatin: 40

X-Cordinate: 97170
Y-Cordinate: 99590
Total Depth: 38.7
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Clay	0.00	
20			-20.00	
20		Kurkar	20.00	
38			-1.30	
40			38.70	

Total Depth: 38.7
logged by: Hazem Altayeb

Borehole ID: AT_95_3
Location:
Well type:
Elevatin: 40

X-Cordinate: 98540
Y-Cordinate: 99480
Total Depth: 37
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Clay	0.00	
			18.00	
22		Kurkar	22.00	
			14.00	
26		Clay	26.00	
			9.00	
32		Kurkar	31.00	
			3.00	
36			37.00	
38				
40				

Total Depth: 37

logged by: Hazem Altayeb

Borehole ID: AT_95_5
Location:
Well type:
Elevatin: 55

X-Cordinate: 100500
Y-Cordinate: 98500
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	55.00	
0		Clay	0.00	
			47.00	
8		Kurkar	8.00	
			43.00	
12		Clay	12.00	
			41.00	
14		Kurkar	14.00	
			21.00	
34		Clay	34.00	
			17.00	
38		Kurkar	38.00	
44				

Total Depth: 84

logged by: Hazem Altayeb

Borehole ID: AT_95_5
Location:
Well type:
Elevatin: 55

X-Cordinate: 100500
Y-Cordinate: 98500
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
47			7.00	
		Clay	48.00	
49			3.00	
		Kurkar	52.00	
53				
79			-25.00	
		Sandstone	80.00	
81			-29.00	
			84.00	
83				
85				
87				
89				

Total Depth: 84

logged by: Hazem Altayeb

Borehole ID: AT_96_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 96403
Y-Cordinate: 103516
Total Depth: 163
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
0		Sand	0.00	
			-2.00	
20		Kurkar	20.00	
			-30.00	
48		Clay	48.00	
			-35.00	
52		Kurkar	53.00	
60				

Total Depth: 163

logged by: Hazem Altayeb

Borehole ID: AT_96_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 96403
Y-Cordinate: 103516
Total Depth: 163
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-45.00	
		Clay	63.00	
			-50.00	
		Kurkar	68.00	
			-65.00	
		Clay	83.00	
			-85.00	
		Sandstone	103.00	

Total Depth: 163

logged by: Hazem Altayeb

Borehole ID: AT_96_1
Location:
Well type:
Elevatin: 18

X-Cordinate: 96403
Y-Cordinate: 103516
Total Depth: 163
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-132.00	
		Sandstone	150.00	
			-145.00	
			163.00	

Total Depth: 163

logged by: Hazem Altayeb

Borehole ID: AT_96_2
Location:
Well type:
Elevatin: 40

X-Cordinate: 96920
Y-Cordinate: 103150
Total Depth: 62
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
		Sand	0.00	
			25.00	
		Kurkar	15.00	
			3.00	
		Clay	37.00	
			-1.00	
		Kurkar	41.00	
			-22.00	
			62.00	

Total Depth: 62

logged by: Hazem Altayeb

Borehole ID: AT_96_3
Location:
Well type:
Elevatin: 40

X-Cordinate: 97950
Y-Cordinate: 102570
Total Depth: 55
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
		Sand	0.00	
			30.00	
		Kurkar	10.00	
			18.00	
		Clay	22.00	
			13.00	
		Kurkar	27.00	
			8.00	
		Clay	32.00	
			3.00	
		Kurkar	37.00	
			-15.00	
			55.00	

Total Depth: 55

logged by: Hazem Altayeb

Borehole ID: AT_96_4
Location:
Well type:
Elevatin: 70

X-Cordinate: 99600
Y-Cordinate: 98700
Total Depth:
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	70.00	
0		Clay	0.00	
62.00				
		Kurkar	8.00	
58.00				
		Clay	12.00	
			56.00	
		Kurak	14.00	
36.00				
		CLay	34.00	
			36.00	
		Kurkar	36.00	
29.00				
		Clay	41.00	
25.00				
		Kurkar	45.00	
15.00				
		Clay	55.00	
11.00				
		Kurkar	59.00	
-3.50				
74			73.50	

Total Depth:

logged by: Hazem Altayeb

Borehole ID: AT_96_5
Location:
Well type:
Elevatin: 59

X-Cordinate: 100500
Y-Cordinate: 98500
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	59.00	
0		Clay	0.00	
49.00				
		Kurkar	10.00	
19.00				
		Clay	40.00	
16.00				
44		Kurkar	43.00	

Total Depth: 84

logged by: Hazem Altayeb

Borehole ID: AT_96_5
Location:
Well type:
Elevatin: 59

X-Cordinate: 100500
Y-Cordinate: 98500
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
47				
49				
51				
53				
55				
57				
59				
61				
-4.00				
63		Clay	63.00	
-9.00				
67		Kurkar	68.00	
69				
71				
73				
75				
77				
79				
81				
-25.00				
83			84.00	
85				
87				
89				

Total Depth: 84

logged by: Hazem Altayeb

Borehole ID: AT_97_4
Location: N G
Well type:
Elevatin: 31.5

X-Cordinate: 100950
Y-Cordinate: 102520
Total Depth: 49
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	31.50	
0		Clay	0.00	
		Clay		
28.00				
		Kurkar	3.50	
		Kurkar		
-17.50				
50			49.00	

Total Depth: 49

logged by: Hazem Altayeb

Borehole ID: AT_97_5
Location: N G
Well type:
Elevatin: 61

X-Cordinate: 101970
Y-Cordinate: 102410
Total Depth: 89
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	61.00	
0		**Sandy Clay** Sandy Clay	0.00	
52.50				
8		**Kurkar** Kurkar	8.50	
14.00				
46		**Clay** Clay	47.00	
10.50				
50			50.50	

Total Depth: 89
logged by: Hazem Altayeb

Borehole ID: AT_97_5
Location: N G
Well type:
Elevatin: 61

X-Cordinate: 101970
Y-Cordinate: 102410
Total Depth: 89
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
52		**Kurkar** Kurkar		
88			-28.00	
89.00				
90				
100				

Total Depth: 89
logged by: Hazem Altayeb

Borehole ID: AT_97_7
Location: N G
Well type:
Elevatin: 40

X-Cordinate: 102670
Y-Cordinate: 102040
Total Depth: 107
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	48.00	
0		**Sand** Sand	0.00	
43.00				
4		**Kurkar** Clay	5.00	
31.00				
16		**Clay** Kurkar	17.00	
27.50				
20		**kurkar**	20.50	
13.50				
34		**clay**	34.50	
10.00				
38		**Kurkar**	38.00	
6.50				
42		**Clay**	41.50	
3.00				
46		**Kurkar**	45.00	
54				

Total Depth: 107
logged by: Hazem Altayeb

Borehole ID: AT_97_7
Location: N G
Well type:
Elevatin: 40

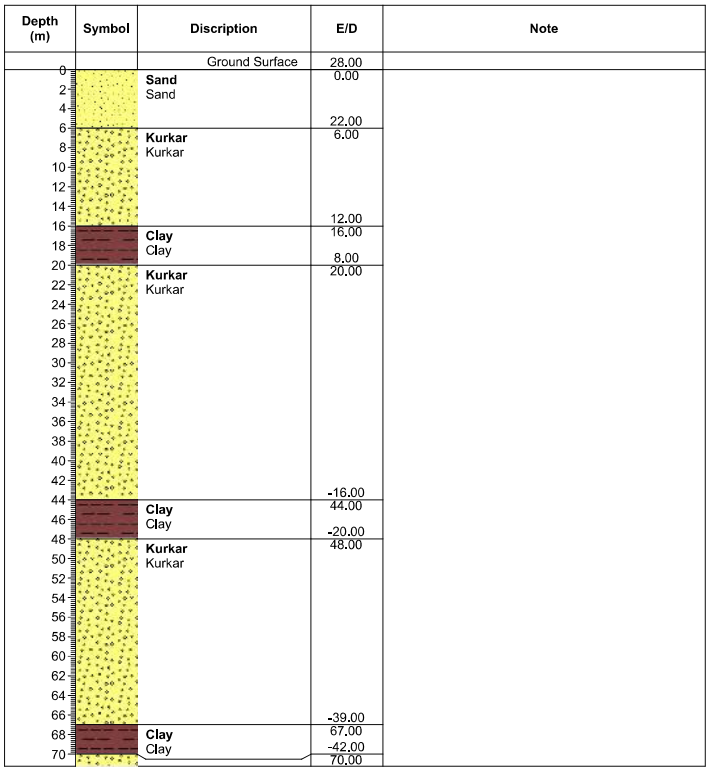
X-Cordinate: 102670
Y-Cordinate: 102040
Total Depth: 107
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
57				
71			-24.50	
72.50				
73		**Clay**	-28.00	
76.00				
75		**KUrkar**	-35.00	
83.00				
83		**Clay**	-38.50	
86.50				
87		**Sandstone**		
107			-59.00	
107.00				
109				

Total Depth: 107
logged by: Hazem Altayeb

Borehole ID: AT_98_1
Location: N G
Well type:
Elevatin: 28

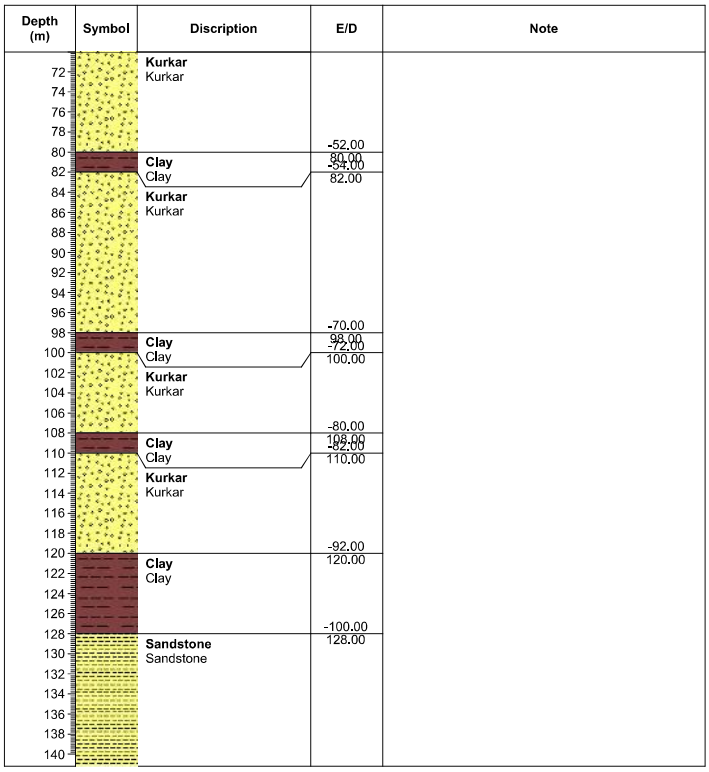
X-Cordinate: 98550
Y-Cordinate: 106918
Total Depth: 196
Water Level:



Total Depth: 196
logged by: Hazem Altayeb

Borehole ID: AT_98_1
Location: N G
Well type:
Elevatin: 28

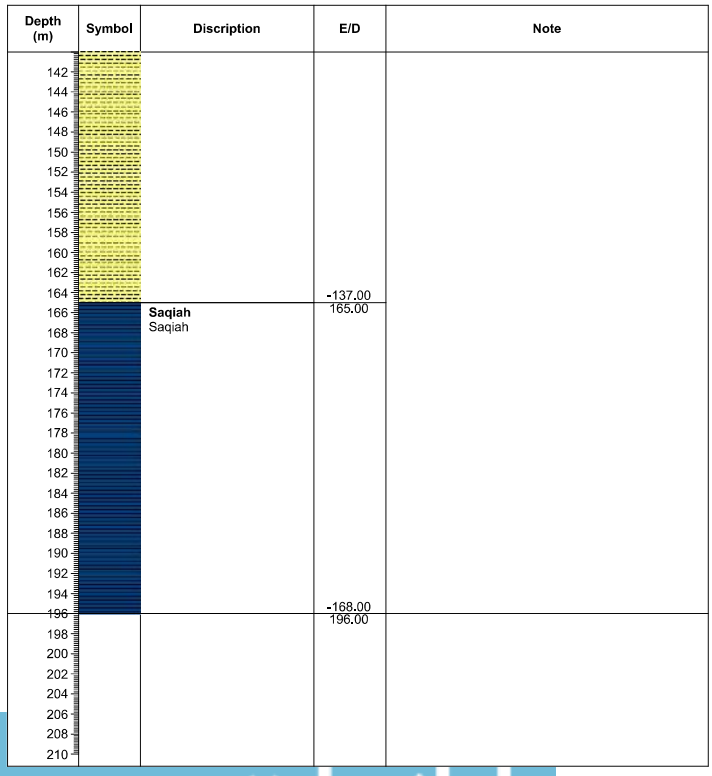
X-Cordinate: 98550
Y-Cordinate: 106918
Total Depth: 196
Water Level:



Total Depth: 196
logged by: Hazem Altayeb

Borehole ID: AT_98_1
Location: N G
Well type:
Elevatin: 28

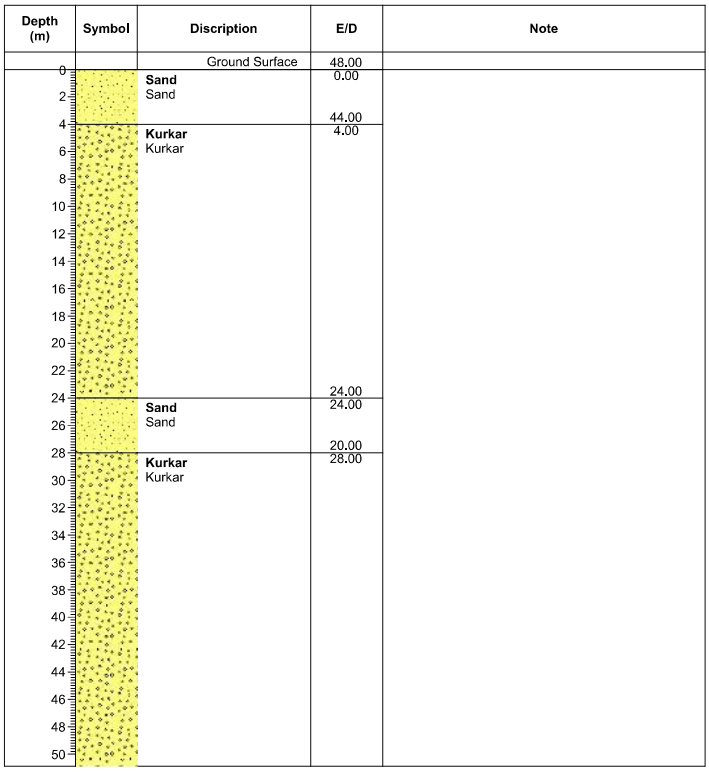
X-Cordinate: 98550
Y-Cordinate: 106918
Total Depth: 196
Water Level:



Total Depth: 196
logged by: Hazem Altayeb

Borehole ID: AT_98_2
Location: N G
Well type:
Elevatin: 48

X-Cordinate: 99916
Y-Cordinate: 105941
Total Depth: 86.5
Water Level:



Total Depth: 86.5
logged by: Hazem Altayeb

Borehole ID: AT_98_2
Location: N G
Well type:
Elevatin: 48

X-Cordinate: 99916
Y-Cordinate: 105941
Total Depth: 86.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-7.00	
		Clay Clay	55.00	
			-11.00	
		Kurkar Kurkar	59.00	
			-34.50	
		Clay Clay	82.50	
			-38.50	
			86.50	

Total Depth: 86.5
logged by: Hazem Altayeb

Borehole ID: B/14/1
Location: N G
Well type:
Elevatin: 72

X-Cordinate: 106823
Y-Cordinate: 106457
Total Depth: 65
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	72.00	
		Sand	0.00	
			62.00	
		Clay	10.00	
			38.00	
		Kurkar	34.00	
			7.00	
			65.00	

Total Depth: 65
logged by: Hazem Altayeb

Borehole ID: B/17/1
Location: N G
Well type:
Elevatin: 70

X-Cordinate: 107260
Y-Cordinate: 106141
Total Depth: 69
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	70.00	
		Sand	0.00	
			60.00	
		Clay	10.00	
			30.00	
		Kurkar	40.00	
			12.00	
		Clay	58.00	
			2.00	
		Kurkar	69.00	

Total Depth: 69
logged by: Hazem Altayeb

Borehole ID: BH/1
Location: N G
Well type:
Elevatin: 67

X-Cordinate: 107750
Y-Cordinate: 106000
Total Depth: 110
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	67.00	
		Clay Clay	0.00	
			37.00	
		Kurkar Kurkar	30.00	

Total Depth: 110
logged by: Hazem Altayeb

Borehole ID: BH/1
Location: N G
Well type:
Elevatin: 67

X-Cordinate: 107750
Y-Cordinate: 106000
Total Depth: 110
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-23.00	
		Sandstone Sandstone	90.00	
			-43.00	
			110.00	

Total Depth: 110
logged by: Hazem Altayeb

Borehole ID: BH/2
Location: N G
Well type:
Elevatin: 66

X-Cordinate: 106500
Y-Cordinate: 104900
Total Depth: 125
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	66.00	
		Sand Sand	0.00	
			46.00	
		Sandy Clay Sandy Clay	20.00	
			26.00	
		Kurkar Kurkar	40.00	

Total Depth: 125
logged by: Hazem ALtayeb

Borehole ID: BH/2
Location: N G
Well type:
Elevatin: 66

X-Cordinate: 106500
Y-Cordinate: 104900
Total Depth: 125
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-24.00	
		Clay Clay	90.00	
			-29.00	
		Sandstone Sandstone	95.00	
			-59.00	
			125.00	

Total Depth: 125
logged by: Hazem ALtayeb

Borehole ID: BH/4
Location: N G
Well type:
Elevatin: 42

X-Cordinate: 105450
Y-Cordinate: 102900
Total Depth: 114
Water Level:

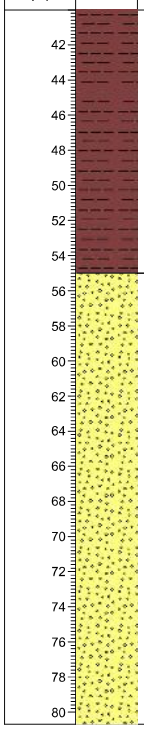
Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	42.00	
		Clay Clay	0.00	
			22.00	
		Sand Sand	20.00	
			12.00	
		Clay Clay	30.00	

Total Depth: 114
logged by: Hazem Altayeb

Borehole ID: BH/4
Location: N G
Well type:
Elevatin: 42

X-Cordinate: 105450
Y-Cordinate: 102900
Total Depth: 114
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-13.00	
		Kurkar Kurkar	55.00	

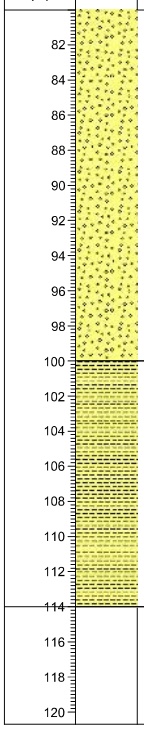


Total Depth: 114 — logged by: Hazem Altayeb

Borehole ID: BH/4
Location: N G
Well type:
Elevatin: 42

X-Cordinate: 105450
Y-Cordinate: 102900
Total Depth: 114
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-58.00	
		Sandstone Sandstone	100.00	
			-72.00	
			114.00	

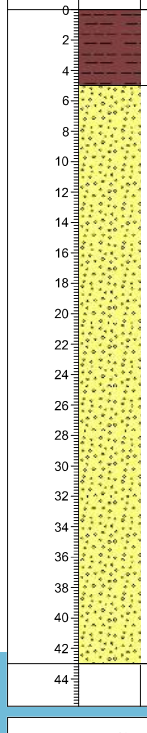


Total Depth: 114 — logged by: Hazem Altayeb

Borehole ID: BJ/1
Location: Gaza
Well type:
Elevatin: 20

X-Cordinate: 95200
Y-Cordinate: 96000
Total Depth: 43
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
		Clay	0.00	
			15.00	
		Kurkar	5.00	
			-23.00	
			43.00	

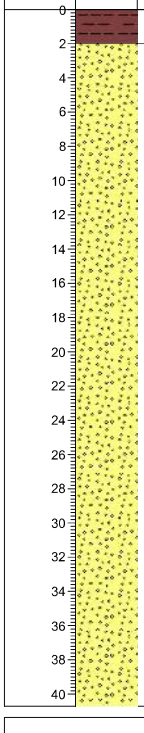


Total Depth: 43 — logged by: Hazem Altayeb

Borehole ID: BJ/3
Location: Gaza
Well type:
Elevatin: 35

X-Cordinate: 97000
Y-Cordinate: 95200
Total Depth: 75
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	35.00	
		Clay	0.00	
			33.00	
		Kurkar	2.00	



Total Depth: 75 — logged by: Hazem Altayeb

Borehole ID: BJ/3
Location: Gaza
Well type:
Elevatin: 35

X-Cordinate: 97000
Y-Cordinate: 95200
Total Depth: 75
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
60		Clay	-26.00 61.00	
62		Kurkar	-28.00 63.00	
74			-40.00 75.00	

Total Depth: 75
logged by: Hazem Altayeb

Borehole ID: BJ/4
Location: Gaza
Well type:
Elevatin: 45

X-Cordinate: 95700
Y-Cordinate: 95300
Total Depth: 46
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	45.00	
0		Clay	0.00	
18		Sand	27.00 18.00	
22		Clay	23.00 22.00	
24		Kurkar	21.00 24.00	
28		Clay	17.50 27.50	
36		Kurkar	9.50 35.50	
46			-1.00 46.00	

Total Depth: 46
logged by: Hazem Altayeb

Borehole ID: BLBH/2S
Location: N G
Well type:
Elevatin: 30

X-Cordinate: 103990
Y-Cordinate: 107140
Total Depth: 40
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Sand Sand	0.00	
8		Silty Clay Silty Clay	31.50 8.50	
20		Clay Clay	20.00 20.00 18.00	
22		Kurkar Kurkar	22.00	
40			0.00 40.00	

Total Depth: 40
logged by: Hazem Altayeb

Borehole ID: BLBH/4D
Location: N G
Well type:
Elevatin: 35

X-Cordinate: 104400
Y-Cordinate: 107000
Total Depth: 40
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	35.00	
0		Sand	0.00 33.00	
2		Clay	2.00	
10		Kurkar	25.50 9.50	
40			-5.00 40.00	

Total Depth: 40
logged by: Hazem Altayeb

Borehole ID: BLBH/10
Location: N G
Well type:
Elevatin: 35
X-Cordinate: 104420
Y-Cordinate: 107060
Total Depth: 11
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	35.00	
0		**Sand** Sand	0.00	
4			30.40	
		Clay Clay	4.60	
8			26.00	
		Sand Sand	9.00	
10			24.00	
			11.00	

Total Depth: 11
logged by: Hazem Altayeb

Borehole ID: C/137
Location: N G
Well type:
Elevatin: 66
X-Cordinate: 105080
Y-Cordinate: 106350
Total Depth: 91
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	66.00	
0		**Sand** Sand	0.00	
			64.00	
2		**Silt** Silt	2.00	
6			58.50	
8		**Sand** Sand	7.50	
18			48.00	
		Sandy Clay Sandy Clay	18.00	
22			44.00	
		Clay Gravely Clay	22.00	
26			40.00	
		Sand Sand	26.00	
30			37.00	
		Kurkar Kurkar	29.00	

Total Depth: 91
logged by: Hazem Altayeb

Borehole ID: C/137
Location: N G
Well type:
Elevatin: 66
X-Cordinate: 105080
Y-Cordinate: 106350
Total Depth: 91
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
90			-25.00	
			91.00	

Total Depth: 91
logged by: Hazem Altayeb

Borehole ID: C/140
Location: Northern Gaza
Well type:
Elevatin: 37
X-Cordinate: 104950
Y-Cordinate: 101500
Total Depth: 63.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	37.00	
0		**Clay** Clay	0.00	
20			17.00	
		Kurkar Kurkar	20.00	

Total Depth: 63.5
logged by: Hazem Altayeb

Borehole ID: C/140
Location: Northern Gaza
Well type:
Elevatin: 37

X-Cordinate: 104950
Y-Cordinate: 101500
Total Depth: 63.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-26.50	
			63.50	

Total Depth: 63.5

logged by: Hazem Altayeb

Borehole ID: CAMP-1 Pilot
Location: N G
Well type:
Elevatin: 24.42

X-Cordinate: 103589.2
Y-Cordinate: 107122.3
Total Depth: 150
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	24.42	
0		**Sand** Sand	0.00	
			21.42	
4		**Silty Clay** Silty Clay	3.00	
10			13.42	
12		**Kurkar** Kurkar	11.00	

Total Depth: 150

logged by: Hazem Altayeb

Borehole ID: CAMP-1 Pilot
Location: N G
Well type:
Elevatin: 24.42

X-Cordinate: 103589.2
Y-Cordinate: 107122.3
Total Depth: 150
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-33.58	
58		**Clay** Marly Clay	58.00	
			-36.08	
60		**Sandy Clay** Sandy Clay	60.50	
			-46.48	
70		**Kurkar** Kurkar	70.90	
			-65.58	
90		**Sandstone** Sandstone	90.00	

Total Depth: 150

logged by: Hazem Altayeb

Borehole ID: CAMP-1 Pilot
Location: N G
Well type:
Elevatin: 24.42

X-Cordinate: 103589.2
Y-Cordinate: 107122.3
Total Depth: 150
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-125.58	
150			150.00	

Total Depth: 150

logged by: Hazem Altayeb

Borehole ID: CAMP-4-Pilot
Location: Gaza
Well type:
Elevatin: 64.55

X-Cordinate: 97734.69
Y-Cordinate: 96591.44
Total Depth: 125
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	64.55	
0		Sandy Clay	0.00	
10			53.85	
10		Sand	10.70	
20			43.55	
22		Sandy Clay	21.00	
24		Sand		
30			32.95	
32		Sandy Clay	31.60	
34			30.65	
34		Kurkar	33.90	
36			28.35	
38		Silty Sand	36.20	
38			26.05	
40		Kurkar	38.50	

Total Depth: 125
logged by: Hazem ALtayeb

Borehole ID: CAMP-4-Pilot
Location: Gaza
Well type:
Elevatin: 64.55

X-Cordinate: 97734.69
Y-Cordinate: 96591.44
Total Depth: 125
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
85			-21.15	
87		Silty Sand	85.70	
91			-26.75	
93		Kurkar	91.30	
95			-31.15	
97		Sandstone	95.70	
125			-60.45	
125			125.00	

Total Depth: 125
logged by: Hazem ALtayeb

Borehole ID: CAMP-10-Pilot
Location: N G
Well type:
Elevatin: 81.88

X-Cordinate: 107429.5
Y-Cordinate: 103939.6
Total Depth: 145
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	81.88	
0		Silty Clay Silty Clay	0.00	
20			61.88	
20		Silty Sand Silty Sand	20.00	
34			47.88	
34		Kurkar Kurkar	34.00	
42			39.78	
42		Clayey Sand Clayey Sand	42.10	
48			33.78	
48		Kurkar Kurkar	48.10	

Total Depth: 145
logged by: Hazem Altayeb

Borehole ID: CAMP-10-Pilot
Location: N G
Well type:
Elevatin: 81.88

X-Cordinate: 107429.5
Y-Cordinate: 103939.6
Total Depth: 145
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
99			-17.12	
99		Sandstone Sandstone	99.00	
115			-33.02	
117		Clay Clay	-35.12	
117			117.00	
145		Sandstone Sandstone	-63.12	
145			145.00	

Total Depth: 145
logged by: Hazem Altayeb

Borehole ID: CB-04
Location: Gaza
Well type:
Elevatin: 60.28

X-Cordinate: 103873
Y-Cordinate: 101673
Total Depth: 70.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	60.28	
0		**Clay**	0.00	
6			53.08	
8		**Sand**	7.20	
16			44.08	
18		**Kurkar**	16.20	
70			-10.22	
			70.50	

Total Depth: 70.5
logged by: Hazem ALtayeb

Borehole ID: D/75-pilot
Location: N G
Well type:
Elevatin: 20.8

X-Cordinate: 101076.8
Y-Cordinate: 105813.5
Total Depth: 141
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.80	
0		**Sand** FINE SAND	0.00	
			17.30	
4		**Silty Clay** SILTY CLAY	3.50	
14			6.30	
16		**Kurkar** Kurkar	14.50	
22			-1.20	
24		**Silty Clay** SILTY CLAY	22.00	
26			-5.20	
28		**Kurkar** Kurkar	26.00	
40				

Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: D/75-pilot
Location: N G
Well type:
Elevatin: 20.8

X-Cordinate: 101076.8
Y-Cordinate: 105813.5
Total Depth: 141
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
42				
78			-57.70	
			78.50	
80		**Clay** MARLY CLAY		

Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: D/75-pilot
Location: N G
Well type:
Elevatin: 20.8

X-Cordinate: 101076.8
Y-Cordinate: 105813.5
Total Depth: 141
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
86			-65.70	
		Silty Clay Silty Clay	86.50 -67.20	
88		**Kurkar**	88.00	
102			-81.20	
		Clay MARLY CLAY	102.00	
104			-84.20	
106		**Sandstone** Sandstone	105.00	
120				

Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: D/75-pilot
Location: N G
Well type:
Elevatin: 20.8

X-Cordinate: 101076.8
Y-Cordinate: 105813.5
Total Depth: 141
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-120.20	
			141.00	

Total Depth: 141

logged by: Hazem Altayeb

Borehole ID: DB/6
Location:
Well type:
Elevatin: 9

X-Cordinate: 85100
Y-Cordinate: 91050
Total Depth: 24
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	9.00	
0		**Sand**	0.00	
			-3.00	
12		**Kurkar**	12.00	
			-15.00	
24			24.00	

Total Depth: 24

logged by: Hazem Altayeb

Borehole ID: E/54A
Location: GAZA
Well type:
Elevatin: 40

X-Cordinate: 99335
Y-Cordinate: 105060
Total Depth: 68
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		**Sand** Sand	0.00	
			32.50	
8		**Clayey Sand** Clayey Sand	7.50	
			25.00	
14		**Kurkar** Kurkar	15.00	
			-7.00	
46		**Clay**	47.00	
			-12.00	
52		**Kurkar**	52.00	
			-17.00	
57		**Clayey Sand** Clayey Sand	57.00	
			-28.00	
68			68.00	

Total Depth: 68

logged by: Hazem ALtayeb

Borehole ID: E/156
Location: N G
Well type:
Elevatin: 27

X-Cordinate: 102067
Y-Cordinate: 104589
Total Depth: 80
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	27.00	
0		**Sand** Sand	0.00	
			7.00	
20		**Clay** Red Clay	20.00	
			2.00	
25		**Kurkar** Kurkar	25.00	

Total Depth: 80

logged by: Hazem Altayeb

Borehole ID: E/156
Location: N G
Well type:
Elevatin: 27

X-Cordinate: 102067
Y-Cordinate: 104589
Total Depth: 80
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
42				
44				
46				
48				
50				
52				
54				
56				
58				
60				
62				
64				
66				
68				
70				
72				
74				
76				
78				
80			-53.00	
			80.00	

Total Depth: 80

logged by: Hazem Altayeb

Borehole ID: E/161
Location: Gaza
Well type:
Elevatin: 28

X-Cordinate: 100300
Y-Cordinate: 104000
Total Depth: 45
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	28.00	
0		**Sand**	0.00	
2		Silty Sand		
4			23.00	
6		**Clay**	5.00	
8		Clay		
10			17.00	
12		**Kurkar**	11.00	
14		Kurkar		
16				
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
42				
44			-17.00	
46			45.00	
48				
50				

Total Depth: 45

logged by: Hazem Altayeb

Borehole ID: Al-Musadar well
Location: M G
Well type:
Elevatin: 61

X-Cordinate: 91852
Y-Cordinate: 90909
Total Depth: 78
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	61.00	
0		**Sand**	0.00	
2				
4				
6			54.00	
8		**Clay**	7.00	
10				
12				
14			46.00	
16		**Kurkar**	15.00	
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				

Total Depth: 78

logged by: Hazem Altayeb

Borehole ID: Al-Musadar well
Location: M G
Well type:
Elevatin: 61

X-Cordinate: 91852
Y-Cordinate: 90909
Total Depth: 78
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
42				
44				
46			15.00	
48		**Clayey Sand**	13.00	
50		**Kurkar**	47.00	
52				
54				
56				
58				
60				
62				
64				
66				
68				
70				
72				
74				
76				
78			-17.00	
80			78.00	

Total Depth: 78

logged by: Hazem Altayeb

Borehole ID: EZ/1
Location:
Well type:
Elevatin: 30

X-Cordinate: 89500
Y-Cordinate: 91250
Total Depth: 53
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	30.00	
0		Sand	0.00	
25.00				
6		Clay	5.00	
10.00				
20		Sand	20.00	
5.00				
26		Clay	25.00	
0.00				
30		Silt	30.00	
-18.00				
48		Clay	48.00	
-23.00				
53.00				

Total Depth: 53
logged by: Hazem Altayeb

Borehole ID: F/68B
Location: Gaza
Well type:
Elevatin: 32

X-Cordinate: 94998
Y-Cordinate: 96627
Total Depth: 35
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	32.00	
0		Sand	0.00	
27.00				
6		Clay	5.00	
2.00				
30		Kurkar	30.00	
-3.00				
35.00				

Total Depth: 35
logged by: Hazem Altayeb

Borehole ID: F/191
Location: Gaza
Well type:
Elevatin: 31.22

X-Cordinate: 94959
Y-Cordinate: 98951
Total Depth: 64
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	31.22	
0		Sand	0.00	
26.22				
6		Clay	5.00	
23.22				
8		Kurkar	8.00	
3.22				
28		Clay	28.00	
1.22				
30		Kurkar	30.00	
-1.78				
34		Clay	33.00	
-4.78				
36		Kurkar	36.00	
-21.28				
52		Clay	52.50	
-26.28				
58		Kurkar	57.50	
-32.78				
64			64.00	

Total Depth: 64
logged by: Hazem Altayeb

Borehole ID: F/199
Location: Gaza
Well type:
Elevatin: 24

X-Cordinate: 95150
Y-Cordinate: 98500
Total Depth: 52.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	24.00	
0		Sand	0.00	
15.50				
8		Sandy CLay	8.50	
13.00				
12		Silty Clay	11.00	
11.50				
		Kurkar	12.50	
-1.50				
26		Clay	25.50	
		Sandy Clay		
-7.00				
32		Kurkar	31.00	
-10.50				
34		SAndy Clay	34.50	
-17.50				
42		Kurkar	41.50	
-28.50				
52			52.50	

Total Depth: 52.5
logged by: Hazem Altayeb

Borehole ID: F/204
Location: Gaza
Well type:
Elevatin: 54

X-Cordinate: 96850
Y-Cordinate: 95670
Total Depth: 65
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	54.00	
0		Clay	0.00	
50			50.00	
		Sandy Clay	4.00	
46			46.00	
		Sand	8.00	
32			32.00	
		Clay	22.00	
			29.00	
		Sandy Clay	25.00	
			27.00	
		Clay	27.00	
17			17.00	
		Kurkar	37.00	
-5			-5.00	
		SAndy Clay	59.00	
		Clayey Sand		
-10			-10.00	
		Kurkar	64.00	
			65.00	

Total Depth: 65
logged by: Hazem Altayeb

Borehole ID: F/205
Location: Gaza
Well type:
Elevatin: 60

X-Cordinate: 97120
Y-Cordinate: 96350
Total Depth: 82
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	60.00	
0		Silty Clay	0.00	
33			33.00	
		Clay	27.00	
24			24.00	
		Kurkar	36.00	

Total Depth: 82
logged by: Hazem Altayeb

Borehole ID: F/205
Location: Gaza
Well type:
Elevatin: 60

X-Cordinate: 97120
Y-Cordinate: 96350
Total Depth: 82
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
8		Clay	8.00	
			52.00	
		Kurkar	53.00	
-22			-22.00	
			82.00	

Total Depth: 82
logged by: Hazem Altayeb

Borehole ID: Fi/2
Location: Gaza
Well type:
Elevatin: 30

X-Cordinate: 96550
Y-Cordinate: 96880
Total Depth: 49
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	30.00	
0		Clay	0.00	
8			8.00	
		Kurkar	22.00	
-19			-19.00	
			49.00	

Total Depth: 49
logged by: Hazem Altayeb

Borehole ID: Fi/3
Location: Gaza
Well type:
Elevatin: 32

X-Cordinate: 96050
Y-Cordinate: 94750
Total Depth: 35
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	32.00	
0		Sand	0.00	
20			11.00	
22		Clay	21.00	
30			2.00	
32		Kurkar	30.00	
34			-3.00	
36			35.00	
40				

Total Depth: 35
logged by: Hazem Altayeb

Borehole ID: Fi/7
Location:
Well type:
Elevatin: 57

X-Cordinate: 96850
Y-Cordinate: 95950
Total Depth: 60
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	57.00	
0		Clay	0.00	
6			50.00	
8		Sand	7.00	
28			29.00	
30		Kurkar	28.00	
60			-3.00	
			60.00	

Total Depth: 60
logged by: Hazem Altayeb

Borehole ID: Fi/8
Location: Gaza
Well type:
Elevatin: 32

X-Cordinate: 95700
Y-Cordinate: 97200
Total Depth: 44
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	32.00	
0		Sand	0.00	
2			29.00	
4		Kurkar	3.00	
42			-12.00	
44			44.00	

Total Depth: 44
logged by: Hazem Altayeb

Borehole ID: G/1
Location:
Well type:
Elevatin: 22

X-Cordinate: 90937
Y-Cordinate: 95740
Total Depth: 60
Water Level:

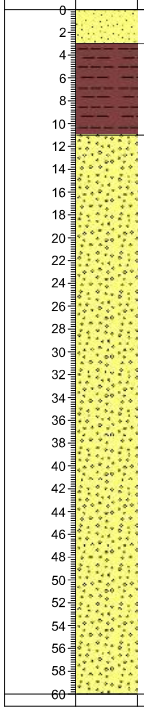
Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
0		Sand	0.00	
4			18.00	
6		Clay	4.00	
16			4.00	
18		Kurkar	18.00	
60			-38.00	
			60.00	

Total Depth: 60
logged by: Hazem Altayeb

Borehole ID: G/2
Location:
Well type:
Elevatin: 22

X-Cordinate: 90544
Y-Cordinate: 95713
Total Depth: 60
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
0		Sand	0.00	
			19.00	
4		Clay	3.00	
10			11.00	
12		Kurkar	11.00	
60			-38.00	
			60.00	

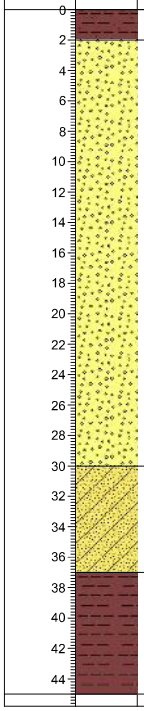


Total Depth: 60
logged by: Hazem Altayeb

Borehole ID: G/45
Location:
Well type:
Elevatin: 29

X-Cordinate: 91853
Y-Cordinate: 95530
Total Depth: 45
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	29.00	
0		Sandy Clay	0.00	
2			27.00	
		Kurkar	2.00	
30			-1.00	
		Clayey Sand	30.00	
36			-8.00	
38		Clay	37.00	
44			-16.00	
			45.00	

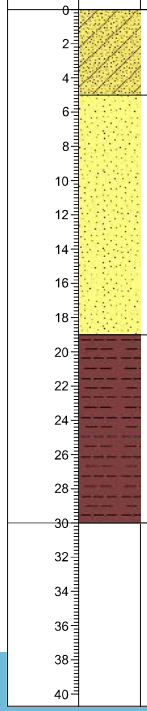


Total Depth: 45
logged by: Hazem Altayeb

Borehole ID: G/49
Location:
Well type:
Elevatin: 9

X-Cordinate: 91376.81
Y-Cordinate: 96448.37
Total Depth: 30
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	9.00	
0		Clayey Sand	0.00	
4			4.00	
		Sand	5.00	
20			-10.00	
		Clay	19.00	
30			-21.00	
			30.00	

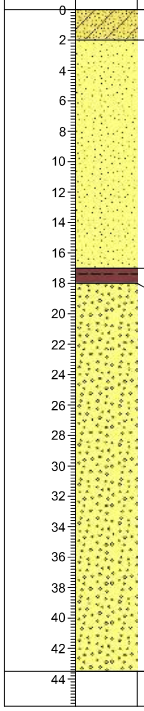


Total Depth: 30
logged by: Hazem Altayeb

Borehole ID: G/56
Location: Gaza
Well type:
Elevatin: 23

X-Cordinate: 93450
Y-Cordinate: 97890
Total Depth: 43.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	23.00	
0		Clayey Sand	0.00	
2			21.00	
		Sand	2.00	
16			6.00	
18		Clay	5.00	
		Kurkar	18.00	
42			-20.50	
			43.50	



Total Depth: 43.5
logged by: Hazem Altayeb

Borehole ID: G/503
Location:
Well type:
Elevatin: 11

X-Cordinate: 90308
Y-Cordinate: 96402
Total Depth: 33
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	11.00	
0		Sand	0.00	
			8.50	
2		Sandy Clay	2.50	
4			6.00	
6		Sand	5.00	
8				
10				
12				
14			-4.00	
16		Clay	15.00	
		Kurkar	16.00	
18				
20				
22				
24				
26				
28				
30				
32			-22.00	
			33.00	
34				
36				
38				
40				

Total Depth: 33
logged by: Hazem Altayeb

Borehole ID: H/88
Location:
Well type:
Elevatin: 2

X-Cordinate: 88999
Y-Cordinate: 94727
Total Depth: 30
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	2.00	
0		Sand	0.00	
2				
4				
6				
8				
10				
12				
14				
16				
18				
			-18.00	
20		Clay	20.00	
			-20.00	
22		Kurkar	22.00	
24				
26				
28				
			-28.00	
30			30.00	
32				
34				
36				
38				
40				

Total Depth: 30
logged by: Hazem Altayeb

Borehole ID: H/98
Location:
Well type:
Elevatin: 3.5

X-Cordinate: 87700
Y-Cordinate: 93700
Total Depth: 63
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	3.50	
0		Sand	0.00	
2				
4				
6				
8				
10			-6.50	
		Kurkar	10.00	
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32			-29.00	
		Silty Clay	32.50	
34			-31.50	
		Clayey Sand	35.00	
36				
38			-36.50	
		Clay	40.00	
40				
42				
44				
46				
48				
50			-47.50	
		Kurkar	51.00	
52				
54			-52.50	
		Clayey Sand	56.00	
56			-55.50	
		Kurkar	59.00	
58				
60			-59.50	
			63.00	
62				
64				

Total Depth: 63
logged by: Hazem Altayeb

Borehole ID: J/13
Location:
Well type:
Elevatin: 36

X-Cordinate: 89464
Y-Cordinate: 90417
Total Depth: 56
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	36.00	
0		Clay	0.00	
2		Sand	33.00	
4		Clay	3.00	
6				
8				
10				
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				
34			1.00	
36		Kurkar	35.00	
38				
40				
42				
44				
46				
48				
50				
52				
54				
56			-20.00	
			56.00	
58				
60				

Total Depth: 56
logged by: Hazem Altayeb

Borehole ID: J/85
Location:
Well type:
Elevatin: 33
X-Cordinate: 88950
Y-Cordinate: 91606
Total Depth: 27
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	33.00	
0		Clay	0.00	
26			6.00	
			27.00	

Total Depth: 27
logged by: Hazem Altayeb

Borehole ID: Ji/11
Location: Gaza
Well type:
Elevatin: 35
X-Cordinate: 96000
Y-Cordinate: 93900
Total Depth: 25.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	35.00	
0		Clay	0.00	
4			30.00	
6		Sand	5.00	
24			9.50	
26			25.50	

Total Depth: 25.5
logged by: Hazem Altayeb

Borehole ID: Ji/13
Location:
Well type:
Elevatin: 35
X-Cordinate: 88460
Y-Cordinate: 91600
Total Depth: 37
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	35.00	
0		Clay	0.00	
14			20.00	
16		Sand	15.00	
22			12.00	
24		Kurkar	23.00	
36			-2.00	
			37.00	

Total Depth: 37
logged by: Hazem Altayeb

Borehole ID: K/7A
Location:
Well type:
Elevatin: 21
X-Cordinate: 86450
Y-Cordinate: 89400
Total Depth: 46.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	21.00	
0		Sand	0.00	
2			18.00	
4		Clay	3.00	
16			5.00	
		Sand	16.00	
26			-6.00	
28		Clay	27.00	
36			-15.00	
		Kurkar	36.00	
46			-25.50	
			46.50	

Total Depth: 46.5
logged by: Hazem Altayeb

Borehole ID: K/20
Location:
Well type:
Elevatin: 22

X-Cordinate: 86265.3
Y-Cordinate: 89777.2
Total Depth: 47
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
0		Sand	0.00	
16		Sandy Clay	6.00 16.00	
22		Sand	0.00 22.00	
26		Sandy Clay	-4.00 26.00	
42		Kurkar	-19.00 41.00	
46			-25.00 47.00	

Total Depth: 47
logged by: Hazem Altayeb

Borehole ID: K/21
Location:
Well type:
Elevatin: 18

X-Cordinate: 85916.63
Y-Cordinate: 89758.36
Total Depth: 37.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
0		Sand	0.00	
30		Clay	-12.00 30.00	
38			-19.50 37.50	

Total Depth: 37.5
logged by: Hazem Altayeb

Borehole ID: K/22
Location:
Well type:
Elevatin: 28

X-Cordinate: 86967.21
Y-Cordinate: 88875.54
Total Depth: 48
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	28.00	
0		Sand	0.00	
4		Clay	25.00 3.00	
26		Sand	2.00 26.00	
30		Clay	-1.00 29.00	
46		Kurkar	-17.00 45.00	
48			-20.00 48.00	

Total Depth: 48
logged by: Hazem Altayeb

Borehole ID: Maqboula
Location:
Well type:
Elevatin: 61

X-Cordinate: 93265
Y-Cordinate: 92337
Total Depth: 74
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	61.00	
0		Clayey Sand	0.00	
6		Sand	54.00 7.00	
10		Clayey Sand	51.00 10.00	
16		Sand	46.00 15.00	
20		Silty Sand	41.00 20.00	
24		Kurkar	36.00 25.00	

Total Depth: 74
logged by: Hazem Altayeb

Borehole ID: Maqboula
Location:
Well type:
Elevatin: 61
X-Cordinate: 93265
Y-Cordinate: 92337
Total Depth: 74
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Clay	-10.00 71.00 -13.00 74.00	

Total Depth: 74 **logged by:** Hazem Altayeb

Borehole ID: Netsarim
Location: Gaza
Well type:
Elevatin: 23
X-Cordinate: 94561.594
Y-Cordinate: 99104.648
Total Depth: 52
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	23.00	
		Sand	0.00 18.00	
		Clay	5.00 15.00	
		Kurkar	8.00 -29.00 52.00	

Total Depth: 52 **logged by:** Hazem Altayeb

Borehole ID: H/33
Location:
Well type:
Elevatin: 6
X-Cordinate: 88348
Y-Cordinate: 93489
Total Depth: 27
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	6.00	
		Sand	0.00	
		Clay	-9.00 15.00	
		Sand	-13.00 19.00	
		Kurkar	-36.00 42.00	

Total Depth: 27 **logged by:** Hazem Altayeb

Borehole ID: Q/16A
Location: Northern Gaza
Well type:
Elevatin: 48
X-Cordinate: 104339.39
Y-Cordinate: 101702.52
Total Depth: 82.4
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	48.00	
		Silty Clay Silty Clay	0.00 42.00	
		Sand Very fine sand	6.00 33.00	
		Kurkar Kurkar	15.00 23.00	
		Sand Sand	25.00 16.00	
		Kurkar Kurkar	32.00	

Total Depth: 82.4 **logged by:** Hazem Altayeb

Borehole ID: Q/16A
Location: Northern Gaza
Well type:
Elevatin: 48

X-Cordinate: 104339.39
Y-Cordinate: 101702.52
Total Depth: 82.4
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-2.00	
		Clay Clay	50.00	
			-6.00	
		Kurkar Kurkar	54.00	
			-17.00	
		Sandy Clay Sandy Clay	65.00	
			-34.40	
			82.40	

Total Depth: 82.4
logged by: Hazem Altayeb

Borehole ID: Q/70
Location: N G
Well type:
Elevatin: 51

X-Cordinate: 104500
Y-Cordinate: 102980
Total Depth: 86.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	51.00	
		Silty Clay Silty Clay	0.00	
			46.00	
		Clay Clay	5.00	
			34.00	
		Sandy Clay Sandy Clay	17.00	
			29.00	
		Sand Sand	22.00	
			23.50	
		Clay Clay	27.50	
			13.00	
		Kurkar Kurkar	38.00	

Total Depth: 86.5
logged by: Hazem ALtayeb

Borehole ID: Q/70
Location: N G
Well type:
Elevatin: 51

X-Cordinate: 104500
Y-Cordinate: 102980
Total Depth: 86.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-35.50	
			86.50	

Total Depth: 86.5
logged by: Hazem ALtayeb

Borehole ID: Q/72
Location: N G
Well type:
Elevatin: 46

X-Cordinate: 102530
Y-Cordinate: 103915
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	46.00	
		Sandy Clay Sandy Clay	0.00	
			36.00	
		Sand Sand	10.00	
			26.50	
		Kurkar Kurkar	19.50	

Total Depth: 84
logged by: Hazem Altayeb

Borehole ID: Q/72
Location: N G
Well type:
Elevatin: 46

X-Cordinate: 102530
Y-Cordinate: 103915
Total Depth: 84
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-38.00	
			84.00	

Total Depth: 84

logged by: Hazem Altayeb

Borehole ID: Q69A
Location: N G
Well type:
Elevatin: 46

X-Cordinate: 105170
Y-Cordinate: 102900
Total Depth: 111.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	46.00	
0		**Clay** Clay	0.00	
12			34.00	
		Sand Sand	12.00	
26			19.00	
		Kurkar Kurkar	27.00	
40				

Total Depth: 111.5

logged by: Hazem Altayeb

Borehole ID: Q69A
Location: N G
Well type:
Elevatin: 46

X-Cordinate: 105170
Y-Cordinate: 102900
Total Depth: 111.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			0.00	
46		**Silty Clay** Silty Clay	46.00	
			-14.00	
60		**Kurkar** Kurkar	60.00	
80				

Total Depth: 111.5

logged by: Hazem Altayeb

Borehole ID: Q69A
Location: N G
Well type:
Elevatin: 46

X-Cordinate: 105170
Y-Cordinate: 102900
Total Depth: 111.5
Water Level:

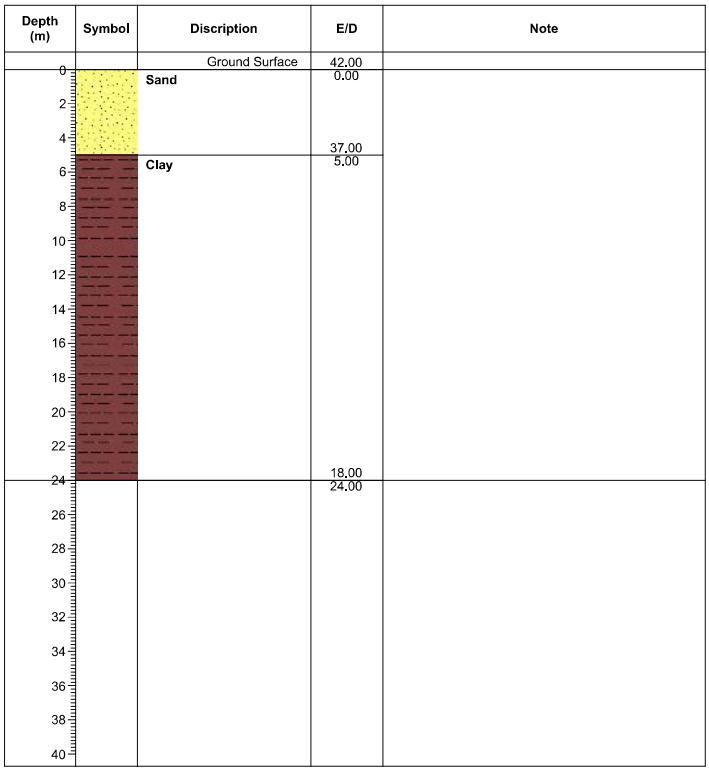
Depth (m)	Symbol	Discription	E/D	Note
			-37.00	
82		**Clay** Clay	83.00	
			-44.00	
90		**Kurkar**	90.00	
			-58.00	
104		**Sandstone** Sandstone	104.00	
			-65.50	
112			111.50	
120				

Total Depth: 111.5

logged by: Hazem Altayeb

Borehole ID: R/218
Location: Gaza
Well type:
Elevatin: 42

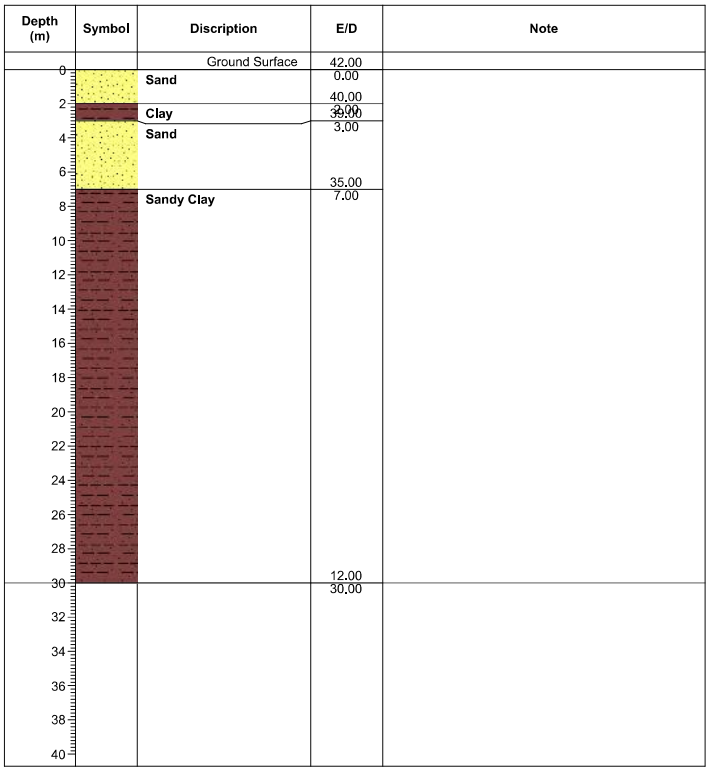
X-Cordinate: 97464
Y-Cordinate: 100763
Total Depth: 24
Water Level:



Total Depth: 24
logged by: Hazem Altayeb

Borehole ID: R/219
Location: Gaza
Well type:
Elevatin: 42

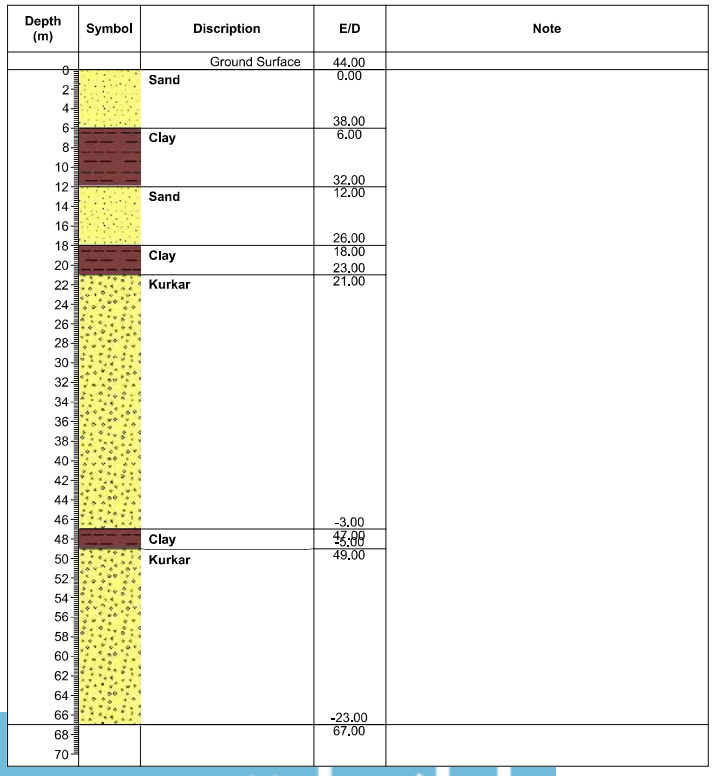
X-Cordinate: 97818
Y-Cordinate: 100174
Total Depth: 30
Water Level:



Total Depth: 30
logged by: Hazem Altayeb

Borehole ID: R/233
Location: Gaza
Well type:
Elevatin: 44

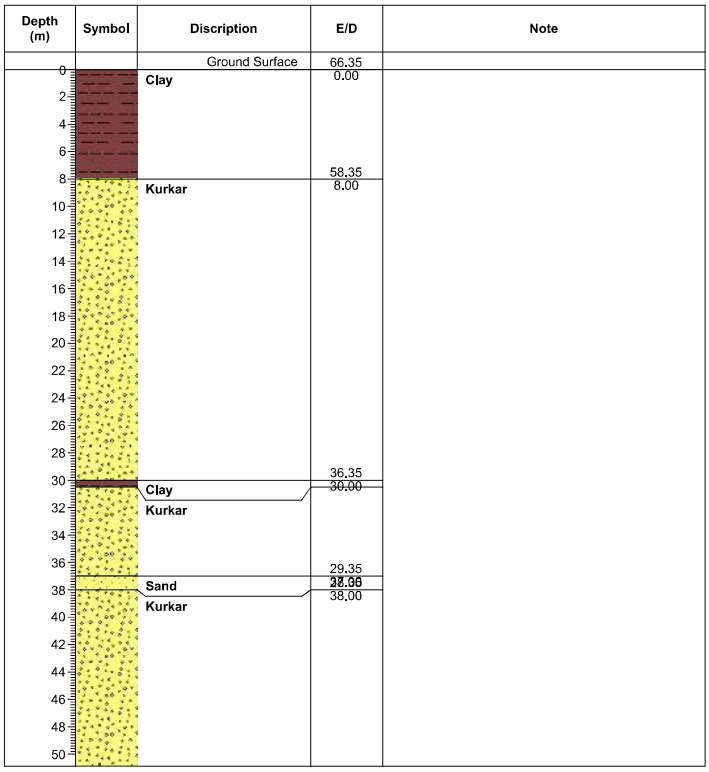
X-Cordinate: 97728
Y-Cordinate: 100921
Total Depth: 67
Water Level:



Total Depth: 67
logged by: Hazem Altayeb

Borehole ID: R/272A
Location: Gaza
Well type:
Elevatin: 66.35

X-Cordinate: 99390
Y-Cordinate: 98470
Total Depth: 95
Water Level:



Total Depth: 95
logged by: Hazem Altayeb

Borehole ID: R/272A
Location: Gaza
Well type:
Elevatin: 66.35

X-Cordinate: 99390
Y-Cordinate: 98470
Total Depth: 95
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-23.65	
		Clay	90.00	
			-28.65	
			95.00	

Total Depth: 95

logged by: Hazem Altayeb

Borehole ID: R/272B
Location:
Well type:
Elevatin: 64.01

X-Cordinate: 99828
Y-Cordinate: 98063
Total Depth: 100.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	64.01	
		Silty Clay	0.00	
			61.01	
		Kurkar	3.00	
			33.01	
		Clay	31.00	
			27.01	
		Kurkar	37.00	
			23.01	
		Sandy Clay	41.00	

Total Depth: 100.5

logged by: Hazem Altayeb

Borehole ID: R/272B
Location:
Well type:
Elevatin: 64.01

X-Cordinate: 99828
Y-Cordinate: 98063
Total Depth: 100.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-6.99	
		Kurkar	71.00	
			-27.99	
		Sandstone	92.00	
			-33.99	
		Sandy Clay	98.00	
			-36.49	
			100.50	

Total Depth: 100.5

logged by: Hazem Altayeb

Borehole ID: R/272C
Location: Gaza
Well type:
Elevatin: 61.82

X-Cordinate: 99942
Y-Cordinate: 98344
Total Depth: 101
Water Level:

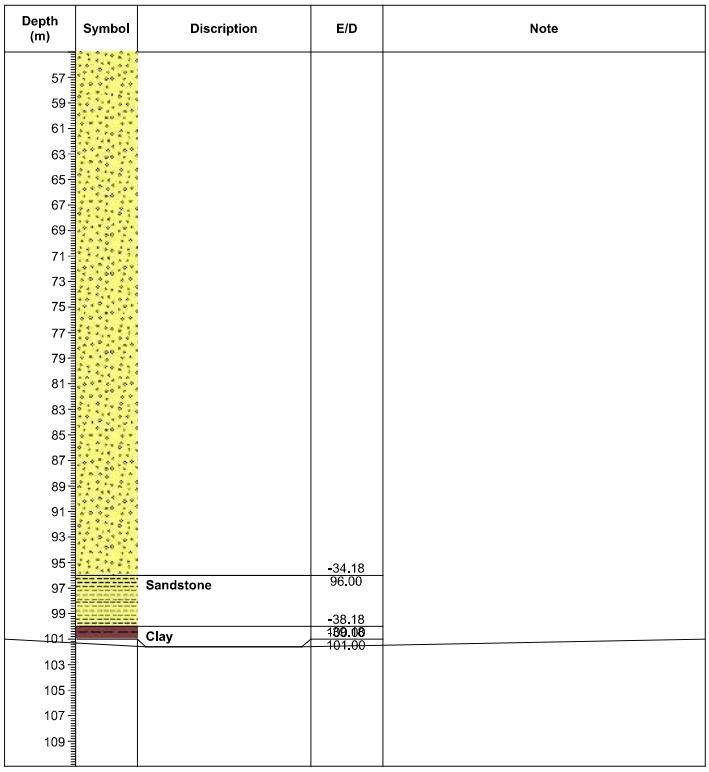
Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	61.82	
		Sandy Clay	0.00	
			52.82	
		Kurkar	9.00	
			34.82	
		Sandy Clay	27.00	
			29.82	
		Kurkar	32.00	
			26.82	
		Sandy Clay	35.00	
			7.82	
		Kurkar	54.00	

Total Depth: 101

logged by: Hazem Altayeb

Borehole ID: R/272C
Location: Gaza
Well type:
Elevatin: 61.82

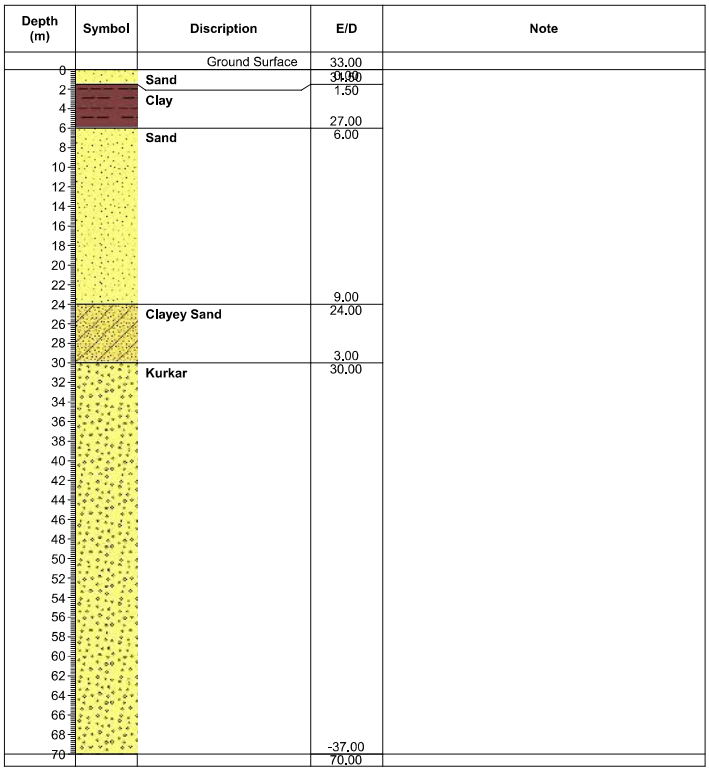
X-Cordinate: 99942
Y-Cordinate: 98344
Total Depth: 101
Water Level:



Total Depth: 101
logged by: Hazem Altayeb

Borehole ID: R/277
Location: Gaza
Well type:
Elevatin: 33

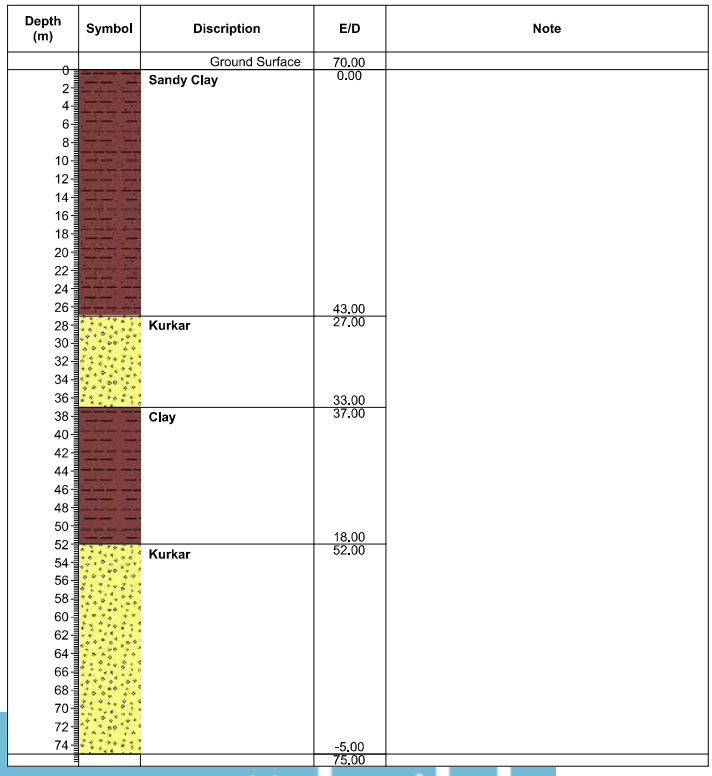
X-Cordinate: 96237
Y-Cordinate: 101529
Total Depth: 70
Water Level:



Total Depth: 70
logged by: Hazem Altayeb

Borehole ID: R/278
Location: Gaza
Well type:
Elevatin: 70

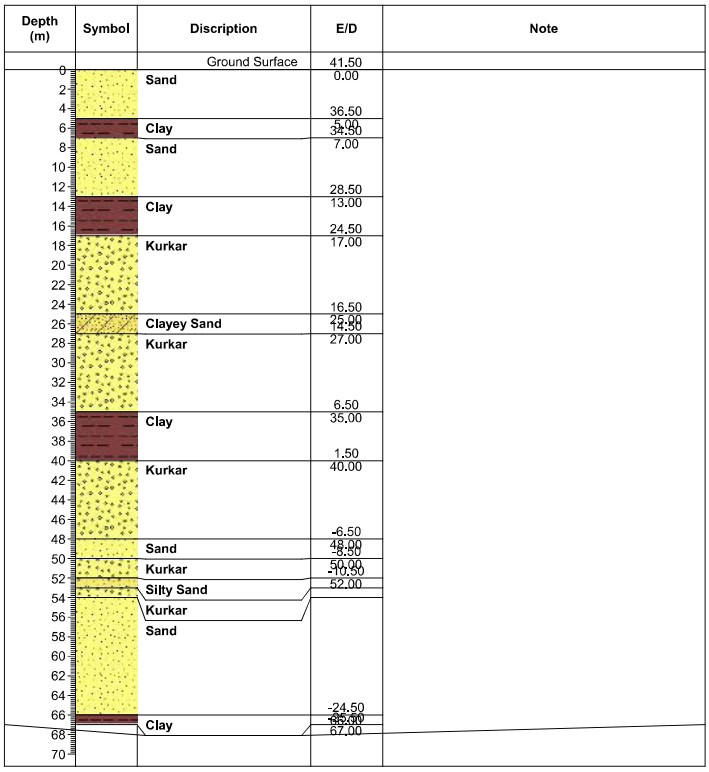
X-Cordinate: 99460
Y-Cordinate: 99140
Total Depth: 75
Water Level:



Total Depth: 75
logged by: Hazem Altayeb

Borehole ID: R/293
Location: Gaza
Well type:
Elevatin: 41.5

X-Cordinate: 96630
Y-Cordinate: 101300
Total Depth: 67
Water Level:



Total Depth: 67
logged by: Hazem Altayeb

Borehole ID: R/305
Location: Gaza
Well type:
Elevatin: 39.871
X-Cordinate: 97550.61
Y-Cordinate: 100273.5
Total Depth: 63
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	39.87	
0		Sand	0.00	
31.87				
8		Clay	8.00	
15.87				
24		Kurkar	24.00	
8.87				
31		Clay	31.00	
-4.13				
44		Kurkar	44.00	
-23.13				
63				

Total Depth: 63
logged by: Hazem Altayeb

Borehole ID: R/308
Location:
Well type:
Elevatin: 26.93
X-Cordinate: 98261.49
Y-Cordinate: 101595.9
Total Depth: 59.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	26.93	
0		Sand	0.00	
20.93				
6		Clay	6.00	
-0.07				
27		Kurkar	27.00	
-32.57				
59.5				

Total Depth: 59.5
logged by: Hazem Altayeb

Borehole ID: R/313
Location:
Well type:
Elevatin: 18
X-Cordinate: 97516.75
Y-Cordinate: 103065.1
Total Depth: 62
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
0		Sand	0.00	
14.00				
4		Silty Sand	4.00	
11.00				
7		Kurkar	7.00	
-12.00				
30		Silty Sand	30.00	
-17.00				
35		Kurkar	35.00	
-44.00				
62				

Total Depth: 62
logged by: Hazem Altayeb

Borehole ID: RG2
Location: Gaza
Well type:
Elevatin: 26
X-Cordinate: 95700
Y-Cordinate: 102350
Total Depth: 23.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	26.00	
0		Sand	0.00	
24.00				
2		Clay	2.00	
17.00				
9		Sand	9.00	
10.50				
15.5		Kurkar	15.50	
2.50				
23.5				

Total Depth: 23.5
logged by: Hazem Altayeb

Borehole ID: S/29
Location:
Well type:
Elevatin: 46

X-Cordinate: 93179
Y-Cordinate: 93846
Total Depth: 92
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	46.00	
0		Clay	0.00	
40			40.00	
40		Sand	6.00	
50			35.00	
50		Kurkar	11.00	

Total Depth: 92

logged by: Hazem Altayeb

Borehole ID: S/29
Location:
Well type:
Elevatin: 46

X-Cordinate: 93179
Y-Cordinate: 93846
Total Depth: 92
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
92			-46.00	
			92.00	

Total Depth: 92

logged by: Hazem Altayeb

Borehole ID: S/42A
Location:
Well type:
Elevatin: 64

X-Cordinate: 92800
Y-Cordinate: 91500
Total Depth: 90
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	64.00	
0		Sand	0.00	
44			44.00	
44		Sandy CLay	20.00	

Total Depth: 90

logged by: Hazem Altayeb

Borehole ID: S/42A
Location:
Well type:
Elevatin: 64

X-Cordinate: 92800
Y-Cordinate: 91500
Total Depth: 90
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
50		Kurkar	14.00	
			50.00	
68		Clay	-4.00	
			68.00	
75		Kurkar	-11.00	
			75.00	
90			-26.00	
			90.00	

Total Depth: 90

logged by: Hazem Altayeb

Borehole ID: S/61
Location:
Well type:
Elevatin: 26

X-Cordinate: 93065
Y-Cordinate: 94481
Total Depth: 29
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	26.00	
0		Clay	0.00	
19.00				
		Kurkar	7.00	
-3.00				
29.00				

Total Depth: 29
logged by: Hazem Altayeb

Borehole ID: S/65A
Location:
Well type:
Elevatin: 42

X-Cordinate: 91580
Y-Cordinate: 92340
Total Depth: 58
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	42.00	
0		Sandy Clay	0.00	
38.00				
		Sand	4.00	
27.00				
		Kurkar	15.00	
-16.00				
58.00				

Total Depth: 58
logged by: Hazem Altayeb

Borehole ID: S/69
Location:
Well type:
Elevatin: 68

X-Cordinate: 91768
Y-Cordinate: 90703
Total Depth: 91
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	68.00	
0		Sandy Clay	0.00	
43.00				
		Kurkar	25.00	
37.00				
		Clay	31.00	
		Kurkar	32.50	
29.00				
		Clay	39.00	
		Kurkar	40.00	
22.00				
		Clay	46.00	
		Kurkar	47.50	

Total Depth: 91
logged by: Hazem Altayeb

Borehole ID: S/69
Location:
Well type:
Elevatin: 68

X-Cordinate: 91768
Y-Cordinate: 90703
Total Depth: 91
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
13.00				
		Clay	55.00	
		KUrkar	11.00	
57.00				
-22.00				
		Clay	91.00	

Total Depth: 91
logged by: Hazem Altayeb

Borehole ID: S/71
Location:
Well type:
Elevatin: 71.46

X-Cordinate: 92675
Y-Cordinate: 91699
Total Depth: 86
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	71.46	
0		Sand	0.00	
4			67.46	
		Clay	4.00	
6			65.46	
		Silty Clay	6.00	
16			54.46	
		Sand	17.00	
30			40.46	
		Clay	31.00	
34			37.46	
		Clayey Sand	34.00	

Total Depth: 86

logged by: Hazem Altayeb

Borehole ID: S/71
Location:
Well type:
Elevatin: 71.46

X-Cordinate: 92675
Y-Cordinate: 91699
Total Depth: 86
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
53			17.46	
		kurkar	54.00	
83			-12.54	
		Clay	84.00	
85			-14.54	
			86.00	

Total Depth: 86

logged by: Hazem Altayeb

Borehole ID: S/72
Location:
Well type:
Elevatin: 44.4

X-Cordinate: 93201.02
Y-Cordinate: 93513
Total Depth: 66
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	44.41	
0		Clay	0.00	
16			28.41	
		Kurkar	16.00	
44			0.41	
		Clay	44.00	
50			-5.59	
		Kurkar	50.00	
66			-21.59	
			66.00	

Total Depth: 66

logged by: Hazem Altayeb

Borehole ID: S/72
Location:
Well type:
Elevatin: 44.4

X-Cordinate: 93201.02
Y-Cordinate: 93513
Total Depth: 66
Water Level:

Depth (m)	Symbol	Discription	E/D	Note

Total Depth: 66

logged by: Hazem Altayeb

Borehole ID: S/80
Location:
Well type:
Elevatin: 55
X-Cordinate: 91984
Y-Cordinate: 91891
Total Depth: 70
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	55.00	
0		Clay	0.00	
48.00				
		Kurkar	7.00	
28.00				
		Clayey Sand	27.00	
21.00				
		Kurkar	34.00	
-15.00				
70			70.00	

Total Depth: 70
logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72
X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	72.00	
0		Clayey Sand	0.00	
67.00				
		Sand	5.00	

Total Depth: 96.5
logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72
X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
62.00				
		Clayey Sand	10.00	
60.00				
		Sand	12.00	

Total Depth: 96.5
logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72
X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note

Total Depth: 96.5
logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
29				
31				
33				
35				
37				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
39		Clay	33.00 39.00	
41				
43				
45				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
48		Kurkar	24.00 48.00	
50				
52				
54				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
57				
59				
61				
63				
65				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
67				
69				
			2.00	
		Sandy Clay	70.00	
71				
73				
			-2.00	
		Kurkar	74.00	

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
76				
78				
80				
82				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-12.00	
		Sandy Clay	84.00	
85				
87				
89				
91				
93				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: S/82
Location:
Well type:
Elevatin: 72

X-Cordinate: 93250
Y-Cordinate: 91900
Total Depth: 96.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
95				
			-24.50	
			96.50	
97				
99				
101				

Total Depth: 96.5

logged by: Hazem Altayeb

Borehole ID: Shiekh Radwan Health Clinic
Location: GAZA
Well type:
Elevatin: 43
X-Cordinate: 99700
Y-Cordinate: 104530
Total Depth: 65
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	43.00	
0		**Sand**	0.00	
2		Sand	40.00	
4		**Silty Clay**	3.00	
6		Silty Clay		
8				
10				
12				
14				
16			26.00	
18		**Sand**	17.00	
20		Silty Sand		
22			20.00	
24		**Kurkar**	23.00	
26		Sand		
28				
30				
32				
34				
36				
38				
40				
42				
44			-1.00	
46		**Silty Clay**	44.00	
48		Silty Clay		
50			-8.00	
52		**Kurkar**	51.00	
54		Sand		
56				
58			-15.00	
60		**Silty Sand**	58.00	
62		Silty Sand		
64			-22.00	
			65.00	

Total Depth: 65
logged by: Hazem Altayeb

Borehole ID: T/37
Location:
Well type:
Elevatin: 77
X-Cordinate: 90770
Y-Cordinate: 89900
Total Depth: 67.7
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	77.00	
0		**Clay**	0.00	
2				
4				
6			70.00	
8		**Sand**	7.00	
10				
12				
14				
16				
18				
20				
22			54.00	
24		**Kurkar**	23.00	
26				
28				
30				
32				
34				
36				
38				
40				
42				
44				
46				
48				
50				
52				
54				
56				
58				
60				
62				
64				
66			9.30	
68			67.70	
70				

Total Depth: 67.7
logged by: Hazem Altayeb

Borehole ID: T/43
Location:
Well type:
Elevatin: 78
X-Cordinate: 90820
Y-Cordinate: 89460
Total Depth: 96
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	78.00	
0		**Sand**	0.00	
2				
4				
6				
8				
10				
12				
14				
16				
18				
20				
22				
24			53.00	
26		**Kurkar**	25.00	
28				
30			47.00	
32		**Clay**	46.00	
		Kurkar	32.00	
34				
36				
38			38.00	
40		**Clay**	37.00	
42		**Kurkar**	41.00	
44				
46				
48			29.00	
50		**Clay**	28.00	
			50.00	

Total Depth: 96
logged by: Hazem Altayeb

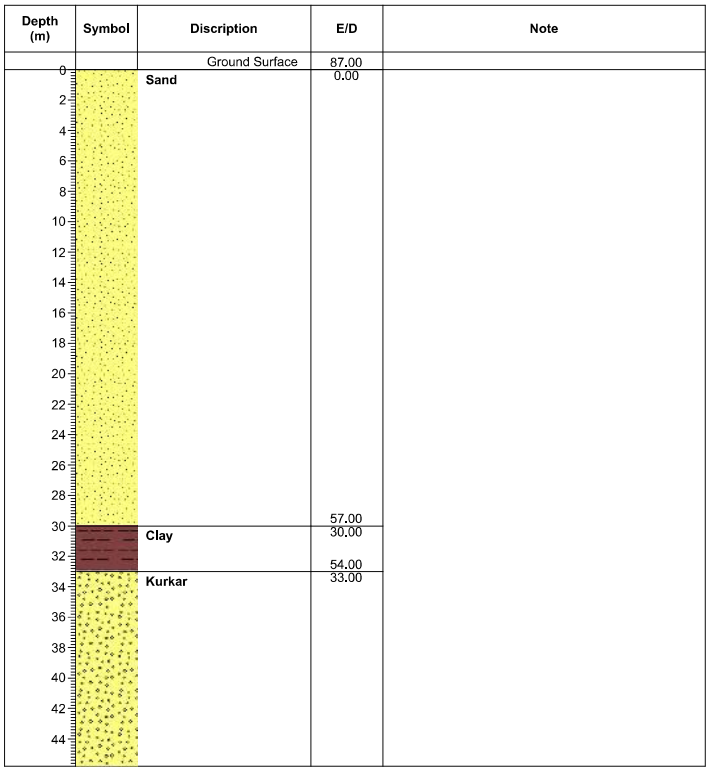
Borehole ID: T/43
Location:
Well type:
Elevatin: 78
X-Cordinate: 90820
Y-Cordinate: 89460
Total Depth: 96
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
52		**Kurkar**		
54				
56				
58				
60				
62				
64			13.00	
66		**Silt**	65.00	
68				
70				
72				
74				
76				
78				
80				
82			-4.00	
84		**Kurkar**	82.00	
86				
88				
90				
92				
94			-17.00	
96		**Clay**	96.00	
98				
100				

Total Depth: 96
logged by: Hazem Altayeb

Borehole ID: T/44
Location:
Well type:
Elevatin: 87

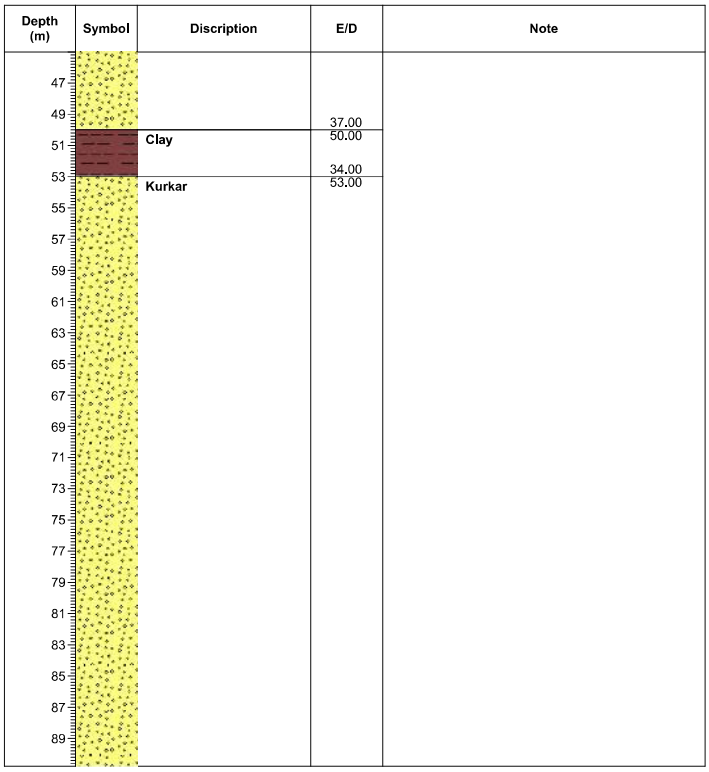
X-Cordinate: 89231
Y-Cordinate: 87642
Total Depth: 126
Water Level:



Total Depth: 126
logged by: Hazem Altayeb

Borehole ID: T/44
Location:
Well type:
Elevatin: 87

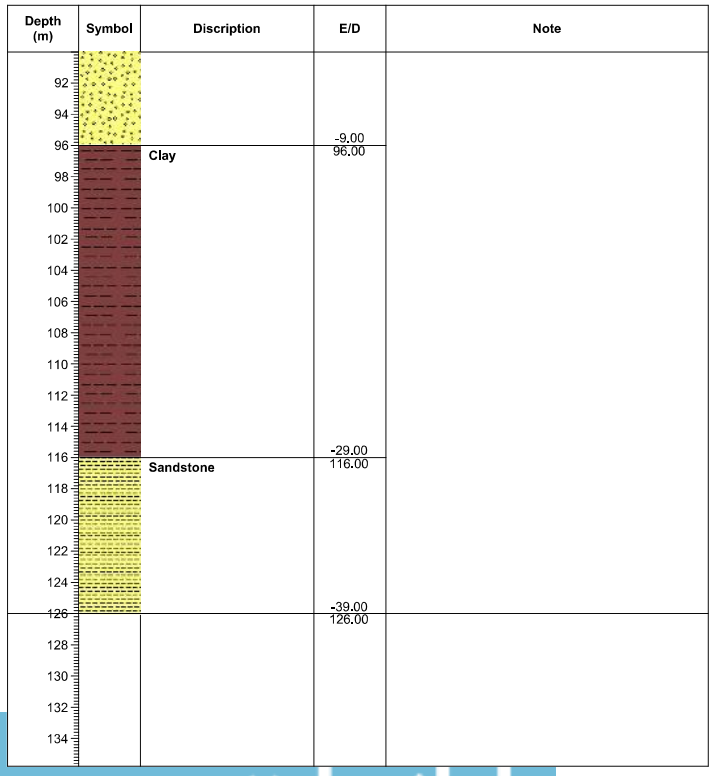
X-Cordinate: 89231
Y-Cordinate: 87642
Total Depth: 126
Water Level:



Total Depth: 126
logged by: Hazem Altayeb

Borehole ID: T/44
Location:
Well type:
Elevatin: 87

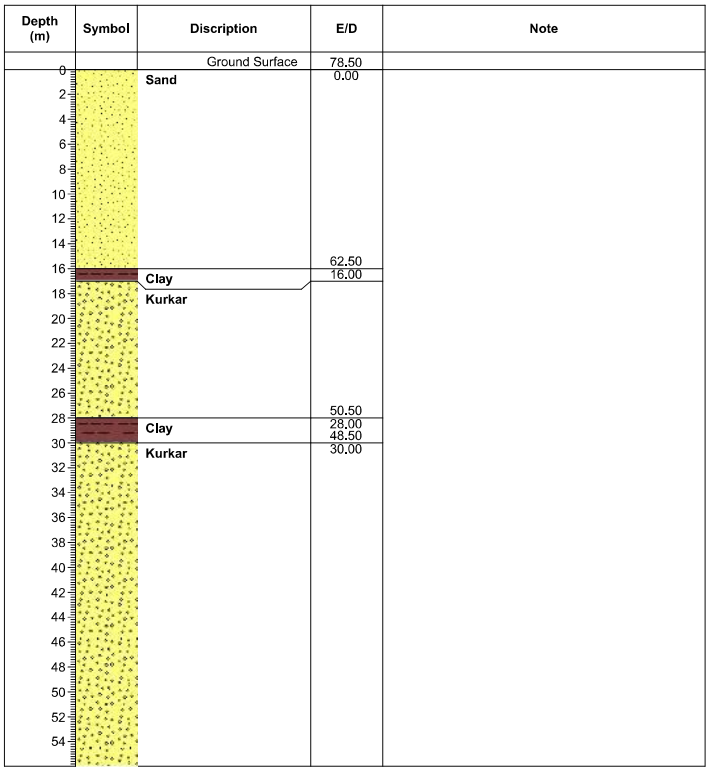
X-Cordinate: 89231
Y-Cordinate: 87642
Total Depth: 126
Water Level:



Total Depth: 126
logged by: Hazem Altayeb

Borehole ID: T/46
Location:
Well type:
Elevatin: 78.54

X-Cordinate: 91983.82
Y-Cordinate: 90272.484
Total Depth: 101
Water Level:



Total Depth: 101
logged by: Hazem Altayeb

Borehole ID: T/46
Location:
Well type:
Elevatin: 78.54
X-Cordinate: 91983.82
Y-Cordinate: 90272.484
Total Depth: 101
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-22.50	
101			101.00	

Total Depth: 101 **logged by:** Hazem Altayeb

Borehole ID: T/48
Location:
Well type:
Elevatin: 79
X-Cordinate: 90867
Y-Cordinate: 89121
Total Depth: 58.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	79.00	
0		Silty Sand	0.00	
5			74.00	
		Sand	5.00	
10			69.00	
		Clay	10.00	
19			60.00	
		Sand	19.00	
26.5			52.50	
		Clay	26.50	
38.5			40.50	
		Kurkar	38.50	
58.5			20.50	
			58.50	

Total Depth: 58.5 **logged by:** Hazem Altayeb

Borehole ID: Tunis AL khadra
Location: Gaza
Well type:
Elevatin: 40
X-Cordinate: 98961
Y-Cordinate: 99705
Total Depth: 58
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Clay	0.00	
8			32.00	
		Kurkar	8.00	
10			38.00	
		Silty Sand	2.00	
		Kurkar		
			-18.00	
58			58.00	

Total Depth: 58 **logged by:** Hazem Altayeb

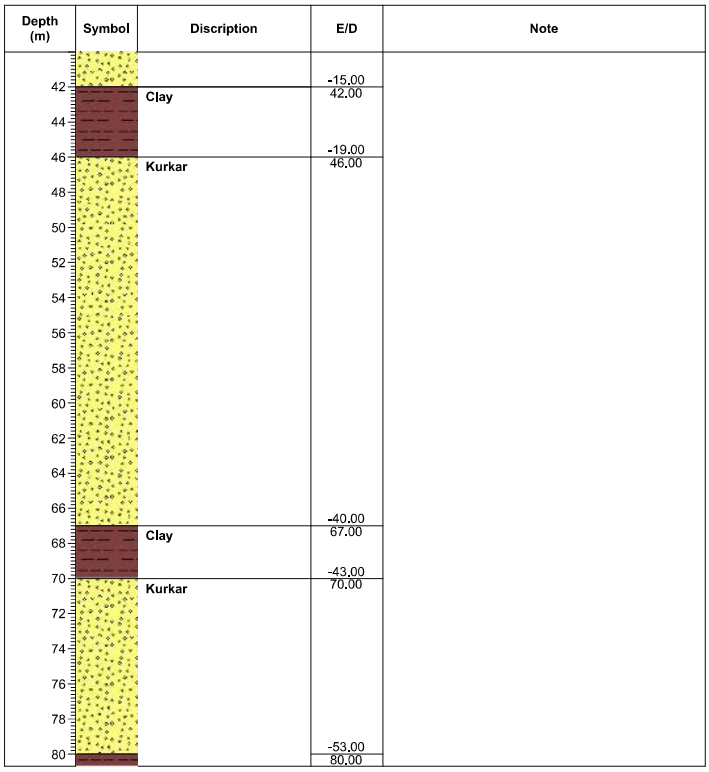
Borehole ID: 2A-B-C-D-E-F
Location: GAZA
Well type:
Elevatin: 27
X-Cordinate: 98350
Y-Cordinate: 105700
Total Depth: 196
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	27.00	
0		Sand Clayey Sand	0.00	
6			21.00	
		Kurkar Kurkar	6.00	
13			13.00	
		Clay	14.00	
18			9.00	
		Kurkar	18.00	

Total Depth: 196 **logged by:** Hazem Altayeb

Borehole ID: 2A-B-C-D-E-F
Location: GAZA
Well type:
Elevatin: 27

X-Cordinate: 98350
Y-Cordinate: 105700
Total Depth: 196
Water Level:

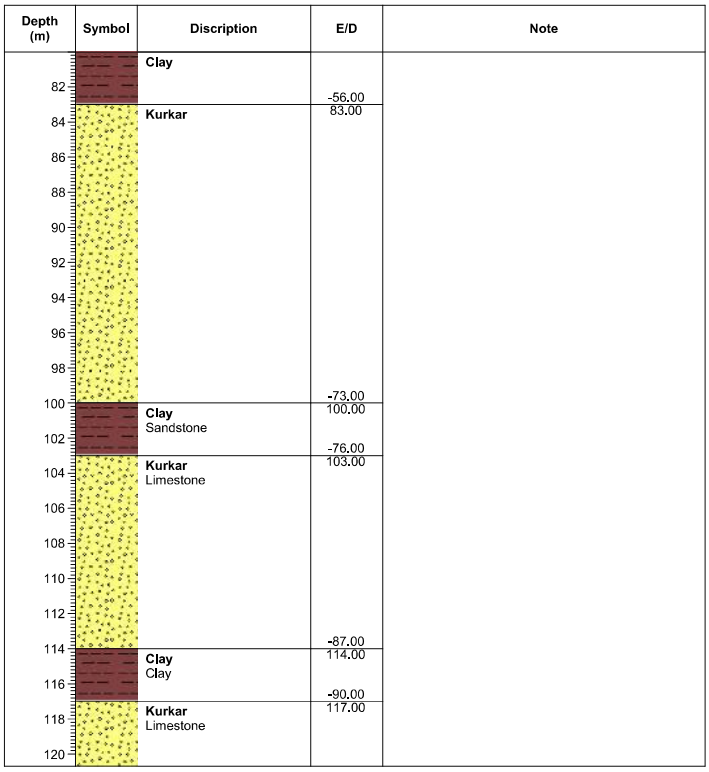


Total Depth: 196

logged by: Hazem Altayeb

Borehole ID: 2A-B-C-D-E-F
Location: GAZA
Well type:
Elevatin: 27

X-Cordinate: 98350
Y-Cordinate: 105700
Total Depth: 196
Water Level:

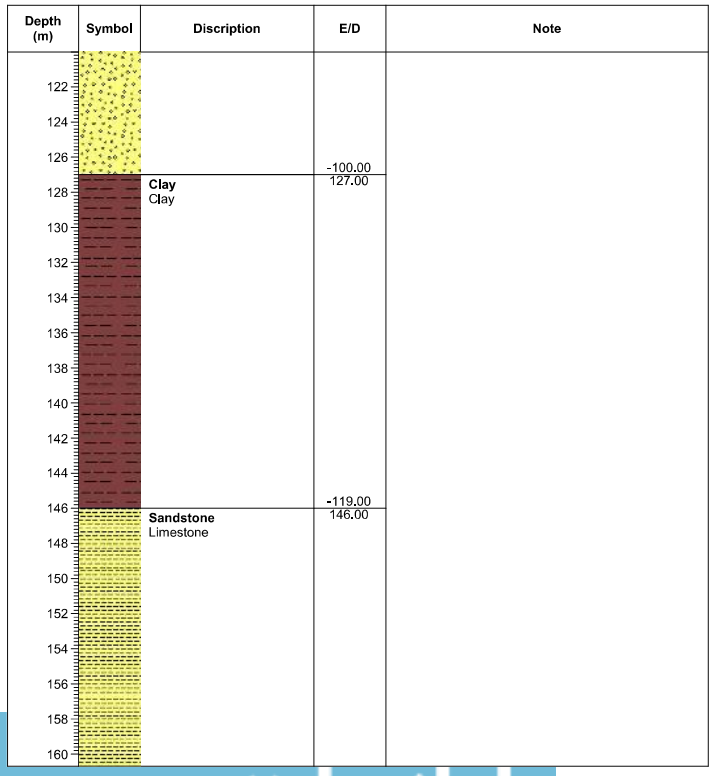


Total Depth: 196

logged by: Hazem Altayeb

Borehole ID: 2A-B-C-D-E-F
Location: GAZA
Well type:
Elevatin: 27

X-Cordinate: 98350
Y-Cordinate: 105700
Total Depth: 196
Water Level:

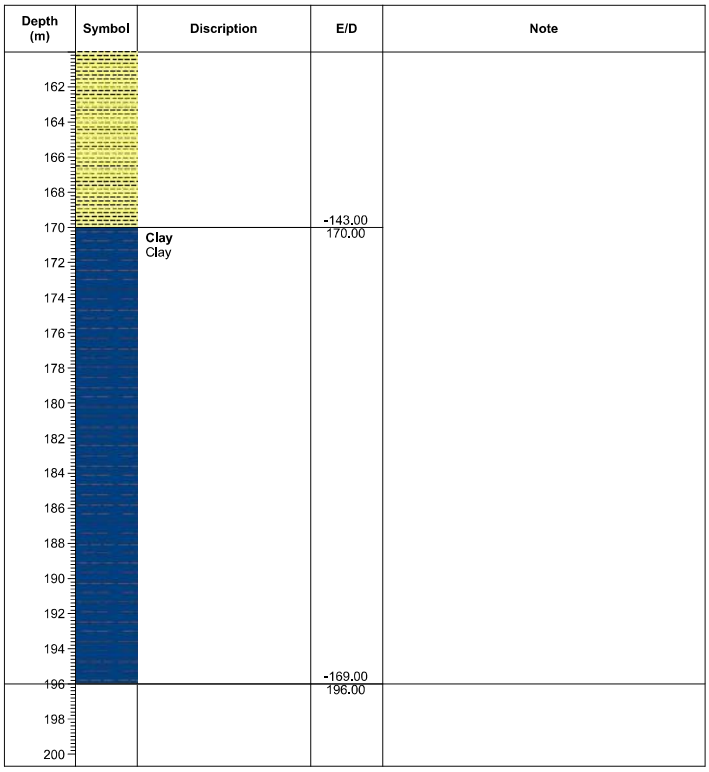


Total Depth: 196

logged by: Hazem Altayeb

Borehole ID: 2A-B-C-D-E-F
Location: GAZA
Well type:
Elevatin: 27

X-Cordinate: 98350
Y-Cordinate: 105700
Total Depth: 196
Water Level:

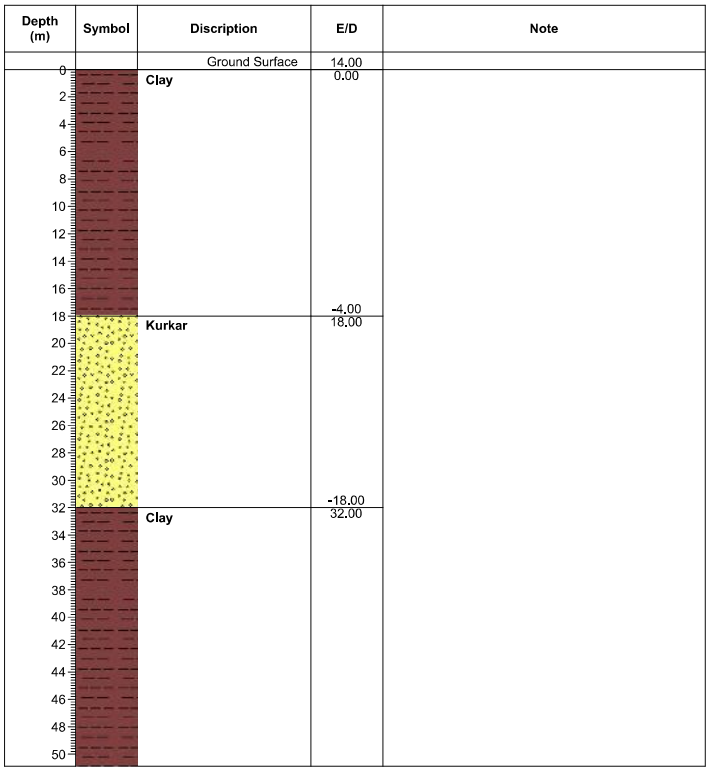


Total Depth: 196

logged by: Hazem Altayeb

Borehole ID: 3 A-B
Location:
Well type:
Elevatin: 14

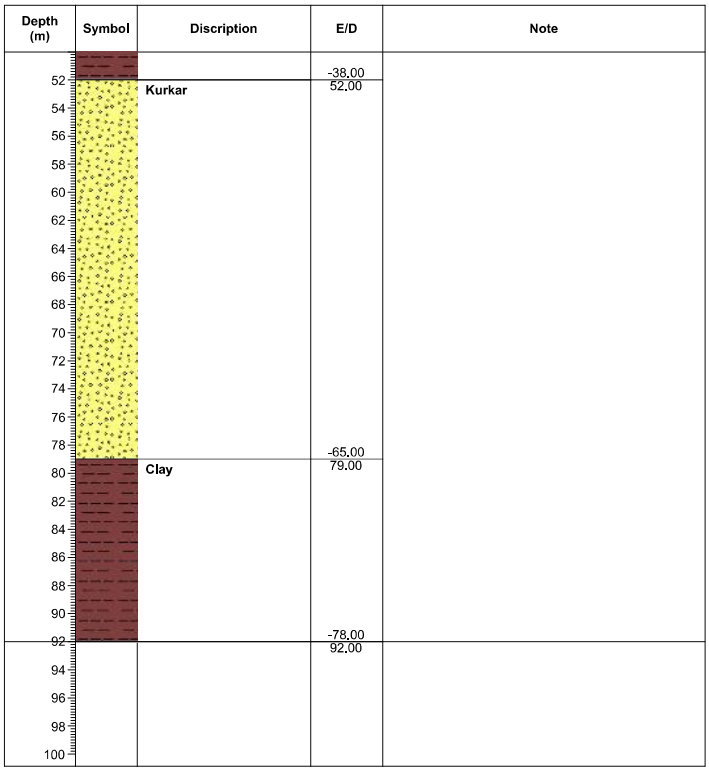
X-Cordinate: 93600
Y-Cordinate: 95550
Total Depth: 92
Water Level:



Total Depth: 92
logged by: Hazem Altayeb

Borehole ID: 3 A-B
Location:
Well type:
Elevatin: 14

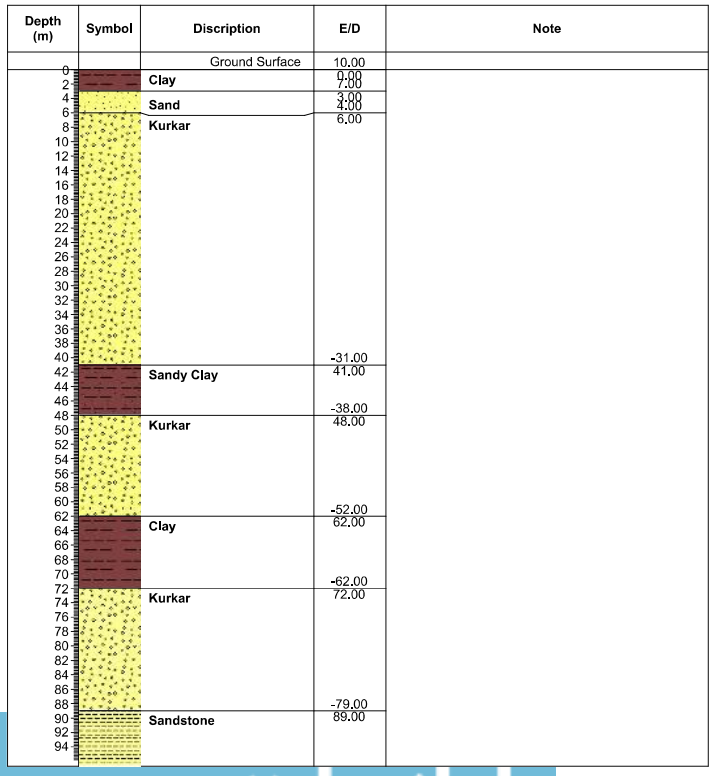
X-Cordinate: 93600
Y-Cordinate: 95550
Total Depth: 92
Water Level:



Total Depth: 92
logged by: Hazem Altayeb

Borehole ID: 6
Location: Gaza
Well type:
Elevatin: 10

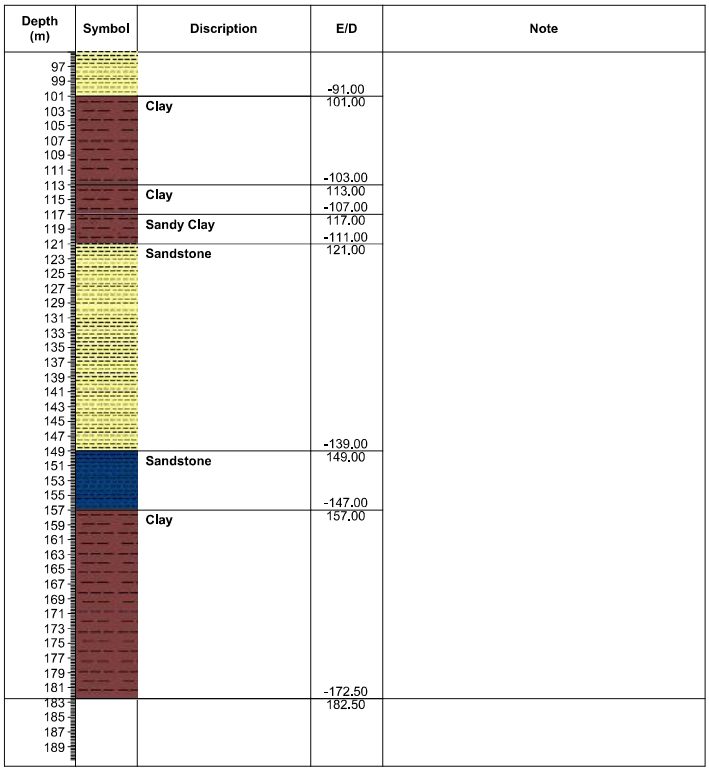
X-Cordinate: 93155
Y-Cordinate: 99693
Total Depth: 182.5
Water Level:



Total Depth: 182.5
logged by: Hazem Altayeb

Borehole ID: 6
Location: Gaza
Well type:
Elevatin: 10

X-Cordinate: 93155
Y-Cordinate: 99693
Total Depth: 182.5
Water Level:



Total Depth: 182.5
logged by: Hazem Altayeb

Borehole ID: 8B
Location: Gaza
Well type:
Elevatin: 22

X-Cordinate: 95600
Y-Cordinate: 98250
Total Depth: 119.1
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
0		Sandy Clay	0.00	
10		Kurkar	11.50 10.50	
16		Clay	4.50 17.50	
30		Kurkar	-7.90 29.90	
54		Clay	-33.50 55.50	
60				

Total Depth: 119.1

logged by: Hazem Altayeb

Borehole ID: 8B
Location: Gaza
Well type:
Elevatin: 22

X-Cordinate: 95600
Y-Cordinate: 98250
Total Depth: 119.1
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
70			-49.10	
72		Kurkar	71.10	
90		Sandstone	-68.00 90.00	
114		Clay	-91.90 113.90	
118			-97.10	
120			119.10	

Total Depth: 119.1

logged by: Hazem Altayeb

Borehole ID: 9
Location: Gaza
Well type:
Elevatin: 20

X-Cordinate: 94540
Y-Cordinate: 99400
Total Depth: 55.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
0		Sand	18.50	
2		Clay	1.50	
18		Kurkar	1.10 18.90	
22		Sandy Clay	-2.60 22.60	
30		Kurkar	-9.60 29.60	
52		Clay	-31.20 51.20	
54			-35.50	
56			55.50	
60				

Total Depth: 55.5

logged by: Hazem Altayeb

Borehole ID: 24
Location: N G
Well type:
Elevatin: 32

X-Cordinate: 99250
Y-Cordinate: 107300
Total Depth: 61.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	32.00	
0		Sand	30.50	
2		Sand Kurkar Kurkar	1.50	
14		Clay Clay	17.00 15.00	
20		Kurkar	12.00 20.00	
42		Clay Clay	-11.00 43.00	
48		Kurkar Limestone	-16.00 48.00	
60			-29.50	
62			61.50	
64				

Total Depth: 61.5

logged by: Hazem Altayeb

Borehole ID: 25 A-B
Location: Nurthern Gaza
Well type:
Elevatin: 39

X-Cordinate: 99900
Y-Cordinate: 106700
Total Depth: 104
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	39.00	
0		**Sand**	0.00	
2		Sand	36.00	
4		**Kurkar**	3.00	
36			2.00	
38		**Clay**	37.00	
40		Brown silty clay	-1.00	
42		**Kurkar**	40.00	
58			-20.00	
60		**Clay**	59.00	
62		Gray silty clay	-23.00	
64		**Kurkar**	62.00	
102			-65.00	
104			104.00	

Total Depth: 104
logged by: Hazem Altayeb

Borehole ID: 26 A-B
Location: N G
Well type:
Elevatin: 16

X-Cordinate: 100550
Y-Cordinate: 108550
Total Depth: 54.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	16.00	
0		**Sand**	0.00	
2			13.00	
4		**Clay**	3.00	
6		Brown clay	11.00	
8		**Sand**	5.00	
52			-37.00	
54		**Clay**	53.00	
56		Gray black clay	-38.50	
60			54.50	

Total Depth: 54.5
logged by: Haem Altayeb

Borehole ID: 28
Location: N G
Well type:
Elevatin: 5

X-Cordinate: 101300
Y-Cordinate: 110100
Total Depth: 92
Water Level: 5

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	5.00	
0		**Sand**	0.00	
2		Fine Sand	2.50	
4		**Clay**	2.50	
6		Clay	3.50	
8		**Sand**		
20			-15.50	
22		**Clay**	20.50	
24			-18.50	
26		**Kurkar**	23.50	

Total Depth: 92
logged by: Hazem Altayeb

Borehole ID: 28
Location: N G
Well type:
Elevatin: 5

X-Cordinate: 101300
Y-Cordinate: 110100
Total Depth: 92
Water Level: 5

Depth (m)	Symbol	Discription	E/D	Note
56			-51.50	
58		**Clay**	56.50	
60		Clay		
70			-65.00	
72		**Kurkar**	70.00	
74		Sandstone		
90			-85.00	
92		**Clay**	90.00	
94		Clay	-87.00	
96			92.00	

Total Depth: 92
logged by: Hazem Altayeb

Borehole ID: 36 A-B
Location: GAZA
Well type:
Elevatin: 43

X-Cordinate: 98950
Y-Cordinate: 105250
Total Depth: 88
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	43.00	
0		**Sand**	40.00	
2		Sand	2.00	
4		**Clay**		
6		Clay		
8				
10				
12				
14			28.00	
16		**Kurkar**	15.00	
18		Limestone		
20				
22				
24			17.50	
26		**Clayey Sand**	25.50	
28		Brown clayey silty	14.50	
30			28.50	
32		**Kurkar**		
34		Limestone		
36				
38				
40				
42				
44				
46				
48				
50				
52			-10.00	
54		**Clay**	53.00	
56		Bright brown clay		
58			-15.00	
60		**Kurkar**	58.00	
62		Limestone		
64				
66				
68				
70				
72				
74				
76				
78				
80				
82				
84			-42.00	
86		**Clay**	85.00	
88		Clay	-45.00	
90			88.00	

Total Depth: 88
logged by: Hazem ALtayeb

Borehole ID: A/60
Location: N G
Well type:
Elevatin: 59

X-Cordinate: 102230
Y-Cordinate: 107556
Total Depth: 40
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	59.00	
0		**Sand**	0.00	
2		Sand		
4				
6				
8			51.00	
10		**Sandy Clay**	8.00	
12		Sandy Clay	48.00	
14		**Clay**	11.00	
16		Clay		
18				
20				
22				
24				
26				
28				
30			29.00	
32		**Sand**	30.00	
34		Sand		
36				
38				
40			19.00	
			40.00	

Total Depth: 40
logged by: Hazem Altayeb

Borehole ID: A/170 A
Location: N G
Well type:
Elevatin: 22

X-Cordinate: 100750
Y-Cordinate: 109100
Total Depth: 34
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
0		**Clay**	0.00	
2		Brown clay		
4			17.00	
6		**Sand**	5.00	
8		Sand		
10				
12				
14				
16				
18				
20				
22				
24				
26			-5.50	
28		**Clay**	27.50	
30		Dark brown clay	-8.00	
32		**Kurkar**	30.00	
34		Kurkar	-12.00	
36			34.00	
38				
40				

Total Depth: 34
logged by: Hazem Altayeb

Borehole ID: A/172
Location: N G
Well type:
Elevatin: 17

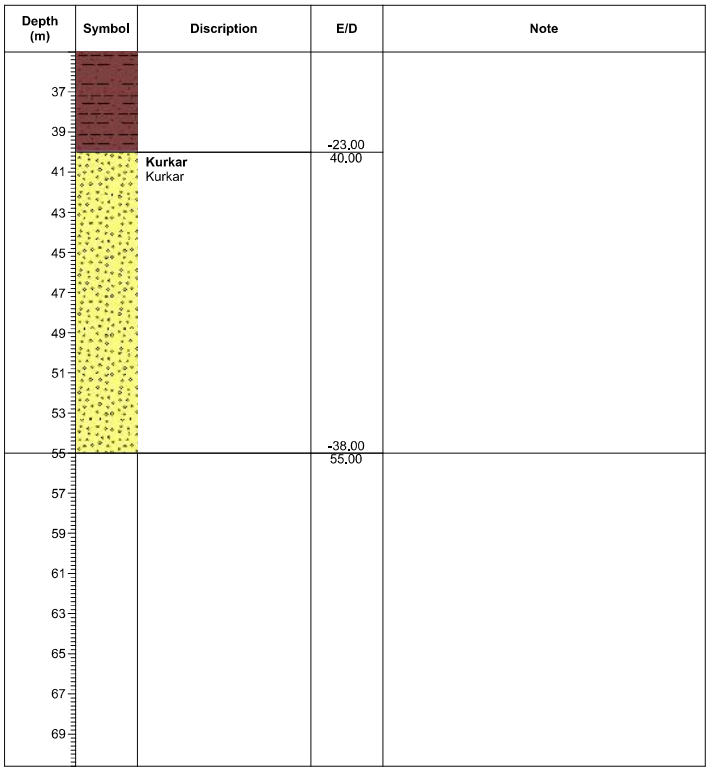
X-Cordinate: 102910
Y-Cordinate: 107963
Total Depth: 55
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	17.00	
0		**Sand**	0.00	
2		Sand		
4				
6				
8				
10				
12				
14				
16				
18			-1.00	
20		**Clay**	18.00	
22		Dark brown muddy clay	-3.00	
24		**Sandy Clay**	20.00	
26		Sandy Clay		
28				
30				
32				
34				

Total Depth: 55
logged by: Hazem Altayeb

Borehole ID: A/172
Location: N G
Well type:
Elevatin: 17

X-Cordinate: 102910
Y-Cordinate: 107963
Total Depth: 55
Water Level:

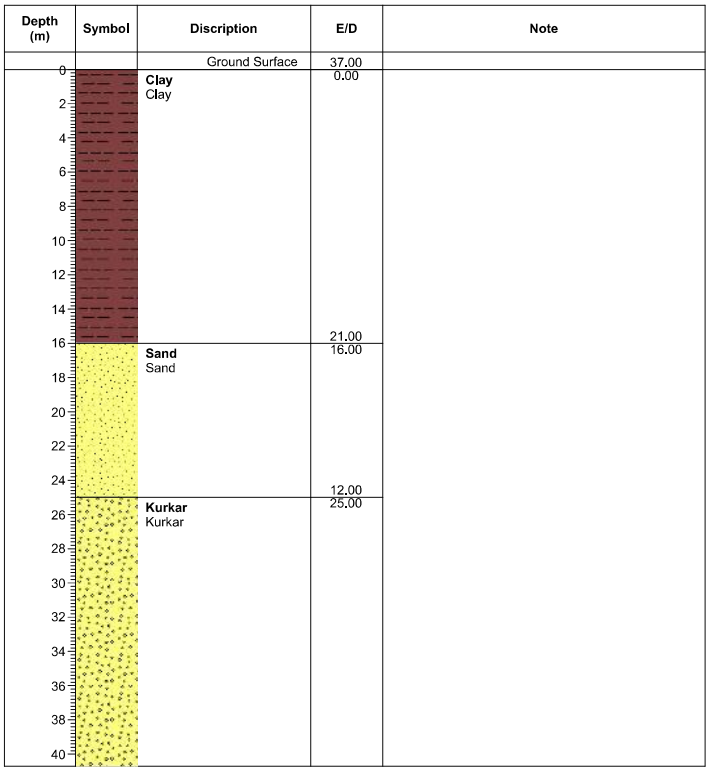


Total Depth: 55

logged by: Hazem Altayeb

Borehole ID: A/188
Location: N G
Well type:
Elevatin: 37

X-Cordinate: 104058
Y-Cordinate: 108119
Total Depth: 75
Water Level:

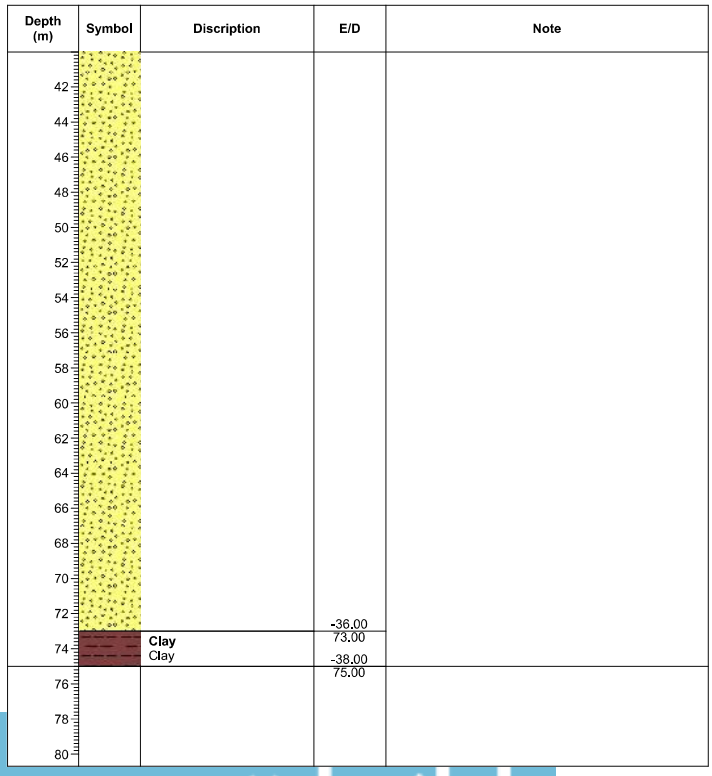


Total Depth: 75

logged by: Hazem ALtayeb

Borehole ID: A/188
Location: N G
Well type:
Elevatin: 37

X-Cordinate: 104058
Y-Cordinate: 108119
Total Depth: 75
Water Level:

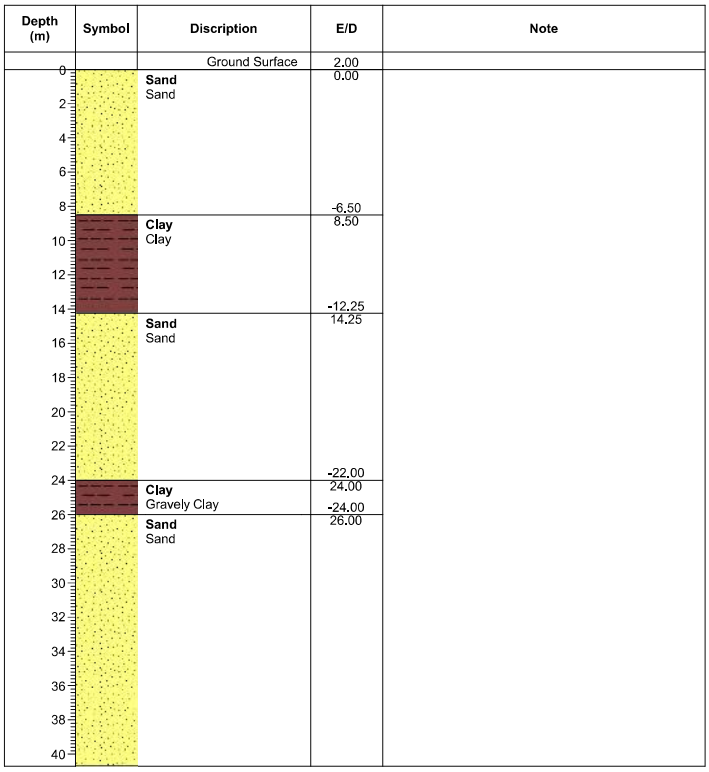


Total Depth: 75

logged by: Hazem ALtayeb

Borehole ID: A/189
Location: N G
Well type:
Elevatin: 2

X-Cordinate: 100133
Y-Cordinate: 109038
Total Depth: 80
Water Level:



Total Depth: 80

logged by: Hazem Altayeb

Borehole ID: A/189
Location: N G
Well type:
Elevatin: 2

X-Cordinate: 100133
Y-Cordinate: 109038
Total Depth: 80
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-50.00	
		Clay Clay	52.00	
			-60.00	
		Kurkar Kurkar	62.00	
			-75.00	
		Clay Clay	77.00	
			-78.00	
			80.00	

Total Depth: 80

logged by: Hazem Altayeb

Borehole ID: A/190
Location: N G
Well type:
Elevatin: 44

X-Cordinate: 102250
Y-Cordinate: 109380
Total Depth: 72
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	44.00	
		Clay Clay	0.00	
			28.00	
		Sand Sand	16.00	
			9.00	
		Kurkar	35.00	

Total Depth: 72

logged by: Hazem Altayeb

Borehole ID: A/190
Location: N G
Well type:
Elevatin: 44

X-Cordinate: 102250
Y-Cordinate: 109380
Total Depth: 72
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-2.50	
		Clay Clay	46.50	
			-7.00	
		Kurkar Kurkar	51.00	
			-20.00	
		Clay	64.00	
			-24.00	
		KUrkar	68.00	
			-28.00	
			72.00	

Total Depth: 72

logged by: Hazem Altayeb

Borehole ID: A/193
Location: N G
Well type:
Elevatin: 51

X-Cordinate: 102390
Y-Cordinate: 109221
Total Depth: 82
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	51.00	
		Clay Clay	0.00	
			24.00	
		Sand Sand	27.00	
			12.00	
		Kurkar Kurkar	39.00	

Total Depth: 82

logged by: Hazem Altayeb

Borehole ID: A/193
Location: N G
Well type:
Elevatin: 51
X-Cordinate: 102390
Y-Cordinate: 109221
Total Depth: 82
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			3.00	
		Clay Clay	48.00	
			-5.00	
		Kurkar Kurkar	56.00	
			-16.00	
		Sandy Clay Sandy Clay	67.00	
			-20.00	
		Kurkar Kurkar	71.00	
			-31.00	
			82.00	

Total Depth: 82
logged by: Hazem Altayeb

Borehole ID: A/195
Location: N G
Well type:
Elevatin: 48
X-Cordinate: 101800
Y-Cordinate: 108480
Total Depth: 80
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	48.00	
		Sand Sand	0.00	

Total Depth: 80
logged by: Hazem Altayeb

Borehole ID: A/195
Location: N G
Well type:
Elevatin: 48
X-Cordinate: 101800
Y-Cordinate: 108480
Total Depth: 80
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			1.00	
		Kurkar Kurkar	47.00	
			-1.00	
		Sandy Clay Sandy Clay	49.00	
			-6.00	
		Kurkar Kurkar	54.00	
			-32.00	
			80.00	

Total Depth: 80
logged by: Hazem Altayeb

Borehole ID: A/196
Location: N G
Well type:
Elevatin: 32
X-Cordinate: 101080
Y-Cordinate: 108032
Total Depth: 32
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	32.00	
		Sand Sand	0.00	

Total Depth: 32
logged by: Hazem Altayeb

Borehole ID: A/196
Location: N G
Well type:
Elevatin: 32

X-Cordinate: 101080
Y-Cordinate: 108032
Total Depth: 32
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-8.00	
		Kurkar	40.00	
		Kurkar		
			-21.00	
			53.00	

Total Depth: 32

logged by: Hazem Altayeb

Borehole ID: A/201
Location: N G
Well type:
Elevatin: 27

X-Cordinate: 103487.9
Y-Cordinate: 107632.3
Total Depth: 42
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	27.00	
0		Sand	0.00	
2		Sand	25.00	
		Clay	2.00	
4		Clay		
6				
			19.00	
8		Kurkar	8.00	
10		Kurkar		
12				
14				
16				
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40				
			-15.00	
42			42.00	
44				

Total Depth: 42

logged by: Hazem Altayeb

Borehole ID: Al-Zahra City Well (Closed)
Location: Gaza
Well type:
Elevatin: 22.5

X-Cordinate: 93354
Y-Cordinate: 98188
Total Depth: 41
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.50	
0		Sand	0.00	
			20.50	
2		Clay	2.00	
4				
6				
8				
10				
12				
14			7.50	
		Kurkar	15.00	
16				
18				
20				
22				
24				
26				
28				
30				
32				
34				
36				
38				
40			-18.50	
			41.00	
42				
44				

Total Depth: 41

logged by: Hazem Altayeb

Borehole ID: Al-Zawayda_Khaled Ben Al Waleed
Location:
Well type:
Elevatin: 28

X-Cordinate: 90640
Y-Cordinate: 93663
Total Depth: 50
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	28.00	
0		Sandy Clay	0.00	
2		Sandy Clay		
4				
6				
			20.00	
8		Silty Clay	8.00	
			18.00	
10		Sand	10.00	
12		Sand		
14				
16				
18				
20			7.00	
		Silty Clay	21.00	
22		Silty Clay		
24				
26				
			0.00	
28		Kurkar	28.00	
30		Kurkar		
32				
34				
36				
38				
40				
42				
44				
46				
48			-20.00	
		Clay	48.00	
			-22.00	
50			50.00	

Total Depth: 50

logged by: Hazem Altayeb

Borehole ID: AT_88_1
Location:
Well type:
Elevatin: 10

X-Cordinate: 85300
Y-Cordinate: 90650
Total Depth: 43
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	10.00	
0		Sand	0.00	
6			6.00	
6		Clay	4.00	
22			-13.00	
23		Sandstone	23.00	
38			-28.00	
38		Clay	38.00	
40			-30.00	
40		Kurkar	40.00	
43			-33.00	
			43.00	

Total Depth: 43
logged by: Hazem Altayeb

Borehole ID: AT_88_2
Location:
Well type:
Elevatin: 12

X-Cordinate: 85450
Y-Cordinate: 90500
Total Depth: 75.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	12.00	
0		Sand	0.00	
8			8.00	
8		Clay	4.00	
32			-20.00	
32		Kurkar	32.00	
46			-34.00	
46		Clay	46.00	
56			-44.00	
56		Sandstone	56.00	
73			-61.00	
73		Clay	73.00	
75.5			-63.50	
			75.50	

Total Depth: 75.5
logged by: Hazem Altayeb

Borehole ID: AT_88_3
Location:
Well type:
Elevatin: 20

X-Cordinate: 86350
Y-Cordinate: 89650
Total Depth: 99
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
0		Sand	0.00	
12			12.00	
8		Clay	8.00	
4			4.00	
16		Sand	16.00	
-4			-4.00	
24		Clay	24.00	
-10			-10.00	
30		Kurkar	30.00	
-25			-25.00	
45		Clay	45.00	
-30			-30.00	
50			50.00	

Total Depth: 99
logged by: Hazem Altayeb

Borehole ID: AT_88_3
Location:
Well type:
Elevatin: 20

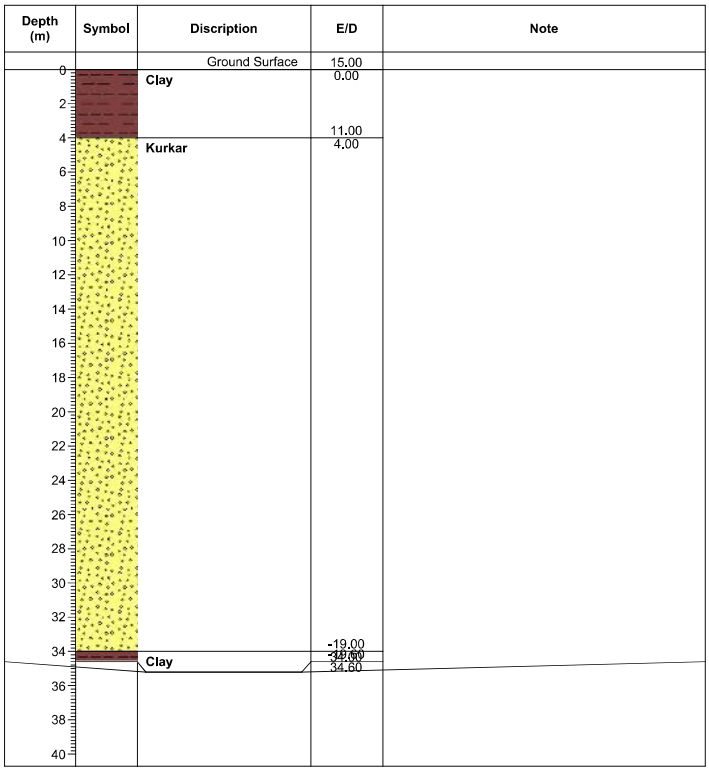
X-Cordinate: 86350
Y-Cordinate: 89650
Total Depth: 99
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
52		Kurkar		
-75			-75.00	
95		Clay	95.00	
-79			-79.00	
99			99.00	

Total Depth: 99
logged by: Hazem Altayeb

Borehole ID: AT_89_1
Location:
Well type:
Elevatin: 15

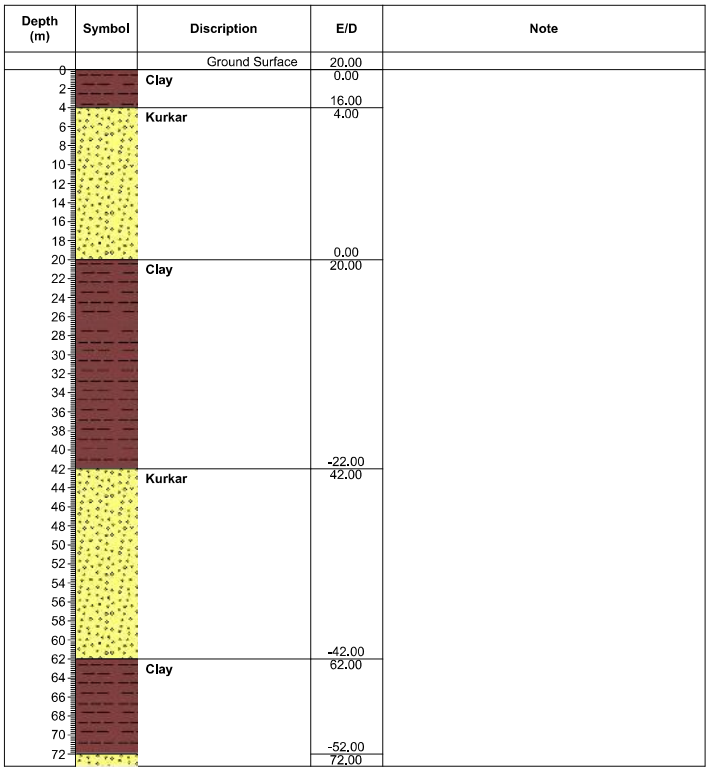
X-Cordinate: 88172
Y-Cordinate: 92873
Total Depth: 34.6
Water Level:



Total Depth: 34.6
logged by: Hazem Altayeb

Borehole ID: AT_89_2
Location:
Well type:
Elevatin: 20

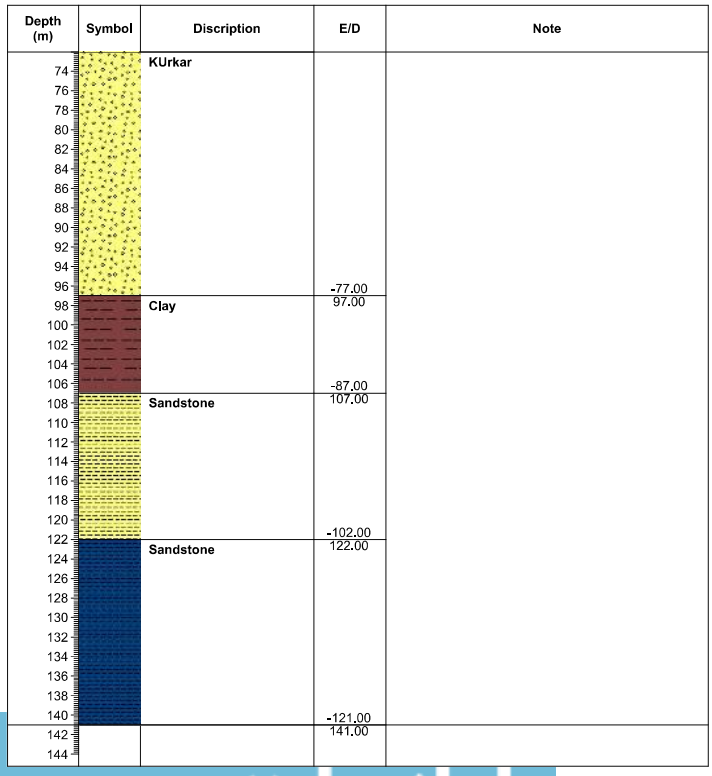
X-Cordinate: 88250
Y-Cordinate: 92100
Total Depth: 141
Water Level:



Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: AT_89_2
Location:
Well type:
Elevatin: 20

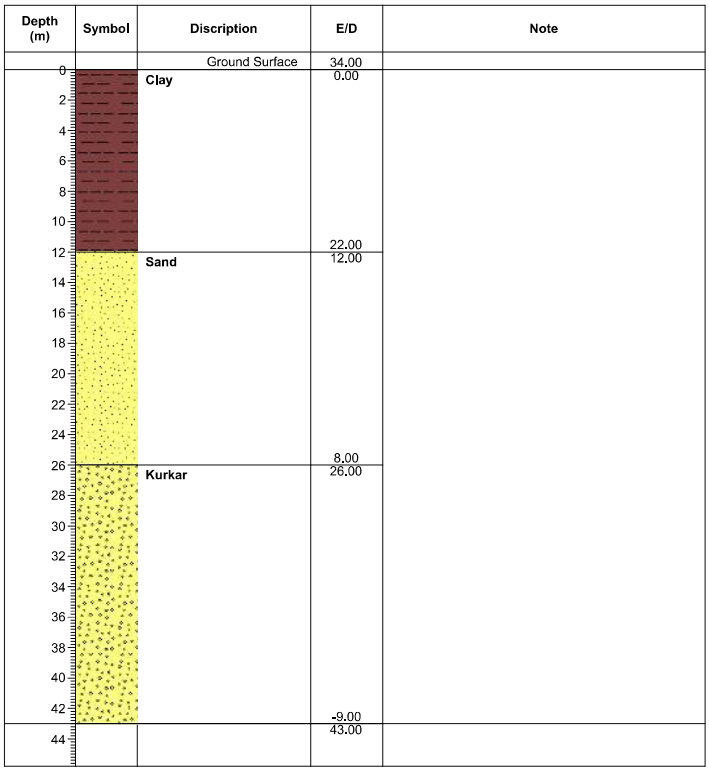
X-Cordinate: 88250
Y-Cordinate: 92100
Total Depth: 141
Water Level:



Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: AT_89_3
Location:
Well type:
Elevatin: 34

X-Cordinate: 88664
Y-Cordinate: 91591
Total Depth: 43
Water Level:



Total Depth: 43
logged by: Hazem Altayeb

Borehole ID: AT_89_4
Location:
Well type:
Elevatin: 28

X-Cordinate: 89460
Y-Cordinate: 91480
Total Depth: 38
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	28.00	
0		Clay	0.00	
22			5.00	
24		Kurkar	23.00	
32			-5.00	
34		Clay	33.00	
38			-10.00	
40			38.00	

Total Depth: 38
logged by: Hazem Altayeb

Borehole ID: AT_89_5
Location:
Well type:
Elevatin: 40

X-Cordinate: 89800
Y-Cordinate: 90400
Total Depth: 46.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Clay	0.00	
10			30.00	
10		Kurkar	10.00	
46			-6.50	
46			46.50	

Total Depth: 46.5
logged by: Hazem Altayeb

Borehole ID: AT_90_1
Location:
Well type:
Elevatin: 6

X-Cordinate: 89000
Y-Cordinate: 94350
Total Depth: 29
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	6.00	
0		Sand	0.00	
8			-2.00	
8		Clay	8.00	
16			-10.00	
16		Kurkar	16.00	
28			-22.00	
28		Clay	28.00	
29			29.00	

Total Depth: 29
logged by: Hazem Altayeb

Borehole ID: AT_90_2
Location:
Well type:
Elevatin: 20

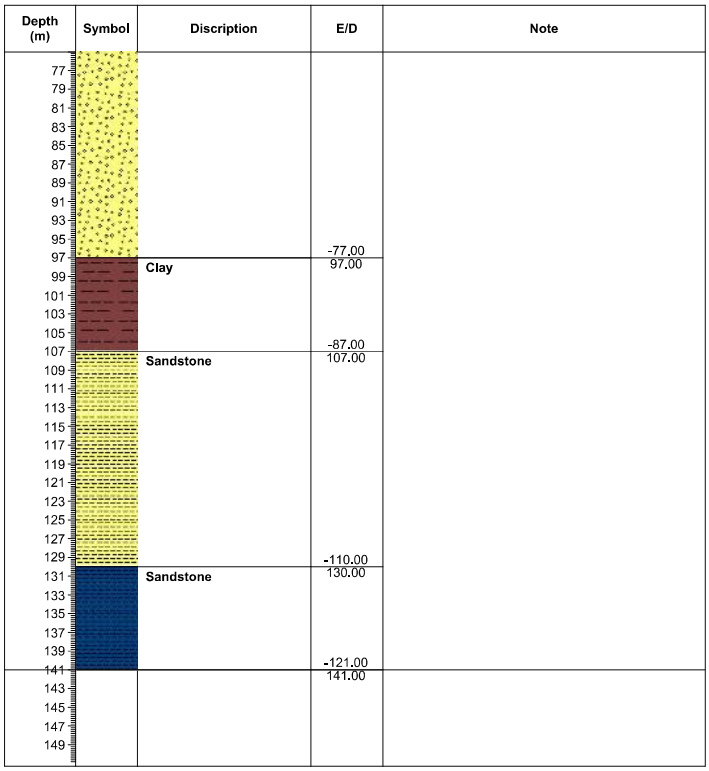
X-Cordinate: 89708
Y-Cordinate: 93747
Total Depth: 141
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
0		Sand	0.00	
4			16.00	
4		Kurkar	4.00	
20			0.00	
20		Clay	20.00	
40			-20.00	
40		Kurkar	40.00	
62			-42.00	
62		Clay	62.00	
72			-52.00	
72		Kurkar	72.00	

Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: AT_90_2
Location:
Well type:
Elevatin: 20

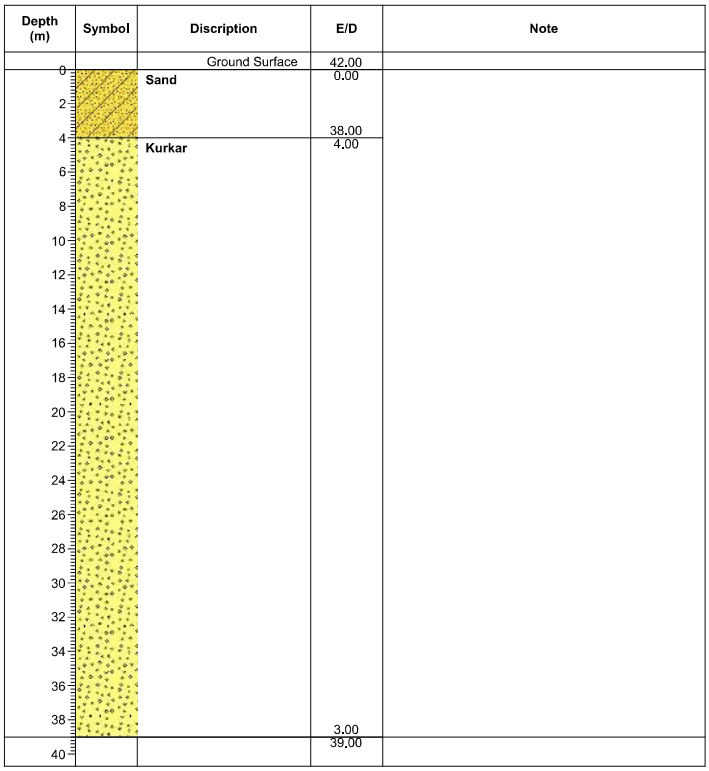
X-Cordinate: 89708
Y-Cordinate: 93747
Total Depth: 141
Water Level:



Total Depth: 141
logged by: Hazem Altayeb

Borehole ID: AT_90_3
Location:
Well type:
Elevatin: 42

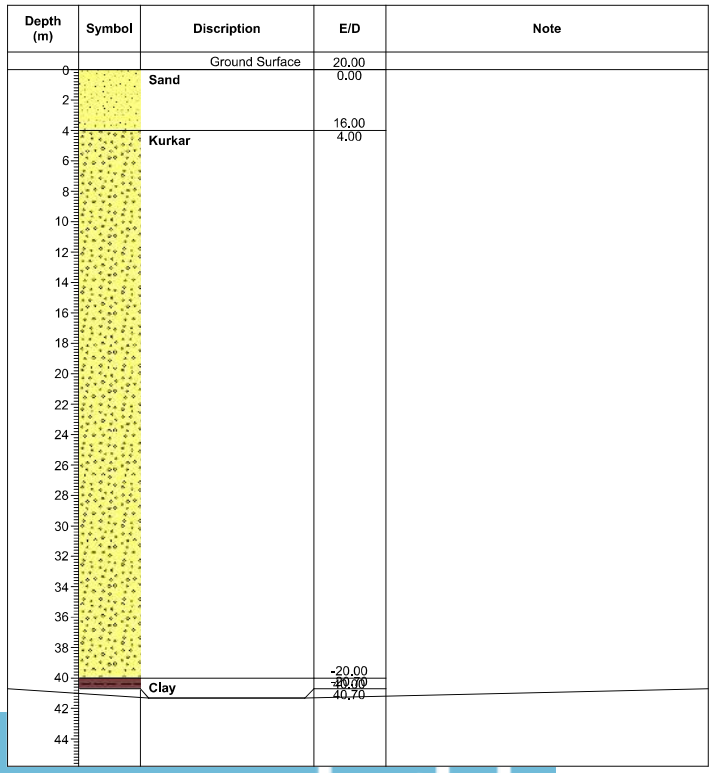
X-Cordinate: 91270
Y-Cordinate: 91590
Total Depth: 39
Water Level:



Total Depth: 39
logged by: Hazem Altayeb

Borehole ID: AT_91_1
Location:
Well type:
Elevatin: 20

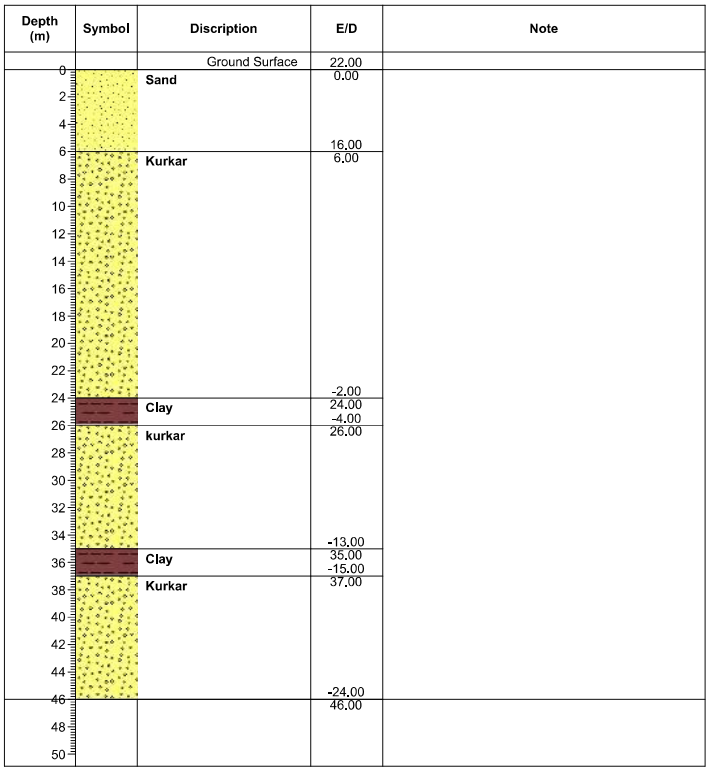
X-Cordinate: 90290
Y-Cordinate: 96020
Total Depth: 40.7
Water Level:



Total Depth: 40.7
logged by: Hazem Altayeb

Borehole ID: AT_91_3
Location:
Well type:
Elevatin: 22

X-Cordinate: 91800
Y-Cordinate: 94500
Total Depth: 46
Water Level:



Total Depth: 46
logged by: Hazem Altayeb

Borehole ID: AT_91_4
Location:
Well type:
Elevatin: 23

X-Cordinate: 91687
Y-Cordinate: 93765
Total Depth: 46.6
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	23.00	
0		Sand	0.00	
6		Kurkar	17.00 6.00	
46			-23.60	
50			46.60	

Total Depth: 46.6

logged by: Hazem Altayeb

Borehole ID: AT_91_5
Location:
Well type:
Elevatin: 40

X-Cordinate: 92000
Y-Cordinate: 92800
Total Depth: 59.7
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	40.00	
0		Clayey Sand	0.00	
20		Kurkar	20.00 20.00	
50		Clay	-10.00 50.00	
54		kurkar	-14.00 54.00	
60			-19.70 59.70	

Total Depth: 59.7

logged by: Hazem Altayeb

Borehole ID: AT_92_1
Location:
Well type:
Elevatin: 20

X-Cordinate: 90585
Y-Cordinate: 96868
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
0		Clayek Sand	0.00	
6		Kurkar	15.00 5.00	
50		Clay	-30.00 50.00	
60		Kurkar	-40.00 60.00	

Total Depth: 183.5

logged by: Hazem Altayeb

Borehole ID: AT_92_1
Location:
Well type:
Elevatin: 20

X-Cordinate: 90585
Y-Cordinate: 96868
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
75		Clay	-55.00 75.00	
80		kurkar	-60.00 80.00	
100		clay	-80.00 100.00	
118		Sandstone	-98.00 118.00	

Total Depth: 183.5

logged by: Hazem Altayeb

Borehole ID: AT_92_1
Location:
Well type:
Elevatin: 20

X-Cordinate: 90585
Y-Cordinate: 96868
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-138.00	
		Sandstone	158.00	
			-163.50	
			183.50	

Total Depth: 183.5
logged by: Hazem Altayeb

Borehole ID: AT_92_2
Location:
Well type:
Elevatin: 18

X-Cordinate: 91700
Y-Cordinate: 96200
Total Depth: 74
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
		Clayey Sand	0.00	
			11.00	
		Sand	7.00	
			1.00	
		Clay	17.00	
			-9.00	
		Kurkar	27.00	
			-28.00	
		Clay	46.00	
			-34.00	
		kurkar	52.00	
			-56.00	
			74.00	

Total Depth: 74
logged by: Hazem Altayeb

Borehole ID: AT_92_4
Location:
Well type:
Elevatin: 22

X-Cordinate: 93600
Y-Cordinate: 94200
Total Depth: 51.9
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	22.00	
		Sand	0.00	
			18.00	
		Kurkar	4.00	
			-10.00	
		Clay	32.00	
			-20.00	
		Kurkar	42.00	
			-29.90	
			51.90	

Total Depth: 51.9
logged by: Hazem Altayeb

Borehole ID: AT_93_1
Location: GAZA
Well type:
Elevatin: 18

X-Cordinate: 92340
Y-Cordinate: 98950
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	18.00	
		Sand	0.00	
			14.00	
		Kurkar Kurkar	4.00	
			-25.00	
		Clay	43.00	
			-35.00	
		Kurkar	53.00	

Total Depth: 183.5
logged by: Hazem Altayeb

Borehole ID: AT_93_1
Location: GAZA
Well type:
Elevatin: 18

X-Cordinate: 92340
Y-Cordinate: 98950
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-55.00	
		Clay	73.00	
			-59.00	
		Kurkar	77.00	
			-79.00	
		Clay	97.00	
			-99.00	
		Sandstone	117.00	

Total Depth: 183.5

logged by: Hazem Altayeb

Borehole ID: AT_93_1
Location: GAZA
Well type:
Elevatin: 18

X-Cordinate: 92340
Y-Cordinate: 98950
Total Depth: 183.5
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
			-137.00	
		Sandstone	155.00	
			-165.50	
			183.50	

Total Depth: 183.5

logged by: Hazem Altayeb

Borehole ID: AT_93_2
Location: GAZA
Well type:
Elevatin: 20

X-Cordinate: 94089
Y-Cordinate: 97042
Total Depth: 119.1
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Ground Surface	20.00	
		Clay	0.00	
			10.00	
		Kurkar	10.00	
			0.00	
		Clay	20.00	
			-8.00	
		Kurkar	28.00	
			-40.00	
			60.00	

Total Depth: 119.1

logged by: Hazem Altayeb

Borehole ID: AT_93_2
Location: GAZA
Well type:
Elevatin: 20

X-Cordinate: 94089
Y-Cordinate: 97042
Total Depth: 119.1
Water Level:

Depth (m)	Symbol	Discription	E/D	Note
		Clay		
			-60.00	
		Kurkar	80.00	
			-75.00	
		Sandstone	95.00	
			-94.00	
		Sandstone	114.00	
			-99.10	
			119.10	

Total Depth: 119.1

logged by: Hazem Altayeb